OXFORD

New Syllabus Primary Mathematics

Teacher's Resource Book

6

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CONTENTS

CHAPTER 1
Algebra

Estimated number of periods: 14

Lesson	Number of Periods	Learning Objectives	Learning Experiences	Textbook Learning	Workbook Practice	Pupil-centred Activities	Concrete Materials
1	6	**Simplifying and Evaluating Algebraic Expressions** • Solve problems involving the simplification and evaluation of algebraic expressions.	• Use concrete objects (e.g. cubes) or draw diagrams to model simple algebraic expressions.	Textbook 6 P1 – 6	Worksheet 1 Workbook 6A P1 – 6	–	–
2	6	**Solving Word Problems** • Solve word problems involving unknown quantities expressed in algebraic terms.	• Form and solve simple linear equations in word problems and make explicit link with model drawing.	Textbook 6 P7– 15	Worksheet 2 Workbook 6A P7 – 14	Textbook 6 P13	–
–	2	**Problem Solving, Maths Journal and Pupil Review**	–	–	Review 1 Workbook 6A P17 – 21	Textbook 6 P14 – 15 Workbook 6A P15 – 16	–

CHAPTER 2
Angles in Geometric Figures

Estimated number of periods: 12

Lesson	Number of Periods	Learning Objectives	Learning Experiences	Textbook Learning	Workbook Practice	Pupil-centred Activities	Concrete Materials
1	10	**Finding Unknown Angles** • Find unknown angles in geometric figures.	• Use the properties of triangles and special quadrilaterals to find unknown angles and explain how they obtain the answers.	Textbook 6 P16 – 32	Worksheet 1 Workbook 6A P22 – 30	Textbook 6 P28	–
–	2	**Problem Solving, Maths Journal and Pupil Review**	–	–	Review 2 Workbook 6A P32 – 39	Textbook 6 P31 – 32 Workbook 6A P31	–

CHAPTER 3
Fractions

Estimated number of periods: 22

Lesson	Number of Periods	Learning Objectives	Learning Experiences	Textbook Learning	Workbook Practice	Pupil-centred Activities	Concrete Materials
1	4	**Dividing a Fraction by a Whole Number** • Divide a proper fraction by a whole number without a calculator.	• Use fraction discs or digital manipulatives to illustrate the concepts and algorithms for division of a proper fraction by a whole number.	Textbook 6 P33 –38	Worksheet 1 Workbook 6A P40 – 43	Textbook 6 P38	Fraction discs
2	4	**Dividing a Whole Number by a Fraction** • Divide a whole number by a proper fraction without a calculator.	• Use fraction discs or digital manipulatives to illustrate the concepts and algorithms for division of a whole number by a proper fraction.	Textbook 6 P39 – 45	Worksheet 2 Workbook 6A P44 – 47	Textbook 6 P45	Fraction discs
3	4	**Dividing a Fraction by a Fraction** • Divide a proper fraction by a proper fraction without a calculator.	• Use fraction discs or digital manipulatives to illustrate the concepts and algorithms for division of a proper fraction by a proper fraction.	Textbook 6 P46 – 52	Worksheet 3 Workbook 6A P48 – 51	–	–
4	8	**Solving Word Problems** • Solve word problems involving the four operations.	• Use calculator to do the 4 operations with fractions (including mixed numbers). • Solve problems using the part-whole and comparison models. • Work in groups to solve multi-step word problems and non-routine problems.	Textbook 6 P53 – 65	Worksheet 4 Workbook 6A P52 – 60	Textbook 6 P63	Fraction discs, mini whiteboard, calculator, markers
–	2	**Problem Solving, Maths Journal and Pupil Review**	–	–	Review 3 Workbook 6A P62 – 67	Textbook 6 P64 – 65 Workbook 6A P61	–

CHAPTER 4
Ratio

Estimated number of periods: 18

Lesson	Number of Periods	Learning Objectives	Learning Experiences	Textbook Learning	Workbook Practice	Pupil-centred Activities	Concrete Materials
1	4	**Ratio and Fraction** • Relate ratio and fraction.	• Use concrete objects or draw pictorial models to demonstrate their understanding of fraction statements such as 'A is $\frac{2}{3}$ of B', 'B is $\frac{3}{2}$ of A' and rewrite the statements using ratio.	Textbook 6 P66 – 73	Worksheet 1 Workbook 6A P68 – 73	Textbook 6 P71	Pens, pencils, paper
2	4	**Finding Part and Whole** • Find the ratio of two quantities in direct proportion and use it to solve direct proportion problems.	• Find the ratio of two quantities in direct proportion and use it to solve direct proportion problems.	Textbook 6 P74 – 81	Worksheet 2 Workbook 6A P74 – 77	–	–
3	8	**Solving Word Problems** • Solve word problems that involve changing ratio.	• Use equivalent ratios and the before-after concept to solve problems involving changing ratio.	Textbook 6 P82 – 92	Worksheet 3 Workbook 6A P78 – 86	–	–
–	2	**Problem Solving, Maths Journal and Pupil Review**	–	–	Review 4 Workbook 6A P88 – 97	Textbook 6 P91 – 92 Workbook 6A P87	Recipes

CHAPTER 5
Percentage

Estimated number of periods: 20

Lesson	Number of Periods	Learning Objectives	Learning Experiences	Textbook Learning	Workbook Practice	Pupil-centred Activities	Concrete Materials
1	4	**Finding the Whole Given a Part and the Percentage** • Find the whole given a part and the percentage.	• Use a pictorial model to represent a percentage part of a quantity in a given situation and use the model to find the quantity.	Textbook 6 P93 – 98	Worksheet 1 Workbook 6A P98 – 101	–	–
2	4	**Percentage Increase and Decrease** • Find percentage increase or decrease based on the original quantity.	• Give real-life examples of percentage change (increase or decrease) and explain how the percentage change is calculated. • Practise using calculator to find percentage change through games, e.g. in a group, students throw a die twice and calculate the change (increase/decrease) and then express the change as a percentage of the original value.	Textbook 6 P99 – 106	Worksheet 2 Workbook 6A P102 – 105	Textbook 6 P106	10-sided die, pen, activity sheet, calculator
3	10	**Solving Word Problems** • Solve word problems involving percentage.	• Make connections between the concepts of 'percentage of percentage' and 'fraction of fraction'.	Textbook 6 P107 – 117	Worksheet 3 Workbook 6A P106 – 114	–	–
–	2	**Problem Solving, Maths Journal and Pupil Review**	–	–	Review 5 Workbook 6A P116 – 123	Textbook 6 P116 – 117 Workbook 6A P115	–

CHAPTER 6
Circles

Estimated number of periods: 30

Lesson	Number of Periods	Learning Objectives	Learning Experiences	Textbook Learning	Workbook Practice	Pupil-centred Activities	Concrete Materials
1	10	**Parts of a Circle** • Describe the different parts of a circle: centre, circumference, diameter, radius. • Find the circumference of a circle and perimeter of a semicircle and a quarter circle.	• Describe circles using terms such as 'centre', 'diameter', 'radius' and 'circumference'. • Work in pairs to measure and recognise that – the distance between the centre and any point on the circumference is always the same. – the bigger the circle, the longer the diameter. – the diameter of a circle is twice its radius. Work in groups to measure the circumferences and diameters of different circles, use calculator to work out the value of $\pi\left(=\frac{\text{circumference}}{\text{diameter}}\right)$ and observe that the value is approximately 3.14 or $\frac{22}{7}$.	Textbook 6 P118 – 129	Worksheet 1 Workbook 6B P1 – 8	Textbook 6 P127	Paper cups, paper cut-outs of cirles, scissors, strings, rulers, coins, paper plates, markers

			• Work in groups to measure and discover that the distance travelled by a circle/wheel along a straight line when it makes one complete turn without skipping is equal to its circumference.				
2	12	**Area of a Circle** • Find the area of a circle. • Find the area of a composite figure made up of square(s), rectangles(s), triangle(s), semicircle(s) and quarter circle(s).	• Estimate the area of a circle using square grid. • Work in groups to cut a circle into 24 pieces and use the pieces to form a rectangle to find the area of the circle. • Make connections between the area of a circle of radius r and the area of a square of length r, e.g. – Area of circle is less than 4 squares ($4r^2$) – Area of circle is more than 2 squares ($2r^2$) – Area of circle is about $3r^2$	Textbook 6 P130 – 137	Worksheet 2 Workbook 6B P9 – 14	Textbook 6 P133, 136	1-cm square grid paper, paper cut-outs of circles, semicircles and quarter circles, scissors, glue
3	6	**Area and Perimeter of Composite Figures** • Find the area and perimeter of figures made up of a variety of squares, rectangles, triangles, semicircles and quarter circles	–	Textbook 6 P138 – 144	Worksheet 3 Workbook 6B P15 – 19	–	–
–	2	**Problem Solving, Maths Journal and Pupil Review**	–	–	Review 6 Workbook 6B P21 – 30	Textbook 6 P143 – 144 Workbook 6A P20	–

CHAPTER 7
Speed

Estimated number of periods: 20

Lesson	Number of Periods	Learning Objectives	Learning Experiences	Textbook Learning	Workbook Practice	Pupil-centred Activities	Concrete Materials
1	4	**Speed, Distance and Time** • Define speed. • Relate distance, time and speed with a formula. • Write speed in different units such as km/hr, m/min, m/s and cm/s.	• Talk about speed in real life such as speed of vehicles (e.g. bicycle, motor car, train, aeroplane) and animals (e.g. horse, cheetah) and make comparisons between the different speeds. Also, discuss other examples such as speed limit traffic signs, 100-m run, speedometer in cars and fan speed. • Interpret and compare speeds in different units e.g. 30 m/min, 30 km/hr. • Talk about a journey and recognise that there are 3 related quantities (distance, time and speed) and given any two quantities, the third quantity can be calculated.	Textbook 6 P145 – 152	Worksheet 1 Workbook 6B P31 – 34	Textbook 6 P152	Stopwatch, measuring tape

2	4	**Average Speed** • Define average speed. • Find average speed by dividing total distance by total time.	–	Textbook 6 P153 – 156	Worksheet 2 Workbook 6B P35 – 38	–	–
3	10	**Solving Word Problems** • Solve up to 3-step word problems involving speed and average speed.	• Draw a diagram to show different scenarios of speed, distance and time (e.g. two vehicles starting from the same point but moving away from each other at constant speeds) and use it to solve problems, e.g. find the distance apart after 3 hours.	Textbook 6 P157 – 165	Worksheet 3 Workbook 6B P39 – 43	–	–
–	2	**Problem Solving, Maths Journal and Pupil Review**	–	–	Review 7 Workbook 6B P45 – 50	Textbook 6 P164 – 165 Workbook 6B P44	–

CHAPTER 8
Volume of Cubes and Cuboids

Estimated number of periods: 14

Lesson	Number of Periods	Learning Objectives	Learning Experiences	Textbook Learning	Workbook Practice	Pupil-centred Activities	Concrete Materials
1	6	**Volume of Cubes and Cuboids** • Find one dimension of a cuboid given its volume and the other dimensions. • Find the length of one edge of a cube given its volume. • Find the height of a cuboid given its volume and base area. • Find the area of a face of a cuboid given its volume and one dimension. Use of the symbols: $\sqrt{}$ and $\sqrt[3]{}$.	• Build cubes of different sizes using unit cubes (or connecting cubes) and commit to memory the volumes of the cubes. • Build a cuboid using unit cubes and determine its height given its volume (total number of unit cubes) and base area (product of two dimensions). • Use calculator to explore – the square roots of numbers and relate them to the lengths of squares given their areas. – the cube roots of numbers and relate them to the edge lengths of cubes given their volumes.	Textbook 6 P166 – 179	Worksheet 1 Workbook 6B P51 – 58	Textbook 6 P177	1-cm cubes
2	6	**Solving Word Problems** • Solve word problems involving volume of a cube/cuboid.	–	Textbook 6 P180 – 192	Worksheet 2 Workbook 6B P59 – 69	Textbook 6 P189	–
–	2	**Problem Solving, Maths Journal and Pupil Review**	–	–	Review 8 Workbook 6B P71 – 80	Textbook 6 P191 – 192 Workbook 6B P70	–

CHAPTER 9
Pie Charts

Estimated number of periods: 12

Lesson	Number of Periods	Learning Objectives	Learning Experiences	Textbook Learning	Workbook Practice	Pupil-centred Activities	Concrete Materials
1	4	**Reading Pie Charts** • Interpret data from a pie chart.	• Discuss examples of data presented in pie charts, and make connections between pie charts and other graphic representations of data. • Use the concept of proportionality to interpret data presented in pie charts in terms of percentages or fractions. • Construct a pie chart using a spreadsheet e.g. Excel	Textbook 6 P193 – 199	Worksheet 1 Workbook 6B P81 – 84	Textbook 6 P198	Software to construct pie chart
2	6	**Solving Word Problems** • Solve word problems involving pie charts.	• Use data to make informed decisions and predictions.	Textbook 6 P200 – 209	Worksheet 2 Workbook 6B P85 – 92	Textbook 6 P206	–
–	2	**Problem Solving, Maths Journal and Pupil Review**	–	–	Review 9 Workbook 6B P95 – 98	Textbook 6 P208 – 209 Workbook 6B P93 – 94	–

CHAPTER 10
Solid Figures

Estimated number of periods: 12

Lesson	Number of Periods	Learning Objectives	Learning Experiences	Textbook Learning	Workbook Practice	Pupil-centred Activities	Concrete Materials
1	4	**Solid Figures** • Describe the characteristics of solid figures: cube, cuboid, cone, cylinder, prism and pyramid.	• Look for examples of prisms and pyramids in their environment and discuss the similarities and differences between them. • Draw 3D objects that are in the shape of prisms or pyramids.	Textbook 6 P210 – 216	Worksheet 1 Workbook 6B P99 – 104	Textbook 6 P213 – 214	–
2	6	**Nets of Solid Figures** • Identify and draw 2D representations of a cube, cuboid, cone, cylinder, prism and pyramid. • Identify the nets of 3D solids: cube, cuboid, cone, cylinder, prism and pyramid. • Identify the solid which can be formed by a given net.	• Visualise and draw the net of a cube, and justify that it is a net of the cube by cutting it out and folding it to form the cube. • Work in groups to make nets of 3D shapes using geoshapes (or polydrons).	Textbook 6 P217 – 229	Worksheet 2 Workbook 6B P105 – 111	Textbook 6 P219, 224	Paper, scissors, ruler Manipulatives
–	2	**Problem Solving, Maths Journal and Pupil Review**	–	–	Review 10 Workbook 6B P113 – 118	Textbook 6 P228 – 229 Workbook 6B P112	–

SYLLABUS MATCHING GRID
CAMBRIDGE PRIMARY MATHEMATICS STAGE 6

Learning Objective	Reference
1. Number	
Numbers and the number system	
Know what each digit represents in whole numbers up to a million.	Chapter 1
Know what each digit represents in one- and two-place decimal numbers.	Book 4 Chapter 8
Multiply and divide any whole number from 1 to 10 000 by 10, 100 or 1000 and explain the effect.	Book 5 Chapter 2
Multiply and divide decimals by 10 or 100 (answers up to two decimal places for division).	Book 5 Chapter 8
Find factors of two-digit numbers.	Book 5 Chapter 1
Find some common multiples, e.g. for 4 and 5.	Book 5 Chapter 1
Round whole numbers to the nearest 10, 100 or 1000.	Book 4 Chapter 1
Round a number with two decimal places to the nearest tenth or to the nearest whole number.	Book 4 Chapter 8
Make and justify estimates and approximations of large numbers.	Book 5 Chapter 1
Use the >, < and = signs correctly.	Across the series
Estimate where four-digit numbers lie on an empty 0 –10 000 line.	Book 4 Chapter 1
Order numbers with up to two decimal places (including different numbers of places).	Book 4 Chapter 8
Recognise and extend number sequences.	Across the series
Recognise and use decimals with up to three places in the context of measurement.	Book 5 Chapter 8
Recognise odd and even numbers and multiples of 5, 10, 25, 50 and 100 up to 1000.	Book 4 Chapter 2
Make general statements about sums, differences and multiples of odd and even numbers.	Across the series
Recognise prime numbers up to 20 and find all prime numbers less than 100.	Book 5 Chapter 1
Recognise the historical origins of our number system and begin to understand how it developed.	Book 4 Chapter 1
Compare fractions with the same denominator and related denominators, e.g. $\frac{3}{4}$ with $\frac{7}{8}$.	Book 4 Chapter 3
Recognise equivalence between fractions, e.g. between $\frac{1}{100}$s, $\frac{1}{10}$s and $\frac{1}{2}$s.	Book 5 Chapter 4
Recognise and use the equivalence between decimal and fraction forms.	Book 4 Chapter 8
Order mixed numbers and place between whole numbers on a number line.	Book 4 Chapter 3
Change an improper fraction to a mixed number, e.g. $\frac{17}{8}$ to $2\frac{1}{8}$.	Book 5 Chapter 4
Reduce fractions to their simplest form, where this is $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ or a number of fifths or tenths.	Book 4 Chapter 3
Begin to convert a vulgar fraction to a decimal fraction using division.	Chapter 3
Understand percentage as parts in every 100 and express $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{10}$, $\frac{1}{100}$ as percentages.	Chapter 5
Find simple percentages of shapes and whole numbers.	Chapter 5
Solve simple problems involving ratio and direct proportion.	Chapter 4
2. Calculation	
Mental strategies	
Know and apply tests of divisibility by 2, 4, 5, 10, 25 and 100.	Book 4 Chapter 2
Use place value and number facts to add or subtract two-digit whole numbers and to add or subtract three-digit multiples of 10 and pairs of decimals, e.g. 560 + 270; 2.6 + 2.7; 0.78 + 0.23.	Book 3 Chapter 2 and Book 4 Chapter 9
Add/subtract near multiples of one when adding numbers with one decimal place, e.g. 5.6 + 2.9; 13.5 – 2.1.	Book 4 Chapter 9
Add/subtract a near multiple of 10, 100 or 1000, or a near whole unit of money, and adjust, e.g. 3127 + 4998; 5678 – 1996.	Book 3 Chapter 2
Use place value and multiplication facts to multiply/divide mentally, e.g. 0.8 × 7; 4.8 ÷ 6.	Book 4 Chapter 9
Multiply pairs of multiples of 10, e.g. 30 × 40, or multiples of 10 and 100, e.g. 600 × 40.	Book 5 Chapter 2
Double quickly any two-digit number, e.g. 78, 7.8, 0.78 and derive the corresponding halves.	Book 5 Chapter 2
Divide two-digit numbers by single-digit numbers, including leaving a remainder.	Book 4 Chapter 2

Addition and Subtraction	
Add two- and three-digit numbers with the same or different numbers of digits/decimal places.	Book 3 Chapter 2, Book 4 Chapter 9
Add or subtract numbers with the same and different numbers of decimal places, including amounts of money.	Book 4 Chapter 9
Multiplication and division	
Multiply pairs of multiples of 10, e.g. 30 × 40, or multiples of 10 and 100, e.g. 600 × 40.	Book 5 Chapter 2
Multiply near multiples of 10 by multiplying by the multiple of 10 and adjusting.	Book 5 Chapter 2
Multiply by halving one number and doubling the other, e.g. calculate 35 × 16 with 70 × 8.	Book 5 Chapter 2
Use number facts to generate new multiplication facts, e.g. the 17× table from 10× + 7× tables.	Book 5 Chapter 2
Multiply two-, three- or four-digit numbers (including sums of money) by a single-digit number and two- or three-digit numbers by two-digit numbers.	Book 5 Chapter 2
Divide three-digit numbers by single-digit numbers, including those leaving a remainder and divide three-digit numbers by two-digit numbers (no remainder) including sums of money.	Book 5 Chapter 2
Give an answer to division as a mixed number, and a decimal (with divisors of 2, 4, 5, 10 or 100).	Chapter 3
Relate finding fractions to division and use them as operators to find fractions including several tenths and hundredths of quantities.	Chapter 3
Know and apply the arithmetic laws as they apply to multiplication (without necessarily using the terms commutative, associative or distributive).	Book 5 Chapter 2
3. Geometry	
Shapes and geometric reasoning	
Visualise and describe the properties of 3D shapes, e.g. faces, edges and vertices.	Chapter 8
Identify and describe properties of quadrilaterals (including the parallelogram, rhombus and trapezium), and classify using parallel sides, equal sides, equal angles.	Chapter 2
Recognise and make 2D representations of 3D shapes including nets.	Chapter 10
Estimate, recognise and draw acute and obtuse angles and use a protractor to measure to the nearest degree.	Book 4 Chapter 5
Check that the sum of the angles in a triangle is 180°, for example, by measuring or paper folding; calculate angles in a triangle or around a point.	Book 5 Chapter 13
Position and movement	
Read and plot co-ordinates in all four quadrants.	Book 3 Chapter 12
Predict where a polygon will be after one reflection, where the sides of the shape are not parallel or perpendicular to the mirror line, after one translation or after a rotation through 90° about one of its vertices.	Book 4 Chapter 6
4. Measure	
Length, mass and capacity	
Select and use standard units of measure. Read and write to two or three decimal places.	Book 5 Chapter 8
Convert between units of measurement (kg and g, *l* and ml, km, m, cm and mm), using decimals to three places, e.g. recognising that 1.245 m is 1 m 24.5 cm.	Book 5 Chapter 8
Interpret readings on different scales, using a range of measuring instruments.	Book 5 Chapter 8
Draw and measure lines to the nearest centimetre and millimetre.	Book 5 Chapters 13 and 14
Time	
Recognise and understand the units for measuring time (seconds, minutes, hours, days, weeks, months, years, decades and centuries); convert one unit of time into another.	Book 4 Chapter 12
Tell the time using digital and analogue clocks using the 24-hour clock.	Book 4 Chapter 12
Compare times on digital and analogue clocks, e.g. realise quarter to four is later than 3:40.	Book 4 Chapter 12
Read and use timetables using the 24-hour clock.	Book 4 Chapter 12
Calculate time intervals using digital and analogue times	Book 4 Chapter 12

 This information is accurate as of March 2020.

Area and perimeter	
Measure and calculate the perimeter and area of rectilinear shapes.	Book 4 Chapter 10
Estimate the area of an irregular shape by counting squares.	Book 3 Chapter 13
Calculate perimeter and area of simple compound shapes that can be split into rectangles.	Book 3 Chapter 13 and Book 4 Chapter 10

5. Handling data

Organising, categorising and representing data	
Solve a problem by representing, extracting and interpreting data in tables, graphs, charts and diagrams, e.g. line graphs for distance and time; a price 'ready-reckoner' for currency conversion; frequency tables and bar charts with grouped discrete data.	Book 4 Chapter 11 and Book 6 Chapter 9
Explore how statistics are used in everyday life.	Chapter 9
Probability	
Use the language associated with probability to discuss events, to assess likelihood and risk, including those with equally likely outcomes.	Book 5 Chapter 15

6. Problem solving

Using techniques and skills in solving mathematical problems	
Choose appropriate and efficient mental or written strategies to carry out a calculation involving addition, subtraction, multiplication or division.	Across the series
Understand everyday systems of measurement in length, weight, capacity, temperature and time and use these to perform simple calculations.	Across the series
Check addition with a different order when adding a long list of numbers; check when subtracting by using the inverse.	Books 4 − 6
Recognise 2D and 3D shapes and their relationships, e.g. a cuboid has a rectangular cross-section.	Book 6 Chapter 10
Estimate and approximate when calculating, e.g. use rounding, and check working.	Across the series
Using understanding and strategies in solving problems	
Explain why they chose a particular method to perform a calculation and show working.	Across the series
Deduce new information from existing information and realise the effect that one piece of information has on another.	Across the series
Use logical reasoning to explore and solve number problems and mathematical puzzles.	Across the series
Use ordered lists or tables to help solve problems systematically.	Across the series
Identify relationships between numbers and make generalised statements using words, then symbols and letters, e.g. the second number is twice the first number plus 5 (n, $2n + 5$); all the numbers are multiples of 3 minus 1 ($3n – 1$); the sum of angles in a triangle is 180°.	Book 5 Chapter 3 and Book 6 Chapter 1
Make sense of and solve word problems, single and multi-step (all four operations), and represent them, e.g. with diagrams or on a number line; use brackets to show the series of calculations necessary.	Across the series
Solve simple word problems involving ratio and direct proportion.	Chapter 4
Solve simple word problems involving percentages, e.g. find discounted prices.	Chapter 5
Make, test and refine hypotheses, explain and justify methods, reasoning, strategies, results or conclusions orally.	Across the series

INTRODUCTION

The Teacher's Resource Book has been designed to promote good teaching practices for teachers to effectively implement the Primary Mathematics Curriculum.

This series provides teachers with the flexibility to choose the elements that are right for their learners. The key focus in Lower Primary Mathematics comprise of the following:

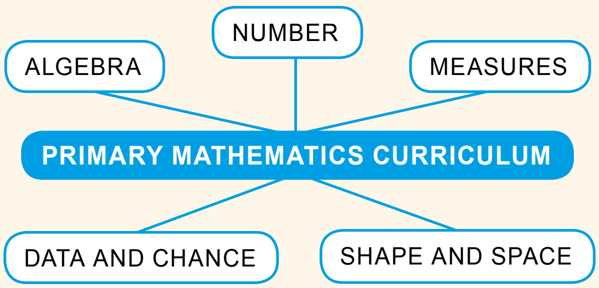
1. pupil-centred learning
2. active participation
3. problem solving
4. critical thinking
5. real-life contextual exercises
6. mathematical communication and reasoning

Teachers must provide a conducive environment for learning Mathematics in the classroom that encourages creativity and enjoyment. When introducing a concept to pupils, teachers need to ensure that pupils are able to relate mathematical activities and problems to relevant and real-life situations. Teaching mathematical concepts in real-life contexts and providing hands-on experience assist pupils to understand the concepts. Therefore, teachers need to provide mathematical contexts that are relevant to the pupils. Pupils need to apply the concepts and skills in various areas of Mathematics to find solutions to problems involving real-life situations. This series engages the pupils to learn by the Concrete-Pictorial-Abstract (C-P-A) approach:

Exploring concepts using **concrete** materials, leading to the use of **pictorial** representations and then, the **abstract**. Using this approach, pupils are first introduced to a concept through real-life examples or hands-on activities. The exercises then progress with the help of pictorial representations. Once they have a good understanding of the concept, mathematical notation; symbols and computations are introduced to achieve mastery in the abstract.

The Teacher's Resource Book provides instructions on the use of resources to help them carry out the abovementioned objectives. If a concept is taught in a comprehensive manner with clear instructions supplemented with hands-on activities and practice, most pupils would be able to achieve the set assessment target. Each pupil has a set pattern and pace of grasping concepts, but the expectation is the plateau of mathematical competency for all. In this regard, the Teacher's Resource Book serves as a support to teachers using this series.

The five main strands of the Primary Mathematics Curriculum are:



The Teacher's Resource Book supports a meaningful and holistic approach to teaching the strands of Mathematics. The buildup of concepts throughout this series is progressive and comprehensive.

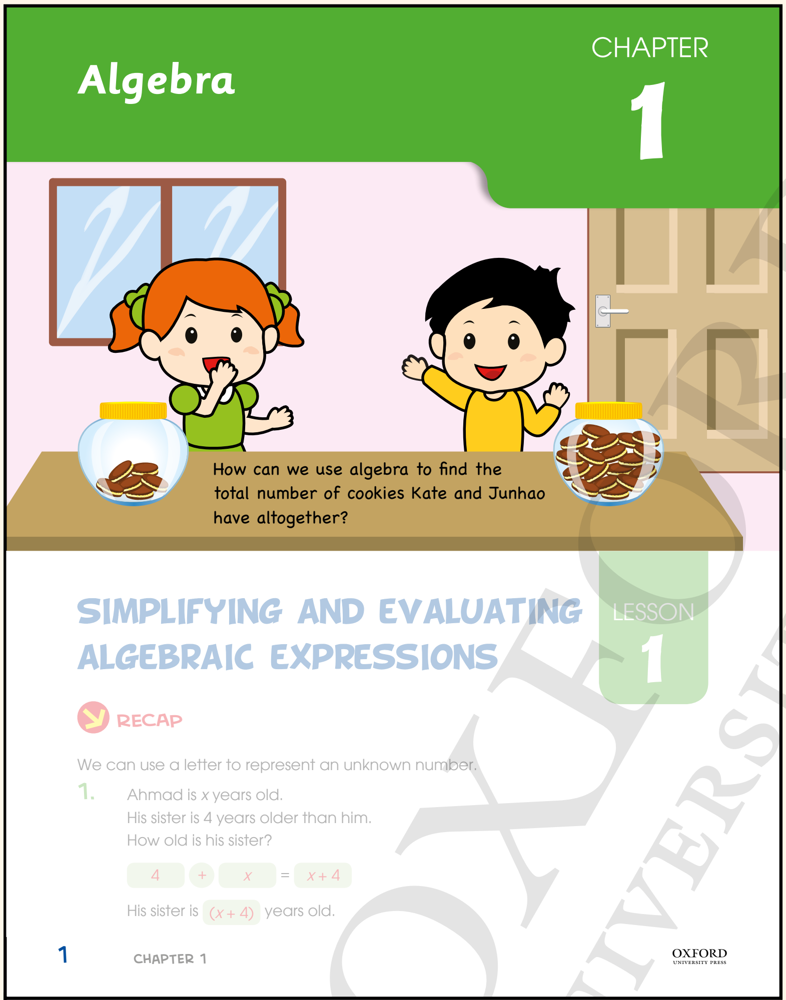
With the implementation of hands-on activities, the learning of a mathematical concept is complemented with experiences that make learning Mathematics enjoyable and give pupils the ownership of independent and group practices. Multiple strategies are implemented through activities in the form of games, model work, standard and non-standard materials and resources. The Teacher's Resource Book facilitates teachers to implement this aspect of the series proficiently. The Teacher's Resource Book provides a structure whereby teachers and coordinators can select, combine and improvise various pedagogical practices for the pupil-centric textbook and workbooks.

In this regard, the Teacher's Resource Book provides the following elements:

- **Scheme of Work** - A tabulated guide showing a breakdown of each lesson's learning objectives, learning experiences, page references of relevant resources, concrete materials required and suggested number of periods required to conduct the lesson, keeping in mind the level of difficulty of the content.
- **Syllabus Matching Grid** - A tabulated guide referring the chapters in this series to the learning objectives of the Cambridge Primary Mathematics curriculum.
- **Exposition of Lessons** - A guide for teachers to prepare and conduct lessons.
- **Answers** - Solutions to questions in the textbook and workbook are provided, along with detailed steps where required.
- **Activities** - Additional activities to assist teachers to support struggling learners and challenge advanced learners.
- **Navigating through the Assessment Activities and Exercises** - An essay explaining to teachers how to use the resources provided effectively when conducting the lessons. The resources include formative and progressive exercises, activities and assessments provided in the textbook and workbook.
- **Activity Handbook** - Activity templates and worksheets for pupils to use when carrying out activities and to supplement the lessons.

ALGEBRA

CHAPTER 1



Textbook 6 P1

Related Resources
NSPM Textbook 6 (P1 – 15)
NSPM Workbook 6A (P1 – 21)

Materials
Mini whiteboard, markers

Lesson

Lesson 1	Simplifying and Evaluating Algebraic Expressions
Lesson 2	Solving Word Problems

Problem Solving, Maths Journal and Pupil Review

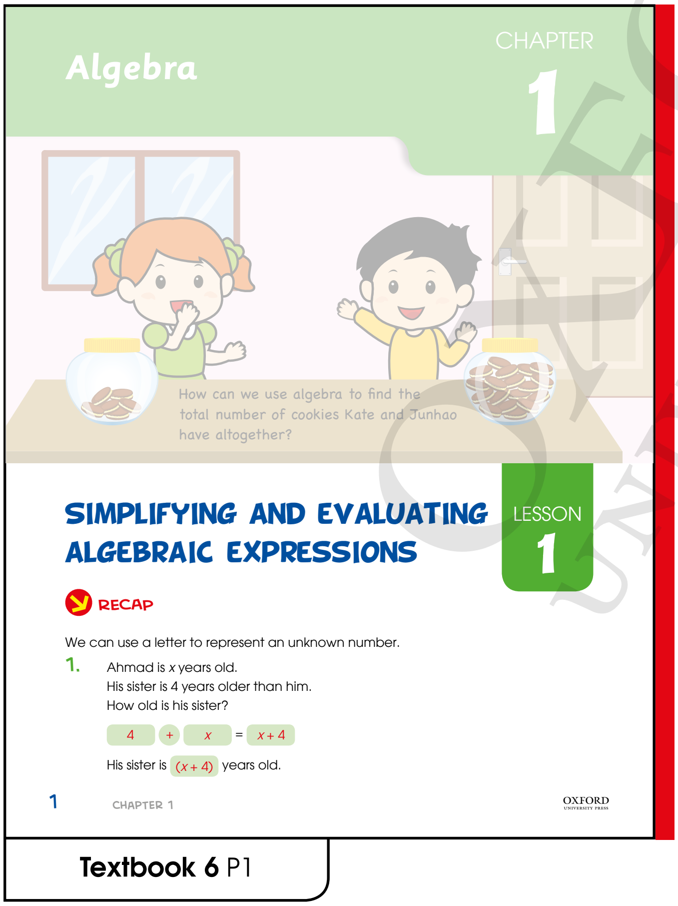
INTRODUCTION

This chapter introduces the concept of algebra. Pupils will learn to express numbers and quantities algebraically, i.e. use letters to represent unknown numbers. Subsequently, pupils can utilise letters and symbols to form algebraic expressions as well as algebraic equations.

LESSON 1 SIMPLIFYING AND EVALUATING ALGEBRAIC EXPRESSIONS

LEARNING OBJECTIVE

1. Solve problems involving the simplification and evaluation of algebraic expressions.


Algebra

CHAPTER 1

How can we use algebra to find the total number of cookies Kate and Junhao have altogether?

SIMPLIFYING AND EVALUATING ALGEBRAIC EXPRESSIONS

LESSON 1

RECAP

We can use a letter to represent an unknown number.

1. Ahmad is x years old.
His sister is 4 years older than him.
How old is his sister?

$4 + x = x + 4$

His sister is $(x + 4)$ years old.

1 CHAPTER 1 OXFORD

Textbook 6 P1

RECAP

Recap with pupils that an expression consisting of a letter that represents an unknown number, is an algebraic expression. Point out to pupils that examples 1 to 4 show four different algebraic expressions which involve the four different operations each.

2. There are 9 apples in a basket.
y apples are rotten and are thrown away.
How many apples are left?

$9 - y = 9 - y$

$(9 - y)$ apples are left.

3. There are p plates and twice as many bowls as plates.
How many bowls are there?

$p \times 2 = 2p$

There are $2p$ bowls.

4. 7 children share q biscuits equally.
How many biscuits does each child get?

$q \div 7 = \frac{q}{7}$

Each child gets $\frac{q}{7}$ biscuits.

IN FOCUS

How can we find the total number of cookies Kate and Junhao have altogether?

Textbook 6 P2

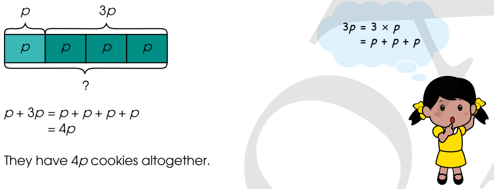
IN FOCUS

Get pupils to express the number of cookies each child has algebraically, and explore the idea of putting these expressions together to express the sum of cookies in one expression.

LET'S LEARN

Simplifying algebraic expressions

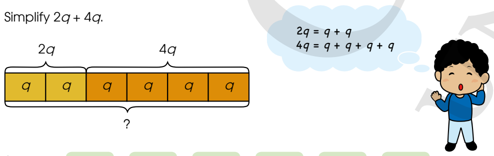
1. Kate has p cookies and Junhao has $3p$ cookies. How many cookies do they have altogether?



$p + 3p = p + p + p + p$
$= 4p$

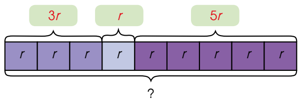
They have $4p$ cookies altogether.

2. Simplify $2q + 4q$.



$2q + 4q = q + q + q + q + q + q$
$= 6q$

3. Simplify $3r + r + 5r$.



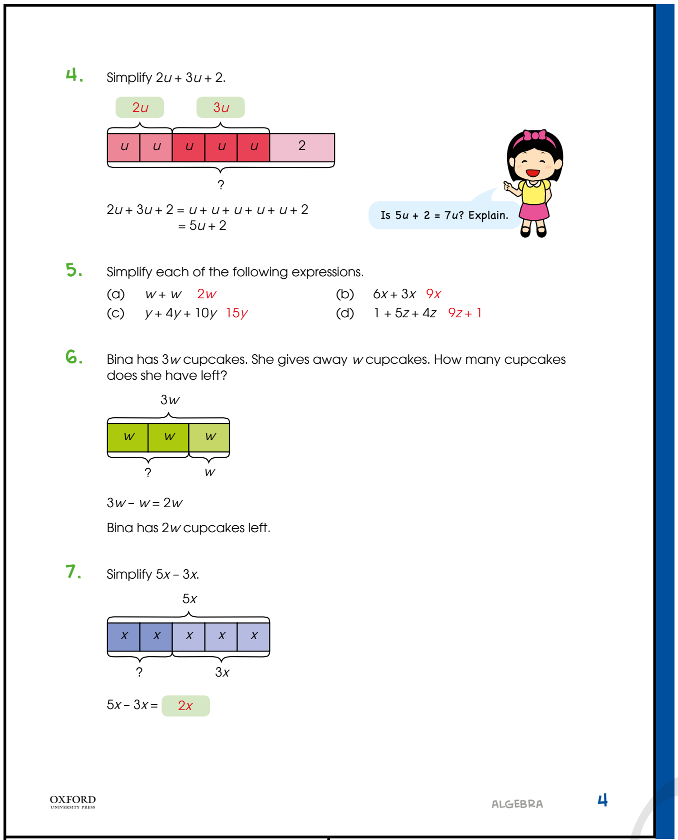
$3r + r + 5r = 9r$

Textbook 6 P3

LET'S LEARN

In Let's Learn 1, the use of concrete materials such as multilink cubes or algebraic tiles help pupils visualise and make sense of the context. Such visualisation can be extended to pictorial form using the bar model as shown in the example. Pupils will explore and understand the concept of the simplification of algebraic expressions involving addition.

For Let's Learn 2 to 5, guide pupils to simplify algebraic expressions involving addition based on different contexts.



4. Simplify $2u + 3u + 2$.

$2u + 3u + 2 = u + u + u + u + u + 2$
$= 5u + 2$

5. Simplify each of the following expressions.
(a) $w + w$ $2w$ (b) $6x + 3x$ $9x$
(c) $y + 4y + 10y$ $15y$ (d) $1 + 5z + 4z$ $9z + 1$

6. Bina has $3w$ cupcakes. She gives away w cupcakes. How many cupcakes does she have left?

$3w - w = 2w$

Bina has $2w$ cupcakes left.

7. Simplify $5x - 3x$.

$5x - 3x =$ $2x$

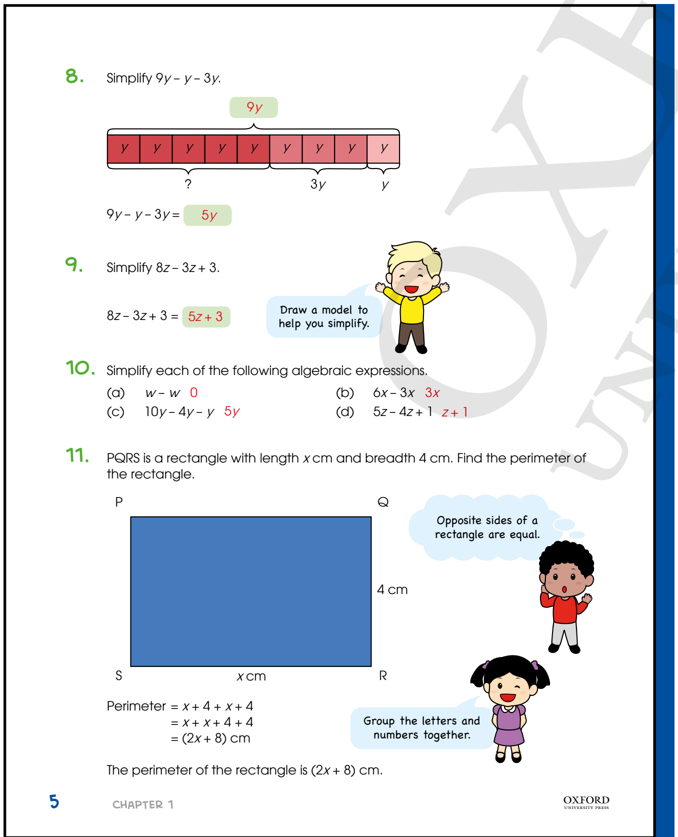
OXFORD ALGEBRA 4

Textbook 6 P4

In Let's Learn 5, note that it must be pointed out that we can simplify $w + w = 2w$, but $2 + w \neq 2w$. Get pupils to explore and explain why, with the help of algebraic tiles or bar models.

Let's Learn 6 uses concrete materials such as multilink cubes or algebraic tiles to help pupils visualise and make sense of the context. Such visualisation can be extended to pictorial form using the bar model as shown in the example. Pupils will explore and understand the concept of the simplification of algebraic expressions involving subtraction. Note that it must be pointed out that we can simplify $3w - w = 2w$, but $3 - w \neq 2w$. Get pupils to explore and explain why, with the help of algebraic tiles or bar models.

For Let's Learn 7 to 10, guide pupils to simplify algebraic expressions involving subtraction based on different contexts.



8. Simplify $9y - y - 3y$.

$9y - y - 3y =$ $5y$

9. Simplify $8z - 3z + 3$.

$8z - 3z + 3 =$ $5z + 3$

10. Simplify each of the following algebraic expressions.
(a) $w - w$ 0 (b) $6x - 3x$ $3x$
(c) $10y - 4y - y$ $5y$ (d) $5z - 4z + 1$ $z + 1$

11. PQRS is a rectangle with length x cm and breadth 4 cm. Find the perimeter of the rectangle.

Perimeter $= x + 4 + x + 4$
$= x + x + 4 + 4$
$= (2x + 8)$ cm

The perimeter of the rectangle is $(2x + 8)$ cm.

5 CHAPTER 1 OXFORD

Textbook 6 P5

Other pointers for the pupils are:
$w - w = 0$ and not $0w$;
$2w - w = w$, and not $1w$.
Explain that $1 \times w = w$.

For Let's Learn 11 to 13, guide pupils to simplify algebraic expressions, based on different contexts. Remind pupils to group variables of the same type together, i.e. letters or numbers, before simplifying them.

12. Simplify $5y + 4 - 2y - 3$.

$$5y + 4 - 2y - 3 = 5y - 2y + 4 - 3$$
$$= 3y + 1$$

13. Simplify each of the following algebraic expressions.

(a) $p + 1 + p$ $2p + 1$ (b) $5 + 9q - 2q$ $5 + 7q$
(c) $2r + 4 - 2r + 3$ 7 (d) $8s + 7 - 1 - 2s$ $6s + 6$

Draw a model to show how you find each answer.

Evaluating algebraic expressions

14. Find the value of $a - 1$ when $a = 4$.

We can find the value of an algebraic expression by substituting the letter with the given number.

$a - 1 = 4 - 1$
$= 3$

Substitute a with 4.

So, when $a = 4$, the value of $a - 1$ is 3.

15. Find the value of $9 + b$ when $b = 2$.

$9 + b = 9 + 2$
$= 11$

16. Find the value of $3c + 15$ when $c = 1$.

$3c + 15 = 3 \times 1 + 15$
$= 3 + 15$
$= 18$

$3c = 3 \times c$

17. Find the value of $20 - 2d$ when $d = 3$.

$20 - 2d = 20 - 2 \times 3$
$= 20 - 6$
$= 14$

Which operation should we do first?

OXFORD UNIVERSITY PRESS ALGEBRA 6

Textbook 6 P6

For Let's Learn 14, explain that the algebraic expression can be evaluated when the letter is substituted with a given number.

For Let's Learn 15 to 19, guide pupils to evaluate the algebraic expressions involving the various operations.

It is important to emphasise to pupils that they must present their working correctly. For example, pupils should not write:

$3c + 15 = 3 \times 1$
$= 3 + 15$
$= 18.$

This is a common error made by pupils.

18. Find the value of $\frac{10 - e}{4}$ when $e = 6$.

$\frac{10 - e}{4} = \frac{10 - 6}{4}$
$= \frac{4}{4}$
$= 1$

Substitute e with 6.

19. Find the value of each of the following expressions when $f = 4$.

(a) $f + 5$ 9 (b) $f - 4$ 0
(c) $9f$ 36 (d) $3f - 8$ 4
(e) $3 + 5f$ 23 (f) $\frac{f + 2}{3}$ 2

PRACTICE

1. Simplify.

(a) $a + a + a + a$ $4a$ (b) $4b + 3b$ $7b$
(c) $6c + 4c + 2c$ $12c$ (d) $8d - 5d$ $3d$
(e) $12e - 3e - 8e$ e (f) $5f + 8f - 9f$ $4f$
(g) $2g + 3 + 4g$ $6g + 3$ (h) $8 - 12h + 12$ $20 - 12h$
(i) $5i + 7 - 3i + 6$ $2i + 13$ (j) $15 + 10j - 12 + 5j$ $15j + 3$

2. Find the value of each of the following expressions when $p = 5$.

(a) $p + 5$ 10 (b) $p - 4$ 1
(c) $3p$ 15 (d) $\frac{p}{5}$ 1
(e) $2p - 8$ 2 (f) $5p + 3$ 28
(g) $\frac{6p}{5}$ 6 (h) $39 - 4p$ 19
(i) $16 + 7p$ 51 (j) $\frac{8p}{2}$ 20
(k) $\frac{p + 3}{4}$ 2 (l) $12 - \frac{3p}{5}$ 9

3. Find the value of each of the following.

(a) $4q - 3$ when $q = 4$ 13 (b) $8 - 2r$ when $r = 3$ 2
(c) $\frac{5s}{4}$ when $s = 8$ 10 (d) $\frac{t + 1}{2}$ when $t = 4$ $2\frac{1}{2}$

Complete Workbook 6A, Worksheet 1 • Pages 1 – 6

7 CHAPTER 1 OXFORD UNIVERSITY PRESS

Textbook 6 P7

PRACTICE

Allow pupils to discuss and work in pairs or groups. Then, go through the questions and solutions with the class. It is important that pupils grasp the relevant concepts before they are given independent work.

Independent seatwork

Assign pupils to complete Worksheet 1 (Workbook 6A P1 – 6).

Answers Worksheet 1 (Workbook 6A P1 – 6)

1. (a) $2p$
   (b) $4q$
   (c) $4r$
   (d) $13s$

2. (a) $2p$
   (b) $2q$
   (c) $7r$
   (d) 0

3. (a) $10m + 8$
   (b) $n + 5$
   (c) $20 - 3p$
   (d) $7q - 2$
   (e) $14 + r$
   (f) $6s + 8$
   (g) $1 + 10x$
   (h) $11y + 9$

4. (a) 10
   (b) 13
   (c) 122
   (d) 0
   (e) 10
   (f) 21

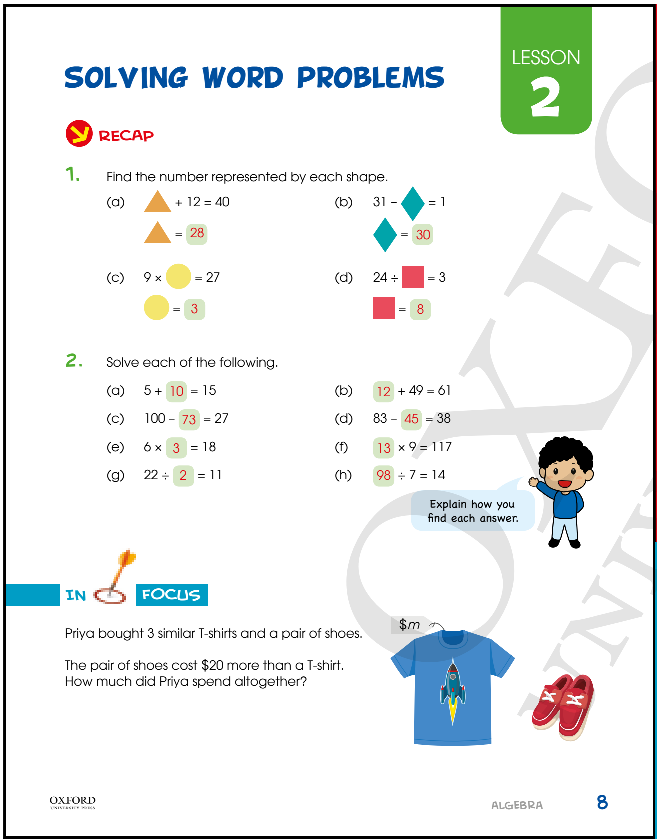
5. (a) 15
   (b) 7
   (c) 8
   (d) 4
   (e) 0
   (f) 17
   (g) 1
   (h) $4\frac{1}{2}$
   (i) 4

LESSON
2

SOLVING WORD PROBLEMS

LEARNING OBJECTIVE

1. Solve word problems involving unknown quantities expressed in algebraic terms.


SOLVING WORD PROBLEMS

LESSON
2

RECAP

1. Find the number represented by each shape.

(a) ▲ + 12 = 40
▲ = 28

(b) 31 − ◆ = 1
◆ = 30

(c) 9 × ● = 27
● = 3

(d) 24 ÷ ■ = 3
■ = 8

2. Solve each of the following.

(a) 5 + 10 = 15
(b) 12 + 49 = 61
(c) 100 − 73 = 27
(d) 83 − 45 = 38
(e) 6 × 3 = 18
(f) 13 × 9 = 117
(g) 22 ÷ 2 = 11
(h) 98 ÷ 7 = 14

Explain how you find each answer.

IN FOCUS

Priya bought 3 similar T-shirts and a pair of shoes.

The pair of shoes cost $20 more than a T-shirt.
How much did Priya spend altogether?

$m

OXFORD UNIVERSITY PRESS

ALGEBRA 8

Textbook 6 P8

RECAP

Get pupils to recall questions they did in previous years, of finding the unknown value represented by a shape or the missing value in a box. Solving for these values is similar to finding the unknown value represented by a letter in an algebraic expression.

IN FOCUS

Get pupils to relate to solving problems in real-world contexts, using algebraic expressions and equations. Pupils may solve the problem with the bar modelling method or other methods; however, encourage pupils to try using algebra.

LET'S LEARN

1. Priya bought 3 similar T-shirts at $\$m$ each and a pair of shoes that cost \$20 more than a T-shirt.

(a) Find the amount of money Priya spent in terms of m.
(b) Each T-shirt cost \$8. How much did Priya spend?

(a) Cost of 3 T-shirts = $\$m \times 3$
= $\$3m$

Cost of the pair of shoes = $\$m + \$20$
= $\$(m + 20)$

Amount Priya spent = $\$3m + \$m + \$20$
= $\$(4m + 20)$

Priya spent $\$(4m + 20)$.

(b) Since each T-shirt cost \$8, $m = 8$.

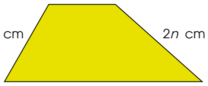
Substitute m with 8.

$4m + 20 = 4 \times 8 + 20$
$= 32 + 20$
$= 52$

Priya spent \$52.

2. The diagram shows a 4-sided figure and the lengths of its sides.

(a) Find the perimeter of the figure in terms of n.
(b) When $n = 4$, find the perimeter of the figure.



(a) Perimeter = $n + n + 2 + 3n + 2n$
= $(7n + 2)$ cm

The perimeter of the figure is $(7n + 2)$ cm.

(b) Perimeter = $7n + 2$
= $7 \times 4 + 2$
= $28 + 2$
= 30 cm

Substitute n with 4.

The perimeter of the figure is 30 cm.

Textbook 6 P9

LET'S LEARN

In Let's Learn 1, pupils need to first understand the information in the context given and form the algebraic expression for the amount of money spent. Following which, they are required to calculate the total amount spent based on the value assigned to the unknown variable. In this example, pupils will go through the process of formulating the algebraic expression and evaluating it.

For Let's Learn 2, guide pupils to find the perimeter in terms of n. Ensure that they understand the need to multiply 7 by the given value of n and to include the '+2' after.

3. Tom bought p similar sketchbooks at \$4 each.

(a) Find the amount Tom spent in terms of p.
(b) Tom bought 9 sketchbooks and gave the cashier \$50. How much did he receive in change?

(a) Amount Tom spent = $\$4 \times p$
= $\$4p$

(b) Amount Tom spent = $\$4 \times 9$
= \$36

Amount of change received = \$50 − \$36
= \$14

Tom received \$14 in change.

4. In a box, there are q red marbles and $(3q + 1)$ blue marbles. There are 12 red marbles. How many marbles are there in the box altogether?

Total number of marbles = $q + 3q + 1$
= $4q + 1$
= $4 \times 12 + 1$
= 49

Substitute q with 12.

There are 49 marbles in the box altogether.

5. Weiming has twice as much money as Ann and Farhan has \$5 more than Ann. Ann has $\$r$.

(a) Find the total amount of money the three pupils have in terms of r.
(b) Ann has \$25. Find the average amount of money each pupil has.

(a) Total amount = $\$(r + 2r + r + 5)$
= $\$(4r + 5)$

The three pupils have a total of $\$(4r + 5)$.

Textbook 6 P10

For Let's Learn 3, remind pupils that the information given in part (b), provides the value of p to substitute into the algebraic expression formed.

For Let's Learn 4, get pupils to read the question carefully and to pick out the value to substitute q with.

For Let's Learn 5, recap with pupils that they have learnt in Grade 5 how to find the average.

(b) r = 25

Average amount each pupil has

$= \frac{4r+5}{3}$

$= \frac{4 \times 25 + 5}{3}$

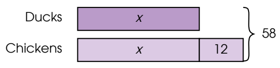
$= \frac{105}{3}$

= \$35

Substitute r with 25.

Each pupil has an average of \$35.

6. At a farm, there are 58 chickens and ducks. There are 12 more chickens than ducks. How many ducks are there?



We can use x to represent the number of ducks. So, the number of chickens is represented by $x + 12$.

We can write an algebraic expression for the total number of chickens and ducks.

Total number of chickens and ducks = $x + x + 12$
$= 2x + 12$

Since we know that the total number of chickens and ducks is 58, we can write an **algebraic equation**.

$2x = 58 - 12$
$= 46$
$x = 46 \div 2$
$= 23$

$2x + 12 = 58$ is an algebraic equation. Find the value of x.

There are 23 ducks at the farm.

11 CHAPTER 1 OXFORD

Textbook 6 P11

Let's Learn 6 allows pupils to explore beyond forming algebraic expressions. They will be required to come up with an algebraic equation and subsequently solve it. To help pupils visualise, model drawing with the number of ducks represented by a bar labelled as x, facilitates the formation of a simple algebraic equation. The operations involved in solving for x can be understood more clearly and carried out with the help of the bar model.

7. Kate is y years old and her brother is 5 years older than she is.

(a) Find Kate's age in 2 years' time in terms of y.

(b) Find her brother's age in 2 years' time in terms of y.

(c) In 2 years' time, the sum of their ages will be 31. How old is Kate now?

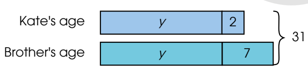
(a) Kate's age now = y
Kate's age in 2 years' time = $y + 2$

In 2 years' time, Kate will be ($y + 2$) years old.

(b) Her brother's age now = $y + 5$
Her brother's age in 2 years' time = $y + 5 + 2$
$= y + 7$

In 2 years' time, Kate's brother will be ($y + 7$) years old.

(c) In 2 years' time



$y = \frac{31 - 2 - 7}{2}$

$= \frac{22}{2}$

$= 11$

Kate is 11 years old now.

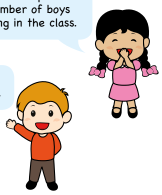
OXFORD ALGEBRA 12

Textbook 6 P12

For Let's Learn 7 and 8, guide pupils to form algebraic equations and solve them, based on different contexts. Encourage pupils to draw bar models to help them visualise and understand the questions before deciding on the operations needed to solve them.

8. There were 42 pupils in a class at first. After 6 boys left the class, there were 3 times as many girls as boys. How many girls were there in the class?

Boys	z	6		42
Girls	z	z	z	



$$z = \frac{42 - 6}{4}$$
$$= \frac{36}{4}$$
$$= 9$$

$$3z = 3 \times 9$$
$$= 27$$

There were 27 girls in the class.

ACTIVITY TIME

Work in pairs.

1. Look at the algebraic equations given.
   (a) $w - 6 = 14$ (b) $3x + 3 = 18$
   (c) $30 - 2y = 20$ (d) $5z = 95$

What you need:

2. Choose an equation and write a word problem to describe the equation.
3. Get your partner to draw a model and solve the word problem.
4. Check your partner's answer.
5. Switch roles and repeat 1 to 4.

13 CHAPTER 1 OXFORD

Textbook 6 P13

ACTIVITY TIME

Writing word problems based on algebraic equations given will allow pupils to exercise their creativity in addition to checking their understanding of the meaning of these equations. It is also important for pupils to correctly apply the relevant operations to solve the equations, with the use of bar models when necessary.

PRACTICE

1. Ahmad is h cm tall. He is 20 cm taller than his younger brother but 35 cm shorter than his father.
(a) Find the height of Ahmad's younger brother in terms of h. $(h - 20)$ cm
(b) Find the height of Ahmad's father in terms of h. $(h + 35)$ cm
(c) Ahmad is 147 cm tall. Find their average height. 152 cm

2. In a tank, there are k angelfish and 4 times as many guppies as angelfish. There are also 3 more goldfish than guppies in the tank. There are 30 fish in the tank in total. How many goldfish are there? 15

3. There were m pupils in a class at first. After a week, 4 more pupils joined the class. 30
(a) Find the number of pupils in the class after a week in terms of m. $m - 20$
(b) There were 40 pupils in the class after a week. How many pupils were there in the class at first? 30

4. Xinyi used 2 bottles of mango syrup and 9 litres of water to make a mango drink. There were n litres of mango syrup in each bottle and she then poured the mango drink equally into 20 glasses.
(a) What was the volume of mango drink in each glass? Give your answer in terms of n. $\frac{2n + 9}{20}$ ℓ
(b) There were 2 ℓ of mango syrup in each bottle. How much mango drink did Xinyi make in all? 13 ℓ

Complete Workbook **6A**, Worksheet **2** • Pages **7 – 14**

MIND WORKOUT

There are two machines, Machine A and Machine B. Each minute, Machine A produces 3 more toys than Machine B. In 5 minutes, Machine A produces n toys and Machine B produces half the number of toys produced by Machine A. How many toys can both machines produce in 1 hour? 540

OXFORD ALGEBRA 14

Textbook 6 P14

PRACTICE

Allow pupils to discuss and work in pairs or groups. Then, go through the questions and solutions with the class.

Independent seatwork

Assign pupils to complete Worksheet 2 (Workbook 6A P7 – 14)

1. $2n + 1 = 2 \times 50 + 1$
   $= 100 + 1$
   $= 101$
   The number is 101.

2. (a) $x + x - 40 = 2x - 40$
   Ahmad and Weiming have $(2x - 40)$ marbles.
   (b) $2x - 40 = 2 \times 55 - 40$
   $= 110 - 40$
   $= 70$
   They have 70 marbles altogether.

3. (a) $p - 120$
   Raju had $(p - 120)$ foreign stamps at first.
   (b) $p - 120 + 2p = 165 - 120 + 2 \times 165$
   $= 165 - 120 + 330$
   $= 375$
   He had 375 foreign stamps in the end.

4. (a) $\frac{q - 24}{40}$
   Each pupil received $\frac{q - 24}{40}$ sweets.
   (b) $\frac{q - 24}{40} = \frac{144 - 24}{40}$
   $= \frac{120}{40}$
   $= 3$
   Each pupil received 3 sweets.

5. (a) $w + 2w = 3w$
   $3w = 177$
   $w = 177 \div 3$
   $= 59$
   The bag costs $59
   (b) $2w = 59 \times 2$
   $= 188$
   The watch costs $118

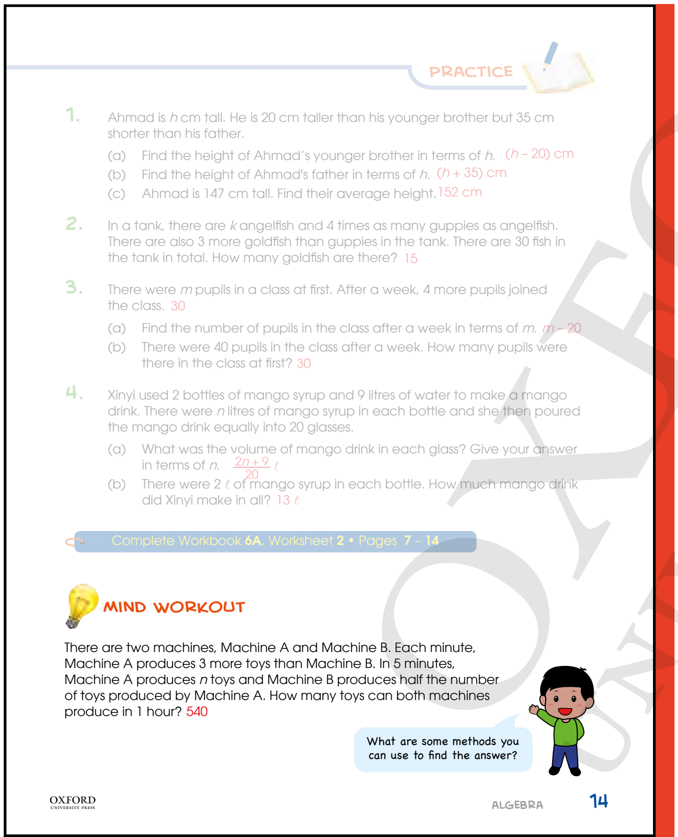
6 (a) Farhan saves $\$(x + 1)$ on Tuesday.
   (b) $x + x + 1 = 2x + 1$
   Farhan saves $\$(2x + 1)$ altogether on Monday and Tuesday.
   (c) $2x + 1 = 2 \times 3 + 1$
   $= 7$
   Frahan saves $7 altogether on Monday and Tuesday.

7. (a) $x + 25$
   Bala's mother is $(x + 25)$ years old.
   (b) $x + x + 25 = 2x + 25$
   The sum of their ages now is $(2x + 25)$ years.
   (c) $x + 25 = 12 + 25$
   $= 37$
   His mother is 37 years old.

8. (a) $24 + 24 + x + 24 + 2x = 72 + 3x$
   The sum of the money shared was $\$(72 + 3x)$.
   (b) $x = 30 - 24$
   $= 6$
   $72 + 3x = 72 + 3 \times 6$
   $= 72 + 18$
   $= 90$
   The sum of money shared was $90.

9. (a) $y + y + 500 + y - 210 = 3y + 290$
   The total mass of the three parcels is $(3y + 290)$ g.
   (b) $3y + 290 = 2000$
   $3y = 2000 - 290$
   $= 1710$
   $y = 1710 \div 3$
   $= 570$
   $y \div 500 = 1070$
   $y - 210 = 360$
   The mass of the first parcel is 570 g, the mass of the second parcel is 1070 g and the mass of the third parcel is 360 g.

PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW


PRACTICE

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Complete Workbook **6A**, Worksheet **2** • Pages **7 – 14**

MIND WORKOUT

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OXFORD

ALGEBRA 14

Textbook 6 P14

MIND WORKOUT

The Mind Workout involves the concept of rate, with the use of letters to represent a particular number of toys. Pupils will need to understand the question well, and apply the concept of rate, in addition to forming an algebraic equation and solving it.

Mind Workout

Date: ____________

The figure below is made up of 8 squares and its perimeter is $36p$ cm.

(a) What is the perimeter of each square?

(b) Siti rearranges the 8 squares to form a figure with the greatest possible perimeter. What is the perimeter of the figure formed?

(a) $36p \div 12 = 3p$
$3p \times 4 = 12p$

The perimeter of each square is $12p$ cm.

(b) $18 \times 3p = 54p$

The perimeter of the figure formed is $54p$ cm.

OXFORD UNIVERSITY PRESS   Algebra   15

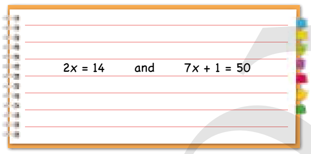
Workbook 6A P15

Mind Workout

For this question, guide pupils by asking them to count how many sides of the squares are included in the perimeter of the figure.

MATHS JOURNAL

Raju solved the algebraic equations and found that the answers are the same.



Write three other algebraic equations that give the same answer as the one above.

SELF-CHECK

I know how to...

- simplify algebraic expressions.
- evaluate algebraic expressions by substitution.
- solve word problems involving algebraic expressions and equations.

15   CHAPTER 1   OXFORD UNIVERSITY PRESS

Textbook 6 P15

MATHS JOURNAL

This Maths Journal provides good practice for pupils to reinforce their understanding of solving algebraic equations by getting them to write different algebraic equations that give the same answer when solved.

Maths Journal

Date: ____________

Is each of the following statements correct?

(a) $2a + 1$ is the same as $1 + 2a$.
Yes

(b) $3b + 4$ is the same as $4b + 3$.
No

(c) $c \times c$ is the same as $2c$.
No

(d) $5d + 2$ is the same as $7d$.
No

(e) $6e \div 5$ is the same as $\frac{6e}{5}$.
Yes

16 Chapter 1 OXFORD

Workbook 6A P16

Maths Journal

Pupils can use this Maths Journal to ensure that they have grasped the concept of algebraic expressions under the different operations.

MATHS JOURNAL

Raju solved the algebraic equations and found that the answers are the same.

$2x = 14$ and $7x + 1 = 50$

Write three other algebraic equations that give the same answer as the one above.

SELF-CHECK

I know how to...

- simplify algebraic expressions.
- evaluate algebraic expressions by substitution.
- solve word problems involving algebraic expressions and equations.

15 CHAPTER 1 OXFORD

Textbook 6 P15

SELF-CHECK

Before getting the pupils to do the self-check, review important concepts.
The self-check can be done after pupils have completed **Review 1** (Workbook 6A P17 – 21).

Answers Review 1 (Workbook 6A P17 – 21)

1. (a) $11a + 12$
   (b) $8b + 10$
   (c) $10c + 35$
   (d) $6d + 3$
   (e) $6e + 11$
   (f) f

2. (a) $(3x + 4)$ cm
   (b) $8x$ cm
   (c) $(3x + 3)$ cm
   (d) $(6x + 2)$ cm

3. (a) 9
   (b) 6
   (c) 5
   (d) 10
   (e) 1
   (f) 2
   (g) 3
   (h) 2

4. (a) $2 \times m + 5 \times m = 7m$
   Mrs Lim spent \$7m altogether.
   (b) $7 \times 4 = \$28$
   Mrs Lim spent \$28 altogether.

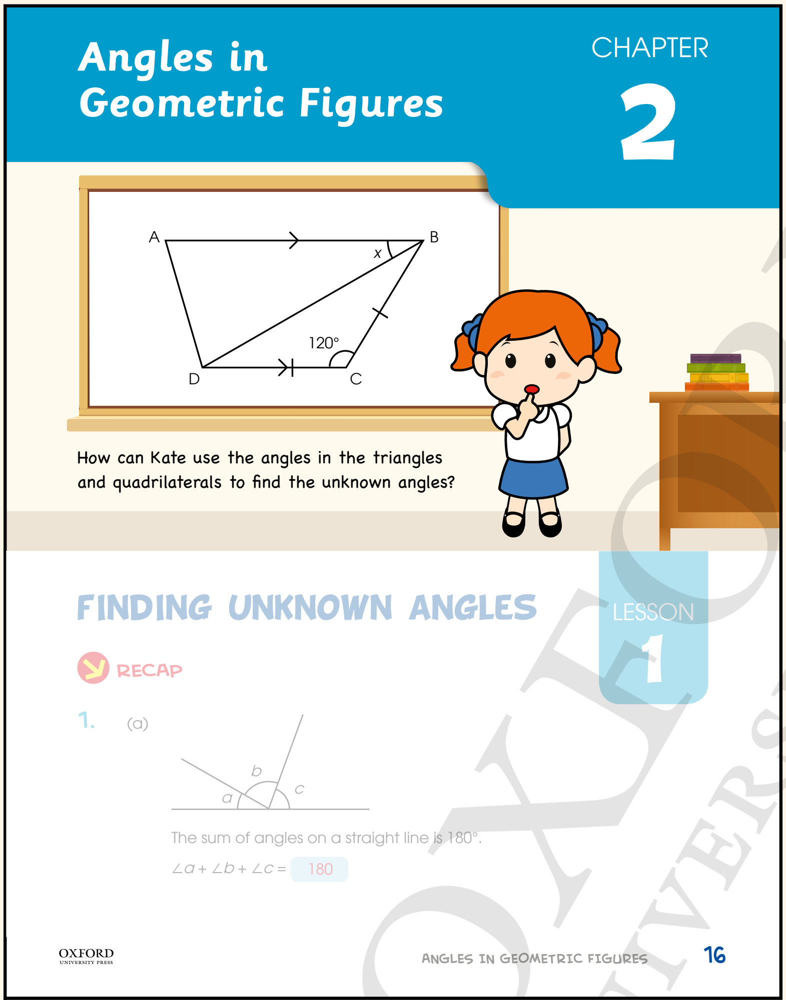
5. (a) $x + 5 + x + 3 = 3x + 10$
   The perimeter of the triangle is $(3x + 10)$ cm.
   (b) $3x + 10 = 3 \times 45 + 10$
   The perimeter of the triangle is 145 cm.

6. (a) $12 + 7y$
   Ann had $(12 + 7y)$ stickers at first.
   (b) $$\begin{aligned} 12 + 7y &= 12 + 7 \times 9 \\ &= 12 + 63 \\ &= 75 \end{aligned}$$
   Ann had 75 stickers at first.

7. (a) $2z + 3$
   There are $(2z + 3)$ green marbles.
   (b) $$\begin{aligned} 2z + 3 &= 19 \\ 2z &= 19 - 3 \\ &= 16 \\ z &= 16 \div 2 \\ &= 8 \end{aligned}$$
   There are 8 red marbles.

ANGLES IN GEOMETRIC FIGURES

CHAPTER 2


Angles in Geometric Figures

CHAPTER 2

How can Kate use the angles in the triangles and quadrilaterals to find the unknown angles?

FINDING UNKNOWN ANGLES

LESSON 1

RECAP

1. (a)

The sum of angles on a straight line is 180°.

$\angle a + \angle b + \angle c =$ 180

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ANGLES IN GEOMETRIC FIGURES 16

Textbook 6 P16

Related Resources

NSPM Textbook 6 (P16 – 32)

NSPM Workbook 6A (P22 – 39)

Materials

-

Lesson

Lesson 1 Finding Unknown Angles

Problem Solving, Maths Journal and Pupil Review

INTRODUCTION

In this lesson pupils will find unknown angles in geometric figures by applying their prior knowledge learnt in grades Four and Five of the following properties:

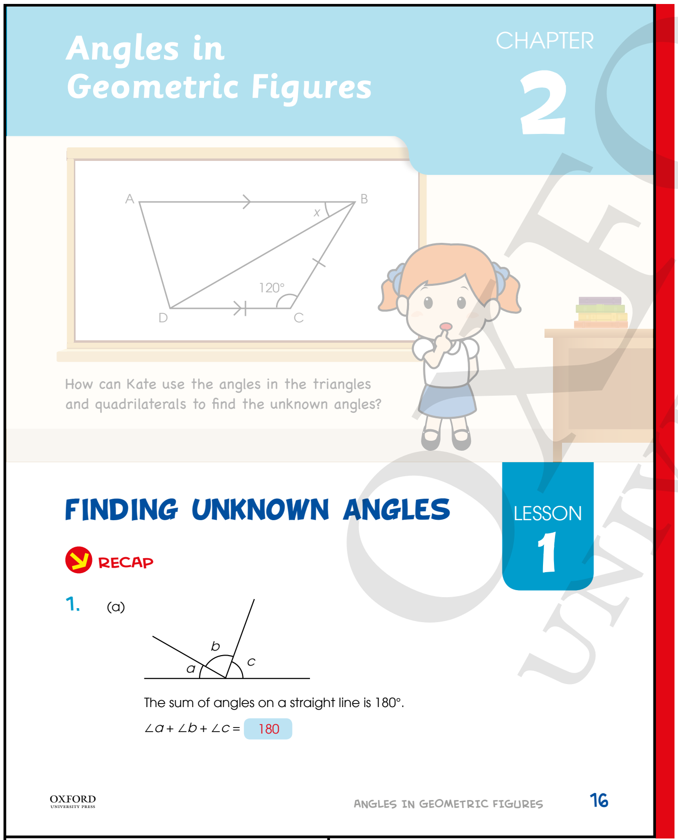
- angles on a straight line,
- angles at a point,
- vertically opposite angles,
- right-angled, isosceles and equilateral triangles,
- square, rectangle, parallelogram, rhombus and trapezium.

Pupils are expected to recognise special triangle(s) and quadrilateral(s) in a given geometric figure and use deductive reasoning to apply the relevant properties to find unknown angle(s).

LESSON 1 FINDING UNKNOWN ANGLES

LEARNING OBJECTIVE

1. Find unknown angles in geometric figures.



Textbook 6 P16

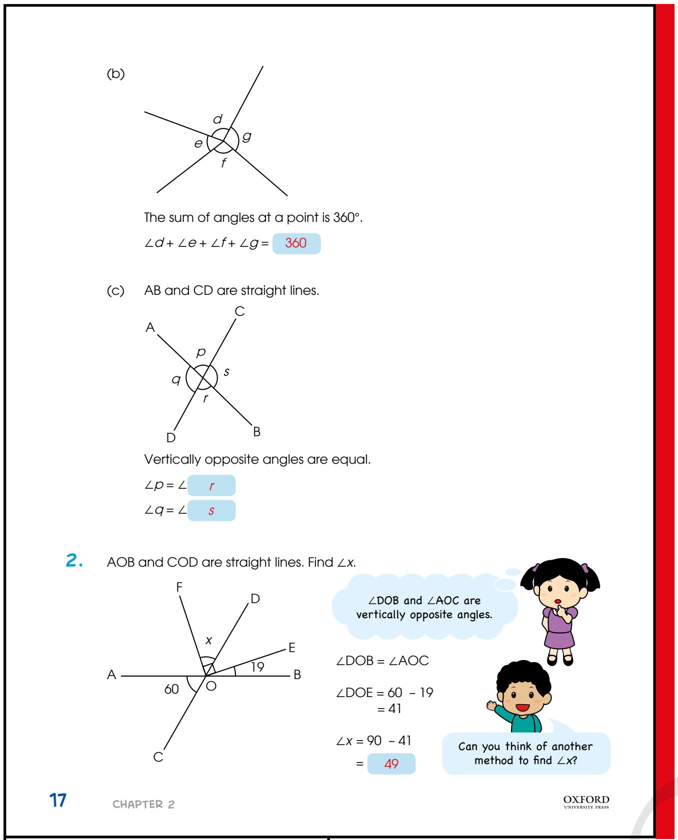
RECAP

Revise properties of angles, triangles and 4-sided figures:

For Let's Learn 1, use the visualiser to show the three figures of (a) to (c). Ask:

- What angle property do you recognise in each of the figures?
- What can you say about the marked angles in each figure?

Allow time for pupils to discuss in pairs and to verbalise the angle property of each figure, before going through the given examples with them.


(b)

The sum of angles at a point is 360°.

$\angle d + \angle e + \angle f + \angle g =$ 360

(c) AB and CD are straight lines.

Vertically opposite angles are equal.

$\angle p = \angle$ r

$\angle q = \angle$ s

2. AOB and COD are straight lines. Find $\angle x$.

$\angle DOB = \angle AOC$

$\angle DOE = 60 - 19$
$= 41$

$\angle x = 90 - 41$
$=$ 49

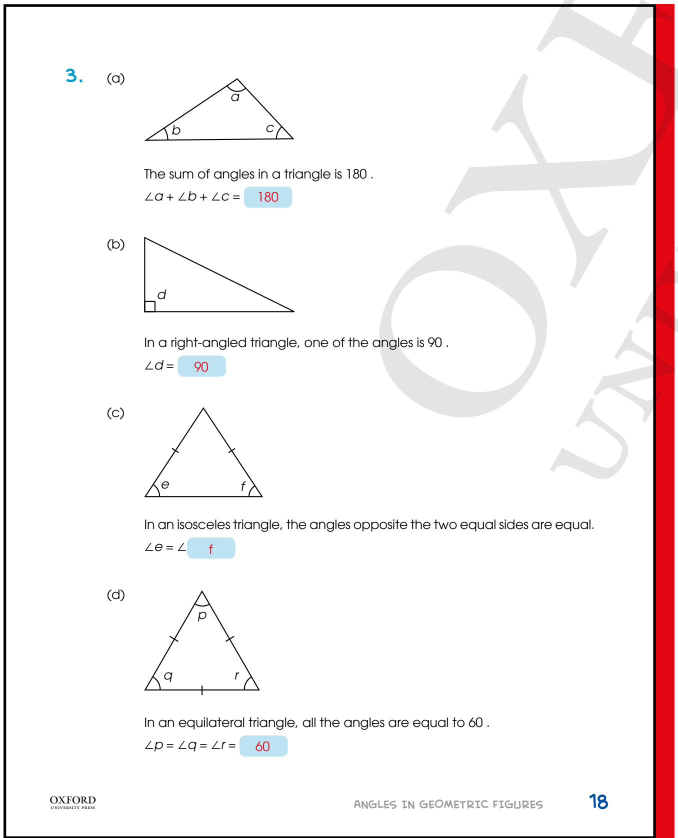
17 CHAPTER 2 OXFORD

Textbook 6 P17

For Let's Learn 2, guide the pupils by asking:

- Can you recognise the pair of vertically opposite angles in this figure?
- How can we use this angle property to find unknown $\angle x$?
- How is $\angle x$ related to $\angle DOE$ and $\angle FOE$?

Allow time for pupils to work in pairs before going through the solution with them. Get pupils to use another angle property to find $\angle x$. Hint: Use the property of sum of angles on a straight line.


3. (a)

The sum of angles in a triangle is 180 .

$\angle a + \angle b + \angle c =$ 180

(b)

In a right-angled triangle, one of the angles is 90 .

$\angle d =$ 90

(c)

In an isosceles triangle, the angles opposite the two equal sides are equal.

$\angle e = \angle$ f

(d)

In an equilateral triangle, all the angles are equal to 60 .

$\angle p = \angle q = \angle r =$ 60

OXFORD ANGLES IN GEOMETRIC FIGURES 18

Textbook 6 P18

For Let's Learn 3, first ask pupils to recall the property of a triangle and names of some special triangles that they have already learnt and list them on the whiteboard. Then ask pupils to match the four triangles of (a) to (d) with their given names. Ask:

- What angle property do you recognise in each of the triangles?
- What can you say about the marked angles in each triangle?

Ensure that pupils are familiar with all the four types of triangles and their properties.

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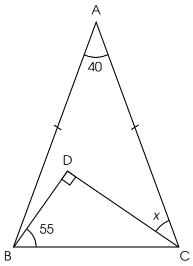
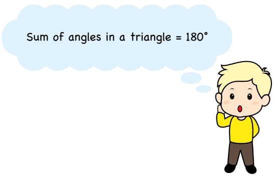
4. ABC is an isosceles triangle and BDC is a right-angled triangle. Find $\angle x$.



$\angle ACB = \angle ABC$
$= (180 - 40) \div 2$
$= 70$

$\angle DCB = 180 - 90 - 55$
$= 35$

$\angle x = 70 - 35$
$= 35$

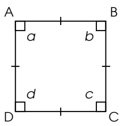


Textbook 6 P19

Let's Learn 4 makes use of the property sum of angles in a triangle.
Get pupils to work in pairs and discuss possible methods and properties they can use to find $\angle x$.
Facilitate their discussion by asking:

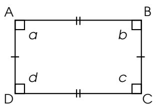
- Can you identify and name the isosceles and the right-angled triangles in this figure?
- Which is the unknown angle we need to find and what do we have to find first?
- How is $\angle x$ related to $\angle ACB$ and $\angle DCB$ and how can we find these angles?
- What can you say about $\angle ACB$ in the isosceles triangle ABC?
- What about $\angle DCB$ in the right-angled triangle BCD?

5. (a)



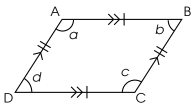
A square has 4 equal sides and 4 right angles.
$\angle a = \angle b = \angle c = \angle d = 90$

(b)



In a rectangle, the opposite sides are equal in length and there are 4 right angles.
$\angle a = \angle b = \angle c = \angle d = 90$

(c)



In a parallelogram, opposite angles are equal. The sum of each pair of angles between parallel sides is 180 .

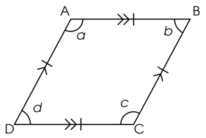
$\angle a = \angle c$, $\angle d = \angle b$
$\angle a + \angle d = 180$ and $\angle a + \angle b = 180$
$\angle c + \angle d = 180$ and $\angle c + \angle b = 180$

Textbook 6 P20

For Let's Learn 5, first get pupils to recall the names of the special 4-sided figures that they have already learnt and write these down on the whiteboard.
Then, get them to match the five quadrilaterals of (a) to (e) with their given names. Ask:

- What are the properties of each 4-sided figure?
- What can you say about the property of the marked angles in each figure?

(d)



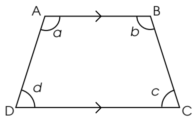
In a rhombus, the four sides are equal in length and opposite angles are equal. The sum of each pair of angles between parallel sides is 180 .

$\angle a = \angle c$, $\angle d = \angle b$

$\angle a + \angle d = 180$ and $\angle a + \angle b = 180$

$\angle c + \angle d = 180$ and $\angle c + \angle b = 180$

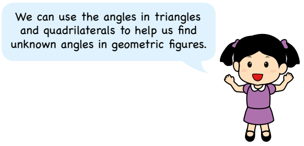
(e)



A trapezium has one pair of parallel sides. The sum of each pair of angles between parallel sides is 180 .

$\angle a + \angle d = 180$

$\angle b + \angle c = 180$



Complete Workbook **6A**, Worksheet **1A** • Pages **22 – 25**

21 CHAPTER 2 OXFORD UNIVERSITY PRESS

Textbook 6 P21

Independent seatwork

Assign pupils to complete Worksheet 1A (P22 – 25)

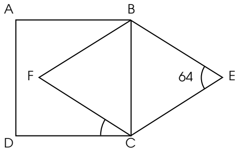
Answers

Worksheet 1A (Workbook 6A P22 – 25)

1. (a) 20
   (b) 135
   (c) 44
   (d) 24
   (e) 55
   (f) 30
   (g) $\angle w = 100°$, $\angle x = 40°$
   (h) $\angle y = 55°$, $\angle z = 35°$

IN FOCUS

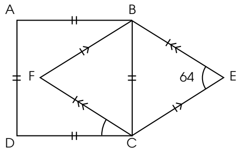
In the figure below, ABCD is a square and BECF is a rhombus.



Bala wants to find ∠DCF.
What information does he need to find first?

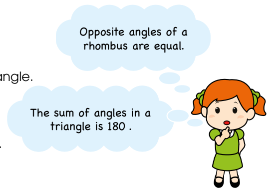
LET'S LEARN

1. ABCD is a square, BECF is a rhombus and ∠BEC = 64 . Find ∠DCF.



∠BFC = ∠BEC = 64
Since BF = FC, BFC is an isosceles triangle.
∠BCF = (180 – 64) ÷ 2
= 58

Since ABCD is a square, ∠BCD = 90 .
∠DCF = 90 – ∠BCF
= 90 – 58
= 32

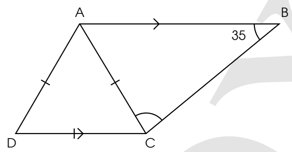


OXFORD

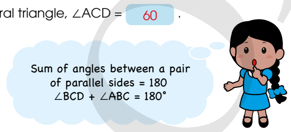
ANGLES IN GEOMETRIC FIGURES 22

Textbook 6 P22

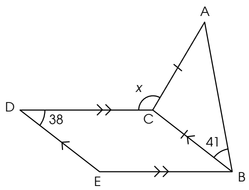
2. In the figure, ABCD is a trapezium and ACD is an equilateral triangle. ∠ABC = 35 . Find ∠ACB.



Since ACD is an equilateral triangle, ∠ACD = 60 .
∠BCD = 180 – 35
= 145
∠ACB = 145 – 60
= 85



3. ABC is an isosceles triangle and BCDE is a parallelogram. ∠CDE = 38 and ∠ABC = 41 . Find ∠x.



∠BCD = 180 – 38
= 142
∠ACB = 180 – 41 – 41
= 98
∠x = 360 – 142 – 98
= 120

23 CHAPTER 2 OXFORD

Textbook 6 P23

IN FOCUS

Show the figure on the visualiser and guide pupils by asking:

- What is the unknown angle that Bala wants to find?
- How is the given information that ABCD is a square and BECF is a rhombus useful to help Bala find the answer?
- How can we use the given ∠BEC = 64°?

Allow time for pupils to think through the questions.

LET'S LEARN

For Let's Learn 1, continuing from 'In Focus', mark out the equal and parallel sides of the square ABCD and rhombus BECF. Guide pupils to use the angle properties of a square and rhombus to find unknown angles. Ask:

- What type of triangles are BCE and BCF?
- How can we use ∠BEC = 64° to find the size of each angle in the rhombus?
- Can you find the unknown ∠DCF in the square if you know ∠BCF?

Get a pupil or a pair to show the class their method and to articulate the properties used. Ask the class if they used other alternative ways.

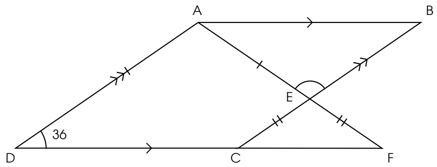
For Let's Learn 2, guide pupils by asking:

- What is the unknown angle?
- How is the unknown ∠ACB related to ∠ACD and ∠BCD? Can we find these angles first?
- How can we use the properties of equilateral triangle ACD and trapezium ABCD to find these angles?
- How do we make use of the given ∠ABC = 35° in the process?

For Let's Learn 3, guide pupils by asking:

- What is the unknown angle?
- How is the unknown ∠ACD related to ∠ACB and ∠BCD? Can we find these angles first?
- How can we use the properties of isosceles triangle ACB and parallelogram BCDE to find these angles?
- How do we make use of the given ∠ABC = 41° and ∠CDE = 38° in the process?

4. ABCD is a parallelogram. ADF and ECF are isosceles triangles and ∠ADF = 36 . Find ∠AEB.



∠BCF = ∠AFD = ∠ADF = 36

∠CEF = 180 – 36 – 36
= 108

Sum of angles in a triangle

So, ∠AEB = ∠CEF = 108

Vertically opposite angles

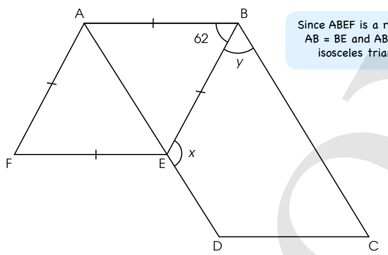
Think of another method to find the unknown angle.

Textbook 6 P24

For Let's Learn 4 to 7, get pupils to focus on the unknown angle and its relationship with any other angle(s) that can be found first. Then lead pupils to the given angle(s), angle property of given triangle(s) and/or 4-sided figure(s) as well as other angle properties that can be used to work out the solution.

In Let's Learn 4, the first line shows the angles that are equal to the given ∠ADF = 36°. Get pupils to think about why this is so before they proceed to find the other angles using the hints provided.

5. ABCD is a parallelogram, ABEF is a rhombus and ∠ABE = 62 . Find ∠x and ∠y.



Since ABEF is a rhombus, AB = BE and ABE is an isosceles triangle.

∠BEA = (180 – 62) ÷ 2
= 59

∠x = 180 – 59
= 121

Angles on a straight line

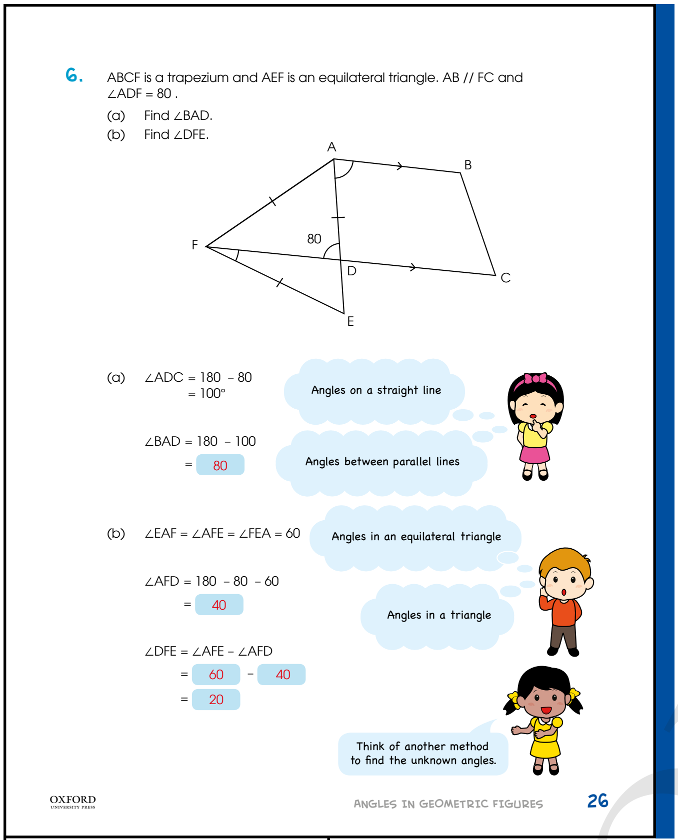
∠y = 180 – 121
= 59

Angles between parallel lines

Textbook 6 P25

For Let's Learn 5, provide the following hints:

- How is ∠x related to ∠BEA? Can we find ∠BEA first?
- If ABEF is a rhombus, what is triangle ABE?
- If ABCD is a parallelogram, what is BCDE?
- Mark the parallel lines. How is ∠y related to ∠x? What property would apply?



6. ABCF is a trapezium and AEF is an equilateral triangle. AB // FC and $\angle ADF = 80$.

(a) Find $\angle BAD$.

(b) Find $\angle DFE$.

(a) $\angle ADC = 180 - 80$
$= 100°$

Angles on a straight line

$\angle BAD = 180 - 100$
$= \boxed{80}$

Angles between parallel lines

(b) $\angle EAF = \angle AFE = \angle FEA = 60$

Angles in an equilateral triangle

$\angle AFD = 180 - 80 - 60$
$= \boxed{40}$

Angles in a triangle

$\angle DFE = \angle AFE - \angle AFD$
$= \boxed{60} - \boxed{40}$
$= \boxed{20}$

Think of another method to find the unknown angles.

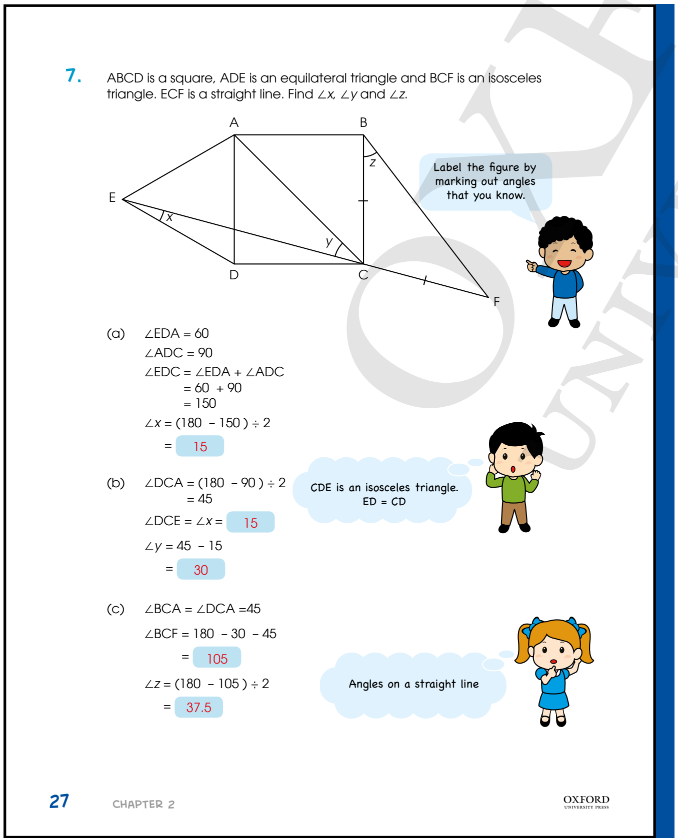
OXFORD UNIVERSITY PRESS ANGLES IN GEOMETRIC FIGURES 26

Textbook 6 P26

For Let's Learn 6, provide the following hints:

(a) If ABCF is a trapezium and AB//FC, how is the unknown ∠BAD related to ∠ADC? Can we find ∠ADC first?

(b) How is the unknown ∠DFE related to ∠AFD and ∠AFE? How can we use the property of equilateral triangle to find the angles?



7. ABCD is a square, ADE is an equilateral triangle and BCF is an isosceles triangle. ECF is a straight line. Find $\angle x$, $\angle y$ and $\angle z$.

(a) $\angle EDA = 60$
$\angle ADC = 90$
$\angle EDC = \angle EDA + \angle ADC$
$= 60 + 90$
$= 150$
$\angle x = (180 - 150) \div 2$
$= \boxed{15}$

(b) $\angle DCA = (180 - 90) \div 2$
$= 45$
$\angle DCE = \angle x = \boxed{15}$
$\angle y = 45 - 15$
$= \boxed{30}$

CDE is an isosceles triangle. ED = CD

(c) $\angle BCA = \angle DCA = 45$
$\angle BCF = 180 - 30 - 45$
$= \boxed{105}$
$\angle z = (180 - 105) \div 2$
$= \boxed{37.5}$

Angles on a straight line

27 CHAPTER 2 OXFORD UNIVERSITY PRESS

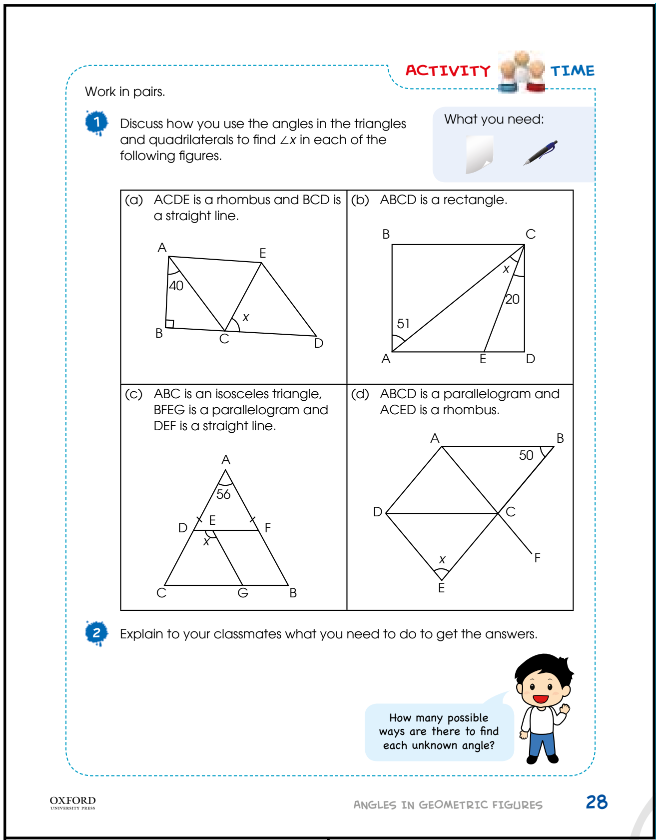
Textbook 6 P27

For Let's Learn 7, get pupils to mark out the known angles of 60° and 90° (relating to the properties of a square, equilateral triangle and isosceles triangle). Provide the following hints:

(a) What kind of triangle is ∠*x* in?

(b) How is ∠*y* related to ∠DCA and ∠DCE? What is triangle DCA?

(c) What kind of triangle is ∠*z* in? Do we know the size of ∠BCF?



ACTIVITY TIME

Work in pairs.

1. Discuss how you use the angles in the triangles and quadrilaterals to find $\angle x$ in each of the following figures.

What you need:

(a) ACDE is a rhombus and BCD is a straight line.

(b) ABCD is a rectangle.

(c) ABC is an isosceles triangle, BFEG is a parallelogram and DEF is a straight line.

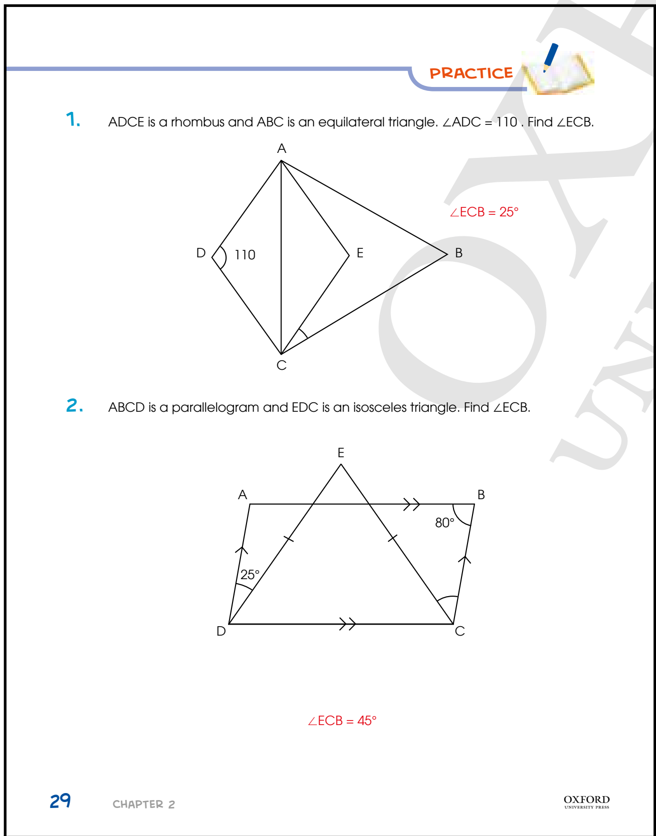
(d) ABCD is a parallelogram and ACED is a rhombus.

2. Explain to your classmates what you need to do to get the answers.

Textbook 6 P28

ACTIVITY TIME

In this activity, pupils can also take turns to work as a Thinker-Doer pair. Allow both pupils to read the question first and decide who the Doer will be. As the Doer solves the problem the Thinker listens, carefully following the explanations, and asking questions to clarify the process the Doer is using.



PRACTICE

1. ADCE is a rhombus and ABC is an equilateral triangle. $\angle ADC = 110$. Find $\angle ECB$.

$\angle ECB = 25°$

2. ABCD is a parallelogram and EDC is an isosceles triangle. Find $\angle ECB$.

$\angle ECB = 45°$

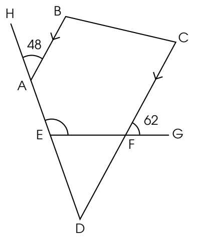
Textbook 6 P29

PRACTICE

For questions 1 to 4, allow pupils to try the questions on their own. After they have done so, get them to exchange their work with a partner to check each other's answers.

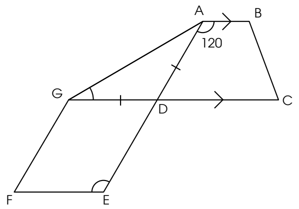
Select some pupils to explain what they did to the class. Discuss other methods that other pupils might have used.

3. ABCD is a trapezium. EFG and DEAH are straight lines. Find ∠AEF.



∠AEF = 110°

4. ABCD is a trapezium, DEFG is a parallelogram and ADG is an isosceles triangle. GDC and ADE are straight lines. Find ∠DGA and ∠DEF.

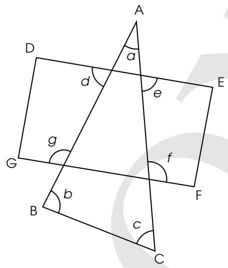


∠DGA = 30°
∠DEF = 120°

Textbook 6 P30

5. ABC is a triangle and DEFG is a rectangle. Find the sum of ∠a, ∠b, ∠c, ∠d, ∠e, ∠f and ∠g.

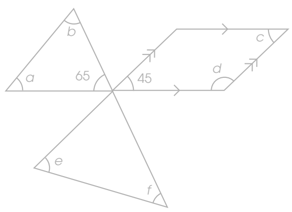
540°



Complete Workbook **6A**, Worksheet **1B** • Pages **26 – 30**

MIND WORKOUT

Find the value of ∠a + ∠b + ∠c + ∠d + ∠e + ∠f. 405°



Textbook 6 P31

Question 5 tests pupils' understanding of angle properties as pupils might not be able to see that they have sufficient information to get the answer.
Give pupils a hint that they should not find the size of each individual unknown angle but instead make use of the properties of sum of angles in a triangle and angles between parallel lines.

Independent seatwork

Assign pupils to complete Worksheet 1B (Workbook 6A P26 – 30)

1. (a) $\angle DAF = \angle ADF$
$= 90^\circ - 65^\circ$
$= 25^\circ$
(b) $\angle AED = \angle AFD$
$= 180^\circ - 25^\circ - 25^\circ$
$= 130^\circ$

2. (a) $\angle DCB = \angle DAB$
$= 180^\circ - 32^\circ - 28^\circ$
$= 120^\circ$
$\angle DCF = 180^\circ - 120^\circ$
$= 60^\circ$
(b) $\angle CDE = 180^\circ - 60^\circ$
$= 120^\circ$

3. (a) $\angle r = 180^\circ - 75^\circ - 65^\circ$
$= 40^\circ$
(b) $\angle ECF = 40^\circ$
$\angle s = (180^\circ - 40^\circ) \div 2$
$= 70^\circ$

4. $\angle FDE = \angle ADC$
$= 180^\circ - 123^\circ$
$= 57^\circ$
$\angle DEF = 180^\circ - 90^\circ - 57^\circ$
$= 33^\circ$

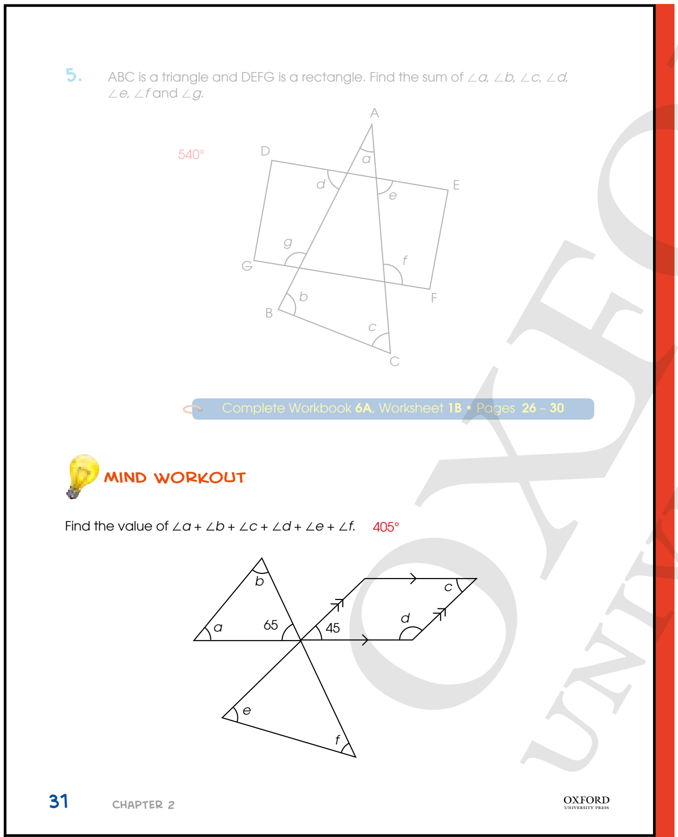
5. $\angle ECF = \angle ACB$
$= (180^\circ - 110^\circ) \div 2$
$= 35^\circ$
$\angle ECD = \angle DCB$
$= 180^\circ - 64^\circ$
$= 116^\circ$
$\angle FCG = 116^\circ - 35^\circ$
$= 81^\circ$

6. $\angle BCD = \angle BAD$
$= 70^\circ$
$\angle DCF = 180^\circ - 70^\circ - 40^\circ$
$= 70^\circ$
$\angle CFE = 180^\circ - 70^\circ$
$= 110^\circ$

*7. (a) $\angle p = 180^\circ - 90^\circ - 30^\circ$
$= 60^\circ$
(b) $\angle FCJ = 180^\circ - 80^\circ - 60^\circ$
$= 40^\circ$
$\angle ACB = 180^\circ - 40^\circ$
$= 140^\circ$
$\angle BAC = (180^\circ - 140^\circ) \div 2$
$= 20^\circ$
$\angle q = 180^\circ - 60^\circ - 20^\circ$
$= 100^\circ$

*8. $\angle a + \angle b = \angle c + \angle d = \angle e + \angle f = 180^\circ - 100^\circ$
$= 80^\circ$
$\angle a + \angle b + \angle c + \angle d + \angle e + \angle f = 3 \times 80^\circ$
$= 240^\circ$

PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW


5. ABC is a triangle and DEFG is a rectangle. Find the sum of ∠a, ∠b, ∠c, ∠d, ∠e, ∠f and ∠g.

540°

Complete Workbook 6A, Worksheet 1B • Pages 26 – 30

MIND WORKOUT

Find the value of ∠a + ∠b + ∠c + ∠d + ∠e + ∠f. 405°

31 CHAPTER 2 OXFORD UNIVERSITY PRESS

Textbook 6 P31

MIND WORKOUT

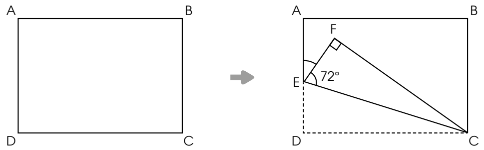
The Mind Workout challenges students to apply the properties of sum of angles in a triangle and angles between parallel lines.
Pupils need to see that it is not necessary to find individual unknown angles but instead draw links such as:

- $\angle a + \angle b = 180° – 65°$
- $\angle c + \angle d = 180°$
- $\angle e + \angle f = 180° – 70°$

Mind Workout

Date: ____________

A rectangular piece of paper ABCD is folded at E to get the figure as shown.
Find ∠AEF.



∠DEC = ∠FEC
= 72°
∠AEF = 180° – 72° – 72°
= 36°

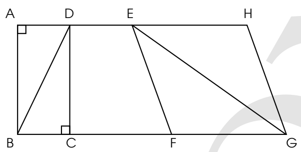
Workbook 6A P31

Mind Workout

Get pupils who struggle with the spatial visualisation to fold a piece of paper. After unfolding it, they can mark out the angles and identify that ∠DEC = ∠FEC. They can then make use of the property of sum of angles on a straight line to find ∠AEF.

MATHS JOURNAL

In the figure below, AH is parallel to BG, EF is parallel to HG and EF = FG = GH = HE.



Is each of the following sentences true or false? Explain your answers.

1. ABGH is a parallelogram. False
2. EFGH is a rhombus. True
3. EFG and EHG are isosceles triangles. True
4. ∠DCF + ∠CFE = 180 False
5. ∠CBD + ∠BDE = 180 True
6. ∠FEG = ∠EGH True

SELF-CHECK

I know how to...

- find unknown angles in geometric figures involving squares, rectangles, parallelograms, rhombuses, trapeziums and triangles.

Textbook 6 P32

MATHS JOURNAL

This task enables pupils to review the properties of triangles and 4-sided figures. They should recognise the angles and sides of a shape that describe the property of the figures.

SELF-CHECK

Before the pupils do the self-check, review the various properties and how they can be applied to find unknown angles with examples.

The self-check can be done after pupils have completed **Review 2** (Workbook 6A P32 – 39).

1. (a) 105
   (b) 55
   (c) 92
   (d) 20
   (e) 69
   (f) 21

2. $\angle BAC = \angle ABC$
   $= 180^\circ - 155^\circ$
   $= 25^\circ$
   $\angle ADC = 180^\circ - 130^\circ$
   $= 50^\circ$
   $\angle x = 180^\circ - 50^\circ - 25^\circ$
   $= 105^\circ$

3. $\angle DBC = (180^\circ - 82) \div 2$
   $= 49^\circ$
   $\angle ABD = 90^\circ - 49^\circ$
   $= 41^\circ$
   $\angle BAE = 180^\circ - 41^\circ$
   $= 139^\circ$

4. $\angle ADE = 180^\circ - 90^\circ - 66^\circ$
   $= 24^\circ$
   $\angle EDC = 90^\circ - 24^\circ$
   $= 66^\circ$
   $\angle ECD = 90^\circ - 43^\circ$
   $= 47^\circ$
   $\angle CED = 180^\circ - 66^\circ - 47^\circ$
   $= 67^\circ$

5. $\angle DAB = 180^\circ - 60^\circ$
   $= 120^\circ$
   $\angle DAE = 120^\circ - 75^\circ$
   $= 45^\circ$
   $\angle AED = 180^\circ - 45^\circ - 60^\circ$
   $= 75^\circ$
   $\angle AEB = 180^\circ - 75^\circ - 45^\circ$
   $= 60^\circ$
   $\angle BEC = 180^\circ - 60^\circ - 75^\circ$
   $= 45^\circ$

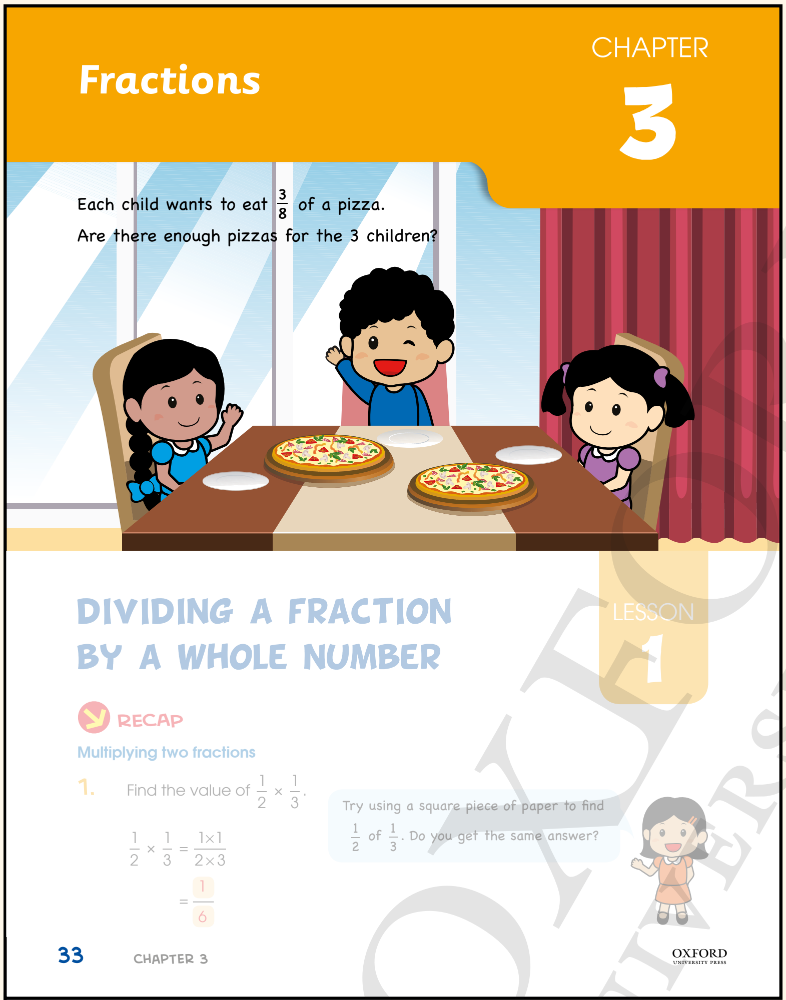
6. (a) $\angle DEB = 180^\circ - 80^\circ$
   $= 100^\circ$
   $\angle CDE = 180^\circ - 100^\circ$
   $= 80^\circ$
   (b) $\angle DAE = 180^\circ - 80^\circ - 60^\circ$
   $= 40^\circ$
   $\angle EAF = 60^\circ - 40^\circ$
   $= 20^\circ$

7. $\angle ABC = 180^\circ - 36^\circ - 36^\circ$
   $= 108^\circ$
   $\angle ADC = 108^\circ + 20^\circ$
   $= 128^\circ$
   $\angle DCA = (180^\circ - 128^\circ) \div 2$
   $= 26^\circ$
   $\angle y = 36^\circ - 26^\circ$
   $= 10^\circ$

8. (a) $\angle DAE = 60^\circ$
   $\angle GAE = 180^\circ - 45^\circ - 60^\circ$
   $= 75^\circ$
   $\angle AEF = 180^\circ - 75^\circ$
   $= 105^\circ$
   (b) $\angle CDE = 90^\circ + 60^\circ$
   $= 150^\circ$
   $\angle CED = (180^\circ - 150^\circ) \div 2$
   $= 15^\circ$
   $\angle AHC = \angle DHE$
   $= 180^\circ - 60^\circ - 15^\circ$
   $= 105^\circ$

FRACTIONS

CHAPTER 3


Fractions

CHAPTER 3

Each child wants to eat $\frac{3}{8}$ of a pizza.
Are there enough pizzas for the 3 children?

DIVIDING A FRACTION BY A WHOLE NUMBER

LESSON 1

RECAP

Multiplying two fractions

1. Find the value of $\frac{1}{2} \times \frac{1}{3}$.

$$\frac{1}{2} \times \frac{1}{3} = \frac{1 \times 1}{2 \times 3}$$
$$= \frac{1}{6}$$

Try using a square piece of paper to find $\frac{1}{2}$ of $\frac{1}{3}$. Do you get the same answer?

33 CHAPTER 3

OXFORD UNIVERSITY PRESS

Textbook 6 P33

Related Resources
NSPM Textbook 6 (P33 – 65)
NSPM Workbook 6A (P40 – 67)

Materials
Fraction discs, mini whiteboard, markers, calculator

Lesson

Lesson 1	Dividing a Fraction by a Whole Number
Lesson 2	Dividing a Whole Number by a Fraction
Lesson 3	Dividing a Fraction by a Fraction
Lesson 4	Solving Word Problems

Problem Solving, Maths Journal and Pupil Review

INTRODUCTION

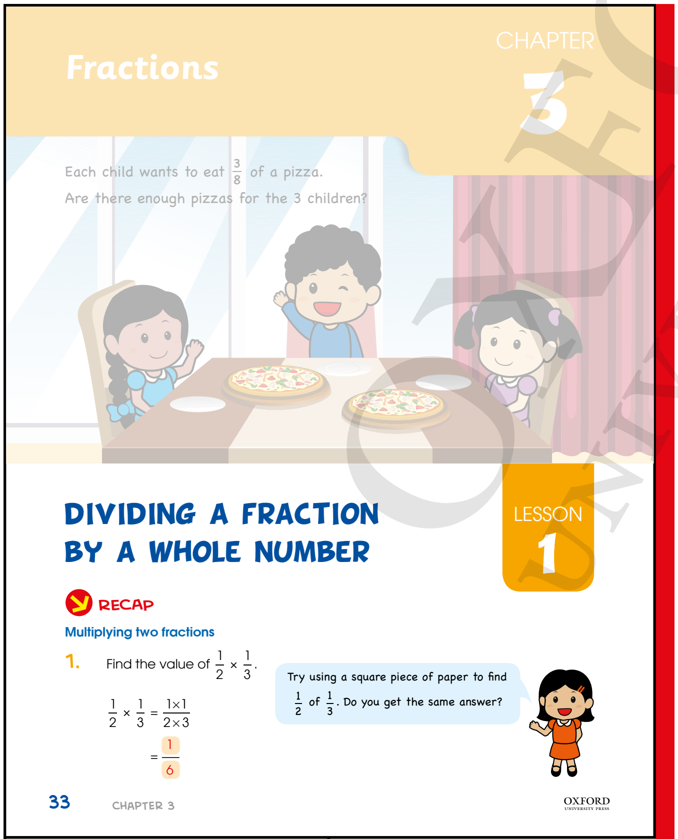
In Grade Five, pupils have learnt to multiply a fraction by another fraction, a mixed number and a whole number. They were also introduced to the association of fractions with division. In this chapter, pupils will learn about the various types of division of fractions. They will revisit the concept of multiplication of fractions and apply this knowledge to the division of a fraction by a whole number and a fraction, as well as the division of a whole number by a fraction.

LESSON 1

DIVIDING A FRACTION BY A WHOLE NUMBER

LEARNING OBJECTIVE

1. Divide a proper fraction by a whole number without a calculator.


Fractions

CHAPTER 3

Each child wants to eat $\frac{3}{8}$ of a pizza.
Are there enough pizzas for the 3 children?

DIVIDING A FRACTION BY A WHOLE NUMBER

LESSON 1

RECAP

Multiplying two fractions

1. Find the value of $\frac{1}{2} \times \frac{1}{3}$.

$\frac{1}{2} \times \frac{1}{3} = \frac{1 \times 1}{2 \times 3}$

$= \boxed{\frac{1}{6}}$

Try using a square piece of paper to find $\frac{1}{2}$ of $\frac{1}{3}$. Do you get the same answer?

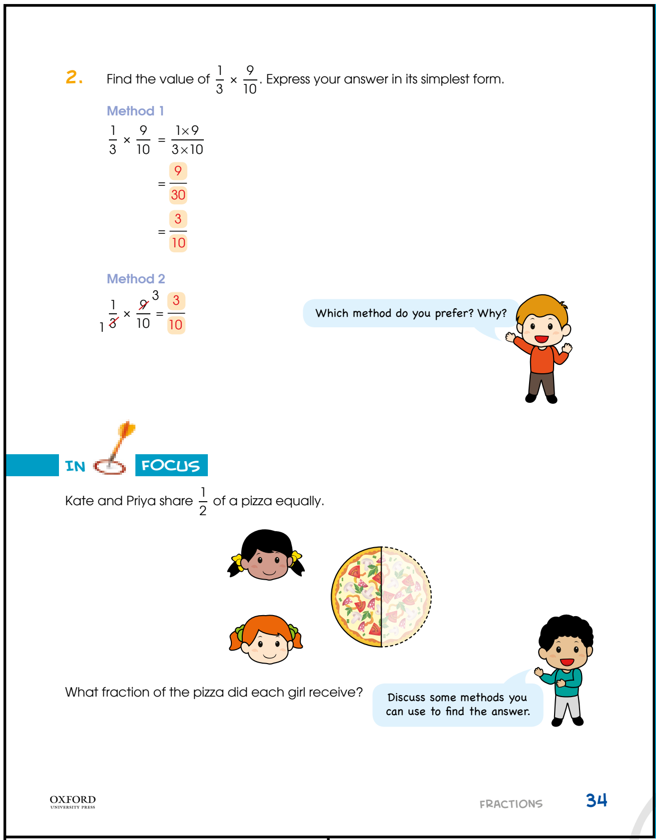
33 CHAPTER 3

OXFORD UNIVERSITY PRESS

Textbook 6 P33

RECAP

Help pupils link their prior knowledge about multiplying two fractions by revisiting the two methods of multiplying fractions and simplifying the result.


2. Find the value of $\frac{1}{3} \times \frac{9}{10}$. Express your answer in its simplest form.

Method 1

$\frac{1}{3} \times \frac{9}{10} = \frac{1 \times 9}{3 \times 10}$

$= \frac{9}{30}$

$= \frac{3}{10}$

Method 2

$\frac{1}{\cancel{3}_1} \times \frac{\cancel{9}^3}{10} = \frac{3}{10}$

IN FOCUS

Kate and Priya share $\frac{1}{2}$ of a pizza equally.

What fraction of the pizza did each girl receive?

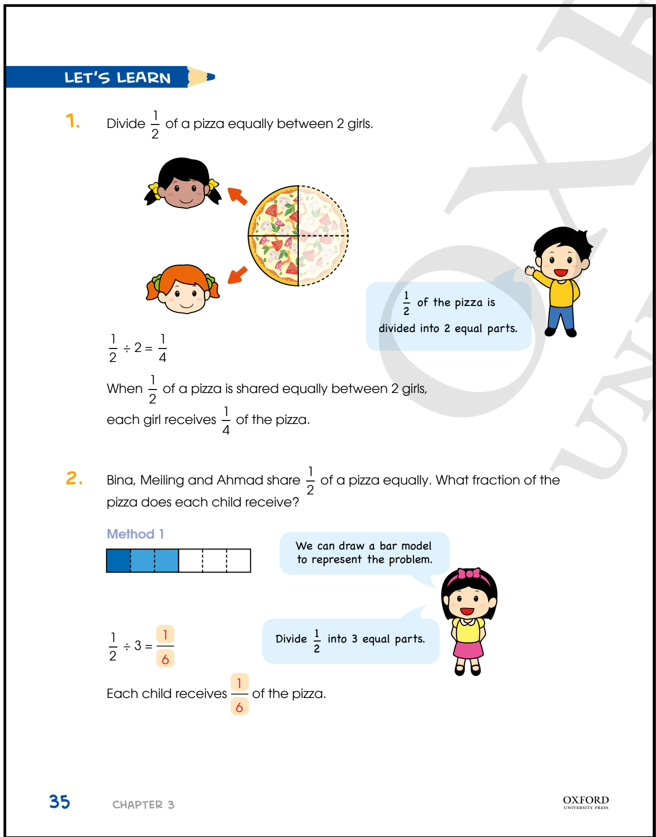
OXFORD FRACTIONS 34

Textbook 6 P34

IN FOCUS

Get pupils to identify with the concept of half. Ask how many slices of pizza each girl would receive if:

- 4 pizzas are divided equally between the 2 girls
- 2 pizzas are divided equally between the 2 girls
- 1 pizza is divided equally between the 2 girls


LET'S LEARN

1. Divide $\frac{1}{2}$ of a pizza equally between 2 girls.

$\frac{1}{2} \div 2 = \frac{1}{4}$

When $\frac{1}{2}$ of a pizza is shared equally between 2 girls, each girl receives $\frac{1}{4}$ of the pizza.

2. Bina, Meiling and Ahmad share $\frac{1}{2}$ of a pizza equally. What fraction of the pizza does each child receive?

Method 1

$\frac{1}{2} \div 3 = \frac{1}{6}$

Each child receives $\frac{1}{6}$ of the pizza.

35 CHAPTER 3 OXFORD

Textbook 6 P35

LET'S LEARN

From the picture in Let's Learn 1, pupils should be able to see how many parts each girl receives out of the whole pizza, i.e. 1 out of 4. Alternatively, the context can also be represented using bar modelling.
Make it clear to pupils that when looking at fractions, we need to quantify in terms of the whole (in this case the whole pizza), and not just the part that is divided.

Let's Learn 2 shows how the bar modelling method can be used. Get pupils to see that since each of the 3 children receives an equal amount, 3 parts make up half the pizza. Thus, guide them to see that 'a third from the half

of the pizza' can be represented by $\frac{1}{2} \div 3$, which can be further simplified to $\frac{1}{3}$ of $\frac{1}{2} = \frac{1}{3} \times \frac{1}{2} = \frac{1}{2} \times \frac{1}{3}$.

Get pupils to draw the link that they can solve this using their prior knowledge of multiplication of two fractions.

Point out that the procedure of division of fractions involves 'change and invert':

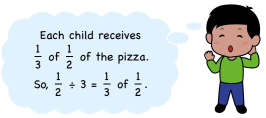
$\frac{1}{2} \div \frac{3}{1} = \frac{1}{2} \times \frac{1}{3}$.

Method 2

$\frac{1}{2} \div 3 = \frac{1}{3}$ of $\frac{1}{2}$

$= \frac{1}{3} \times \frac{1}{2}$

$= \frac{1}{6}$



Each child receives $\frac{1}{6}$ of the pizza.

3. Find the value of each of the following. Explain.

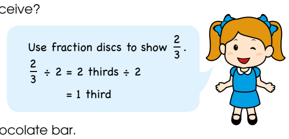
(a) $\frac{1}{3} \div 3$ $\frac{1}{9}$ (b) $\frac{1}{2} \div 5$ $\frac{1}{10}$

(c) $\frac{1}{4} \div 3$ $\frac{1}{12}$ (d) $\frac{1}{5} \div 2$ $\frac{1}{10}$

4. Nora and Weiming shared $\frac{2}{3}$ of a chocolate bar equally. What fraction of the chocolate bar did each child receive?

Method 1

$\frac{2}{3} \div 2 = \frac{1}{3}$



Each child received $\frac{1}{3}$ of the chocolate bar.

Method 2

$\frac{2}{3} \div 2 = \frac{1}{2}$ of $\frac{2}{3}$

$= \frac{1}{2} \times \frac{2}{3}$

$= \frac{1}{3}$

Each child received $\frac{1}{3}$ of the chocolate bar.

OXFORD UNIVERSITY PRESS FRACTIONS 36

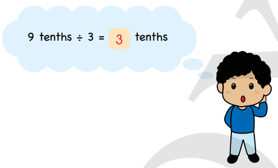
Textbook 6 P36

Let's Learn 4 and 5 deal with non-unit fractions. Highlight to pupils that their final answer should always be in the simplest form.

5. Find the value of $\frac{9}{10} \div 3$.

Method 1

$\frac{9}{10} \div 3 = \frac{3}{10}$



Method 2

$\frac{9}{10} \div 3 = \frac{1}{3} \times \frac{9}{10}$

$= \frac{3}{10}$

6. Find the value of $\frac{3}{4} \div 2$.

Method 1

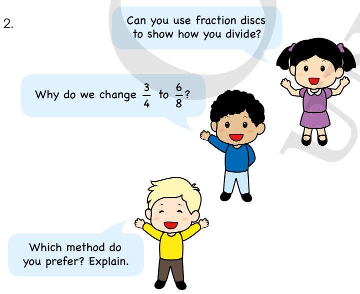
$\frac{3}{4} \div 2 = \frac{6}{8} \div 2$

$= \frac{3}{8}$

Method 2

$\frac{3}{4} \div 2 = \frac{1}{2} \times \frac{3}{4}$

$= \frac{3}{8}$



7. Find the value of each of the following. Explain.

(a) $\frac{5}{8} \div 5$ $\frac{1}{8}$ (b) $\frac{11}{12} \div 11$ $\frac{1}{12}$

(c) $\frac{8}{11} \div 4$ $\frac{2}{11}$ (d) $\frac{6}{9} \div 3$ $\frac{2}{9}$

(e) $\frac{4}{5} \div 8$ $\frac{1}{10}$ (f) $\frac{3}{4} \div 9$ $\frac{1}{12}$

37 CHAPTER 3 OXFORD UNIVERSITY PRESS

Textbook 6 P37

In Let's Learn 6, no simplification is involved. Get pupils to see that method 1 involves the division of the numerator. Ask:

- Do we get a whole number if we divide 3 by 2?
- How should we change the fraction such that the numerator is divisible by 2?

Let's Learn 7 allows pupils to get more practice, without working statements provided as hints. Pupils should be able to show their working.

ACTIVITY TIME

Work in pairs.

1. For each of the following questions, use fraction discs to show how you find the answer.
   - (a) $\frac{1}{2} \div 6$
   - (b) $\frac{1}{5} \div 2$
   - (c) $\frac{3}{5} \div 3$
   - (d) $\frac{7}{8} \div 7$
   - (e) $\frac{4}{5} \div 2$
   - (f) $\frac{10}{12} \div 5$
   - (g) $\frac{3}{4} \div 2$
   - (h) $\frac{2}{3} \div 4$

What you need:

2. Write two different equations to show how you solve each question.
3. Compare your answers with your classmates.

What do you notice about the two equations that you have written for each question?

PRACTICE

1. Find the value of each of the following.
   - (a) $\frac{1}{3} \div 4$ $\frac{1}{12}$
   - (b) $\frac{6}{11} \div 3$ $\frac{2}{11}$
   - (c) $\frac{5}{8} \div 10$ $\frac{1}{16}$
   - (d) $\frac{4}{7} \div 12$ $\frac{1}{21}$
2. A chef divides $\frac{4}{5}$ kg of flour equally into 8 bags. How much flour is there in each bag? $\frac{1}{10}$ kg
3. Xinyi has a ribbon that is $\frac{3}{10}$ m long. She cuts the ribbon into 2 equal parts. What is the length of each part? $\frac{3}{20}$ m

Complete Workbook **6A**, Worksheet **1** • Pages **40 – 43**

OXFORD UNIVERSITY PRESS FRACTIONS 38

Textbook 6 P38

ACTIVITY TIME

The use of fraction discs can help pupils to visualise the division of fractions. In pairs, each pupil can try one of the two methods and check that they arrive at the same answers.

PRACTICE

Give pupils some time to work on the practice questions. Allow them to use their preferred method to obtain the answers.

Independent seatwork

Assign pupils to complete Worksheet 1 (Workbook 6A P40 – 43)

Answers

Worksheet 1 (Workbook 6A P40 – 43)

1. (a) $\frac{1}{8}$
   (b) $\frac{1}{15}$

2. (a) $\frac{1}{14}$
   (b) $\frac{3}{7}$
   (c) $\frac{2}{11}$
   (d) $\frac{1}{9}$
   (e) $\frac{1}{24}$
   (f) $\frac{1}{25}$
   (g) $\frac{1}{54}$
   (h) $\frac{3}{16}$

3. $\frac{1}{8}$

4. $\frac{3}{10}$

5. $\frac{5}{11}$

6. $\frac{5}{56}$ m

7. $\frac{2}{45}$ ℓ

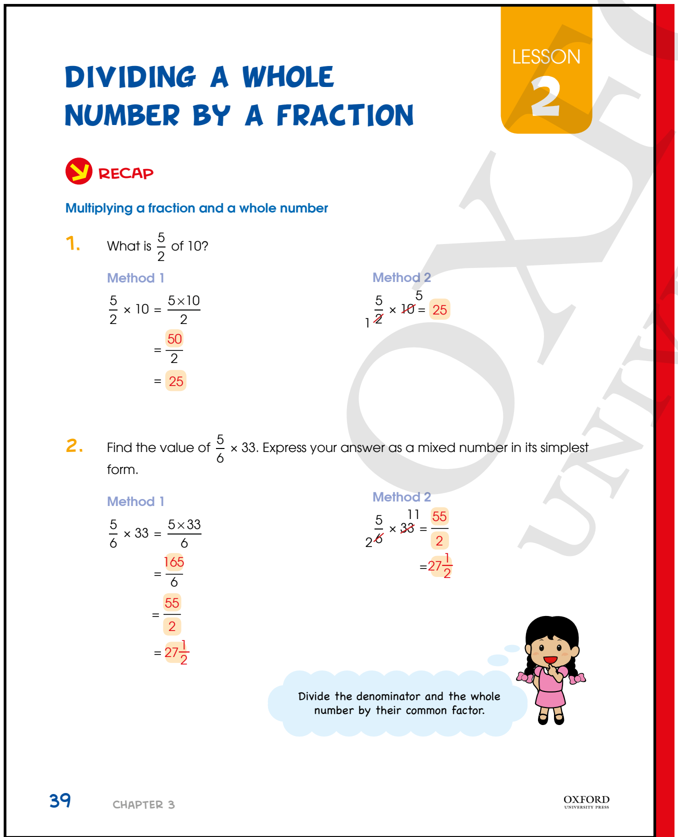
8. $\frac{3}{50}$ kg

LESSON 2

DIVIDING A WHOLE NUMBER BY A FRACTION

LEARNING OBJECTIVE

1. Divide a whole number by a proper fraction wihout a calculator.



DIVIDING A WHOLE NUMBER BY A FRACTION

LESSON 2

RECAP

Multiplying a fraction and a whole number

1. What is $\frac{5}{2}$ of 10?

Method 1

$\frac{5}{2} \times 10 = \frac{5 \times 10}{2}$

$= \frac{50}{2}$

$= 25$

Method 2

$\frac{5}{{}_1\cancel{2}} \times \cancel{10}^{5} = 25$

2. Find the value of $\frac{5}{6} \times 33$. Express your answer as a mixed number in its simplest form.

Method 1

$\frac{5}{6} \times 33 = \frac{5 \times 33}{6}$

$= \frac{165}{6}$

$= \frac{55}{2}$

$= 27\frac{1}{2}$

Method 2

$\frac{5}{{}_2\cancel{6}} \times \cancel{33}^{11} = \frac{55}{2}$

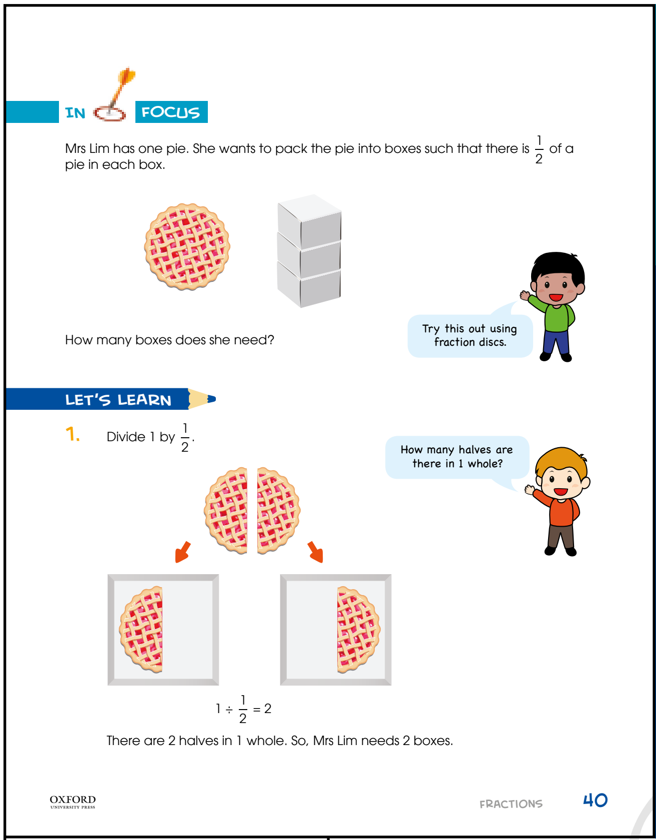
$= 27\frac{1}{2}$

39 CHAPTER 3 OXFORD

Textbook 6 P39

RECAP

Ensure that pupils are able to recall how to multiply a fraction and a whole number and obtain a final answer in the simplest form.



IN FOCUS

Mrs Lim has one pie. She wants to pack the pie into boxes such that there is $\frac{1}{2}$ of a pie in each box.

How many boxes does she need?

LET'S LEARN

1. Divide 1 by $\frac{1}{2}$.

$1 \div \frac{1}{2} = 2$

There are 2 halves in 1 whole. So, Mrs Lim needs 2 boxes.

OXFORD UNIVERSITY PRESS FRACTIONS 40

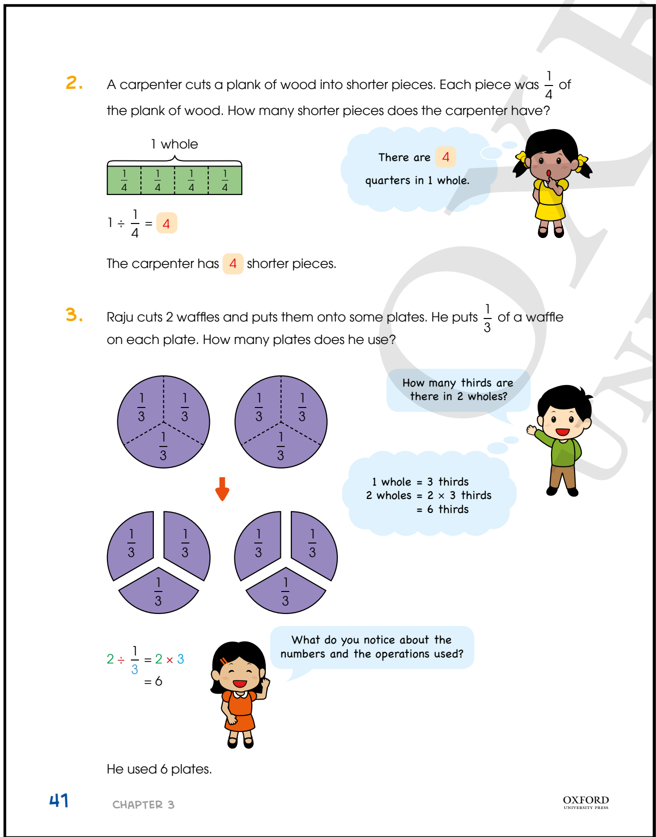
Textbook 6 P40

IN FOCUS

Most pupils are familiar with partitive division (e.g. 'how many pies are there in each box?') compared to quotative (e.g. 'how many boxes needed?'). Check for pupils' understanding and rectify any misconceptions.

LET'S LEARN

The picture shows clearly that with each half in a box, 2 boxes are needed.



2. A carpenter cuts a plank of wood into shorter pieces. Each piece was $\frac{1}{4}$ of the plank of wood. How many shorter pieces does the carpenter have?

$1 \div \frac{1}{4} = 4$

The carpenter has 4 shorter pieces.

3. Raju cuts 2 waffles and puts them onto some plates. He puts $\frac{1}{3}$ of a waffle on each plate. How many plates does he use?

$2 \div \frac{1}{3} = 2 \times 3$
$= 6$

He used 6 plates.

41 CHAPTER 3 OXFORD UNIVERSITY PRESS

Textbook 6 P41

Let's Learn 2 demonstrates the use of bar models to solve the problem. Pupils may find this useful as it enables them to count the number of units.

Let's Learn 3 introduces a dividend which is more than 1 whole. After pupils have grasped the concept that there are 6 thirds in 2 wholes, highlight to them that the 'change and invert' method can be used to get the answer.

4. Meiling pours 3 ℓ of orange juice into some cups. There is $\frac{1}{5}$ ℓ of orange juice in each cup. How many cups of orange juice does Meiling pour?

1 whole = 5 fifths
3 wholes = 3 × 5 fifths
= 15 fifths

$3 \div \frac{1}{5} = 3 \times 5$
$= 15$

She pours 15 cups of orange juice.

5. Find the value of each of the following.

(a) $1 \div \frac{1}{3}$ 3
(b) $1 \div \frac{1}{10}$ 10
(c) $2 \div \frac{1}{8}$ 16
(d) $3 \div \frac{1}{12}$ 36
(e) $5 \div \frac{1}{6}$ 30
(f) $8 \div \frac{1}{9}$ 72

6. Find the value of $2 \div \frac{2}{3}$.

How many $\frac{2}{3}$'s are there in 2 wholes?

Method 1

$2 \div \frac{2}{3} = 3$

There are 6 thirds in 2 wholes.
6 thirds ÷ 2 thirds = 3
There are 3 groups of $\frac{2}{3}$'s in 2 wholes.

OXFORD UNIVERSITY PRESS FRACTIONS 42

Textbook 6 P42

For Let's Learn 4, ensure that pupils do not get confused by the units. $\frac{1}{5}$ l is the same as saying $\frac{1}{5}$ of 1l.

Thus, 5 fifths make up 1 whole.

For Let's Learn 5, get pupils to practise drawing models and/or using the 'change and invert' method to get the answers.

Use Let's Learn 6 to encourage pupils to observe the similarities between what they learnt in the previous lesson, of division of fraction with whole number, and what they are learning in this lesson.

Method 2

Number of thirds in 1 whole = 3
Number of thirds in 2 wholes = 2 × 3
= 6
Number of two-thirds in 2 wholes = 6 ÷ 2
= 3

Why do we divide 6 by 2?

To find the value of $2 \div \frac{2}{3}$, we multiplied 2 by 3 and divided the answer by 2.

So, $2 \div \frac{2}{3}$ is the same as $2 \times \frac{3}{2}$.

$2 \div \frac{2}{3} = \cancel{2}^{1} \times \frac{3}{\cancel{2}_{1}}$
$= 3$

What do you notice about the numbers and the operations used?

7. What is $3 \div \frac{3}{5}$?

How many $\frac{3}{5}$'s are there in 3 wholes?

$3 \div \frac{3}{5} = 3 \times \frac{5}{3}$
$= 5$

Dividing by $\frac{3}{5}$ is the same as multiplying by $\frac{5}{3}$.

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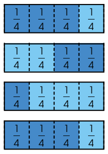
Textbook 6 P43

For Let's Learn 7, get pupils to conclude the basic rule for division involving fractions, i.e. 'change and invert'.

8. What is $4 \div \frac{3}{4}$? Express your answer as a mixed number in its simplest form.

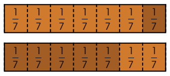


$4 \div \frac{3}{4} = 4 \times \frac{4}{3}$
$= \frac{16}{3}$
$= 5\frac{1}{3}$

How many $\frac{3}{4}$'s are there in 4 wholes?

What does your answer mean? Explain.

9. Find the value of $2 \div \frac{6}{7}$. Express your answer as a mixed number in its simplest form.



$2 \div \frac{6}{7} = 2 \times \frac{7}{6}$
$= \frac{14}{6}$
$= 2\frac{1}{3}$

Dividing by $\frac{6}{7}$ is the same as multiplying by $\frac{7}{6}$.

10. Find the value of each of the following. Express each answer as a mixed number in its simplest form where necessary.

(a) $5 \div \frac{5}{6}$ 6 (b) $8 \div \frac{4}{7}$ 14

(c) $2 \div \frac{4}{5}$ $2\frac{1}{2}$ (d) $12 \div \frac{9}{10}$ $13\frac{1}{3}$

OXFORD UNIVERSITY PRESS FRACTIONS 44

Textbook 6 P44

For Let's Learn 8 and 9, the answers obtained are not whole numbers. Get pupils to observe the bar models, and interpret how the remaining unit(s), which cannot form a whole number, will be divided.

ACTIVITY TIME

Work in pairs.

1. Take turns to use fraction discs and draw a model to find the value of each of the following.

(a) $5 \div \frac{1}{2}$ (b) $8 \div \frac{2}{3}$

(c) $6 \div \frac{9}{10}$ (d) $4 \div \frac{8}{9}$

What you need:

2. Check each other's answers.

PRACTICE

1. Divide. Express each answer as a mixed number in its simplest form where necessary.

(a) $2 \div \frac{1}{5}$ 10 (b) $5 \div \frac{1}{7}$ 35

(c) $9 \div \frac{3}{4}$ 12 (d) $8 \div \frac{4}{5}$ 10

(e) $7 \div \frac{3}{5}$ $11\frac{2}{3}$ (f) $11 \div \frac{8}{9}$ $12\frac{3}{8}$

2. How many quarters are there in 4 wholes? 16

3. Some pupils shared 4 chocolate bars equally. Each pupil received $\frac{2}{3}$ of a chocolate bar. How many pupils were there? 6

Complete Workbook **6A**, Worksheet **2** • Pages **44 – 47**

45 CHAPTER 3 OXFORD UNIVERSITY PRESS

Textbook 6 P45

ACTIVITY TIME

In pairs, one pupil can work on using fraction discs while another can use bar models. Get pupils to also practise using 'change and invert'.

PRACTICE

Give pupils some time to work on the practice questions. Allow them to use their preferred method to obtain the answers.

Independent seatwork

Assign pupils to complete Worksheet 2 (Workbook 6A P44 – 47)

Answers

Worksheet 2 (Workbook 6A P44 – 47)

1. (a) $4\frac{1}{2}$

   (b) $1\frac{1}{3}$

   (c) 9

   (d) $5\frac{1}{3}$

2. (a) 5
   (b) 8
   (c) 15
   (d) 24
   (e) 5
   (f) 8

3. (a) $7\frac{1}{2}$

   (b) $2\frac{2}{3}$

   (c) $10\frac{1}{2}$

   (d) $4\frac{2}{3}$

   (e) $14\frac{2}{3}$

   (f) $7\frac{7}{9}$

4. 3

5. 15

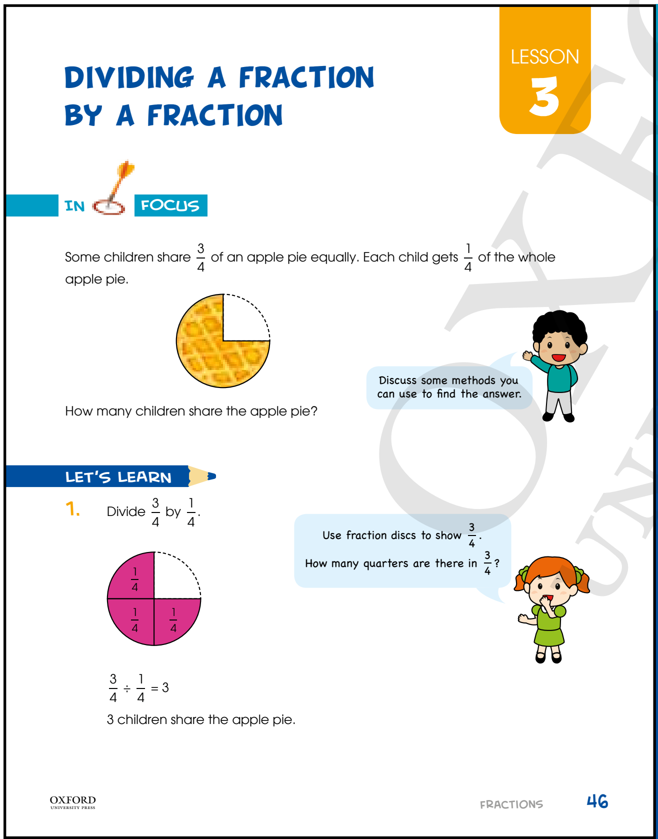
6. 8

LESSON 3

DIVIDING A FRACTION BY A FRACTION

LEARNING OBJECTIVE

1. Divide a proper fraction by a proper fraction without a calculator.



DIVIDING A FRACTION BY A FRACTION

LESSON 3

IN FOCUS

Some children share $\frac{3}{4}$ of an apple pie equally. Each child gets $\frac{1}{4}$ of the whole apple pie.

How many children share the apple pie?

LET'S LEARN

1. Divide $\frac{3}{4}$ by $\frac{1}{4}$.

$\frac{3}{4} \div \frac{1}{4} = 3$

3 children share the apple pie.

OXFORD UNIVERSITY PRESS FRACTIONS 46

Textbook 6 P46

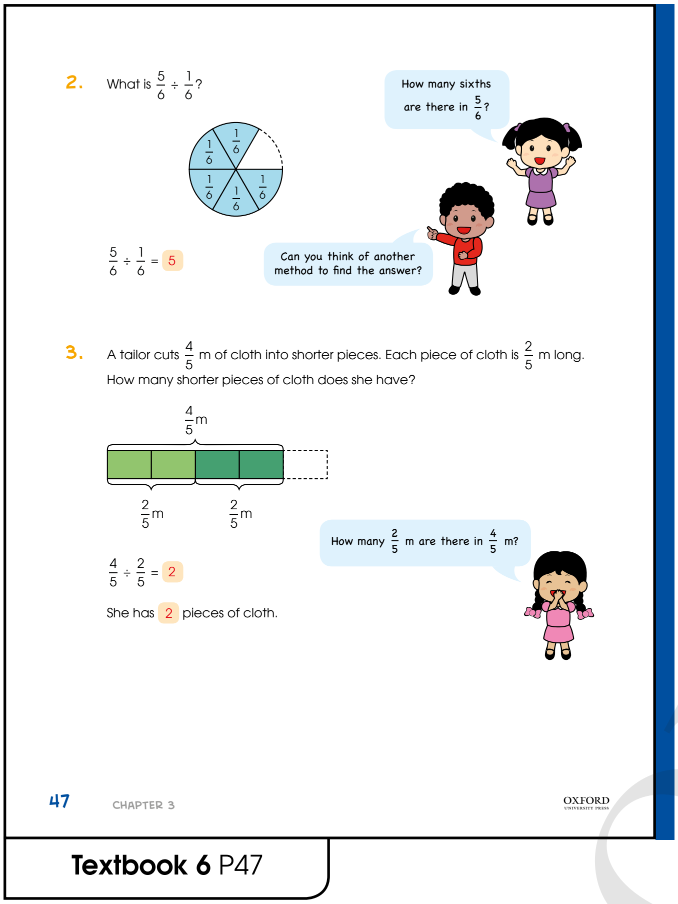
IN FOCUS

Prompt pupils by asking:

- How many quarters are there in $\frac{3}{4}$?
- How many children can there be if each child gets $\frac{1}{4}$?

LET'S LEARN

Pupils are introduced to the concept of division of a fraction by a fraction using fraction discs.



2. What is $\frac{5}{6} \div \frac{1}{6}$?

How many sixths are there in $\frac{5}{6}$?

$\frac{5}{6} \div \frac{1}{6} = 5$

Can you think of another method to find the answer?

3. A tailor cuts $\frac{4}{5}$ m of cloth into shorter pieces. Each piece of cloth is $\frac{2}{5}$ m long. How many shorter pieces of cloth does she have?

$\frac{4}{5}$ m

$\frac{2}{5}$ m $\frac{2}{5}$ m

How many $\frac{2}{5}$ m are there in $\frac{4}{5}$ m?

$\frac{4}{5} \div \frac{2}{5} = 2$

She has 2 pieces of cloth.

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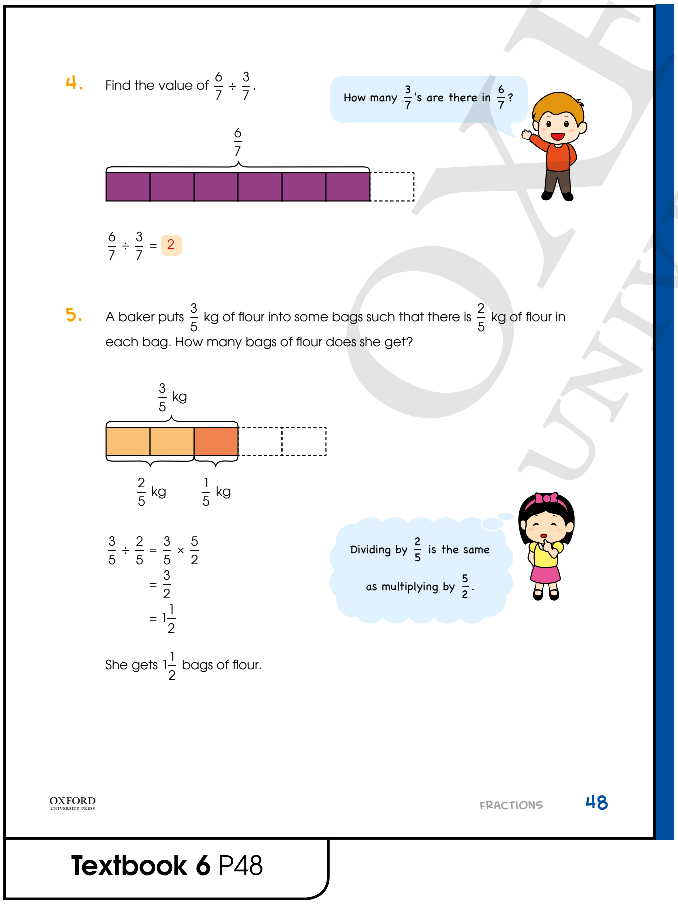
Textbook 6 P47

In Let's Learn 2, fraction discs are used again. Get pupils to see that another method would be using bar models to visualise the division of a fraction.

Let's Learn 3 shows the use of bar models. Ensure that pupils understand that the last $\frac{1}{5}$ should not be included in the division.



4. Find the value of $\frac{6}{7} \div \frac{3}{7}$.

How many $\frac{3}{7}$'s are there in $\frac{6}{7}$?

$\frac{6}{7}$

$\frac{6}{7} \div \frac{3}{7} = 2$

5. A baker puts $\frac{3}{5}$ kg of flour into some bags such that there is $\frac{2}{5}$ kg of flour in each bag. How many bags of flour does she get?

$\frac{3}{5}$ kg

$\frac{2}{5}$ kg $\frac{1}{5}$ kg

$$\frac{3}{5} \div \frac{2}{5} = \frac{3}{5} \times \frac{5}{2} = \frac{3}{2} = 1\frac{1}{2}$$

Dividing by $\frac{2}{5}$ is the same as multiplying by $\frac{5}{2}$.

She gets $1\frac{1}{2}$ bags of flour.

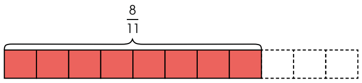
OXFORD UNIVERSITY PRESS FRACTIONS 48

Textbook 6 P48

For Let's Learn 4, point out to pupils that so far, they have come across the division of fractions with the same denominators. Pupils should observe that the answers can be easily obtained through the division of the numerator values.

Let's Learn 5 demonstrates the use of the 'change and invert' method. Highlight to pupils that they can cancel out '5' and to leave the answer as a mixed number.

6. What is $\frac{8}{11} \div \frac{3}{11}$? Express your answer as a mixed number in its simplest form.



$\frac{8}{11} \div \frac{3}{11} = \frac{8}{11} \times \frac{11}{3}$

$= \frac{8}{3}$

$= 2\frac{2}{3}$

Dividing by $\frac{3}{11}$ is the same as multiplying by $\frac{11}{3}$.

7. Find the value of $\frac{7}{9} \div \frac{5}{9}$. Express your answer as a mixed number in its simplest form.

$\frac{7}{9} \div \frac{5}{9} = \frac{7}{9} \times \frac{9}{5}$

$= \frac{7}{5}$

$= 1\frac{2}{5}$

Dividing by $\frac{5}{9}$ is the same as multiplying by $\frac{9}{5}$.

Can you draw a model to show how you find the answer?

8. Find the value of each of the following. Express each answer in its simplest form.

(a) $\frac{3}{5} \div \frac{1}{5}$ 3 (b) $\frac{9}{10} \div \frac{3}{10}$ 3

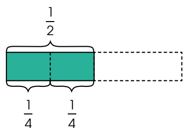
(c) $\frac{5}{8} \div \frac{3}{8}$ $1\frac{2}{3}$ (d) $\frac{7}{12} \div \frac{5}{12}$ $1\frac{2}{5}$

Textbook 6 P49

For Let's Learn 6 to 8, get pupils to use the 'change and invert' method and ensure that they are able to convert the improper fractions into mixed numbers to obtain the final answer.

9. What is $\frac{1}{2} \div \frac{1}{4}$?

Method 1



How many $\frac{1}{4}$'s are there in $\frac{1}{2}$?

$\frac{1}{2} \div \frac{1}{4} = \frac{2}{4} \div \frac{1}{4}$

$= 2$

Method 2

$\frac{1}{2} \div \frac{1}{4} = \frac{1}{2} \times \frac{4}{1}$

$= 2$

Dividing by $\frac{1}{4}$ is the same as multiplying by 4. So, we keep the first fraction, change the ÷ to × and invert the second fraction to find the answer.

10. Find the value of $\frac{3}{4} \div \frac{3}{8}$.

Method 1

$\frac{3}{4} \div \frac{3}{8} = \frac{6}{8} \div \frac{3}{8}$

$= 2$

Method 2

$\frac{3}{4} \div \frac{3}{8} = \frac{3}{4} \times \frac{8}{3}$

$= 2$

Which method do you prefer? Explain.

Textbook 6 P50

For Let's Learn 9 and 10, pupils are exposed to two methods. Method 1 involves converting the fraction(s) to have the same denominator while method 2 directly uses 'change and invert'. Ensure that pupils understand both methods before they choose which they prefer.

11. Find the value of each of the following. Express each answer in its simplest form.

(a) $\frac{1}{6} \div \frac{1}{3}$ $\frac{1}{2}$ (b) $\frac{5}{6} \div \frac{5}{12}$ 2

(c) $\frac{2}{3} \div \frac{4}{9}$ $1\frac{1}{2}$ (d) $\frac{7}{12} \div \frac{3}{4}$ $\frac{7}{9}$

12. Divide $\frac{1}{3}$ by $\frac{1}{2}$.

$$\frac{1}{3} \div \frac{1}{2} = \frac{1}{3} \times 2$$
$$= \frac{2}{3}$$

How many halves are there in $\frac{1}{3}$?

Are there other methods to divide?

13. Find the value of $\frac{2}{5} \div \frac{4}{7}$.

$$\frac{2}{5} \div \frac{4}{7} = \frac{2}{5} \times \frac{7}{4}$$
$$= \frac{7}{10}$$

How can you check whether the answer is correct? Discuss.

14. What is $\frac{3}{4} \div \frac{3}{10}$? Express your answer as a mixed number in its simplest form.

$$\frac{3}{4} \div \frac{3}{10} = \frac{3}{4} \times \frac{10}{3}$$
$$= \frac{5}{2}$$
$$= 2\frac{1}{2}$$

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Textbook 6 P51

Remind pupils that it is important to understand the various contexts under which the different methods apply, and they should not rely too heavily on the rule of 'change and invert'.

15. Find the value of $\frac{6}{7} \div \frac{4}{5}$. Express your answer as a mixed number in its simplest form.

$$\frac{6}{7} \div \frac{4}{5} = \frac{6}{7} \times \frac{5}{4}$$
$$= \frac{15}{14}$$
$$= 1\frac{1}{14}$$

16. Find the value of each of the following. Express each answer in its simplest form.

(a) $\frac{1}{5} \div \frac{1}{4}$ $\frac{4}{5}$ (b) $\frac{2}{3} \div \frac{6}{7}$ $\frac{7}{9}$

(c) $\frac{5}{6} \div \frac{5}{8}$ $1\frac{1}{3}$ (d) $\frac{7}{16} \div \frac{5}{12}$ $1\frac{1}{20}$

PRACTICE

1. Divide. Express each answer in its simplest form.

(a) $\frac{5}{9} \div \frac{1}{9}$ 5 (b) $\frac{10}{11} \div \frac{5}{11}$ 2

(c) $\frac{4}{5} \div \frac{4}{10}$ 2 (d) $\frac{2}{3} \div \frac{5}{6}$ $\frac{4}{5}$

2. Find the value of each of the following. Express each answer as a mixed number in its simplest form.

(a) $\frac{1}{3} \div \frac{2}{9}$ $1\frac{1}{2}$ (b) $\frac{6}{7} \div \frac{3}{10}$ $2\frac{6}{7}$

(c) $\frac{7}{10} \div \frac{2}{5}$ $1\frac{3}{4}$ (d) $\frac{2}{3} \div \frac{3}{8}$ $1\frac{7}{9}$

Complete Workbook **6A**, Worksheet **3** • Pages **48 – 51**

OXFORD UNIVERSITY PRESS FRACTIONS 52

Textbook 6 P52

For Let's Learn 15, prompt pupils by asking:

- Can any of the numbers be cancelled out?
- Can we further simplify the answer?

PRACTICE

Get pupils to work on the practice questions. Remind them that any of their preferred methods can be used.

Independent seatwork

Assign pupils to complete Worksheet 3 (Workbook 6A P48 – 51).

 Worksheet 3 (Workbook 6A P48 – 51)

1. (a) 2
   (b) 3
   (c) 2
   (d) $2\frac{1}{3}$
   (e) $1\frac{1}{4}$
   (f) $\frac{1}{3}$

2. (a) $\frac{11}{18}$
   (b) $\frac{5}{12}$
   (c) $\frac{5}{12}$
   (d) $3\frac{1}{16}$
   (e) $\frac{8}{9}$
   (f) $\frac{12}{13}$

3. $1\frac{3}{8}$

4. $1\frac{1}{6}$ cm

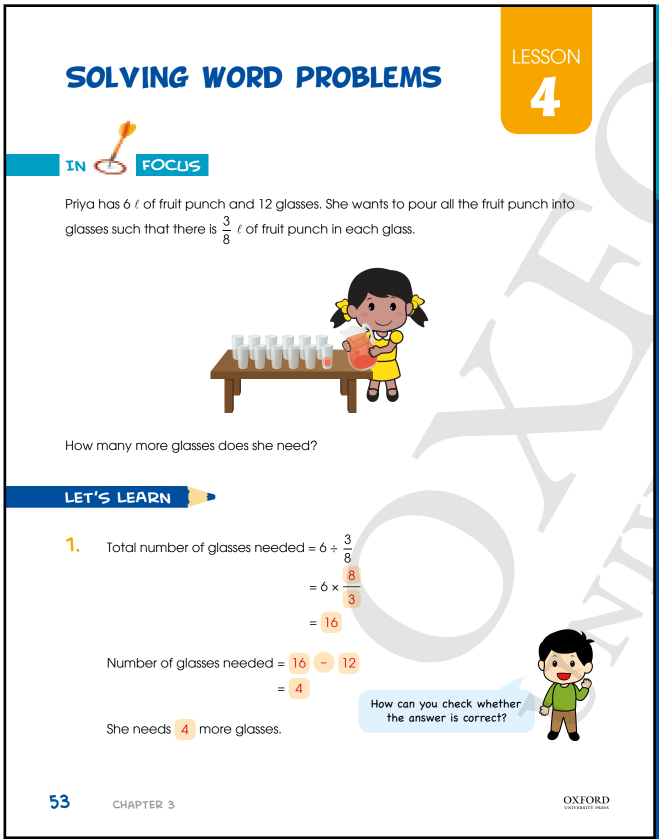
5. 10

LESSON 4

SOLVING WORD PROBLEMS

LEARNING OBJECTIVE

1. Solve word problems involving the four operations.



SOLVING WORD PROBLEMS

LESSON 4

IN FOCUS

Priya has 6 ℓ of fruit punch and 12 glasses. She wants to pour all the fruit punch into glasses such that there is $\frac{3}{8}$ ℓ of fruit punch in each glass.

How many more glasses does she need?

LET'S LEARN

1. Total number of glasses needed $= 6 \div \frac{3}{8}$

$= 6 \times \frac{8}{3}$

$= 16$

Number of glasses needed $= 16 - 12$

$= 4$

She needs 4 more glasses.

Textbook 6 P53

IN FOCUS

Highlight to pupils that this problem requires further calculations, instead of simply dividing the fraction.

LET'S LEARN

Pupils should be familiar with dividing a whole number by a fraction. The problem requires a further interpretation of the answer from the division, in order for them to answer the question. Remind them to read the information given carefully.

2. Kate and her brother were training for their fitness test. Kate ran $1\frac{3}{5}$ km while her brother ran $2\frac{11}{20}$ km. One lap of the running track is $\frac{2}{5}$ km long.
Who ran more laps? How many more?

$$1\frac{3}{5} \div \frac{2}{5} = \frac{8}{5} \div \frac{2}{5}$$
$$= \frac{8}{5} \times \frac{5}{2}$$
$$= \boxed{4}$$

Kate ran 4 laps.

$$2\frac{11}{20} \div \frac{2}{5} = \frac{51}{20} \div \frac{2}{5}$$
$$= \frac{51}{20} \times \frac{5}{2}$$
$$= \frac{51}{8}$$
$$= 6\frac{3}{8}$$

Kate's brother ran $6\frac{3}{8}$ laps.

$6\frac{3}{8} - 4 = 2\frac{3}{8}$

Kate's brother ran $2\frac{3}{8}$ more laps.

Check your answer.

Textbook 6 P54

Let's Learn 2 involves the division of a fraction by a fraction. Remind pupils to be careful when using the calculator and/or cancelling out common factors.

3. Meiling cut $\frac{9}{10}$ kg of butter into 12 slices of equal mass. She then used some slices of butter to bake cupcakes. Meiling used $\frac{3}{20}$ kg of butter to bake the cupcakes. How many slices of butter did she have left?

Mass of each slice of butter = $\frac{9}{10} \div 12 = \frac{3}{40}$ kg

Number of slices of butter used = $\frac{3}{20} \div \frac{3}{40} = 2$

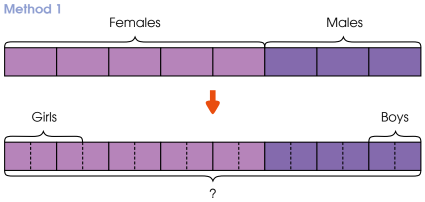
Number of slices of butter left = $12 - 2 = 10$

She had 10 slices of butter left.

Are there other methods to solve this question?

4. $\frac{5}{8}$ of the audience at a musical are females. $\frac{3}{10}$ of the females are girls and $\frac{1}{3}$ of the males are boys. There are 21 more girls than boys. How many people are there in the audience?

Method 1



3 units − 2 units = 1 unit
1 unit = 21
16 units = 16 × 21
= 336

$1 - \frac{5}{8} = \frac{3}{8}$ of the audience are males.

There are 336 people in the audience.

Textbook 6 P55

In Let's Learn 3, encourage pupils to think of an alternative method and get them to present it to the class.

For Let's Learn 4, guide pupils to visualise the information provided using bar models. They should be able to see that the fractions given can be easily reflected in the model in order to solve the problem.

Method 2

Fraction of audience that are girls = $\frac{3}{10} \times \frac{5}{8}$

$= \frac{3}{16}$

Fraction of audience that are boys = $\frac{1}{3} \times \frac{3}{8}$

$= \frac{1}{8}$

$\frac{3}{16} - \frac{1}{8} = \frac{3}{16} - \frac{2}{16}$

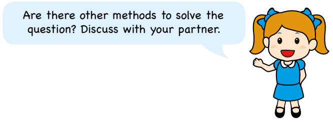
$= \frac{1}{16}$

$\frac{1}{16}$ of the audience = 21

$\frac{16}{16}$ of the audience = 16 × 21

= 336

There are 336 people in the audience.



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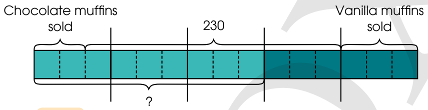
Textbook 6 P56

For the second method, remind pupils that the phrase "$\frac{3}{10}$ of the females are girls" means that $\frac{3}{10} \times \frac{5}{8}$ of the entire audience are girls.

The same can be done to work out how many boys there are.

5. Mrs Ali baked some muffins. $\frac{3}{5}$ of the muffins were chocolate and the rest were vanilla. After she sold $\frac{2}{9}$ of the chocolate muffins and $\frac{1}{2}$ of the vanilla muffins, 230 muffins were left. How many chocolate muffins did Mrs Ali bake?

Method 1



10 units = 230

1 unit = 230 ÷ 10

= 23

9 units = 23 × 9

= 207

Mrs Ali baked 207 chocolate muffins.

Method 2

$\frac{2}{9} \times \frac{3}{5} = \frac{2}{15}$

$\frac{1}{2} \times \frac{2}{5} = \frac{1}{5}$

$1 - \frac{2}{15} - \frac{1}{5} = \frac{2}{3}$

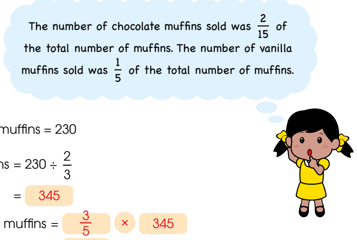
$\frac{2}{3}$ of total number of muffins = 230

Total number of muffins = 230 ÷ $\frac{2}{3}$

= 345

Number of chocolate muffins = $\frac{3}{5}$ × 345

= 207



Mrs Ali baked 207 chocolate muffins.

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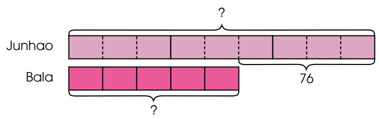
Textbook 6 P57

For Let's Learn 5, go through with pupils how the model was drawn. Get them to fill in the blanks after they understand the model.

For method 2, highlight to pupils that the total number of muffins is represented by 1 whole.

6. Junhao and Bala both collect stamps. $\frac{1}{3}$ of Junhao's stamps is equal to $\frac{3}{5}$ of Bala's stamps. Junhao has 76 more stamps than Bala. How many stamps does each of them have?



4 units = 76
1 unit = 76 ÷ 4
= 19
9 units = 19 × 9
= 171
5 units = 19 × 5
= 95

We use 3 units to represent $\frac{3}{5}$ of Bala's stamps. So, we also use 3 units to represent $\frac{1}{3}$ of Junhao's stamps.

Junhao has 171 stamps and Bala has 95 stamps.

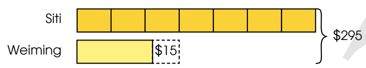
Can you think of other methods to solve this question?

OXFORD UNIVERSITY PRESS FRACTIONS 58

Textbook 6 P58

For Let's Learn 6, go through with pupils how the model was drawn. After which, they should be able to fill in the blanks on their own and get the answers.

7. Siti and Weiming had a total of \$295. After Siti spent $\frac{4}{7}$ of her money and Weiming received \$15, they had an equal amount of money left. How much more money did Siti have than Weiming at first?



10 units = \$295 + \$15
= \$ 310
1 unit = \$ 310 ÷ 10
= \$ 31

Siti had $1 - \frac{4}{7} = \frac{3}{7}$ of her money left.

Amount of money Siti had at first = \$ 31 × 7
= \$ 217

Amount of money Weiming had at first = \$ 31 × 3 − \$15
= \$ 93 − \$15
= \$ 78

Difference in amount of money at first = \$ 217 − \$ 78
= \$ 139

Siti had \$ 139 more than Weiming at first.

Can you think of other methods to solve this question?

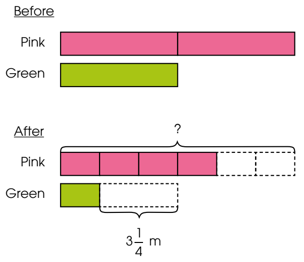
59 CHAPTER 3 OXFORD UNIVERSITY PRESS

Textbook 6 P59

For Let's Learn 7, pupils need to observe that after an additional \$15, Weiming would have $\frac{3}{7}$ of Siti's original amount. Ask:

- How many units out of the original 7 would Siti have left?
- If this is equivalent to what Weiming has after adding \$15, what can we say is the total amount of 10 units?

8. Ann had a pink ribbon and a green ribbon. The pink ribbon was twice as long as the green ribbon. After Ann used $\frac{1}{3}$ of the pink ribbon and $3\frac{1}{4}$ m of the green ribbon, the length of the pink ribbon left was 4 times that of the green ribbon left. What was the length of the pink ribbon at first? Express your answer as a mixed number in its simplest form.



2 units = $3\frac{1}{4}$ m

1 unit = $3\frac{1}{4} \div 2$

= $1\frac{5}{8}$ m

6 units = $1\frac{5}{8} \times 6$

= $9\frac{3}{4}$ m

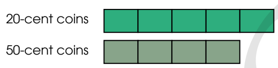
The length of the pink ribbon at first was $9\frac{3}{4}$ m.

Textbook 6 P60

For Let's Learn 8, the model is very useful to visualise the given information. Guide pupils and ask:

- After the ribbons are used, if we represent the green ribbon by 1 unit, how many units would the pink ribbon be represented by?
- How many thirds of the original length of pink ribbon does this correspond to?
- If the original length of the green ribbon was half that of the pink ribbon, how many units does $3\frac{1}{4}$ m equate to?

9. In Raju's coin box, there are only 20-cent and 50-cent coins. There are $\frac{1}{4}$ more 20-cent coins than 50-cent coins. Raju has a total of \$54 in his coin box. How many 20-cent coins are there in his coin box?



Value of 20-cent coins in one group = 20¢ × 5
= \$1

Value of 50-cent coins in one group = 50¢ × 4
= \$2

Value of 20-cent and 50-cent coins in one group = \$1 + \$2
= \$3

Number of groups of coins = 54 ÷ 3
= 18

Number of 20-cent coins = 18 × 5
= 90

The number of 20-cent coins in his coin box is 90.

Textbook 6 P61

In Let's Learn 9, pupils have to consider five 20-cent coints and four 50-cent coints as a 'group'. Point out to pupils that the total value in each group will be the same, and hence we will be able to find the number of groups that make up \$54.
Get pupils to understand that value of coins and number of coins are two different variables.

10. Farhan, Tom and Xinyi shared a gift for their friend. Farhan paid $\frac{1}{4}$ of the cost of the gift. Tom paid \$11 and $\frac{1}{6}$ of the cost of the gift. Xinyi paid \$25 and $\frac{1}{3}$ of the cost of the gift. How much did the gift cost?

$$1 - \frac{1}{4} - \frac{1}{6} - \frac{1}{3} = 1 - \frac{3}{12} - \frac{2}{12} - \frac{4}{12}$$
$$= \frac{3}{12}$$
$$= \frac{1}{4}$$

$\frac{1}{4}$ of the cost of the gift = \$11 + \$25
= \$ 36

Why do we add to find $\frac{1}{4}$ of the cost of the gift?

Cost of the gift = \$ 36 × 4
= \$ 144

The gift cost \$ 144.

Check your answer.

Textbook 6 P62

In Let's Learn 10, point out to pupils that Tom paid \$11 + $\frac{1}{6}$ of the gift and similarly, Xinyi paid \$25 + $\frac{1}{3}$ of the gift.
Hence, the remainder of the cost after subtracting the given fractions is equal to \$11 + \$25.

ACTIVITY TIME

Work in groups of 4.

1. Look at the questions given.

What you need:

1. Ann, Bala and Xinyi shared a sum of money. Ann and Bala received $\frac{1}{2}$ of the money. Bala and Xinyi received $\frac{5}{8}$ of the money. Xinyi received \$9 more than Ann and Bala received \$9. How much did the three pupils share?
2. A figure is made up of two different rectangles, ABCD and PQRS. $\frac{1}{8}$ of rectangle ABCD overlaps with $\frac{1}{5}$ of rectangle PQRS. The area of the part that overlaps is 2.6 cm². Find the total area of the figure.
3. Nora poured all the water from a jug into 3 beakers. The amount of water in the first beaker was $\frac{3}{4}$ the amount of water in the second beaker and the amount of water in the third beaker was $\frac{1}{6}$ less than the amount of water in the first beaker. The third beaker has 45 ml less water than the first beaker. Find the amount of water in the jug at first.

2. In your groups, show how you solve each question.
3. Present your work to the class and explain your answers.

Textbook 6 P63

ACTIVITY TIME

In groups of 4, pupils can try different methods to solve the problem. Check that each method will give the same final answer.

PRACTICE

1. $\frac{3}{4}$ of the spectators at a football match are male. $\frac{1}{9}$ of the males are boys and $\frac{2}{7}$ of the females are girls. There are 1344 spectators at the football match altogether. Are there more girls or boys? How many more? 16 more boys

2. In a box, $\frac{5}{8}$ of the beads were red, $\frac{1}{3}$ of the remaining beads were green and the rest were blue. After $\frac{5}{6}$ of the blue beads and 5 green beads were used, 128 beads were left. How many beads were there in the box at first? 168

3. Ahmad wants to buy an encyclopaedia and a storybook. $\frac{2}{9}$ of the cost of an encyclopaedia is equal to $\frac{3}{7}$ of the cost of a storybook. The encyclopaedia costs \$26 more than the storybook. How much does Ahmad have to pay for both books? \$82

Complete Workbook **6A**, Worksheet **4** • Pages **52 – 60**

MIND WORKOUT

Sam and Junhao were playing a game. At the beginning of the game, Sam had 16 more marbles than Junhao. After the first round, Sam gave $\frac{3}{5}$ of his marbles to Junhao. After the second round, Junhao gave $\frac{5}{12}$ of his marbles to Sam and Junhao had $\frac{7}{9}$ as many marbles as Sam. How many marbles did Sam have at first? 40

What are the different methods you can use to solve this question? Discuss with your partner.

OXFORD UNIVERSITY PRESS FRACTIONS 64

Textbook 6 P64

PRACTICE

Allow pupils to work in pairs or individually on the practice questions.

Independent seatwork

Assign pupils to complete Worksheet 4 (Workbook 6A P52 – 60)

Answers Worksheet 4 (Workbook 6A P52 – 60)

1. $1 - \frac{1}{8} - \frac{2}{5} - \frac{1}{4} = \frac{9}{40}$

   $\frac{9}{40}$ of the sum of money = \$126

   $\frac{40}{40}$ of the sum of money = \$126 ÷ 9 × 40
   = \$560

   Mrs Ali had \$560 at first.

2. $\frac{9}{17}$ of the distance = $2\frac{7}{10}$ km

   $\frac{17}{17}$ of the distance = $2\frac{7}{10} \div 9 \times 17$
   = $5\frac{1}{10}$ km

   Mr Lim drove a total of $5\frac{1}{10}$ km.

3. (a) $\frac{3}{4} \div \frac{3}{5} = 1\frac{1}{4}$

   The length of AB is $1\frac{1}{4}$ m.

   (b) $\frac{1}{2} \times \frac{3}{5} \times 1\frac{1}{4} = \frac{3}{8}$

   The area of the shaded triangle is $\frac{3}{8}$ m^2.

4. $\frac{7}{10} \div \frac{1}{9} = 6\frac{3}{10}$

   The greatest number of such smaller pieces of wood he will get is 6.

5. $\frac{3}{4} \div \frac{1}{8} = 6$

   There are 6 groups in the class.

6. $\frac{1}{3}$ of the tank → 4

   $\frac{2}{3}$ of the tank → 4 × 2 = 8

   He needs to pour 8 more pails of water into the tank.

7. $\frac{2}{9} = \frac{14}{63}$

$\frac{7}{10} = \frac{14}{20}$

249 ÷ 83 = 3

3 × 63 = 189

There were 189 adults.

8. Fraction of visitors that were women $= \frac{3}{5} \times \frac{5}{9}$

$= \frac{1}{3}$

Fraction of visitors that were boys $= \frac{5}{12} \times \frac{4}{9}$

$= \frac{5}{27}$

$\frac{1}{3} - \frac{5}{27} = \frac{4}{27}$

$\frac{34}{27}$ of the visitors = 300

$\frac{27}{27}$ of the visitors = 300 ÷ 4 × 27

= 2025

There were 2025 visitors on that day.

9. $\frac{2}{7} = \frac{16}{56}$

$\frac{1}{8} = \frac{7}{56}$

9 units = $13.50

1 unit = $1.50

112 units = $1.50 × 112

= $168

They had $168 altogether at first.

10. $\frac{7}{10} - \frac{3}{10} = \frac{4}{10}$

$\frac{4}{10}$ of cost = $13.80

$\frac{3}{10}$ of cost = $13.80 ÷ 4 × 3

= $10.35

$10.35 – $5.85 = $4.50

Sam paid $4.50.

11. $\frac{1}{4} \times \frac{5}{7} = \frac{5}{28}$

The number of butter cookies left was $\frac{5}{28}$ of the number of cookies she baked.

$\frac{3}{4} \times \frac{2}{7} = \frac{6}{28}$

$\frac{6}{28} - \frac{5}{28} = \frac{1}{28}$

$\frac{1}{28}$ of the original number of cookies = 9

Number of cookies baked = 9 × 28

= 252

Meiling baked 252 cookies.

*12. For every 3 chickens, there is 1 sheep.
In each group, there are 6 chicken legs and 4 sheep legs.
There are 2 more chicken legs than sheep legs in each group.

96 ÷ 2 = 48

There are 48 sheep at the farm.

PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW

PRACTICE

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Complete Workbook **6A**, Worksheet **4** • Pages **52 – 60**

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What are the different methods you can use to solve this question? Discuss with your partner.

OXFORD UNIVERSITY PRESS FRACTIONS 64

Textbook 6 P64

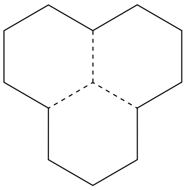
MIND WORKOUT

Get pupils to draw bar models and hint to them to work backwards.

Mind Workout

Date: ____________

Fill in the blanks. Use the figure shown below to help you.

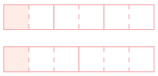


(a) $3 \div \frac{1}{6} = 18$ (b) $3 \div \frac{1}{2} = 6$ (c) $3 \div \frac{3}{2} = 2$

Maths Journal

Date: ____________

In the space given, draw two models to show that $\frac{1}{2} \times \frac{1}{3}$ is the same as $\frac{1}{2} \div 3$.



$\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

$\frac{1}{2} \div 3 = \frac{1}{6}$

Workbook 6A P61

Mind Workout

Some pupils may be able to see that the fraction can be obtained by dividing the whole number on the LHS by that on the RHS.

MATHS JOURNAL

Write a word problem involving at least two out of the four operations involving fractions.

Example

Mr Ho spent $\frac{1}{4}$ of his salary on transport and $\frac{2}{5}$ on food. He saved $\frac{5}{7}$ of the remainder and divided the rest equally among his 4 children. What fraction of Mr Ho's salary did each child get?

The four operations are addition, subtraction, multiplication and division.

Show how you solve your word problem and explain what your answer means.

SELF-CHECK

I know how to...

- divide a proper fraction by a whole number.
- divide a whole number by a proper fraction.
- divide a proper fraction by a proper fraction.
- solve word problems involving the four operations of fractions.

Textbook 6 P65

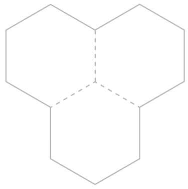
MATHS JOURNAL

Remind pupils to make use of a variety of fractions and that if values are involved, they must make sense. For instance, if the question is about a quantity of an item, the answer needs to be a whole number. Pupils can exchange their word problems with their partner and solve each other's.

Mind Workout

Date:

Fill in the blanks. Use the figure shown below to help you.



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Maths Journal

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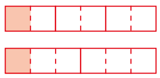

$\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

$\frac{1}{2} \div 3 = \frac{1}{6}$

Fractions 61

Workbook 6A P61

Maths Journal

This journal task reinforces the concept of the division of a fraction to ensure that pupils have a clear understanding.

MATHS JOURNAL

Write a word problem involving at least two out of the four operations involving fractions.

Example

Mr Ho spent $\frac{1}{4}$ of his salary on transport and $\frac{2}{5}$ on food. He saved $\frac{5}{7}$ of the remainder and divided the rest equally among his 4 children. What fraction of Mr Ho's salary did each child get?

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SELF-CHECK

I know how to...

- divide a proper fraction by a whole number.
- divide a whole number by a proper fraction.
- divide a proper fraction by a proper fraction.
- solve word problems involving the four operations of fractions.

65 CHAPTER 3 OXFORD

Textbook 6 P65

SELF-CHECK

Review the important concepts before going through the self-check.

The self-check can be done after pupils have completed **Review 3** (Workbook 6A P62 – 67)

1. (a) $\frac{1}{6}$
   (b) $\frac{1}{16}$
   (c) $3\frac{1}{3}$
   (d) $6\frac{2}{5}$
   (e) $\frac{2}{3}$
   (f) $\frac{2}{3}$
   (g) $1\frac{7}{9}$
   (h) $\frac{27}{32}$

2. 12

3. 10 days

4. $3\frac{1}{5}$

5. $\frac{4}{9} = \frac{12}{27}$
   $\frac{2}{11} = \frac{12}{22}$
   $27 + 22 = 49$
   $343 \div 49 = 7$
   $7 \times 27 = 189$
   There are 189 girls in the hall.

6. Raju spent $\frac{2}{5}$ of his money and Ann spent $\frac{3}{5}$ of her money.
   $\frac{2}{5} = \frac{6}{15}$
   $\frac{3}{5} = \frac{6}{10}$
   $15 + 10 = 25$
   \$450 ÷ 25 × 10 = \$180
   Ann had \$180 at first.

7. $\frac{7}{8} \times \frac{1}{2} = \frac{7}{16}$
   The number of local coins he has left is $\frac{7}{16}$ of the original number of coins.
   $71 - 6 = 65$
   $\frac{7}{16} - \frac{1}{8} = \frac{5}{16}$
   $65 \div 5 \times 16 = 208$
   He had 208 coins at first.

8. $\frac{5}{12}$ of amount of water → $30 \div 2 = 15$
   $\frac{5}{12}$ of the amount of water in the container can be used to make 15 cups of tea.
   $\frac{7}{12}$ of the amount of water in the container was used to make tea.
   $15 \div 5 \times 7 = 21$
   He made 21 cups of tea.

RATIO

CHAPTER 4


Ratio

CHAPTER 4

How can we compare the lengths of the two pieces of tape using ratio and fraction?

RATIO AND FRACTION

LESSON 1

RECAP

Ratios can be used to compare two or more quantities.

1. There are 2 boys and 3 girls.

The ratio of the number of boys to the number of girls is 2 : 3.
The ratio of the number of girls to the number of boys is 3 : 2.

OXFORD UNIVERSITY PRESS

RATIO 66

Textbook 6 P66

Related Resources
NSPM Textbook 6 (P66 – 92)
NSPM Workbook 6A (P68 – 97)

Materials
Pens, pencils, paper, recipes

Lesson

Lesson 1	Ratio and Fraction
Lesson 2	Finding Part and Whole
Lesson 3	Solving Word Problems

Problem Solving, Maths Journal and Pupil Review

INTRODUCTION

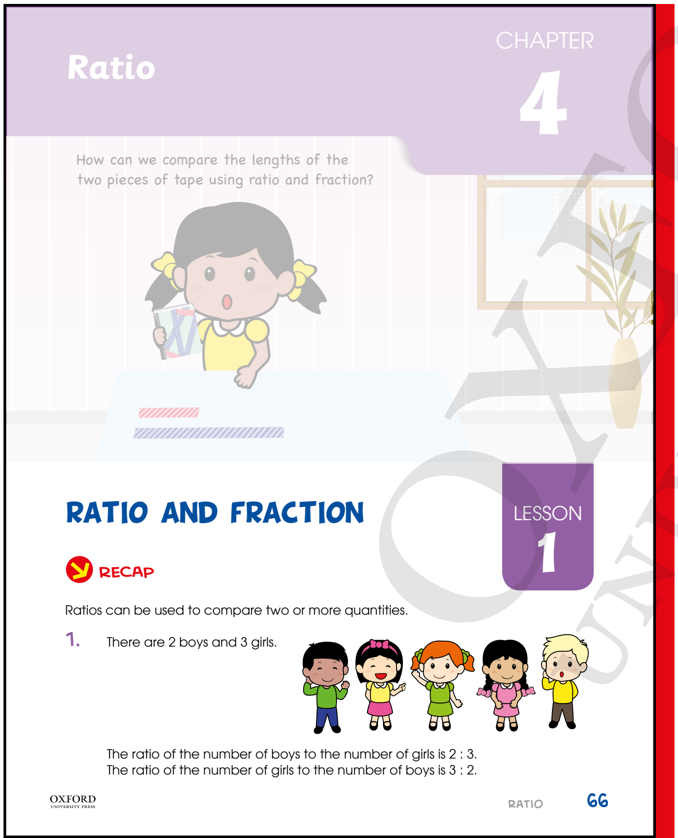
The concept of ratio has been introduced in Grade Five. This chapter establishes the relationship between ratio and fraction, allowing pupils to draw links to what they are familiar with. Pupils will also learn how to relate the ratio of two quantities to direct proportion and to solve problems involving direct proportion and ratio.

LESSON 1

RATIO AND FRACTION

LEARNING OBJECTIVE

1. Relate ratio and fraction.


Ratio

CHAPTER 4

How can we compare the lengths of the two pieces of tape using ratio and fraction?

RATIO AND FRACTION

LESSON 1

RECAP

Ratios can be used to compare two or more quantities.

1. There are 2 boys and 3 girls.

The ratio of the number of boys to the number of girls is 2 : 3.
The ratio of the number of girls to the number of boys is 3 : 2.

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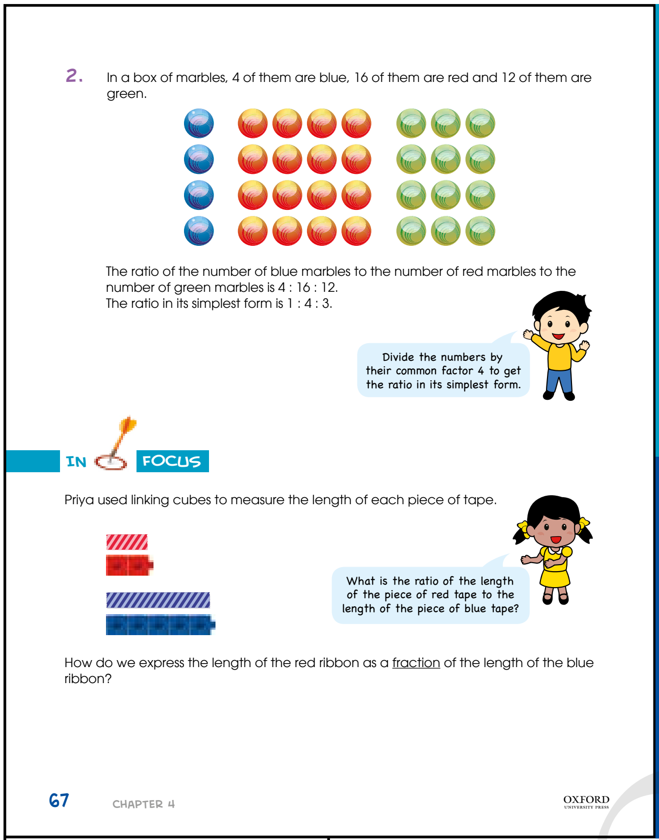
RATIO 66

Textbook 6 P66

RECAP

Get pupils to recall how quantities can be compared using ratio. Remind pupils of important concepts such as the order of writing the quantities as well as equivalent ratios.



2. In a box of marbles, 4 of them are blue, 16 of them are red and 12 of them are green.

The ratio of the number of blue marbles to the number of red marbles to the number of green marbles is 4 : 16 : 12.
The ratio in its simplest form is 1 : 4 : 3.

Divide the numbers by their common factor 4 to get the ratio in its simplest form.

IN FOCUS

Priya used linking cubes to measure the length of each piece of tape.

What is the ratio of the length of the piece of red tape to the length of the piece of blue tape?

How do we express the length of the red ribbon as a fraction of the length of the blue ribbon?

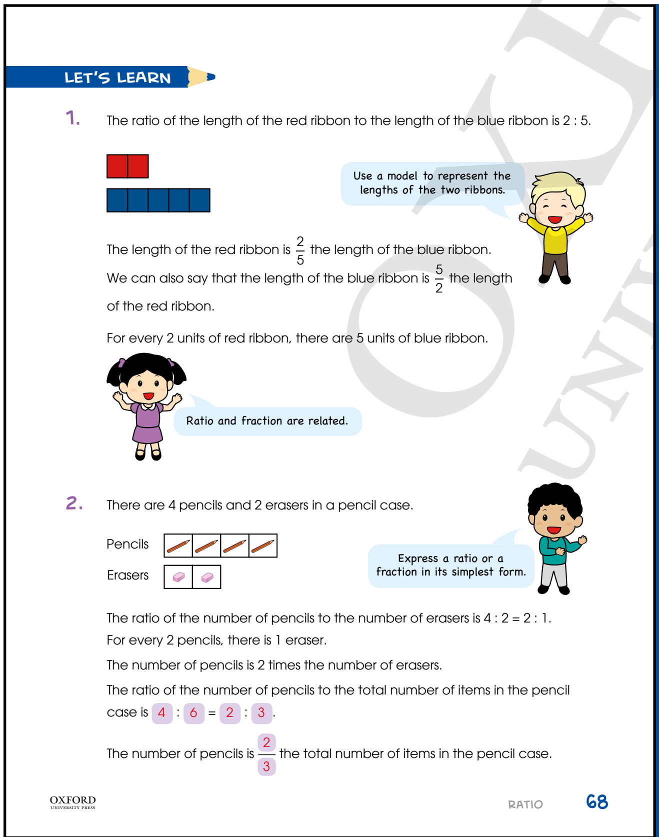
67 CHAPTER 4 OXFORD UNIVERSITY PRESS

Textbook 6 P67

IN FOCUS

Use the chapter opener to discuss how the lengths of the two pieces of tape can be compared. Pupils could use estimation or measurement to find out the lengths of the two pieces of tape. Ask:

- How many units long is the red tape and blue tape respectively?
- What is the ratio of the length of the red tape to the length of the blue tape?
- What fraction of the length of the blue tape is the length of the red tape?



LET'S LEARN

1. The ratio of the length of the red ribbon to the length of the blue ribbon is 2 : 5.

Use a model to represent the lengths of the two ribbons.

The length of the red ribbon is $\frac{2}{5}$ the length of the blue ribbon.
We can also say that the length of the blue ribbon is $\frac{5}{2}$ the length of the red ribbon.

For every 2 units of red ribbon, there are 5 units of blue ribbon.

Ratio and fraction are related.

2. There are 4 pencils and 2 erasers in a pencil case.

Pencils

Erasers

Express a ratio or a fraction in its simplest form.

The ratio of the number of pencils to the number of erasers is 4 : 2 = 2 : 1.
For every 2 pencils, there is 1 eraser.
The number of pencils is 2 times the number of erasers.
The ratio of the number of pencils to the total number of items in the pencil case is 4 : 6 = 2 : 3.

The number of pencils is $\frac{2}{3}$ the total number of items in the pencil case.

OXFORD UNIVERSITY PRESS RATIO 68

Textbook 6 P68

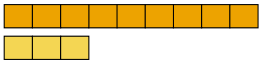
LET'S LEARN

Let's Learn 1 highlights that ratio and fraction are related. Get pupils to see that expressing one length in terms of the other in a ratio is interchangeable with a fraction and vice versa.

Let's Learn 2 tests pupils' basic understanding of simplifying a ratio and converting this information to a fraction. Pay special attention that pupils may mix up the numerator and denominator when expressing the answer in a fraction. Show pupils that they can identify which quantity should be the denominator based on the sentence structure, whereby the item that comes after the fraction in the sentence will be the denominator.

3. At a zoo, there are 9 giant pandas and 3 polar bears.

Giant pandas
Polar bears



Express each of the following in its simplest form.

(a) The ratio of the number of giant pandas to the number of polar bears at the zoo is 3 : 1.

(b) The number of polar bears is $\frac{1}{3}$ the number of giant pandas.

(c) For every polar bear, there are 3 giant pandas.

(d) The ratio of the number of polar bears to the total number of giant pandas and polar bears is 1 : 4.

(e) The number of giant pandas is $\frac{3}{4}$ the total number of giant pandas and polar bears.

4. Compare the amount of water in Beakers A, B and C.

Beaker A Beaker B Beaker C

(a) The ratio of the amount of water in Beaker A to the amount of water in Beaker B is 5 : 8.

(b) The ratio of the amount of water in Beaker B to the amount of water in Beaker C is 4 : 1.

(c) The ratio of the amount of water in Beaker A to the amount of water in Beaker B to the amount of water in Beaker C is 5 : 8 : 2.

(d) The amount of water in Beaker B is 4 times the amount of water in Beaker C.

(e) The amount of water in Beaker C is $\frac{1}{4}$ the amount of water in Beaker B.

(f) The amount of water in Beaker A is $\frac{1}{3}$ the total amount of water in the three beakers.

Textbook 6 P69

For Let's Learn 3, go through with pupils how they can make use of the bar model to represent the information and subsequently find the answers to the questions.

For Let's Learn 4, pupils will have to carefully examine the amount of water in each beaker and proceed to compare them in ratio form. Remind pupils to read carefully the fractions that parts (e) and (f) ask for, especially since there are more than two quantities in this example.

5. Nora is 12 years old and her cousin is 4 years old.

(a) The ratio of Nora's age to her cousin's age is 3 : 1.

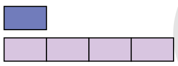
(b) Nora's cousin is $\frac{1}{3}$ as old as Nora.

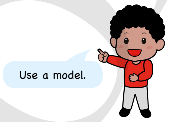
(c) Nora is 3 times as old as her cousin.

(d) The ratio of Nora's age to their total age is 3 : 4.

6. The duration of a television documentary is $\frac{1}{4}$ the duration of a movie.

Documentary
Movie





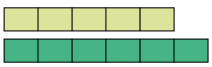
(a) The ratio of the duration of the documentary to the duration of the movie is 1 : 4.

(b) The ratio of the duration of the documentary to the total duration of the documentary and the movie is 1 : 5.

(c) The duration of the movie is $\frac{4}{5}$ the total duration of the documentary and the movie.

7. Mrs Tan's salary is $\frac{5}{6}$ as much as Mr Tan's salary.

Mrs Tan
Mr Tan



(a) What is the ratio of Mrs Tan's salary to Mr Tan's salary? 5 : 6

(b) What is the ratio of Mrs Tan's salary to their total salary? 5 : 11

(c) Express Mrs Tan's salary as a fraction of their total salary. $\frac{5}{11}$

Textbook 6 P70

For Let's Learn 5, remind pupils that they should always leave their answers in the simplest form.

For Let's Learn 6 and 7, reinforce that drawing bar models will be helpful to visualise the given information and enable pupils to get the answers easily.

8. The breadth of a rectangle is $\frac{3}{4}$ as long as its length.

(a) The ratio of the breadth of the rectangle to its length is 3 : 4.

(b) The ratio of the length of the rectangle to its perimeter is 2 : 7. or 4 : 14

(c) The breadth of the rectangle is $\frac{3}{14}$ as long as its perimeter.

ACTIVITY TIME

Work in groups of 4.

What you need:

1. Count the number of pens and the number of pencils all the pupils in your group have.
2. Draw a model to compare the number of pens and pencils.
3. Complete the following statements:
   (a) The number of pens is $\frac{\square}{\square}$ of the number of pencils.
   (b) The number of pencils is $\frac{\square}{\square}$ of the number of pens.
4. Rewrite the statements in 3 using ratio.
5. Repeat 1 to 4 using different numbers of pens and pencils.

Textbook 6 P71

For Let's Learn 8, get pupils to draw out the rectangle to allow them to visualise how many units the perimeter would be.

ACTIVITY TIME

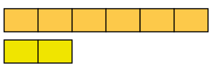
In groups of 4, get pupils to count the number of pens and the number of pencils that they have in total and write the numbers down.
Each pupil can take charge of each part and the other pupils can check their work.
If there is time, pupils can repeat the activity using other stationery items.

PRACTICE

1. Weiming has 6 tennis balls and 2 basketballs.

Tennis balls

Basketballs



Express each of the following in its simplest form.

(a) The ratio of the number of tennis balls to the number of basketballs is 3 : 1.

(b) The number of basketballs is $\frac{1}{3}$ the number of tennis balls.

(c) The number of tennis balls is 3 times the number of basketballs.

(d) The ratio of the number of tennis balls to the total number of tennis balls and basketballs is 3 : 4.

(e) Express the number of basketballs as a fraction of the total number of tennis balls and basketballs. $\frac{1}{4}$

2. Mrs Ali bought 5 kg of white rice and 1 kg of brown rice.

(a) The ratio of the mass of white rice to the mass of brown rice she bought is 5 : 1.

(b) The mass of brown rice is $\frac{1}{5}$ the mass of white rice.

(c) The mass of the white rice Mrs Ali bought is 5 times the mass of the brown rice she bought.

(d) The mass of the brown rice Mrs Ali bought is $\frac{1}{6}$ the total mass of rice she bought.

Textbook 6 P72

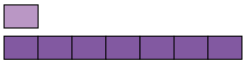
PRACTICE

Work with pupils on the practice questions.

3. In a class, the number of pupils who wear glasses is $\frac{1}{7}$ of the number of pupils who **do not** wear glasses.

Pupils who wear glasses

Pupils who **do not** wear glasses



(a) What is the ratio of the number of pupils who wear glasses to the number of pupils who **do not** wear glasses? 1 : 7

(b) The number of pupils who **do not** wear glasses is 7 times the number of pupils who wear glasses.

(c) What is the ratio of the number of pupils who wear glasses to the total number of pupils? 1 : 8

(d) Express the number of pupils who wear glasses as a fraction of the total number of pupils in the class. $\frac{1}{8}$

(e) Express the number of pupils who **do not** wear glasses as a fraction of the total number of pupils in the class. $\frac{7}{8}$

Complete Workbook **6A**, Worksheet **1** • Pages **68 – 73**

73 CHAPTER 4 OXFORD

Textbook 6 P73

Independent seatwork

Assign pupils to complete Worksheet 1 (Workbook 6A P68 – 73)

Answers

Worksheet 1 (Workbook 6A P68 – 73)

1. (a) 7 : 2
   (b) $\frac{2}{7}$
   (c) 2 : 9
   (d) $\frac{2}{9}$
   (e) $\frac{7}{9}$

2. (a) 9 : 10
   (b) $\frac{9}{10}$
   (c) $\frac{10}{9}$
   (d) $\frac{10}{19}$

3. (a) 3 : 4
   (b) 2
   (c) 3 : 2 : 4
   (d) 4 : 9
   (e) $\frac{2}{9}$

4. (a) 70 min
   (b) 3 : 4 or 30 : 40
   (c) $\frac{3}{4}$ or $\frac{30}{40}$
   (d) $\frac{4}{3}$ or $\frac{40}{30}$

5. (a) 8 : 9
   (b) 9 : 17
   (c) $\frac{8}{9}$
   (d) $\frac{8}{17}$

6. (a) $\frac{8}{3}$
   (b) 3 : 8
   (c) 3 : 11
   (d) $\frac{8}{11}$

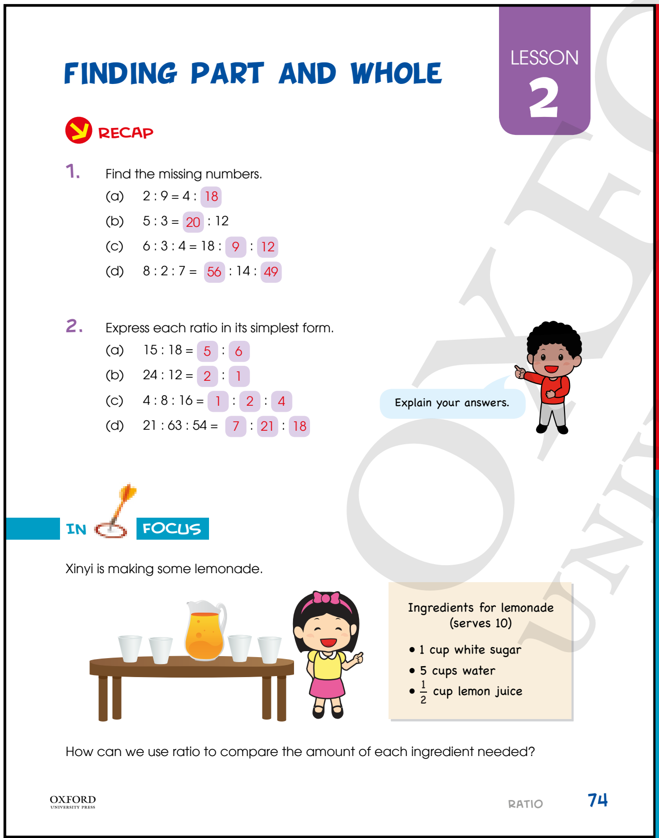
7. (a) $\frac{1}{2}$
   (b) $\frac{2}{3}$
   *(c) $\frac{3}{8}$

LESSON
2

FINDING PART AND WHOLE

LEARNING OBJECTIVE

1. Find the ratio of two quantities in direct proportion and use it to solve direct proportion problems.



FINDING PART AND WHOLE

LESSON 2

RECAP

1. Find the missing numbers.
   (a) 2 : 9 = 4 : 18
   (b) 5 : 3 = 20 : 12
   (c) 6 : 3 : 4 = 18 : 9 : 12
   (d) 8 : 2 : 7 = 56 : 14 : 49

2. Express each ratio in its simplest form.
   (a) 15 : 18 = 5 : 6
   (b) 24 : 12 = 2 : 1
   (c) 4 : 8 : 16 = 1 : 2 : 4
   (d) 21 : 63 : 54 = 7 : 21 : 18

Explain your answers.

IN FOCUS

Xinyi is making some lemonade.

Ingredients for lemonade (serves 10)
- 1 cup white sugar
- 5 cups water
- $\frac{1}{2}$ cup lemon juice

How can we use ratio to compare the amount of each ingredient needed?

OXFORD UNIVERSITY PRESS　RATIO　74

Textbook 6 P74

RECAP

Recap equivalent ratios and writing ratios in the simplest form. Get pupils to explain their answers. For example, in 1(a), pupils could mention that they multiply 2 by 2 to get 4, so they must also multiply 9 by 2 to get 18.

$$\begin{array}{ccc} 2 & : & 9 \\ \downarrow \times 2 & & \downarrow \times 2 \\ 4 & : & 18 \end{array}$$

IN FOCUS

Prompt pupils by asking: what is the ratio of the number of cups of white sugar
- to the number of cups of water?
- to the number of cups of lemon juice?

Get pupils to draw out a model to represent $1 : \frac{1}{2}$ without having a fraction.

LET'S LEARN

1. A recipe for lemonade is shown.

Ingredients for lemonade (serves 10)

- 1 cup white sugar
- 5 cups water
- $\frac{1}{2}$ cup lemon juice

(a) Xinyi uses 4 cups of white sugar. How many cups of water does she need?

Number of cups of white sugar	1	2	3	4
Number of cups of water	5	10	15	20

The ratio of the number of cups of white sugar to the number of cups of water is 1 : 5.

Use equivalent ratios to find the number of cups of water needed.

1 : 5 = 2 : 10 = 3 : 15 = 4 : 20

Sugar : Water
1 : 5
× 4   × 4
4 : 20

When Xinyi uses 4 cups of white sugar, she needs 20 cups of water.

75 CHAPTER 4 OXFORD UNIVERSITY PRESS

Textbook 6 P75

LET'S LEARN

In Let's Learn 1(a), pupils should be able to observe a pattern from the table.

Get pupils to see that the number of cups of water increases as the number of cups of white sugar increases. The 1 : 5 ratio is kept constant.

(b) How many cups of white sugar does Xinyi need when she uses 30 cups of water?

Number of cups of white sugar	1	2	3	4	5	6
Number of cups of water	5	10	15	20	25	30

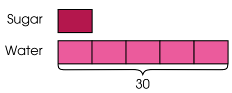
Method 1

1 : 5 = 6 : 30

She needs 6 cups of white sugar.

Sugar : Water
1 : 5
× 6   × 6
6 : 30

Method 2



5 units = 30
1 unit = 30 ÷ 5
= 6

She needs 6 cups of white sugar.

OXFORD UNIVERSITY PRESS RATIO 76

Textbook 6 P76

In Let's Learn 1(b), pupils can make use of equivalent ratios or the bar modelling method to obtain the answer.

2. Raju uses the same recipe to make lemonade.

Ingredients for lemonade
(serves 10)

- 1 cup white sugar
- 5 cups water
- $\frac{1}{2}$ cup lemon juice

(a) He uses 4 cups of white sugar. How many cups of lemon juice does he need?

Number of cups of white sugar	1	2	3	4
Number of cups of lemon juice	$\frac{1}{2}$	1	$1\frac{1}{2}$	2

Method 1

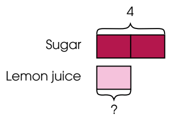
The ratio of the number of cups of white sugar to the number of cups of lemon juice is 2 : 1. Explain how you tell.

Sugar : Lemon juice
2 : 1
× 2 ↓ ↓ × 2
4 : 2

2 : 1 = 4 : 2

He needs 2 cups of lemon juice.

Method 2



2 units = 4
1 unit = 4 ÷ 2
= 2

He needs 2 cups of lemon juice.

Textbook 6 P77

For Let's Learn 2, the same two methods can be used as in Let's Learn 1.

Point out to pupils that it is also possible to find the number of cups of lemon juice needed by taking $\frac{1}{2} \times 4$ to obtain 2 as the number of cups of lemon juice needed is $\frac{1}{2}$ the number of cups of white sugar.

(b) How many cups of white sugar does Bala need when he uses 9 cups of lemon juice?

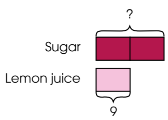
Method 1

Sugar : Lemon juice
2 : 1
× 9 ↓ ↓ × 9
18 : 9

2 : 1 = 18 : 9

He needs 18 cups of white sugar.

Method 2



1 unit = 9
2 units = 9 × 2
= 18

He needs 18 cups of white sugar.

Textbook 6 P78

From parts (a) and (b), pupils should see that it does not matter which variable is known.

Get pupils to understand that using the same ratio, they can find the unknown quantity of one variable when given the quantity of the other.

3. Ahmad wants to use the same recipe to make 20 servings of lemonade. How many cups of each ingredient does he need?

Ingredients for lemonade
(serves 10)

- 1 cup white sugar
- 5 cups water
- $\frac{1}{2}$ cup lemon juice

The recipe is for 10 servings. To make 20 servings, multiply the number of cups by $20 \div 10 = \boxed{2}$.

Number of cups of white sugar needed = $\boxed{2} \times 1$
$= \boxed{2}$

Number of cups of water needed = $\boxed{2} \times 5$
$= \boxed{10}$

Number of cups of lemon juice needed = $\boxed{2} \times \frac{1}{2}$
$= \boxed{1}$

4. The ingredients for baking 8 macarons are:

- 3 egg whites
- $\frac{1}{4}$ cup white sugar
- $\frac{1}{2}$ cup confectioner's sugar
- 1 cup fine ground almonds

How much of each ingredient is needed to bake 40 macarons?

$40 \div 8 = \boxed{5}$

Number of egg whites needed = $\boxed{5} \times 3 = \boxed{15}$

Number of cups of white sugar needed = $\boxed{5} \times \frac{1}{4} = \boxed{1\frac{1}{4}}$

Number of cups of confectioner's sugar needed = $\boxed{5} \times \frac{1}{2} = \boxed{2\frac{1}{2}}$

Number of cups of fine ground almonds needed = $\boxed{5} \times 1 = \boxed{5}$

79 CHAPTER 4 OXFORD

Textbook 6 P79

In Let's Learn 3, the recipe needs to be modified to serve 20 people. Prompt pupils by asking how they can get 20 from 10. Guide them to subsequently change the quantities of the ingredients.

Similarly, in Let's Learn 4, pupils should think of how 40 can be obtained from 8.

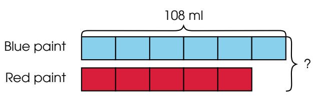
5. The ratio of the length of a rectangle to its breadth is 4 : 1. The perimeter of the rectangle is 70 cm. Find the length and the breadth of the rectangle.

10 units = 70 cm
1 unit = $70 \div 10$
= 7 cm
4 units = 7×4
= 28 cm

Perimeter = 4 + 1 + 4 + 1
= 10 units

The length of the rectangle is 28 cm and the breadth of the rectangle is 7 cm.

6. To get purple paint, Meiling mixed blue paint with red paint in the ratio 6 : 5. She used 108 ml of blue paint. Find the total amount of purple paint that Meiling made.



6 units = 108 ml
1 unit = $108 \div 6$
= $\boxed{18}$ ml
11 units = $\boxed{18} \times \boxed{11}$
= $\boxed{198}$ ml

Meiling made $\boxed{198}$ ml of purple paint.

OXFORD RATIO 80

Textbook 6 P80

For Let's Learn 5, guide pupils to see that the perimeter (in units) can be obtained by adding up all the sides.

For Let's Learn 6, drawing a model can help pupils visualise better.

PRACTICE

1. At a fruit stall, apples are sold at 3 for $1.
(a) Complete the table.

Amount of money ($)	1	2	3	4	5
Number of apples	3	6	9	12	15

(b) How many apples can Xinyi buy with $8? 24

2. To make her own bubble solution, Siti uses 2 tablespoons of laundry detergent for every cup of warm water.
(a) How many tablespoons of laundry detergent does Siti need when she uses 6 cups of warm water? 12
(b) How many cups of warm water does Siti need when she uses 6 tablespoons of laundry detergent? 3

3. The following ingredients are needed to make 8 servings of tuna pasta.

3 cups macaroni	1 can tuna
1 can condensed cream of chicken soup	$\frac{1}{2}$ cup French fried onions

Mrs Lim wants to make 24 servings of tuna pasta. How much of each ingredient does she need? 9 cups macaroni, 3 cans tuna, 3 cans condensed cream of chicken soup, $1\frac{1}{2}$ cups French fried onions

4. In a primary school, the ratio of the number of girls to the number of boys is 6 : 7. There are 1820 pupils altogether. How many boys are there in the school? 980

Complete Workbook **6A**, Worksheet **2** • Pages **74 – 77**

Textbook 6 P81

PRACTICE

Work with pupils on the practice questions.

Independent seatwork

Assign pupils to complete Worksheet 2 (Workbook 6A P74 – 77)

 Worksheet 2 (Workbook 6A P74 – 77)

1.

Number of cups of chicken broth	1	2	3	4	5
Number of cups of tomato paste	2	4	6	8	10

2.

Number of eggs	3	6	9	12	15
Number of teaspoons of baking soda	1	2	3	4	5

3.

Number of local stamps	8	16	24	32	40	48	56
Number of foreign stamps	3	6	9	12	15	18	21

4. 5 chocolate bars
   5 cups condensed milk
   10 cups cream

5. 3
   Bina can make 3 such necklaces.

6. (a) 125 ÷ 5 × 3 = 75
   There are 75 hens at the farm.
   (b) 125 ÷ 5 × 8 = 200
   There are 200 hens and ducks altogether.

7. 2 units = 26
   1 unit = 26 ÷ 2
   = 13
   16 units = 13 × 16
   = 208
   Their total height is 208 cm.

8. <u>At first</u>
   Number of marbles in cup : Number of marbles in box
   9 : 3
   3 : 1
   Number of marbles left in cup = 9 – 3
   = 6
   In order for the ratio to remain the same, there should be 2 marbles in the box.
   3 – 2 = 1
   He should remove 1 marble from the box.

LESSON

3

SOLVING WORD PROBLEMS

LEARNING OBJECTIVE

1. Solve word problems that involve changing ratios.

SOLVING WORD PROBLEMS

LESSON 3

IN FOCUS

According to a recipe for stew, the ratio of the number of carrots needed to the number of potatoes needed is 2 : 1. The ratio of the number of potatoes needed to the number of onions needed is also 2 : 1. A chef wants to use 8 carrots to make a pot of stew. How many onions does he need?

How can we tell?

LET'S LEARN

1. How many onions does the chef need when he uses 8 carrots?

Carrots : Potatoes

$$\begin{array}{ccc} 2 & : & 1 \\ 4 & : & 2 \end{array} \quad (\times 2)$$

Potatoes : Onions

2 : 1

> The number of potatoes is the same. So, the number of units representing the number of potatoes must be the same in both ratios.

Carrots	:	Potatoes	:	Onions
4	:	2	:	1

The ratio of the number of carrots to the number of potatoes to the number of onions needed is 4 : 2 : 1.

4 units = 8
1 unit = 8 ÷ 4
= 2

The chef needs 2 onions.

Textbook 6 P82

IN FOCUS

Discuss with pupils how the problem can be solved. Guide pupils to annotate the crucial information in the problem (i.e. Carrots : Potatoes = 2 : 1 and Potatoes : Onions = 2 : 1).

LET'S LEARN

Get pupils to identify the constant item, i.e. potatoes. Guide pupils to combine the three items into one ratio by representing Carrots : Potatoes as 4 : 2.

2. The ratio of the number of stamps Ann has to the number of stamps Farhan has is 3 : 5. The ratio of the number of stamps Farhan has to the number of stamps Sam has is 4 : 7. The three of them have 134 stamps altogether. How many stamps does Sam have?

Ann	:	Farhan
3	:	5
12	:	20

× 4, × 4

Farhan	:	Sam
4	:	7
20	:	35

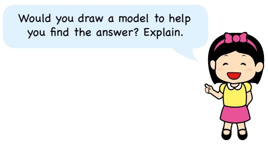
× 5, × 5

Total number of units = 12 + 20 + 35
= 67

67 units = 134
1 unit = 134 ÷ 67
= 2

35 units = 35 × 2
= 70

Sam has 70 stamps.

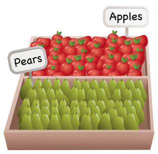


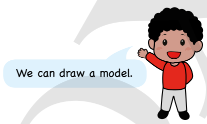
Textbook 6 P83

Let's Learn 2 requires pupils to change both ratios in order to combine them. Ask:

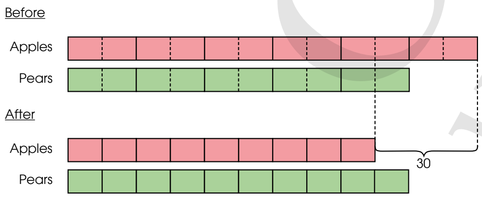
- Which of the three names appears in both ratios?
- How do we make this quantity the same number of units in both ratios?

3. At a fruit stall, the ratio of the number of apples to the number of pears was 6 : 5. After 30 apples were sold, the ratio of the number of apples to the number of pears became 9 : 10. How many pears were there at the stall?



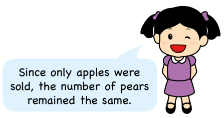


Method 1



3 units = 30
1 unit = 30 ÷ 3
= 10
10 units = 10 × 10
= 100

There were 100 pears at the stall.

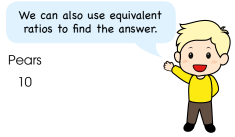


Textbook 6 P84

For Let's Learn 3, guide pupils to see that the same method used in Let's Learn 1 and 2 cannot be applied. Start by going through the bar modelling method to help pupils visualise the information given. Ask:

- Since only apples were sold, what remains constant?
- If the number of pears stays the same, how can we represent the before and after models of 'pears' such that they have an equal number of units?

Method 2



Before

Apples : Pears

6 : 5 (× 2)

12 : 10

After

Apples : Pears

9 : 10

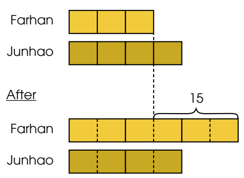
Difference in the number of units of apples = 12 – 9
= 3

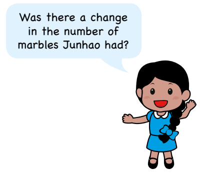
3 units = 30
1 unit = 30 ÷ 3
= 10
10 units = 10 × 10
= 100

There were 100 pears at the stall.

4. The ratio of the number of marbles Farhan had to the number of marbles Junhao had was 3 : 4. After Farhan bought 15 more marbles, the ratio became 3 : 2. How many marbles did Farhan and Junhao have altogether at first?

Method 1



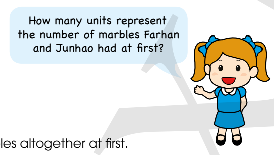


Textbook 6 P85

Guide pupils to observe that both methods allow them to find the difference in the number of units of apples, which will equal the number of apples sold.

In Let's Learn 4, pupils may mistakenly think that the number of marbles Farhan had remained constant as this was represented by 3 units in both ratios. Guide pupils to read the information properly in order to observe that Farhan's number of marbles was the one that changed.

3 units = 15
1 unit = 15 ÷ 3
= 5
7 units = 5 × 7
= 35



Farhan and Junhao had 35 marbles altogether at first.

Method 2

Before

Farhan : Junhao

3 : 4

After

Farhan : Junhao

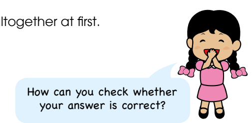
3 : 2 (× 2)

6 : 4

Difference in the number of units for Farhan's marbles = 6 – 3
= 3

3 units = 15
1 unit = 15 ÷ 3
= 5
7 units = 5 × 7
= 35

Farhan and Junhao had 35 marbles altogether at first.



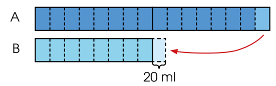
Textbook 6 P86

Get pupils to substitute their answers into the question to check that they are correct, i.e. obtain the same ratios before and after as given in the question.

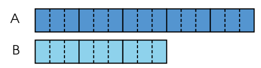
5. The ratio of the amount of juice in glass A to the amount of juice in glass B is 2 : 1. When 20 ml of juice is poured from glass A to glass B, the ratio becomes 5 : 3. What is the total amount of juice in both glasses?

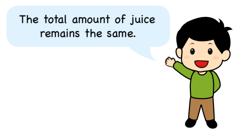
Method 1

Before



After





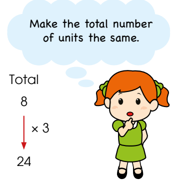
1 unit = 20 ml

24 units = 20 × 24

= 480 ml

The total amount of juice in both glasses is 480 ml.

Method 2



Before

A	:	B	Total
2	:	1	3
× 8		× 8	× 8
16	:	8	24

Before

A	:	B	Total
5	:	3	8
× 3		× 3	× 3
15	:	9	24

Decrease in number of units of A = 16 – 15
= 1

1 unit = 20 ml

24 units = 20 × 24

= 480 ml

The total amount of juice in both glasses is 480 ml.

Textbook 6 P87

For Let's Learn 5, pupils may have difficulty understanding the concept that the total amount of juice remains the same. If they are unable to visualise this using the model, prompt them by asking:

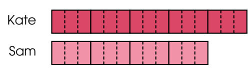
- If you poured some water from your bottle to your partner's, what is the total amount of water both of you have before and after?
- Does the total amount remain the same?

Guide pupils to see that in this case, they will have to manipulate the total number of units, instead of one factor as they did in the previous examples.

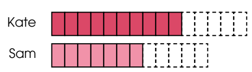
6. The ratio of the amount of money Kate had to the amount of money Sam had was 5 : 4. After both of them spent $5, the ratio became 10 : 7. How much money did Sam have at first?

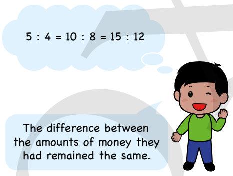
Method 1

Before



After

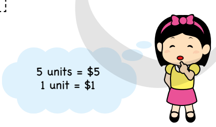




5 units = $5

12 units = $12

Sam had $12 at first.



Method 2

Before

Kate	:	Sam	Difference
5	:	4	1
× 3		× 3	× 3
15	:	12	3

After

Kate	:	Sam	Difference
10	:	7	3

Decrease in each person's number of units = 15 – 10
= 5

5 units = $5

12 units = $12

Sam had $12 at first.

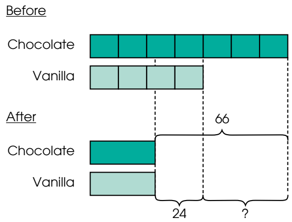
Textbook 6 P88

For Let's Learn 6, the total amount of money changes, but the difference between what Kate and Sam had remains constant. Use concrete numbers to help pupils understand the concept before going through the example. For instance, ask:

- If your partner has $5 and you have $4, what is the difference?
- If both of you spend $2 each, how much would each of you be left with?
- What is the difference now?

Get pupils to see that in the example, the number of units 'lost' from both Kate and Sam will have to be the same, which is equal to what they each spent.

7. A baker made some chocolate and vanilla cookies. The ratio of the number of chocolate cookies to the number of vanilla cookies she made was 7 : 4. After 66 chocolate cookies and 24 vanilla cookies were sold, the number of chocolate cookies and vanilla cookies became the same. How many vanilla cookies were left in the end?



3 units = 66 − 24
= 42
1 unit = 42 ÷ 3
= 14
4 units = 14 × 4
= 56

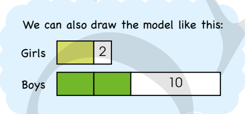
Number of vanilla cookies left = 56 − 24
= 32

32 vanilla cookies were left in the end.

Textbook 6 P89

Let's Learn 7 further broadens pupils' understanding of ratios as two quantities change. Prompt pupils that when the number of chocolate and vanilla cookies are the same, the ratio is 1 : 1. By comparing the models, it is not possible to see how many units of cookies were sold. Guide pupils to see that it is only possible to deduce the value of each unit through the difference in the number of chocolate and vanilla cookies sold.

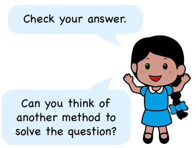
8. The number of girls to the number of boys in a swimming club was in the ratio 1 : 2. After 2 girls and 10 boys joined the club, the ratio became 1 : 3. How many boys were there in the club at first?



Comparing the models for the boys, we get

1 unit = 10 − 2 × 3
= 10 − 6
= 4
2 units = 4 × 2
= 8

There were 8 boys in the club at first.



Textbook 6 P90

For Let's Learn 8, pupils may be confused over how to compare the number of boys. Prompt pupils that two models can be drawn for the boys after the new members join; one in comparison to the girls, i.e. 3 times as much, and one based on 10 boys joining. Get pupils to see that these two models are equivalent and they can then solve the problem based on the difference in units identified.

PRACTICE

1. The ratio of the length of a pink ribbon to the length of a blue ribbon was 3 : 5. After 20 cm of the blue ribbon was cut to make a bow, the ratio of the length of the pink ribbon to the remaining length of the blue ribbon was 9 : 11. What was the length of the pink ribbon? 45 cm

2. The ratio of the number of stamps Weiming has to the number of stamps Raju has is 9 : 5. After Weiming gives Raju 8 stamps, the ratio becomes 4 : 3. How many stamps do Weiming and Raju have altogether? 112

3. Ahmad had $36 and Xinyi had $27. Each of them spent the same amount of money. The ratio of the amount of money Ahmad had to the amount of money Xinyi had became 5 : 2. How much did each of them spend? $21

4. Mrs Tan bought some fish and chicken. The ratio of the mass of fish to the mass of chicken was 5 : 4. After she used 260 g of fish and 160 g of chicken to cook a meal, the mass of fish left was the same as the mass of chicken left. How much fish did Mrs Tan have left? 240 g

Complete Workbook **6A**, Worksheet **3** • Pages **78 – 86**

MIND WORKOUT

In a club, the ratio of the number of boys to the number of girls was 3 : 2. After 3 boys joined the club and 6 girls left the club, the ratio of the number of boys to the number of girls remaining in the club was 7 : 2. How many children were there in the club at first? 30

There is a change in both the number of boys and the number of girls. What is the change in the number of units for each?

91 CHAPTER 4 OXFORD

Textbook 6 P91

PRACTICE

Let pupils work in pairs or individually on the practice questions.

Independent seatwork

Assign pupils to complete Worksheet 3 (Workbook 6A P78 – 86)

Answers

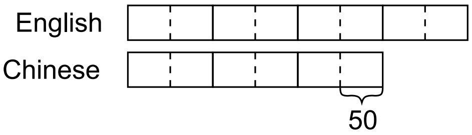
Worksheet 3 (Workbook 6A P78 – 86)

1. 3 units = 15
   1 unit = 15 ÷ 3
   = 5
   4 units = 5 × 4
   = 20
   There were 20 chickens and sheep at the farm in the end.

2. (a) Flamingos : Pelicans
   5 : 2
   50 : 20
   Pelicans : Owls
   20 : 1
   Flamingos : Pelicans : Owls
   50 : 20 : 1
   The ratio of the number of flamingos to the number of pelicans to the number of owls at the attraction is 50 : 20 : 1.
   (b) 1 unit = 3
   50 units = 50 × 3
   = 150
   There are 150 flamingos at the attraction.

3. (a) Ahmad : Siti
   6 : 5
   54 : 45
   Ahmad : Meiling
   9 : 4
   54 : 24
   Ahmad : Siti : Meiling
   54 : 45 : 24
   Number of units = 54 + 45 + 24
   = 123 units
   123 units = $123
   1 unit = $1
   45 units = 45 × $1
   = $45
   Siti has $45.

4. <u>After</u>



(a) 1 unit = 50

8 units = 50 × 8 = 400

There were 400 English books in the library.

(b) 14 units = 50 × 14 = 700

The total number of English and Chinese books in the library in the end was 700.

5. Initial ratio

6A : 6B

4 : 5

32 : 40

Ratio in the end

6A : 6B

7 : 8

35 : 40

35 – 32 = 3

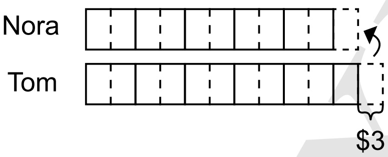
3 units = $6

40 units = $6 ÷ 3 × 40

= $80

Primary 6B collected $80.

6.



1 unit = $3

22 units = $3 × 22

= $66

Nora and Tom had $66 altogether.

7. Initial ratio

Number of pens : Number of pencils

7	:	5
14	:	10

14 – 11 = 3

10 – 7 = 3

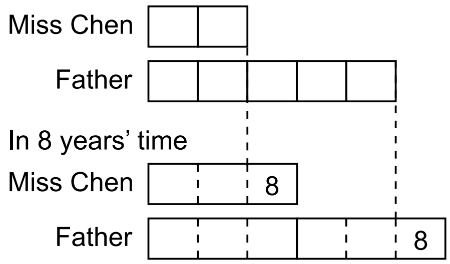
3 units = 21

7 units = 21 ÷ 3 × 7

= 49

49 pencils were left.

8. Now



1 unit = 8

5 units = 8 × 5

= 40

Miss Chen's father is 40 years old now.

9. <u>Initial ratio</u>

Priya : Xinyi

40 : 28

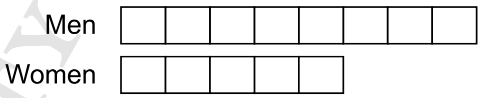
10 : 7

1 unit = 40 ÷ 10

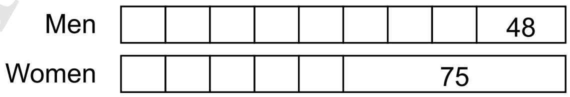
= 4

Priya gave Xinyi $4.

10. <u>Before</u>



<u>After</u>



3 units = 75 – 48

= 27

13 units = 27 ÷ 3 × 13

= 117

117 + 48 + 75 = 240

There are 240 men and women in the hall now.

11. <u>Initial ratio</u>

Number of blue balls : Number of red balls

4	:	1

<u>Ratio in the end</u>

Number of blue balls : Number of red balls

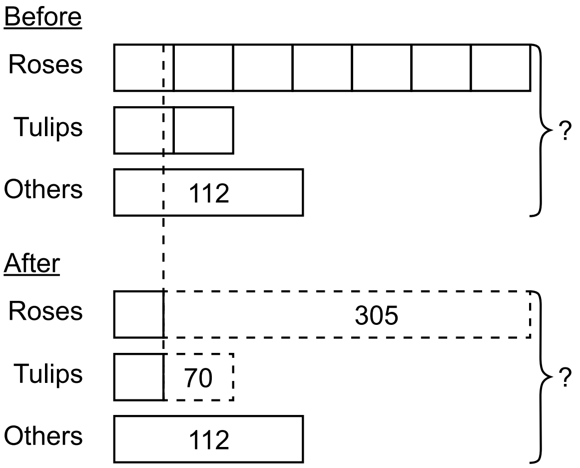
3	:	1
6	:	2

2 units = 8

4 units = 8 × 2

= 16

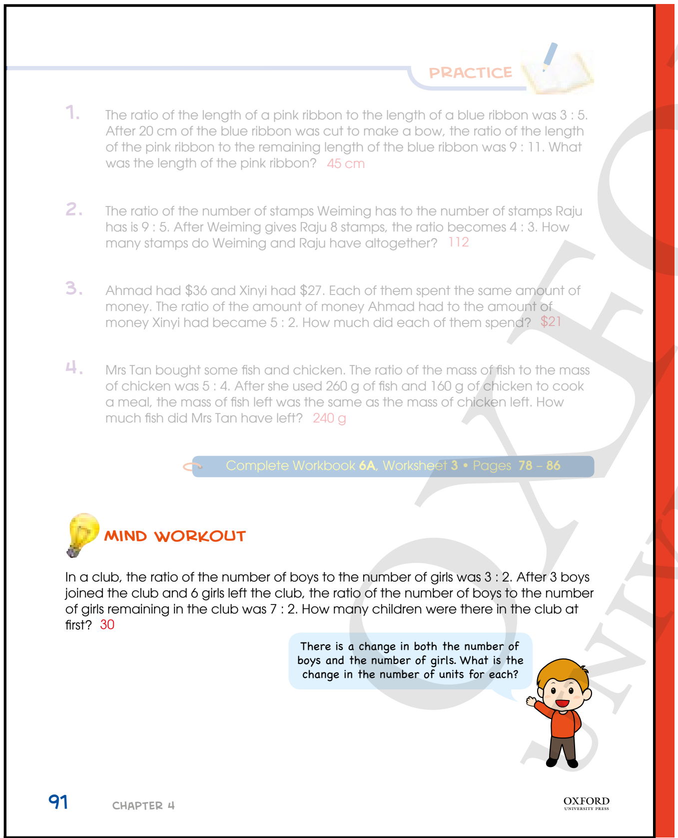
There were 16 blue balls at first.

12. 

5 units = 305 – 70
= 235
1 unit = 235 ÷ 5
= 47
Total number of flowers at first
= 47 × 9 + 112
= 535
The florist had 535 stalks of flowers at first.

13. For every 6 adult tickets sold, 5 child tickets were sold.
Cost of tickets in one group = \$10 × 6 + \$6 × 5
= \$90
Number of groups of tickets sold = 8100 ÷ 90
= 90
Number of adult tickets sold = 90 × 6
= 540
540 adult tickets were sold.

PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW



PRACTICE

1. The ratio of the length of a pink ribbon to the length of a blue ribbon was 3 : 5. After 20 cm of the blue ribbon was cut to make a bow, the ratio of the length of the pink ribbon to the remaining length of the blue ribbon was 9 : 11. What was the length of the pink ribbon? 45 cm

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Complete Workbook 6A, Worksheet 3 • Pages 78 – 86

MIND WORKOUT

In a club, the ratio of the number of boys to the number of girls was 3 : 2. After 3 boys joined the club and 6 girls left the club, the ratio of the number of boys to the number of girls remaining in the club was 7 : 2. How many children were there in the club at first? 30

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Textbook 6 P91

MIND WORKOUT

If pupils have difficulties with the problem, facilitate by providing the following guidance:

- Refer to Let's Learn 8 and identify any similarities and differences.
- Draw a model of the initial 3 : 2 ratio.
- Add a value of 3 to the boys.
- For the girls, out of 2 units, how can we represent 6 girls leaving? (Get pupils to see that they need to 'subtract' a value of 3 from each unit)
- How can we make the units of the boys the same as the girls?
- Comparing the models for before and after, how many units does the extra 4 × 3 correspond to?

Mind Workout

Date: ____________

Ann had some 50¢ coins and some 20¢ coins. The ratio of the number of 50¢ coins to the number of 20¢ coins she had was 3 : 5. The value of the 50¢ coins was $3 more than the value of the 20¢ coins. How many 20¢ coins did Ann have?

For every 3 50¢ coins, there were 5 20¢ coins.

Value of 50¢ coins in each group = 3 × 50¢
= $1.50

Value of 20¢ coins in each group = 5 × 20¢
= $1

Difference in the value of each group = $1.50 – $1
= $0.50

Number of groups = 3 ÷ 0.50
= 6

Number of 20¢ coins = 6 × 5
= 30

Ann had 30 twenty-cent coins.

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Ratio 87

Workbook 6A P92

Mind Workout

Highlight to pupils that the ratio of the number of 50-cent coins to the number of 20-cent coins is not the same as the ratio of the value of 50-cent coins to the value of 20-cent coins.
Guide pupils to view the number of coins in terms of 'groups' where the difference in the total value of all the groups will equal to $3.

MATHS JOURNAL

Plan a party for 10 people.

Search on the Internet for a cookie recipe and a drink recipe. Given that all 10 people eat and drink the same amount, write down the recipe and the amount of each ingredient you will need. Explain how you work out each amount.

SELF-CHECK

I know how to...

- compare quantities using fraction and ratio.
- find unknown quantities in a given ratio.
- solve word problems involving ratios.

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RATIO 92

Textbook 6 P92

MATHS JOURNAL

Allow pupils some time to find the recipes and state how many people their recipes serve. Discuss how they would find the quantities needed if there were 10 people attending their party. Consider giving an example and demonstrating how the answer can be obtained if pupils need further guidance.

SELF-CHECK

Before pupils proceed to do the self-check, review the important concepts by asking for examples learnt for each objective.

The self-check can be done after pupils have completed **Review 4** (Workbook P88 – 97) as consolidation for the chapter.

1. (a) 2 : 1

   (b) $\frac{3}{4}$

   (c) 2

   (d) $\frac{2}{3}$

2. (a) 2 : 3 or 10 : 15

   (b) $\frac{2}{3}$ or $\frac{10}{15}$

3. (a) 2 : 1

   (b) $\frac{1}{2}$

   (c) $\frac{2}{3}$

   (d) 3 : 1 : 2

4. (a)

Amount saved ($)	10	20	30	40	50
Amount received ($)	2	4	6	8	10

   (b) $120 ÷ 10 × 2 = $24
   He received $24.

5.

Number of apples	2	4	6	8	10
Number of carrots	4	8	12	16	20

6. $1\frac{2}{3}$ cups cocoa powder. $3\frac{3}{4}$ cups white sugar, $\frac{5}{8}$ cups boiling water, 15 cups milk, $2\frac{1}{2}$ cups cream

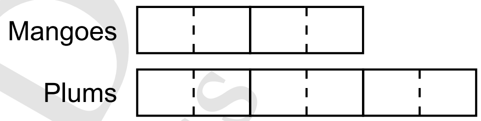
7. $\frac{5}{14}$

8. 36 ÷ 9 = 4
   4 × 17 = 68
   There are 68 pupils in Class 6A and 6B altogether.

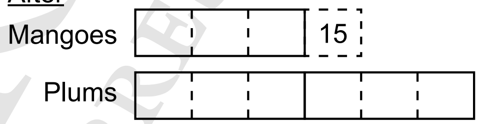
9. $156 ÷ 12 = $13
   $13 × 2 = $26
   Farhan has $26 more than Junhao.

10. Initial ratio
    Number of apples : Number of pears
    14 : 10
    4 units = 240
    1 unit = 240 ÷ 4
    = 60
    14 units = 60 × 14
    = 840
    He had 840 apples at first.

11. Before

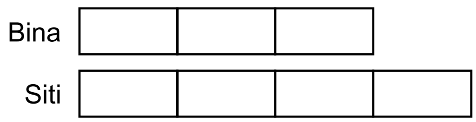


After

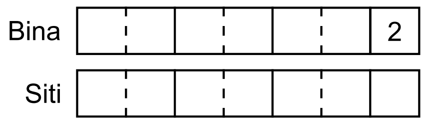


1 unit = 15
6 units = 15 × 6
= 90
There were 90 plums.

12. Before



After



1 unit = 2
6 units = 2 × 6
= 12
Bina had 12 stickers at first.

13. <u>Now</u>

Mother's age : Raju's age

2 : 1

10 : 5

<u>In 10 years' time</u>

Mother's age : Raju's age

12 : 7

Difference in number of units = 2

2 units = 10

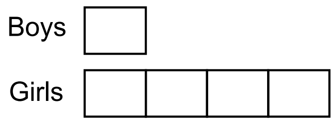
1 unit = 5

5 units = 5 × 5

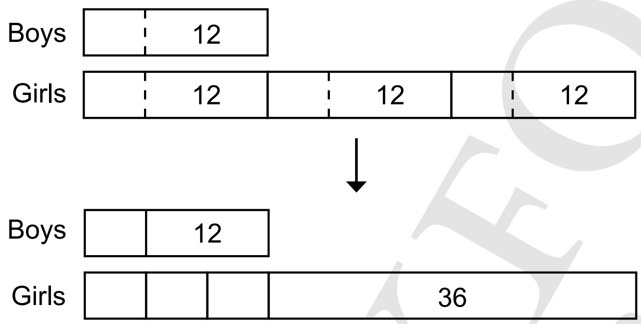
= 25

Raju is 25 years old now.

14. <u>Before</u>



<u>After</u>



1 unit = 36 – 25

= 11

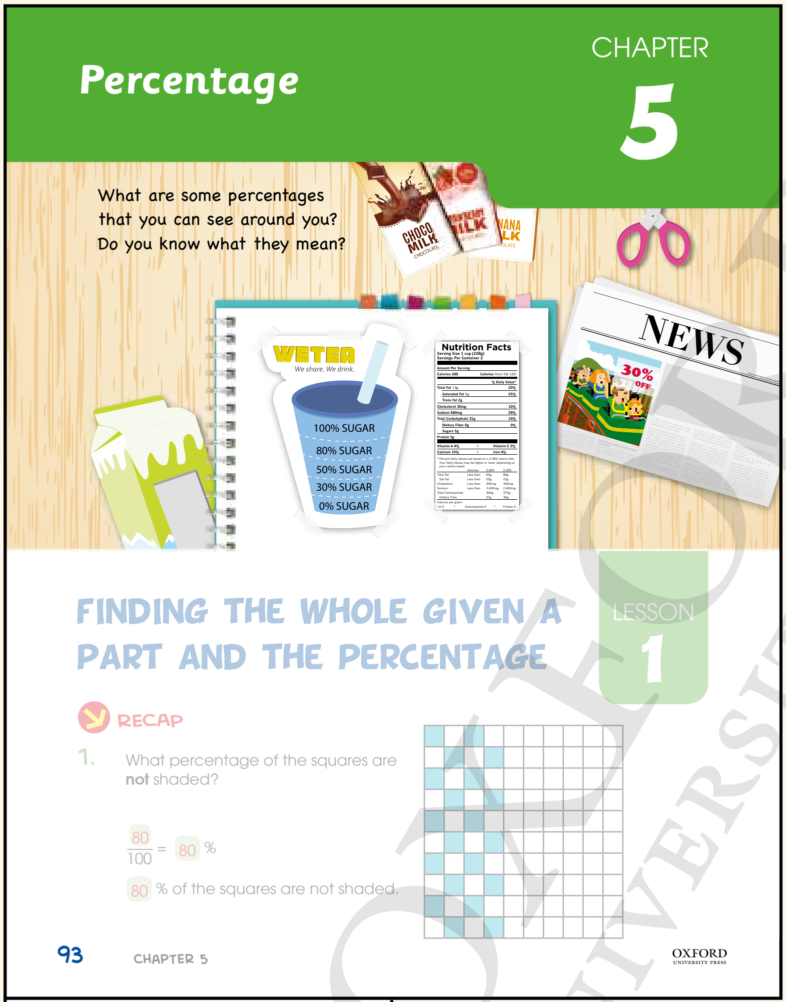
4 units = 11 × 4

= 44

There were 44 girls at the party at first.

PERCENTAGE

CHAPTER 5


Percentage

CHAPTER
5

What are some percentages that you can see around you? Do you know what they mean?

FINDING THE WHOLE GIVEN A PART AND THE PERCENTAGE

LESSON 1

RECAP

1. What percentage of the squares are **not** shaded?

$\frac{80}{100} = 80\%$

80 % of the squares are not shaded.

93 CHAPTER 5 OXFORD UNIVERSITY PRESS

Textbook 6 P93

Related Resources
NSPM Textbook (P93 – 117)
NSPM Workbook 6A (P98 – 123)

Materials
10-sided die, pen, activity sheet, calculator

Lesson

Lesson 1	Finding the Whole Given a Part and the Percentage
Lesson 2	Percentage Increase and Decrease
Lesson 3	Solving Word Problems

Problem Solving, Maths Journal and Pupil Review

INTRODUCTION

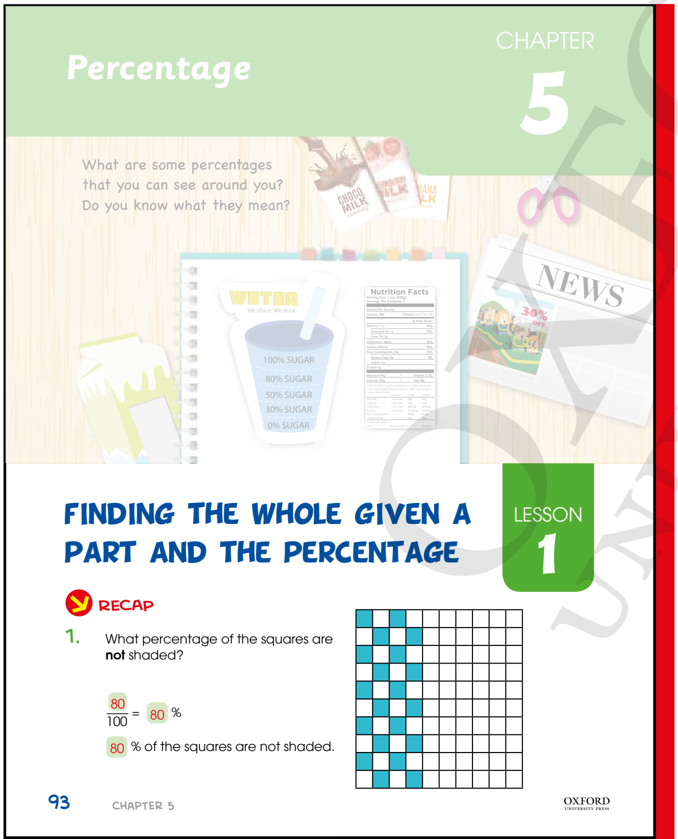
Pupils have learnt what “percent” means in Grade Five. This chapter will expose pupils to more comprehensive uses of percentage and allow them to better appreciate how percentage can express one quantity in the form of another. Pupils thus encounter more real-life applications of percentage, especially involving percentage increase and decrease.

LESSON 1

FINDING THE WHOLE GIVEN A PART AND THE PERCENTAGE

LEARNING OBJECTIVE

1. Find the whole given a part and the percentage.



Percentage

CHAPTER 5

What are some percentages that you can see around you? Do you know what they mean?

FINDING THE WHOLE GIVEN A PART AND THE PERCENTAGE

LESSON 1

RECAP

1. What percentage of the squares are **not** shaded?

$\frac{80}{100} = 80$ %

80 % of the squares are not shaded.

93 CHAPTER 5

OXFORD

Textbook 6 P93

RECAP

Revisit the definition of percentage (% means out of 100), expressing percentage as a fraction and finding a percentage of a whole.

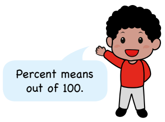
2. Express 45% as a fraction.

$45\% = \frac{45}{100} = \frac{9}{20}$

3. What is 25% of 92?

25% of $92 = \frac{25}{100} \times 92$

$= 23$



IN FOCUS

Nutrition facts can be found on the packaging of food items and they show important information about its components.

Based on the label shown, 10% of the daily recommended intake of carbohydrates is 31 g. Do you know how we can find the daily recommended intake of carbohydrates?

Nutrition Facts
Serving Size 1 cup (228g)
Servings Per Container 2

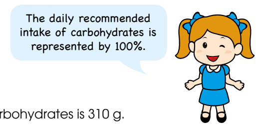
Amount Per Serving	
Calories 260	Calories from Fat 120
	% Daily Value*
Total Fat 13g	**20%**
Saturated Fat 5g	**25%**
Trans Fat 2g	
Cholesterol 30mg	**10%**
Sodium 660mg	**28%**
Total Carbohydrate 31g	**10%**
Dietary Fiber 0g	**0%**
Sugars 5g	
Protein 5g	
Vitamin A 4% •	Vitamin C 2%
Calcium 15% •	Iron 4%

LET'S LEARN

1. 10% of the daily recommended intake of carbohydrates is 31 g. What is the daily recommended intake of carbohydrates?

Method 1

10% of daily intake = 31 g
1% of daily intake = 31 ÷ 10
= 3.1 g
100% of daily intake = 3.1 × 100
= 310 g



The daily recommended intake of carbohydrates is 310 g.

Textbook 6 P94

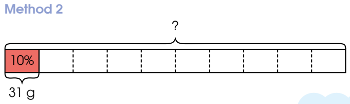
IN FOCUS

Use the chapter opener to discuss examples of percentage in real-life contexts. Get pupils to express 10% as a fraction so that the problem becomes familiar to them.

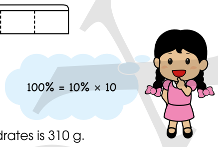
LET'S LEARN

Highlight to pupils that in the presentation of their working, they should not write 10% = 31 as this would be mathematically incorrect. They would need to specify 10% of a specific quantity. Alternatively, pupils can write 10% → 31. The arrow refers to "represents".

Method 2



10% of daily intake = 31 g
100% of daily intake = 31 × 10
= 310 g



The daily recommended intake of carbohydrates is 310 g.

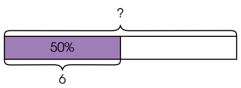
2. 50% of a number is 6. What is the number?

Method 1

50% of the number = 6	50% → 6
1% of the number = 6 ÷ 50	1% → 6 ÷ 50
= 0.12	= 0.12
100% of the number = 0.12 × 100	100% → 0.12 × 100
= 12	= 12

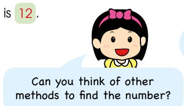
The number is 12.

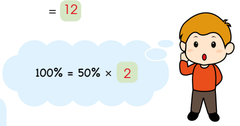
Method 2



50% of the number = 6	50% → 6
100% of the number = 6 × 2	100% → 6 × 2
= 12	= 12

The number is 12.

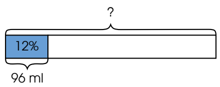




Textbook 6 P95

For Let's Learn 2, get pupils to remember that 50% is equal to $\frac{1}{2}$. The problem can then be solved easily since the answer is just twice of 6.

3. 12% of the amount of water in a container is 96 ml. How much water is there in the container?



12% of the amount of water = 96 ml

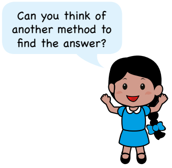
1% of the amount of water = 96 ÷ 12

= 8 ml

100% of the amount of water = 8 × 100

= 800 ml

There are 800 ml of water in the container.



4. Meiling read 14% of a book in the morning and another 35% of the same book at night. She read 140 pages at night. Find the total number of pages in the book.

35 % of the book = 140 pages

1% of the book = 140 ÷ 35

= 4 pages

100% of the book = 4 × 100

= 400 pages

The book has a total of 400 pages.

OXFORD UNIVERSITY PRESS PERCENTAGE 96

Textbook 6 P96

Let's Learn 3 and 4 are quite straightforward. Pupils should be able to solve them using the same method. In Let's Learn 4, get pupils to recognise that the information that Meiling read 14% of the book in the morning is redundant.

5. In a concert hall, 252 seats are occupied. 84% of the seats in the concert hall are occupied. How many seats are there in the concert hall altogether?

84 % of the seats = 252

1% of the seats = 252 ÷ 84

= 3

100% of the seats = 3 × 100

= 300

There are 300 seats in the concert hall altogether.

6. In a primary school, 55% of the pupils are girls. There are 540 boys in the school. How many pupils are there in the school?

45 % of the pupils = 540

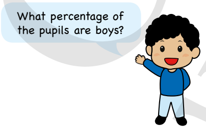
1% of the pupils = 540 ÷ 45

= 12

100% of the pupils = 12 × 100

= 1200

There are 1200 pupils in the school.



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Textbook 6 P97

Let's Learn 5 is also similar to the previous two examples.

For Let's Learn 6, pupils will have to obtain the percentage of boys first.

7. Mr Lim travelled 75% of his journey on the first day and completed the remaining part of the journey on the second day. He travelled a total of 324 km on the first day. Find the total distance that Mr Lim travelled over the two days.

75 % of his journey = 324 km

1% of his journey = 324 ÷ 75

= 4.32 km

100% of his journey = 4.32 × 100

= 432 km

Mr Lim travelled a total of 432 km over the two days.

Do you know how you can use fractions to find the answer?

$75\% = \frac{3}{4}$

PRACTICE

1. Draw a model to show how you find each answer.
   (a) 20% of a number is 7. What is the number? 35
   (b) 25% of a number is 50. What is the number? 200
   (c) 4% of a number is 3. What is the number? 75
   (d) 13% of a number is 65. What is the number? 500

2. Mr Ali spent $1800 on food last month. This was 30% of his monthly salary. Find Mr Ali's monthly salary. $6000

3. At a football match, 25% of the spectators wore red T-shirts and 3750 spectators did **not** wear red T-shirts. How many spectators were there altogether? 5000

4. 45% of the pupils in a school are girls. There are 810 girls in the school. How many pupils are there in the school altogether? 1800

Complete Workbook **6A**, Worksheet **1** • Pages **98 – 101**

Textbook 6 P98

Let's Learn 7 exposes pupils to another percentage that can be easily converted to a fraction. Get pupils to note that being familiar with percentages such as 25%, 50% and 75% and their respective fractions will be helpful in solving problems.

PRACTICE

Work with pupils on the practice questions.

Independent seatwork

Assign pupils to complete Worksheet 1 (Workbook 6A P98 – 101)

Answers

Worksheet 1 (Workbook 6A P98 – 101)

1. (a) $\frac{6}{50} \times 100 = 12$

   (b) $\frac{7}{5} \times 100 = \$140$

   (c) $\frac{56}{7} \times 100 = 800$ ml

   (d) $\frac{24}{80} \times 100 = 30$

2. $\frac{63}{90} \times 100 = 70$

3. $\frac{60}{40} \times 100 = 150$ km

4. $\frac{1360}{85} \times 100 = \$1600$

5. $\frac{14.40}{18} \times \$100 = \$80$

6. $\frac{27}{75} \times 25 = 9$

7. $\frac{42}{70} \times 100 = 60$

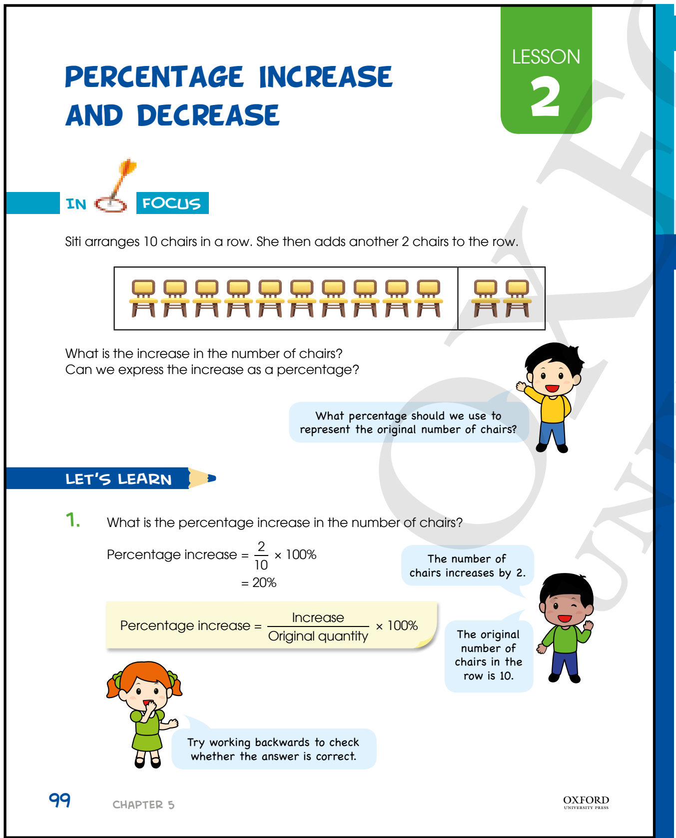
8. $\frac{2448}{68} \times 100 = \$3600$

LESSON 2

PERCENTAGE INCREASE AND DECREASE

LEARNING OBJECTIVE

1. Find percentage increase or decrease based on the original quantity.



LESSON 2

PERCENTAGE INCREASE AND DECREASE

IN FOCUS

Siti arranges 10 chairs in a row. She then adds another 2 chairs to the row.

What is the increase in the number of chairs?
Can we express the increase as a percentage?

LET'S LEARN

1. What is the percentage increase in the number of chairs?

Percentage increase = $\frac{2}{10} \times 100\%$
= 20%

Percentage increase = $\frac{\text{Increase}}{\text{Original quantity}} \times 100\%$

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Textbook 6 P99

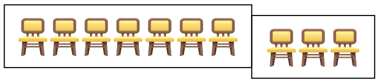
IN FOCUS

Get pupils to express the increase as a fraction first. Guide them by asking what value the denominator should take.

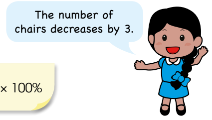
LET'S LEARN

Ensure that pupils remember the formula and highlight that the denominator should always be the original quantity. Their working must also include multiplication of 100%.

2. Weiming arranges 10 chairs in a row. He removes 3 chairs from the row. What is the percentage decrease in the number of chairs?

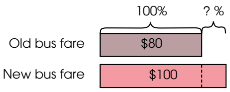


Percentage decrease = $\frac{3}{10} \times 100\%$
= 30%



Percentage decrease = $\frac{\text{Decrease}}{\text{Original quantity}} \times 100\%$

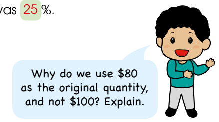
3. At a primary school, the school bus fare was increased from \$80 a month to \$100 a month. What was the percentage increase in the bus fare?



Increase = \$100 – \$80
= \$20

Percentage increase = $\frac{20}{80} \times 100\%$
= 25 %

The percentage increase in the bus fare was 25 %.



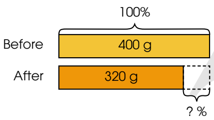
Textbook 6 P100

Let's Learn 2 introduces percentage decrease. Similar to Let's Learn 1, highlight to pupils to remember the formula and that the denominator should always be the original quantity.

For Let's Learn 3, ask:

- What is the increase in the bus fare?
- What is the original bus fare?

4. The mass of a box of marbles was 400 g. After removing some marbles from the box, the mass became 320 g. Find the percentage decrease in the mass of the box of marbles.

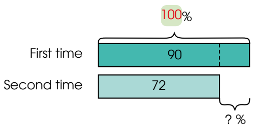


Decrease = 400 – 320
= 80 g

Percentage decrease = $\frac{80}{400} \times 100\%$
= 20 %

The percentage decrease in the mass of the box of marbles was 20 %.

5. Ann scored 90 points in a game. She played the same game again and scored 72 points. Find the percentage decrease in the number of points Ann scored.



Decrease = 90 – 72
= 18

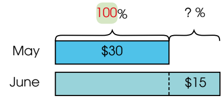
Percentage decrease = $\frac{18}{90} \times 100\%$
= 20 %

The percentage decrease was 20 %.

Textbook 6 P101

Let's Learn 4 and 5 are similar to Let's Learn 3, but deal with a percentage decrease. Remind pupils to identify the original quantity correctly.

6. Bala saved $30 in May. In June, he saved $15 more than he did in May. What was the percentage increase in the amount Bala saved in June?

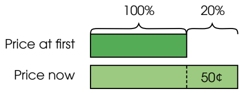


Percentage increase = $\frac{15}{30} \times 100\%$

= 50 %

The percentage increase was 50 %.

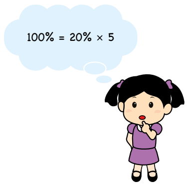
7. The price of a plate of chicken rice increased by 50¢. The percentage increase in the price of a plate of chicken rice was 20%. How much did each plate of chicken rice cost at first?



20% of the price = 50¢

100% of the price = 50¢ × 5

= $ 2.50



Each plate of chicken rice cost $ 2.50 at first.

OXFORD UNIVERSITY PRESS PERCENTAGE 102

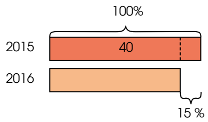
Textbook 6 P102

Let's Learn 6 is straightforward whereby pupils do not have to make preliminary calculations. Remind them to use the original quantity as the denominator.

Let's Learn 7 requires pupils to work backwards when provided with the price and percentage increase.

Highlight to pupils that since 20% is $\frac{1}{5}$ of 100%, we will need to multiply 50 cents by 5 to get the answer.

8. In 2015, 40 pupils went for a swimming programme. In 2016, the number of pupils who went for the programme decreased by 15%. Find the number of pupils who went for the swimming programme in 2016.



15% of number of pupils = $\frac{15}{100} \times 40$

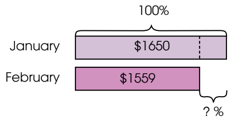
= 6

Number of pupils who went in 2016 = 40 − 6

= 34

34 pupils went for the swimming programme in 2016.

9. In January, the price of a computer was $1650. Its price decreased to $1559 in February. Find the percentage decrease in the price of the computer, giving your answer correct to the nearest 1%.



Decrease = $ 1650 − $ 1559

= $ 91

Percentage decrease = $\frac{91}{1650} \times 100\%$

= 6 % (to the nearest 1%)

The percentage decrease in the price of the computer was 6 %.

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Textbook 6 P103

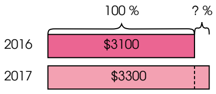
For Let's Learn 8, get pupils to analyse the model and see that 15% less of 40 can be calculated.
Point out to them that an alternative method of finding 85% of 40 will give you the correct answer as well.

Let's Learn 9 involves rounding off the answer.
Explain to pupils that it is the same as rounding off to the nearest whole number.

10. The table shows the monthly salary of a bank officer over two years.

Monthly salary in 2016	$3100
Monthly salary in 2017	$3300

Find the percentage increase in his salary, giving your answer correct to the nearest 0.1%.



Increase = 3300 − 3100

= 200

Percentage increase = $\frac{200}{3100}$ × 100%

= 6.5 % (to the nearest 0.1%)

The percentage increase in his salary was 6.5 %.

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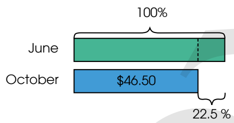
Textbook 6 P104

For Let's Learn 10, explain to pupils that rounding off to the nearest 0.1% is the same as rounding off to 1 decimal place.

11. The price of oil per barrel decreased by 22.5% from June to October. Each barrel of oil cost $46.50 in October. What was the price of each barrel of oil in June?



100% − 22.5% = 77.5%

77.5% of price in June = $46.50

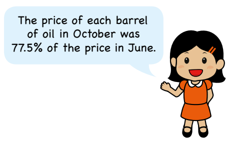
1% of price in June = $46.50 ÷ 77.5

= $ 0.60

100% of price in June = $ 0.60 × 100

= $ 60

The price of each barrel of oil in June was $ 60 .



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Textbook 6 P105

For Let's Learn 11, remind pupils to ensure that they place the decimal point correctly when using the calculator.

ACTIVITY TIME

Play in groups of 4.

1. Roll a 10-sided die and record the number in a table.
2. Roll the die again and record the second number.
3. Calculate the increase or decrease.

What you need:

Example

First number	Second number	Increase/Decrease
8	6	2

4. Use a calculator to find the percentage increase or decrease. The first player to get the correct answer gets 1 point.
5. Repeat 1 to 4. The first player to get 10 points wins!

PRACTICE

1. There were 5 stickers in a row. Tom added 1 sticker to the row. What was the percentage increase in the number of stickers? 20%
2. 54 schools took part in a drama competition last year. This year, 48 schools took part. Find the percentage decrease in the number of schools that took part in the competition. Express your answer as a mixed number. $11\frac{1}{9}\%$
3. The cost of a movie ticket in 1980 was \$3. Now, each ticket costs \$7.50. Find the percentage increase in the cost of a movie ticket from 1980 to now. 150%
4. 5 members left a club. This was a 2.5% decrease in the number of members in the club. How many members were there in the club at first? 200
5. The price of a car was reduced by 8% to \$92 000. What was the original price of the car? \$100 000

Complete Workbook **6A**, Worksheet **2** • Pages **102 – 105**

OXFORD UNIVERSITY PRESS PERCENTAGE 106

Textbook 6 P106

ACTIVITY TIME

Demonstrate how the game is played. If needed, print an activity sheet for pupils to record their answers so that the answers can be checked later.

PRACTICE

Work with pupils on the practice questions.

Independent seatwork

Assign pupils to complete Worksheet 2 (Workbook 6A P102 – 105)

Answers

Worksheet 2 (Workbook 6A P102 – 105)

1. $\frac{2}{8} \times 100\% = 25\%$
2. $\frac{500}{4000} \times 100\% = 12.5\%$
3. $\frac{6}{25} \times 100\% = 24\%$
4. $\frac{40}{200} \times 100\% = 20\%$
5. $\frac{56}{112} \times 100 = 50$
6. $\frac{18}{90} \times 100 = \$20$
7. $\frac{300}{1800} \times 100\% \approx 16.7\%$
8. (a) 330 ml

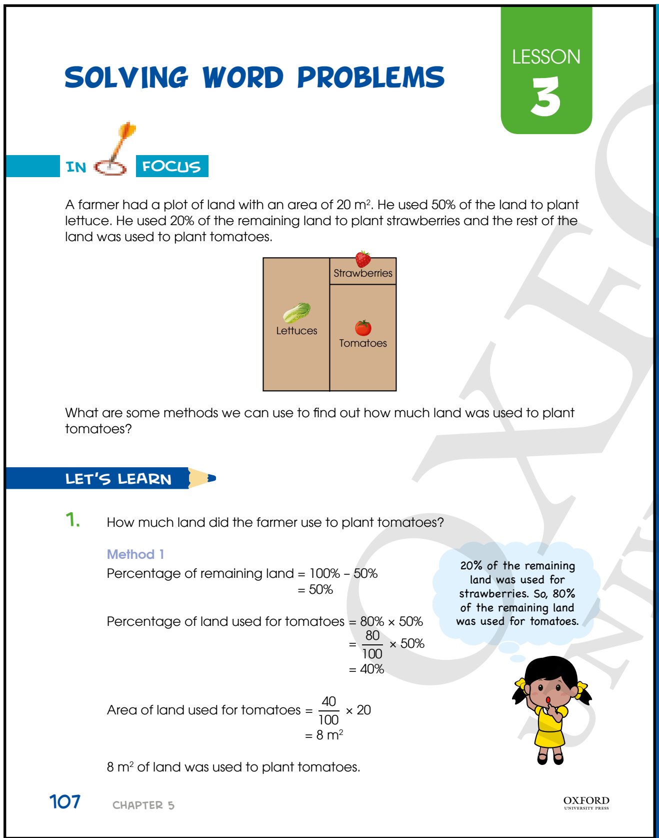
   (b) $\frac{330}{2500} \times 100\% \approx 13\%$
9. $\frac{6.40}{17.50} \times 100\% \approx 37\%$
10. $\frac{400000}{100} \times 88 = \$352\ 000$

LESSON 3

SOLVING WORD PROBLEMS

LEARNING OBJECTIVE

1. Solve word problems involving percentage.



SOLVING WORD PROBLEMS

LESSON 3

IN FOCUS

A farmer had a plot of land with an area of 20 m². He used 50% of the land to plant lettuce. He used 20% of the remaining land to plant strawberries and the rest of the land was used to plant tomatoes.

What are some methods we can use to find out how much land was used to plant tomatoes?

LET'S LEARN

1. How much land did the farmer use to plant tomatoes?

Method 1

Percentage of remaining land = 100% – 50%
= 50%

Percentage of land used for tomatoes = 80% × 50%
$= \frac{80}{100} \times 50\%$
= 40%

Area of land used for tomatoes $= \frac{40}{100} \times 20$
= 8 m²

8 m² of land was used to plant tomatoes.

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Textbook 6 P107

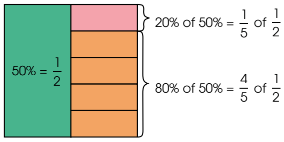
IN FOCUS

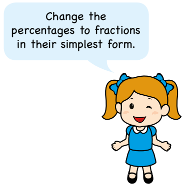
Ensure that pupils are able to associate different methods of using percentage and fractions to solve problems.

LET'S LEARN

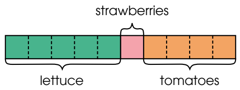
Show pupils that it is possible to multiply two percentages together since a percentage is a fraction (out of 100).

Method 2





We can show this using a bar model.



Fraction of land used for tomatoes $= \frac{4}{5} \times \frac{1}{2}$

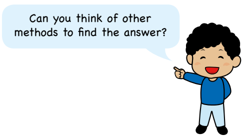
$= \frac{4}{10}$

$= \frac{2}{5}$

Area of land used for tomatoes $= \frac{2}{5} \times 20$

$= 8\ \text{m}^2$

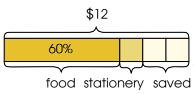
8 m² of land was used to plant tomatoes.



Textbook 6 P108

For pupils who have difficulties with the concept of percentage, using fractions would likely be more familiar to them.

2. Nora's weekly allowance is $12. Last week, she spent 60% of her allowance on food, $\frac{1}{3}$ of the remaining amount on stationery and saved the rest. How much did Nora save last week?



Percentage of allowance remaining = 100% – 60%

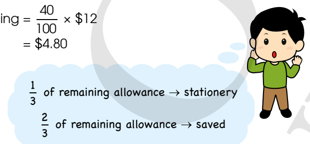
= 40%

Amount of allowance remaining $= \frac{40}{100} \times \$12$

= $4.80

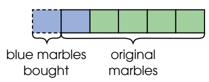
Amount saved $= \frac{2}{3} \times \$4.80$

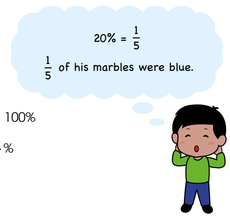
= $ 3.20



Nora saved $ 3.20 last week.

3. Sam had some marbles. 20% of the marbles were blue and the rest were green. He bought an equal number of blue marbles. What percentage of his marbles now are blue?





Percentage of blue marbles now $= \frac{2}{6} \times 100\%$

$= 33\frac{1}{3}\%$

$33\frac{1}{3}\%$ of his marbles now are blue.

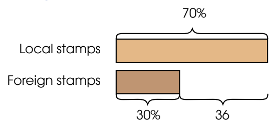
Textbook 6 P109

For Let's Learn 2, remind pupils to note that they need to find $\frac{2}{3}$ of the remainder, i.e. of 40%, and not of the entire allowance.

For Let's Learn 3, highlight to pupils that drawing a model would be helpful for visualisation. The number of green marbles would be 4 times that of the original number of blue marbles, since 80% is 4 times that of 20%.

4. Raju has some stamps. 70% of his stamps are local stamps and the rest are foreign stamps. Raju has 36 more local stamps than foreign stamps. How many stamps does Raju have in all?

Method 1



100% – 70% = 30% of Raju's stamps are foreign stamps.

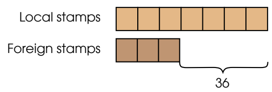
Difference in percentage = 70% – 30%
= 40 %

40 % of stamps = 36

100% of stamps = $\frac{36}{40} \times 100\%$
= 90

Raju has 90 stamps in all.

Method 2



$70\% = \frac{7}{10}$

$30\% = \frac{3}{10}$

4 units = 36
1 unit = 36 ÷ 4
= 9
10 units = 9 × 10
= 90

Raju has 90 stamps in all.

Textbook 6 P110

For Let's Learn 4, pupils will need to draw the link that the difference in percentage of stamps is equal to the difference in number. The number of stamps in total when represented by 100% can then be obtained easily.

5. Mr Wong had some watches for sale. He sold 24 watches on Sunday and $\frac{1}{7}$ of the remaining watches on Monday. Then, he had 60% of the watches he had at first. How many watches did Mr Wong have at first?

$\frac{6}{7}$ of the remaining → 60% of the original number

$\frac{7}{7}$ of the remaining → 70 % of the original number

100% – 70 % = 30 %

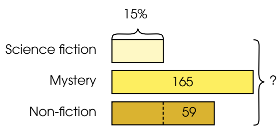
30 % → 24

10% → 24 ÷ 3 = 8

100% → 8 × 10 = 80

Mr Wong had 80 watches at first.

6. There are some books on a bookshelf. 15% of the books are science fiction books, 165 are mystery books and the rest are non-fiction books. There are 59 fewer science fiction books than non-fiction books. How many books are there altogether?



Number of non-fiction books = 15% of total + 59

100% – 15% – 15% = 70 %

70 % of total number of books = 165 + 59
= 224

1% of total number of books = $\frac{224}{70}$

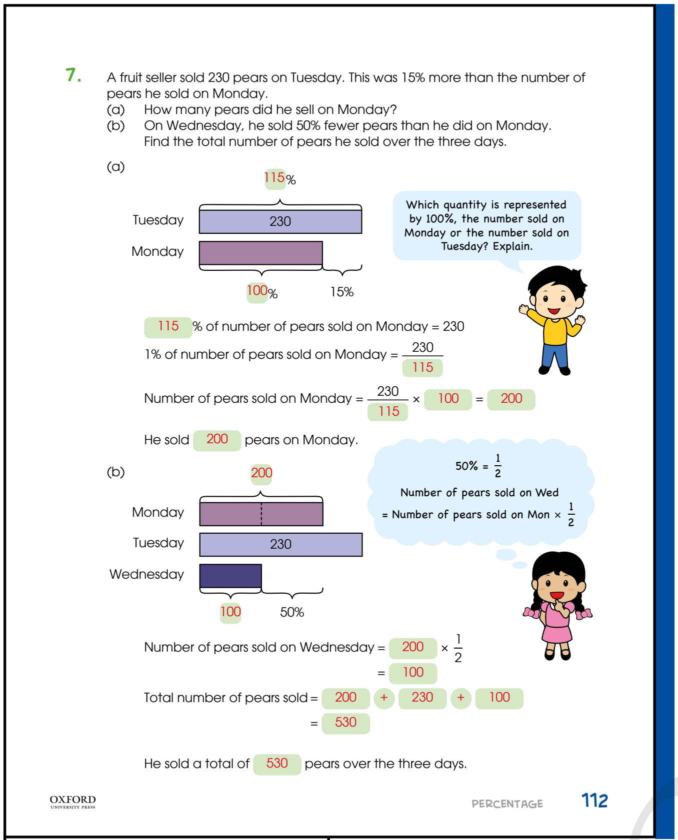
100% of total number of books = $\frac{224}{70} \times 100$
= 320

There are 320 books altogether.

Textbook 6 P111

For Let's Learn 5, a model is not provided. Get pupils to draw a model to help them visualise if needed.

For Let's Learn 6, point out to pupils that the percentage of science fiction books given are based on the total number of all the books. Hence, 70% of the books is equal to 165 + 59.


7. A fruit seller sold 230 pears on Tuesday. This was 15% more than the number of pears he sold on Monday.
(a) How many pears did he sell on Monday?
(b) On Wednesday, he sold 50% fewer pears than he did on Monday. Find the total number of pears he sold over the three days.

(a)

115 % of number of pears sold on Monday = 230

1% of number of pears sold on Monday = $\frac{230}{115}$

Number of pears sold on Monday = $\frac{230}{115} \times 100 = 200$

He sold 200 pears on Monday.

(b)

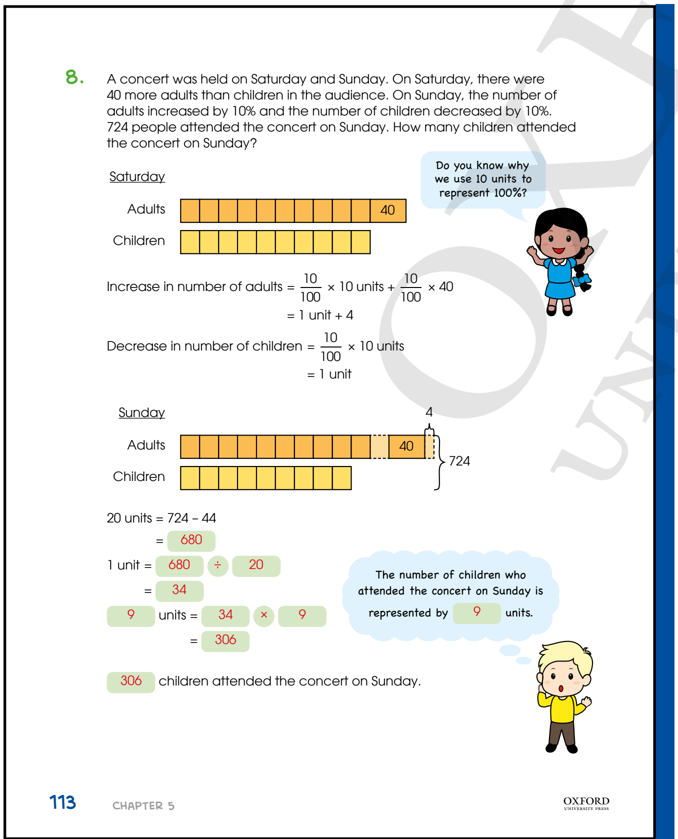
Number of pears sold on Wednesday = $200 \times \frac{1}{2}$
= 100

Total number of pears sold = 200 + 230 + 100
= 530

He sold a total of 530 pears over the three days.

Textbook 6 P112

For Let's Learn 7, get pupils to deduce which quantity is represented by 100%. Give them a hint that based on the formula for percentage increase, the original quantity would be the quantity that did not change.


8. A concert was held on Saturday and Sunday. On Saturday, there were 40 more adults than children in the audience. On Sunday, the number of adults increased by 10% and the number of children decreased by 10%. 724 people attended the concert on Sunday. How many children attended the concert on Sunday?

Increase in number of adults = $\frac{10}{100} \times 10$ units + $\frac{10}{100} \times 40$
= 1 unit + 4

Decrease in number of children = $\frac{10}{100} \times 10$ units
= 1 unit

20 units = 724 – 44
= 680

1 unit = 680 ÷ 20
= 34

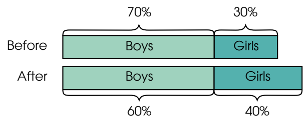
9 units = 34 × 9
= 306

306 children attended the concert on Sunday.

Textbook 6 P113

For Let's Learn 8, highlight to pupils that the two groups of adults and children have to be taken as 100% each when accounting for their increase or decrease by 10%. 10 units would thus be convenient, as 10% would correspond to one unit. Ensure that pupils are aware that 100% of the adults on Saturday includes the 40 more adults than children, and hence when increasing this amount by 10%, they would have to add 1 unit + 4.

9. 60 pupils were selected to represent their school in a Science competition. 30% of the pupils were girls. Then, some girls were added to the team such that 40% of the pupils were girls. How many girls were added?



The number of boys remained the same.

Number of girls at first $= \frac{30}{100} \times 60$
$= 18$

Number of boys $= \frac{70}{100} \times 60$
$= 42$

60% of new total = 42

1% of new total $= 42 \div 60$
$= 0.7$

100% of new total $= 0.7 \times 100$
$= 70$

Number of girls added $= 70 - 60$
$= 10$

10 girls were added to the team.

How can you check your answer?

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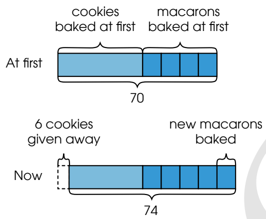
PERCENTAGE 114

Textbook 6 P114

Let's Learn 9 involves a changing of bases. Drawing a before-after model would help pupils to see that 60% of the new base is equal to 70% of the original base. Alternatively, pupils could be guided to use ratios to solve the problem. The original ratio of the number of girls to the number of boys = 3 : 7 and the subsequent ratio of the number of girls to the number of boys = 2 : 3. As the number of boys remain constant, the ratios could be re-written as 9 : 21 and 14 : 21 respectively.

10. Mrs Lim baked 70 cookies and macarons. She gave 6 cookies away and baked more macarons, increasing the number of macarons by 25%. After that, Mrs Lim had a total of 74 cookies and macarons. How many macarons did Mrs Lim bake at first?



1 unit = 74 + 6 – 70
= 10

4 units $= 10 \times 4$
= 40

How can you check your answer? Discuss with your partner.

Mrs Lim baked 40 macarons at first.

PRACTICE

1. Kate had 8 cups of flour. She used 50% of the flour to bake pineapple tarts and $\frac{1}{4}$ of the remaining flour to bake cookies. How many cups of flour were left?

3

2. Priya had \$50. She used 20% of it to buy a book and 30% of the remainder to buy a skirt. She saved the rest of the money. How much money did she save?

\$28

115 CHAPTER 5 OXFORD UNIVERSITY PRESS

Textbook 6 P115

For Let's Learn 10, remind pupils that 25% is equal to $\frac{1}{4}$.

Hence, if the original number of units for macarons is 4, it increases by 1 unit after more are baked.

PRACTICE

Allow pupils to work in pairs or individually on the practice questions.

3. 56% of the pupils in a school were boys. There were 132 more boys than girls. How many pupils were there in the school altogether? 1100

4. Mrs Lee baked a total of 120 chocolate cupcakes and vanilla cupcakes. After selling an equal number of cupcakes of each flavour, she had 90% of the chocolate cupcakes and 80% of the vanilla cupcakes left. How many cupcakes did Mrs Lee sell altogether? 12

5. There were 30 000 pens and markers at a factory. After 100 pens were thrown away, more markers were produced such that the number of markers increased by 7%. In the end, there were 30 250 pens and markers at the factory. How many markers were there at first? 5000

6. An event was held at the Night Safari on Friday and Saturday. On Friday, there were 50 more boys than girls. On Saturday, the number of boys increased by 20% and the number of girls increased by 10%. There were 2820 boys and girls at the Night Safari on Saturday. How many girls were there on Friday? 1200

7. There were 80 pink and blue beads in a box. 40% of the beads were pink. Some blue beads were removed from the box such that the percentage of pink beads became 64%. How many blue beads were removed? 30

Complete Workbook **6A**, Worksheet **3** • Pages **106 – 114**

MIND WORKOUT

Weiming had a square piece of paper with an area of 81 cm². He cut the paper such that it became a smaller square piece of paper with an area of 49 cm². Find the percentage decrease in the length of the paper, giving your answer to the nearest whole number.

22% (to the nearest 1%)

OXFORD UNIVERSITY PRESS PERCENTAGE 116

Textbook 6 P116

Independent seatwork

Assign pupils to complete Worksheet 3 (Workbook 6A P106 – 114)

Answers

Worksheet 3 (Workbook 6A P106 – 114)

1. $\frac{75}{100} \times 36 = 27$
   Nora had 27 cupcakes left.

2. $100\% - 30\% - 25\% = 45\%$
   $45\% \rightarrow 540$
   $100\% \rightarrow \frac{540}{45} \times 100 = 1200$
   The total number of people at the funfair is 1200.

3. $\frac{80}{100} \times \$16 = \$12.80$
   $\frac{75}{100} \times \$12.80 = \$9.60$
   The book cost $9.60.

4. $\frac{60}{100} \times 25 = 15$
   $\frac{80}{100} \times 15 = 12$
   12 squares are coloured green.

5. Percentage of journey covered on third day
   $= \frac{1}{4} \times 70\%$
   $= 17.5\%$
   $\frac{9}{17.5} \times 100 \approx 51$
   The total distance travelled is 51 km.

6. $100\% - 28\% = 72\%$
   $72\% - 28\% = 44\%$
   $44\% \rightarrow 88$
   $100\% \rightarrow \frac{88}{44} \times 100 = 200$
   There are 200 shirts in the box altogether.

7. $\frac{2700}{112.5} \times 100 = \$2400$
   Miss Chen's salary last year was $2400.

8. 50% → 3824

100% → 3824 × 2 = 7648

There were 7648 members in the fitness club in 2015.

9. 20 – 4 = 16
18 – 16 = 2

2 angelfish were added into the tank.

50% of the number of angelfish = 2
100% of the number of angelfish = 2 × 2
= 4

20 – 4 = 16
There were 16 clownfish in the tank at first.

10. Number of apples = $\frac{60}{100}$ × 120
= 72

Number of oranges at first = 120 – 72
= 48

Number of oranges left = $\frac{72}{80}$ × 20
= 18

Number of oranges sold = 48 – 18
= 30

30 oranges were sold.

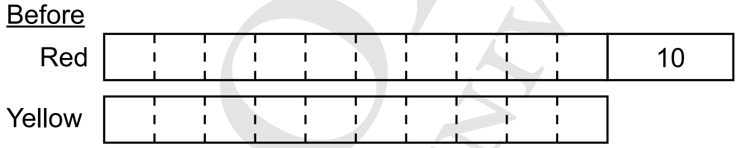
11. Amount she paid for second dress = $\frac{76 - 20}{2}$ = \$28

Amount she paid for first dress = \$28 + \$20
= \$48

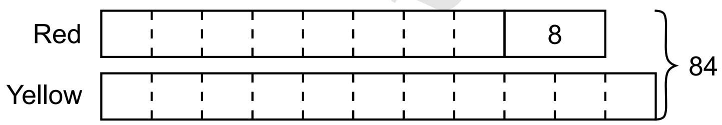
Original price of first dress = $\frac{48}{80}$ × 100
= \$60

The original price of the first dress was \$60.

12. <u>Before</u>



<u>After</u>



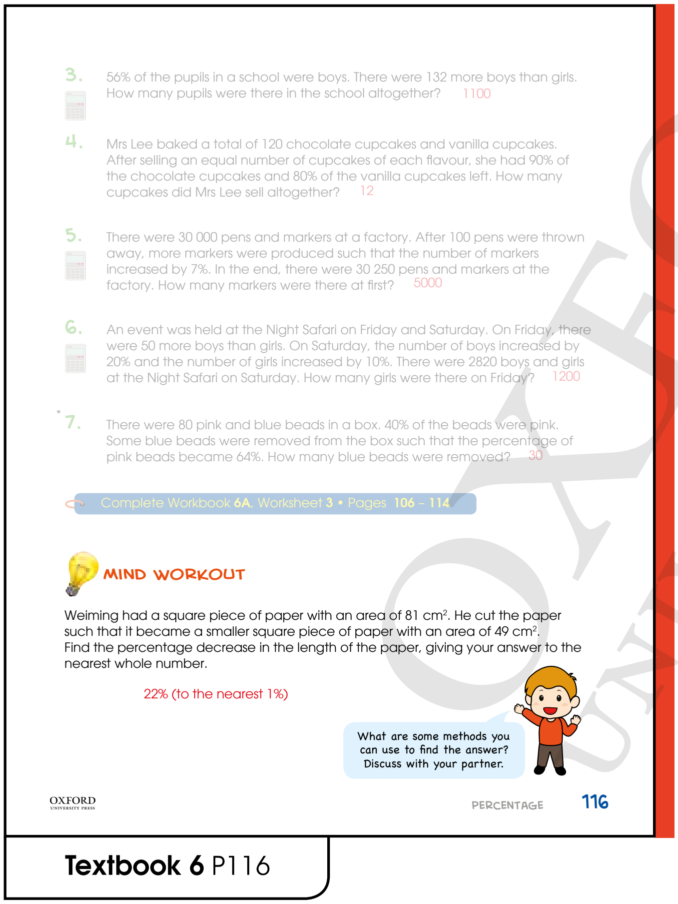
19 units = 84 – 8
= 76

1 unit = 76 ÷ 19
= 4

10 units = 4 × 10
= 40

There were 40 yellow marbles in the box at first.

PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW



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Complete Workbook 6A, Worksheet 3 • Pages 106 – 114

MIND WORKOUT

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22% (to the nearest 1%)

OXFORD

PERCENTAGE 116

Textbook 6 P116

MIND WORKOUT

Pupils will need to obtain the length of each square first, and subsequently find the decrease.

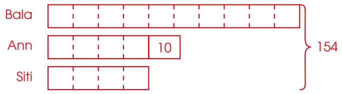
Highlight to pupils that it is wrong to find the decrease in the area first and then square root this value. This method cannot be used as when a paper is cut into a smaller square, the decrease in area is not a square. Demonstrate this using a piece of paper if pupils are unclear.

Mind Workout

Date: ____________

Ann, Bala and Siti had 154 marbles altogether. After Bala gave Ann 14 marbles, Ann had 10 more marbles than Siti. The number of marbles Siti had was 40% of the number of marbles Bala had left. How many marbles did Ann have at first?

After



18 units = 154 – 10
= 144
1 unit = 144 ÷ 18
= 8
4 units = 8 × 4
= 32
Number of marbles Ann had at first = 32 + 10 – 14
= 28

Ann had 28 marbles at first.

Percentage 115

Workbook 6A P115

Mind Workout

Pupils who have grasped the conversion of percentages such as 25%, 50% and 75% into fractions may proceed to see that 40% can be expressed as $\frac{2}{5}$, where Siti would have 2 units and Bala, 5 units.

MATHS JOURNAL

At the supermarket, Nora noticed a percentage written on a packet of drinks.

Is the percentage given accurate? Explain.

SELF-CHECK

I know how to...

- find the whole given a part and a percentage.
- find percentage increase and decrease.
- solve word problems involving percentage.

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Textbook 6 P117

MATHS JOURNAL

Get pupils to discuss how to calculate the percentage of free cans, i.e. percentage increase. They should see that the percentage given is wrong. Get them to deduce how the erroneous percentage (33%) was calculated. Remind pupils of the common mistake of using the wrong base in the calculation.

SELF-CHECK

Before pupils proceed to do the self-check, review the important concepts by asking for examples learnt for each objective.

The self-check can be done after pupils have completed **Review 5** (Workbook 6A P116 – 123).

1. (a) $\frac{6}{25} \times 100 = 24$

   (b) $\frac{24}{40} \times 100 = 60$ kg

2. $\frac{28}{80} \times 20 = 7$

3. $\frac{14}{70} \times 100 = 20$

4. $100\% - 30\% - 20\% = 50\%$
   $50\% \rightarrow \$50.40$
   $10\% \rightarrow \$50.40 \div 5 = \$10.08$
   $20\% \rightarrow \$10.08 \times 2 = \$20.16$
   Bina spent $20.16 on the dress.

5. $\frac{2}{10} \times 100\% = 20\%$

6. $\frac{36}{90} \times 100 = 40$

7. (a) Total distance $= 3200 + 1800$
   $= 5000$ m
   $\frac{3200}{5000} \times 100\% = 64\%$
   The distance he jogged on Saturday is 64% of the total distance jogged on both days.

   (b) $3200 - 1800 = 1400$
   $\frac{1400}{3200} \times 100\% = 43.75\%$
   The percentage decrease is 43.75%.

8. $\frac{80}{100} \times \$50 = \$40$
   $\frac{70}{100} \times \$40 = \$28$
   Meiling saved $28.

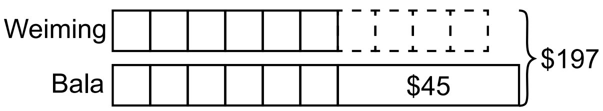
9. 70% of the remainder $\rightarrow 14$
   100% of the remainder $\rightarrow \frac{14}{7} \times 10 = 20$
   $\frac{2}{5}$ of the cream puffs $\rightarrow 20$
   $\frac{5}{5}$ of the cream puffs $\rightarrow \frac{20}{2} \times 5 = 50$
   She made 50 cream puffs.

10. Amount she paid for second book $= \frac{15.30 - 6.30}{2}$
    $= \$4.50$
    Amount she paid for first book $= \$4.50 + \$6.30$
    $= \$10.80$
    Original price of first book $= \frac{10.80}{90} \times 100$
    $= \$12$
    The original price of the first book was $12.

11. Number of blue pens $= \frac{60}{100} \times 50$
    $= 30$
    Number of red pens at first $= 50 - 30$
    $= 20$
    Number of red pens left $= \frac{1}{2} \times 30$
    $= 15$
    Number of red pens removed $= 20 - 15$
    $= 5$
    5 red pens were removed from the box.

12. $100\% - 35\% = 65\%$
    $65\% - 35\% = 30\%$
    $30\% \rightarrow 18$
    $10\% \rightarrow 18 \div 3 = 6$
    $100\% \rightarrow 6 \times 10 = 60$
    There are 60 chocolate balls in the box altogether.

13. Number of boys in the school $= 144 \times 5$
    $= 720$
    45% of the pupils in the school $= 720$
    100% of the pupils in the school $= \frac{720}{45} \times 100$
    $= 1600$
    There are 1600 pupils in the school.

14. 

    16 units $= \$197 - \$45$
    $= \$152$
    1 unit $= \$152 \div 16$
    $= \$9.50$
    Amount Bala had $= \$9.50 \times 6 + \$45$
    $= \$102$
    Bala had $102.

1. 3

2. 1

3. 4

4. 4

5. 2

6. 3

7. 4

8. 3

9. 3

10. 3

11. 4

12. 4

13. 2

14. 1

15. 3

Section B

16. 11

17. 110

18. 4

19. $\frac{6}{5}$

20. 128

21. $4p + 4$

22. $4q + 6$

23. $\frac{1}{18}$

24. $\frac{1}{2}$

25. 1 : 4

26. $350 - 225 = 125$ g

$\frac{125}{25} \times 100 = 500$ g

$\frac{1}{2} \times 500 = 250$ g

$350 - 250 = 100$ g

The mass of the empty bottle is 100 g.

27. $7p + 18p + p + 11 = 26p + 11$

$= 26 \times 9 + 11$

$= 245$ g

Nora had 245 g of butter at first.

28. $\angle BCD = \angle BAD$

$= 140°$

$\angle BDC = (180° - 140°) \div 2$

$= 20°$

$\angle y = 90° - 20$

$= 70°$

29. $\frac{3}{5} = \frac{6}{10}$

$\frac{2}{7} = \frac{6}{21}$

$21 - 10 = 11$

11 units = 605 ml

1 unit = $605 \div 11$

= 55

31 units = 55×31

= 1705 ml

= 1.705 ℓ

30. Primary 5

Number of boys	:	Number of girls
3	:	4
6	:	8

Primary 6

Number of boys	:	Number of girls
5	:	9

In both levels

Number of boys	:	Number of girls
11	:	17

The ratio of the total number of boys to the total number of girls in the two levels is 11 : 17.

Section C

1. $70\% \rightarrow \$16.10$

   $100\% \rightarrow \frac{16.10}{70} \times 100 = \$23$

   Its price before the discount was $23.

2. $\frac{414}{18} \times 5 = 115$

   The length of the rectangle is 115 cm.

3. $1\frac{1}{2} - \frac{3}{4} = \frac{3}{4}$

   $\frac{3}{4} \div 2 = \frac{3}{8}$

   Each child received $\frac{3}{8}$ of a pie.

4. Bina gave $\frac{7q - 2}{2}$ apples to her friends.

5. $\$1400 - \$1190 = \$210$

   $\frac{210}{1400} \times 100\% = 15\%$

   The percentage discount given was 15%.

6. $48 \div 3 = 16$

   $\frac{3}{4} \times 16 = 12$

   $16 \times 2 = 32$

   $32 - 12 = 20$

   The difference is 20.

7. 2 novels and 3 colouring books → $108

   6 novels and 9 colouring books → $108 × 3 = $324

   3 novels and 2 colouring books → $117

   6 novels and 4 colouring books → $117 × 2 = $234

   5 colouring books → $324 – $234 = $90

   1 colouring book → $90 ÷ 5 = $18

   1 novel → ($108 – $18 × 3) ÷ 2 = $27

   $\frac{18}{27} = \frac{2}{3}$

   The cost of a colouring book is $\frac{2}{3}$ of the cost of a novel.

8. Initial ratio

Number of red marbles	:	Number of blue marbles
7	:	9

   Ratio in the end

Number of red marbles	:	Number of blue marbles
2	:	3
6	:	9

   1 unit = 5

   9 units = 5 × 9
   = 45

   There were 45 blue marbles in the box.

9. $\frac{40}{60} \times 100\% = 66\frac{1}{3}\%$

   $100\% - 66\frac{1}{3}\% = 33\frac{1}{3}\%$

   $33\frac{1}{3}\% \rightarrow \$2.50$

   $100\% \rightarrow (\$2.50 \div 33\frac{1}{3}) \times 100 = \$7.50$

   Meiling had $7.50 at first.

10. (a) The cost of the armchair was $\$(339 - 5x)$.

    (b) $339 - 5x = 339 - 5 \times 8$
    $= 339 - 40$
    $= 299$

    $299 \times 5 = 1495$

    5 armchairs cost $1495.

11. (a) $50y + 4y \times 15 = 50y + 60y$
    $= 110y$

    The total capacity of 5 beakers and 15 bottles is $110y$ ml.

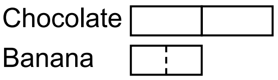
    (b) Capacity of beaker = 10 × 60
    = 600 ml

    Capacity of bottle = 4 × 60
    = 240 ml

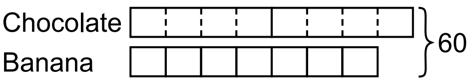
    Number of bottles he can fill = 600 ÷ 240
    $= 2\frac{1}{2}$

    The most number of bottles he can fill is 2.

12. After giving away



Before



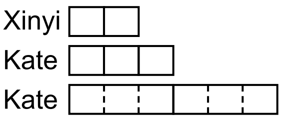
1 unit = 60 ÷ 15
= 4

2 units = 4 × 2
= 8

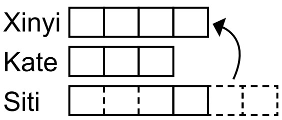
8 + 12 = 20

She had 20 banana muffins in the end.

13. Before



After



1 unit = 27

11 units = 27 × 11
= 297

The three girls had 297 stickers altogether.

14. Number of people who attended on each day
= 360 ÷ 3 × 8
= 960

Number of children who attended on Saturday
= 960 ÷ 5 × 2
= 384

384 children attended the performance on Saturday.

15. (a) ∠FCD = 180° – 100°
= 80°

∠FCB = 180° – 80°
= 100°

∠FBC = (180° – 100°) ÷ 2
= 40°

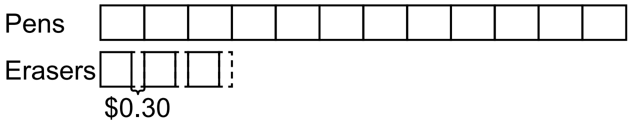
∠DEF = 180° – 100° – 40°
= 40°

(b) ∠BFC = 40°

∠AFB = 180° – 40°
= 140°

∠BAF = (180° – 140°) ÷ 2
= 20°

16.



20% → 3

100% → $\frac{3}{20}$ × 100 = 15

15 erasers cost as much as 12 pens.

12 × $0.30 = $3.60

3 erasers cost $3.60.

$3.60 ÷ 3 = $1.20

$1.20 + $0.30 = $1.50

$1.50 × 12 + $1.20 × 3 = $21.60

Raju spent $21.60 altogether.

17. For every 20-cent coins, there were three 50-cent coins.

Value of coins in each group = $0.20 + $1.50
= $1.70

Number of groups = $10.20 ÷ $1.70
= 6

6 × 2 = 12

There were 12 more 50-cent coins than 20-cent coins.

18. (a) ∠ECD = 90° – 60°
= 30°

Since ABCD is a square and BCE is an equilateral triangle,

CE = CD.

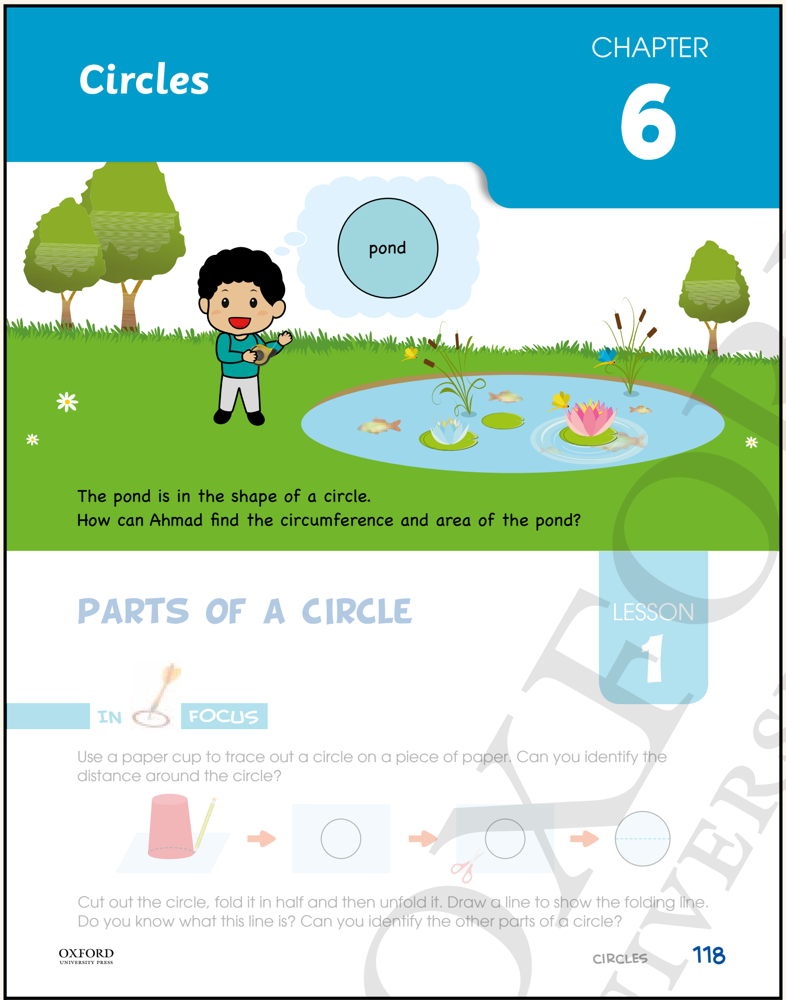
∠CDE = (180° – 30°) ÷ 2
= 75°

(b) ∠DEC =∠AEB = 75°

∠AED = 360° – 75° – 60° – 75°
= 150°

CIRCLES

CHAPTER 6



Textbook 6 P118

Related Resources
NSPM Textbook 6 (P118 – 144)
NSPM Workbook 6B (P1 – 30)

Materials
Paper cups, coins, paper plates, markers, paper cut-outs of circles, semicircle and quarter circles, scissors, strings, rulers, 1-cm square grid paper, glue

Lesson

Lesson 1	Parts of a Circle
Lesson 2	Area of a Circle
Lesson 3	Area and Perimeter of Composite Figures

Problem Solving, Maths Journal and Pupil Review

INTRODUCTION

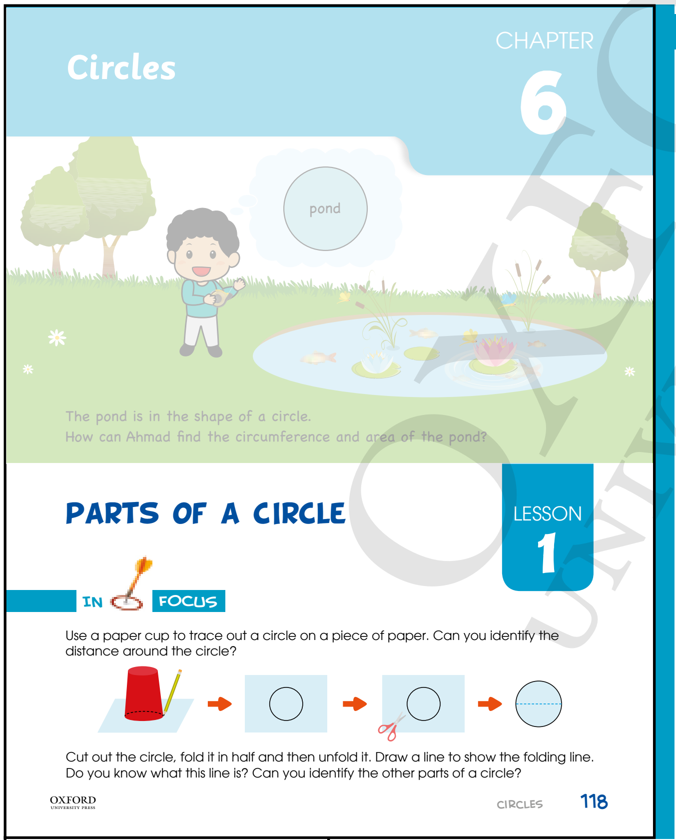
Pupils have previously learnt the shapes of circle, semicircle and quarter circle. In Grade Three, they were taught to find the area and perimeter of squares and rectangles and in Grade Five, the area of triangles. In this chapter, they will learn more about the parts of a circle such as circumference, diameter and radius, and to find its area. Pupils will also learn how to find the area and perimeter of semicircles and quarter circles as well as composite figures, which are made up of these shapes and other familiar shapes.

LESSON
1

PARTS OF A CIRCLE

LEARNING OBJECTIVES

1. Describe the different parts of a circle: centre, circumference, diameter, radius.
2. Find the circumference of a circle and the perimeter of a semicircle and a quarter circle.


Circles

CHAPTER 6

The pond is in the shape of a circle.
How can Ahmad find the circumference and area of the pond?

PARTS OF A CIRCLE

LESSON 1

IN FOCUS

Use a paper cup to trace out a circle on a piece of paper. Can you identify the distance around the circle?

Cut out the circle, fold it in half and then unfold it. Draw a line to show the folding line. Do you know what this line is? Can you identify the other parts of a circle?

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CIRCLES 118

Textbook 6 P118

IN FOCUS

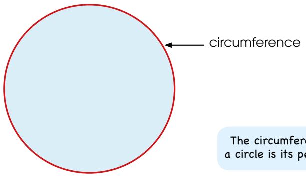
Discuss the chapter opener of the circular pond and get pupils to give other real-life examples of circles in their surroundings.

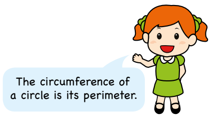
Get pupils to work in pairs and carry out the activity of tracing a circle on a piece of paper. Ask:
- What do you call the line that goes around the circle?
- What do you call the line that divides the circle into halves?

LET'S LEARN

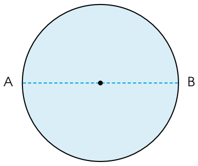
Circumference, diameter and radius

1. The **circumference** of a circle is the distance around the circle.

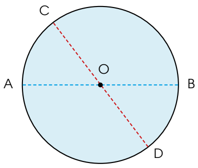


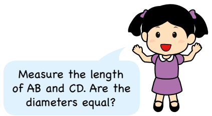


2. The line AB divides the circle into halves. AB is a **diameter** of the circle.



Fold the paper circle again in half in a different way.





The line CD is another diameter of the circle.
AB and CD meet at a point O, which is the **centre** of the circle.

Textbook 6 P119

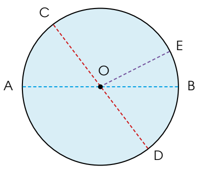
LET'S LEARN

In Let's Learn 1, recap with pupils that the perimeter of a shape is the total length around it. Tell pupils: We have a special name for the perimeter of a circle. Write the word 'circumference' on the whiteboard and guide pupils in reading it aloud.

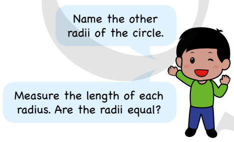
For Let's Learn 2, get pupils to look at their circle cut-outs and identify the line that cuts through the centre. Tell pupils that this is called the diameter. Ask:

- Do all diameters divide the circle into halves?
- Are all diameters equal in length?
- What is the point where all diameters meet?
- If you are given a new circle cut-out, how can you locate the centre of this circle?

Draw another line from the centre O to the circumference of the circle.



OE is a **radius** of the circle.
Any line drawn from the centre to the circumference of the circle is a radius of the circle.
OE and OB are **radii** of the circle.



Compare the lengths of the diameters AB and CD to the lengths of the radii OE and OB. What do you notice?

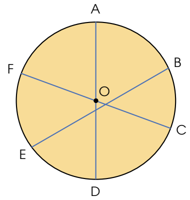
In any circle, the diameter is twice the length of the radius.
Diameter = 2 × Radius
Radius = Diameter ÷ 2

Textbook 6 P120

Guide pupils to identify and name a radius of the circle cut-out. Let them know that radius is the singular form while radii is the plural form. Get them to draw more radii and to compare their lengths with the lengths of the diameters measured previously. Ask:

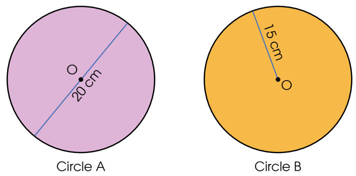
- Is the distance from the centre to any part of the circumference always the same? Are all radii equal in length?
- How many radii can be drawn on a circle?
- What can you say about the length of a radius compared to the diameter?

3. In the figure, O is the centre of the circle.



(a) Name the diameters. AD and FC
(b) Name the radii. OA, OC, OD, OF
(c) Which line is **not** a diameter? Explain. BE
(d) Are the lengths OA and OF the same? Explain. Yes

4. O is the centre of each circle.



(a) Radius of circle A = 20 ÷ 2
= 10 cm

(b) Diameter of circle B = 15 × 2
= 30 cm

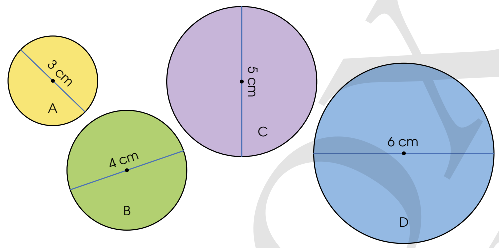
(c) Which circle is bigger? Explain. Circle B

Textbook 6 P121

Let's Learn 3 tests the understanding of pupils about the parts of a circle. Get pupils to answer the questions and provide explanations.

For Let's Learn 4, pupils should not directly measure the length from the book as the diagrams are not drawn to scale. Guide pupils to conclude that the longer the diameter or radius of a circle, the bigger the circle.

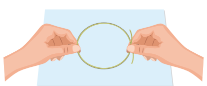
5. The four circles shown are drawn to scale and their diameters are given. Measure the circumference of each circle using a string.



Copy and complete the table.

Circle	Diameter	Circumference	Circumference Diameter (correct to 1 decimal place)
A	3 cm	9.4 cm	3.1
B	4 cm	12.5 cm	3.1
C	5 cm	15.7 cm	3.1
D	6 cm	18.8 cm	3.1

What do you notice?



The circumference of a circle is about 3.1 times its diameter.

Textbook 6 P122

In Let's Learn 5, the circles are drawn to scale. Get pupils to work in pairs to measure the circumference. Allow them to use a calculator to find the value of Circumference ÷ Diameter.

From the table, when the circumference of any circle is divided by its diameter, the value is always the same. This value is called **pi** and is represented by the symbol π.

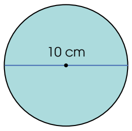
We usually take the value of π to be **3.14** or $\frac{22}{7}$.

Key in [π] [=] on your calculator. What value do you get?

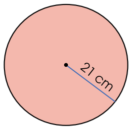
Circumference ÷ Diameter = π
Circumference = π × Diameter
= π × 2 × Radius

6. Find the circumference of each of the following circles.

(a) (Take π = 3.14)
Circumference = π × 10
= 3.14 × 10
= 31.4 cm



(b) (Take $\pi = \frac{22}{7}$)
Circumference = π × 2 × 21
= $\frac{22}{7}$ × 2 × 21
= 132 cm



Textbook 6 P123

Pupils should observe that they got a constant value of 3.1 (correct to 1 d.p.). Introduce the symbol π and share with pupils that this is a Greek letter derived from the first letter of the Greek word *perimetros*, which means circumference. This could help pupils remember how π is related to the circumference of a circle.

Get pupils to press the π key on their calculators and highlight to them that 3.14 or $\frac{22}{7}$ is an estimation of this value. Guide pupils to see how the formula for finding circumference can be derived.

7. Find the circumference of a paper plate with radius 11.5 cm. Leave your answer in terms of π.

Circumference = π × 2 × 11.5
= 23π cm

What does it means to leave your answer in terms of π?

8. Find the circumference of each circle. (Take π = 3.14)
(a) diameter = 20 cm 62.8 cm
(b) radius = 15 m 94.2 m

9. Find the circumference of each circle. (Take $\pi = \frac{22}{7}$)
(a) radius = 7 m 44 m
(b) diameter = 28 cm 88 cm

10. The diameter of the Singapore Flyer is 150 m. Find its circumference. (Take π = 3.14)

Circumference = π × 150
= 471 m

11. Find the circumference of a circular clock with radius 12.3 cm. Give your answer correct to 2 decimal places. (Take π = 3.14)

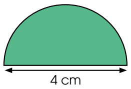
Circumference = π × 2 × 12.3
= 77.24 cm (to 2 decimal places)

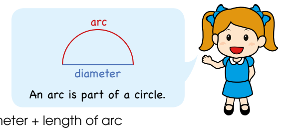
Textbook 6 P124

For Let's Learn 7 to 11, allow pupils to familiarise themselves with applying the formula to find the circumference of a circle using the different estimations of π. Go through with pupils what it means to leave their answers in terms of π.

Semicircles and quarter circles

12. Find the perimeter of a semicircle with diameter 4 cm. (Take $\pi = 3.14$)





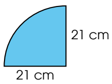
Perimeter of the semicircle = diameter + length of arc

$$= 4 + \left(\frac{1}{2} \times \pi \times 4\right)$$

$$= 4 + \left(\frac{1}{2} \times 3.14 \times 4\right)$$

$$= \boxed{10.28} \text{ cm}$$

13. A circle with radius 21 cm is divided into 4 identical quarter circles. What is the perimeter of one quarter circle? (Take $\pi = \frac{22}{7}$)



Perimeter of one quarter circle

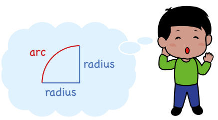
= radius + radius + length of arc

$$= 21 + 21 + \left(\frac{1}{4} \times \pi \times 2 \times 21\right)$$

$$= 21 + 21 + \left(\frac{1}{4} \times \frac{22}{7} \times 2 \times 21\right)$$

$$= 42 + \boxed{33}$$

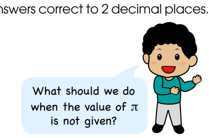
$$= \boxed{75} \text{ cm}$$



14. Find the perimeter of each figure. Give your answers correct to 2 decimal places.

(a) A quarter circle of radius 4.5 m 16.07 m

(b) A semicircle of radius 3.8 cm 19.54 cm



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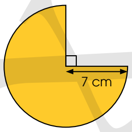
Textbook 6 P125

Use Let's Learn 12 to illustrate how to find the perimeter of a semicircle. Get pupils to fold their circle cut-outs in half and to trace out the perimeter of this semicircle. Emphasise to pupils that they must include the diameter, and not just take half of the circumference.

For Let's Learn 13, get pupils to fold their semicircle into half. Highlight to them that the perimeter of a quarter circle is made up of two radii and an arc, which is a quarter of the circumference of a circle.

In Let's Learn 14, the value of π is not given. Explain to pupils in such situations, they can use the calculator value and round off their answers to the required number of decimal places.

15. The figure shows three-quarter of a circle. Find its perimeter. (Take $\pi = \frac{22}{7}$)



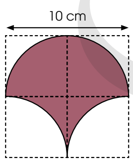
Perimeter of the figure = 7 + 7 + length of arc

$$= 14 + \left(\frac{3}{4} \times \pi \times 2 \times 7\right)$$

$$= 14 + \left(\frac{3}{4} \times \frac{22}{7} \times 2 \times 7\right)$$

$$= \boxed{47} \text{ cm}$$

16. The shaded figure is made up of 4 identical quarter circles. Find the perimeter of the figure. (Take $\pi = 3.14$)



Method 1

Perimeter of the figure = 4 × length of each arc

$$= 4 \times \left(\frac{1}{4} \times \pi \times 2 \times 5\right)$$

$$= 10\pi$$

$$= \boxed{31.4} \text{ cm}$$

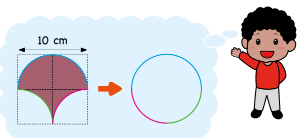
Method 2

Perimeter of the figure

= Circumference of the circle

$= \boxed{\pi} \times \boxed{10}$

$= \boxed{31.4}$ cm



OXFORD UNIVERSITY PRESS CIRCLES 126

Textbook 6 P126

For Let's Learn 15, pupils should be able to cancel out the common factors to calculate the length of the arc. Get a pair to illustrate on the whiteboard or visualiser how they can obtain the answer.

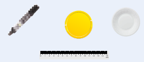
For Let's Learn 16, show the figure on a visualiser. Ask the class how many arcs make up the perimeter of the figure. Guide pupils to see that the 4 arcs are quarter circles with the same radius. Some pupils might be able to visualise that these 4 arcs make up the circumference of a circle. Allow pupils to work in pairs and use two methods to find the answer.

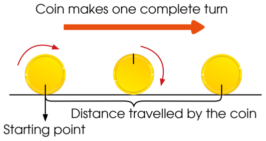
ACTIVITY TIME

Work in pairs.

1. Make a marking on the circumference of the coin.
2. Draw a straight line on a piece of paper and mark a starting point.
3. Place the coin on the line so that the marking on the coin touches the starting point.
4. Turn the coin along the line until the coin makes one complete turn. Mark this point on the line.

What you need:

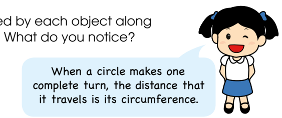




5. Measure the distance travelled by the coin in one complete turn. Then measure the diameter of the coin and calculate its circumference.
6. Repeat 1 to 5 using a paper plate. Then copy and complete the table.

Object	Distance travelled in one complete turn	Diameter	Circumference
Coin	cm	cm	cm
Paper plate	cm	cm	cm

7. Compare the distance travelled by each object along the line and its circumference. What do you notice?



Textbook 6 P127

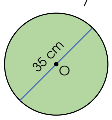
ACTIVITY TIME

Get pupils to work in pairs and complete the activity. When all pairs have completed the activity, get them to think of real-life examples where the distance a circle travels can be applied. For instance, ask pupils to compare two bicycles, one with bigger wheels than another. They should be able to conclude that when travelling at the same speed, the bicycle with bigger wheels would cover a greater distance.

PRACTICE

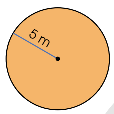
1. Find the circumference of each circle with centre O.

(a) (Take $\pi = \frac{22}{7}$)



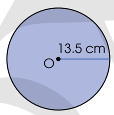
110 cm

(b) (Take $\pi = 3.14$)



31.4 m

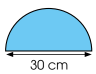
(c) (Take $\pi = 3.14$)



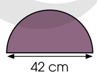
84.78 cm

2. Find the perimeter of each semicircle or quarter circle.

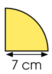
(a) (Take $\pi = 3.14$) 77.1 cm



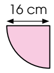
(b) (Take $\pi = \frac{22}{7}$) 108 cm



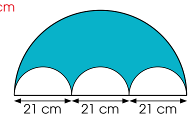
(c) (Take $\pi = \frac{22}{7}$) 25 cm



(d) (Take $\pi = 3.14$) 57.12 cm



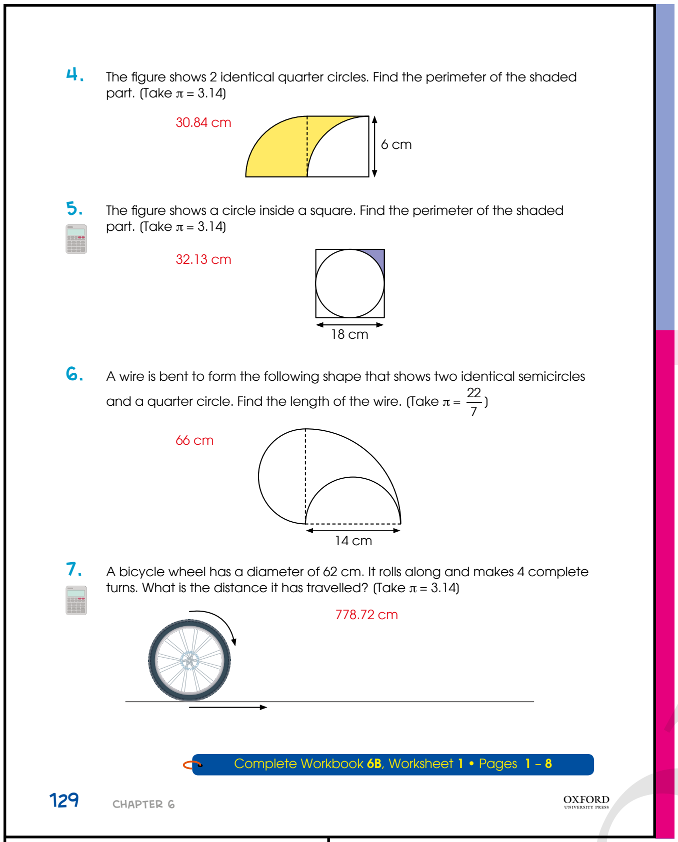
3. The figure is formed using 4 semicircles. Find the perimeter of the shaded part.
(Take $\pi = \frac{22}{7}$) 198 cm



Textbook 6 P128

PRACTICE

Allow pupils to work in pairs on the practice questions.


4. The figure shows 2 identical quarter circles. Find the perimeter of the shaded part. (Take $\pi = 3.14$)

30.84 cm

5. The figure shows a circle inside a square. Find the perimeter of the shaded part. (Take $\pi = 3.14$)

32.13 cm

6. A wire is bent to form the following shape that shows two identical semicircles and a quarter circle. Find the length of the wire. (Take $\pi = \frac{22}{7}$)

66 cm

7. A bicycle wheel has a diameter of 62 cm. It rolls along and makes 4 complete turns. What is the distance it has travelled? (Take $\pi = 3.14$)

778.72 cm

Complete Workbook **6B**, Worksheet **1** • Pages **1 – 8**

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Textbook 6 P129

For questions 4 to 6, some guidance may be required. Ask:

- Can you describe the parts that make up the unknown perimeter of the given shape?
- Can you identify any hidden length, diameter or radius required to make the calculations?
- What are the steps that you need to take? What method would you use?

Independent seatwork

Select some examples of word problems from Worksheet 1 (Workbook 6B P1 – 8) for pupils to get more practice before assigning them to complete the rest as independent seatwork.

Answers

Worksheet 1 (Workbook 6B P1 – 8)

1. (a) PQ, RS
   (b) OP, OQ, OR, OS, OV

2. (a) $3.14 \times 4 = 12.56$ cm
   (b) $2 \times 3.14 \times 15 = 94.2$ cm

3. (a) $2 \times \frac{22}{7} \times 21 = 132$ cm
   (b) $\frac{22}{7} \times 49 = 154$ cm

4. (a) $\left(\frac{1}{2} \times 3.14 \times 6\right) + 6 = 15.42$ cm
   (b) $\left(\frac{1}{2} \times 3.14 \times 7.5\right) + 7.5 = 19.28$ cm
   (c) $\left(\frac{1}{2} \times 2 \times \frac{22}{7} \times 12\right) + 24 = 61.71$ cm

5. (a) $\left(\frac{1}{4} \times 2 \times 3.14 \times 100\right) + 100 + 100 = 357$ cm
   (b) $\left(\frac{1}{4} \times 2 \times \frac{22}{7} \times 35\right) + 35 + 35 = 125$ cm
   (c) $\left(\frac{1}{4} \times 2 \times \frac{22}{7} \times 17.5\right) + 17.5 + 17.5$
   $= 62.5$ cm

6. $\left(\frac{1}{4} \times 2 \times \frac{22}{7} \times 7\right) + \left(\frac{22}{7} \times 7\right) = 33$ cm

7. $(3.14 \times 10) + \left(\frac{1}{2} \times 3.14 \times 20\right) = 62.8$ cm

8. $\left(\frac{1}{4} \times 2 \times \frac{22}{7} \times 35\right) + \left(\frac{1}{2} \times \frac{22}{7} \times 35\right) + 35$
   $= 145$ cm

9. $\left(\frac{1}{2} \times 3.14 \times 10\right) + \left(\frac{1}{4} \times 2 \times 3.14 \times 10\right)$
   $= 31.4$ cm

10. $\left(\frac{1}{2} \times 3.14 \times 24\right) + 12 = 49.68$ cm

11. $2 \times \pi \times 16 = 100.5$ cm

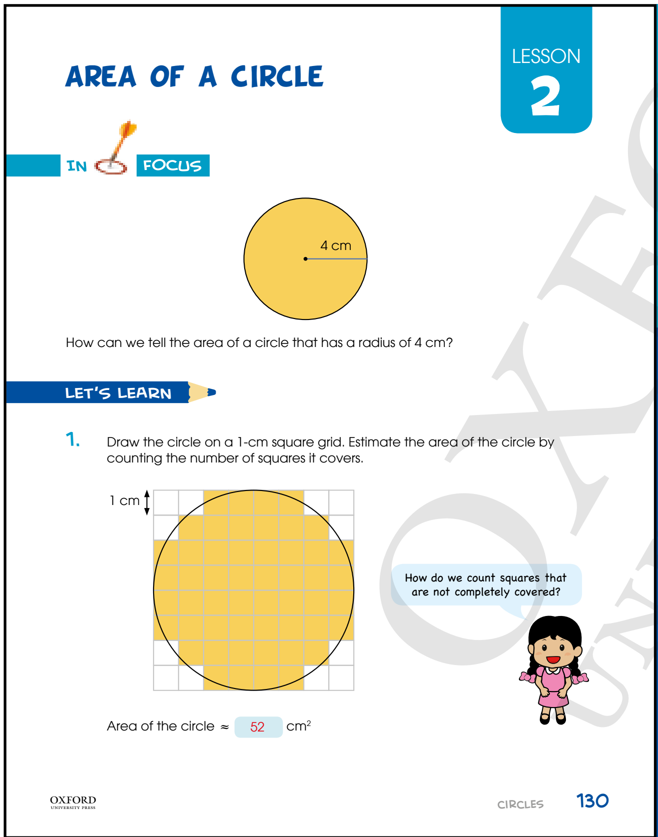
12. (a) $\frac{22}{7} \times 14 = 44$ cm
    $44 \times 10 = 440$ cm
    The wheel moves 440 cm in 10 complete turns.
    (b) $88 \div 44 = 2$
    The wheel will make 2 complete turns.

LESSON 2

AREA OF A CIRCLE

LEARNING OBJECTIVES

1. Find the area of a circle.
2. Find the area of a composite figure made up of square(s), rectangles(s), triangles(s), semicircles(s) and quarter circles(s).


AREA OF A CIRCLE

LESSON 2

IN FOCUS

4 cm

How can we tell the area of a circle that has a radius of 4 cm?

LET'S LEARN

1. Draw the circle on a 1-cm square grid. Estimate the area of the circle by counting the number of squares it covers.

1 cm

How do we count squares that are not completely covered?

Area of the circle ≈ 52 cm²

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CIRCLES 130

Textbook 6 P130

IN FOCUS

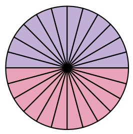
Using the visualiser, show the class a circle cut-out. Get pupils to think of possible methods to find the area of a circle. Ask:

- Can you recall the meaning of area?
- How can we find the amount of surface a circle takes up?

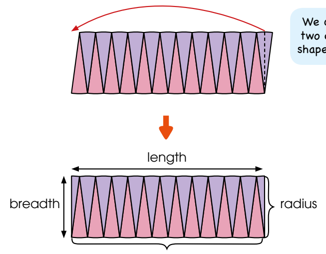
LET'S LEARN

Demonstrate the method of using 1-cm squares to cover the surface of the circle to find an estimate of its area. Place a piece of 1-cm square grid transparency over the circle on the visualiser and get pupils to count how many squares are taken up by the circle. Allow them to make the estimation for an area covering more than half a square to be counted as 1 square.

2. We can find the area of a circle in another way.
Cut a paper circle into 24 equal pieces.



Rearrange all the pieces to form the figure as shown.



$\frac{1}{2}$ × circumference of the circle

Area of a circle ≈ Area of the rectangle
= Length × Breadth
= π × Radius × Radius

Area of circle = π × Radius × Radius

Circumference of circle
= 2 × π × Radius
$\frac{1}{2}$ × Circumference of circle
= $\frac{1}{2}$ × 2 × π × Radius
= π × Radius

131 CHAPTER 6 OXFORD

Textbook 6 P131

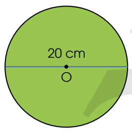
For Let's Learn 2, a group activity can be conducted. Hint to pupils that they can use a formula to find the area of a circle.

Allow pupils to work in groups of 2 to 4. Provide each group with a circle cut-out with 24 equal sectors marked out, a pair of scissors and some glue. Give clear instructions on how to cut and rearrange the pieces to form a rectangle. After pupils have formed the rectangle, guide them to see how the formula can be derived. Ask:

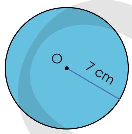
- Can you identify the length and breadth of the rectangle formed?
- How are these related to the radius and circumference of the original circle?

3. Find the area of each circle with centre O.

(a) (Take π = 3.14)
Area = π × 10 × 10
= 3.14 × 100
= 314 cm²



(b) (Take π = $\frac{22}{7}$)
Area = π × 7 × 7
= $\frac{22}{7}$ × 7 × 7
= 154 cm²



4. Find the area of a movie DVD that has a diameter of 12 cm. (Take π = 3.14)

Area = π × 6 × 6
= 113.04 cm²

5. Find the area of a pizza with radius 13 cm. (Take π = 3.14)

Area = π × 13 × 13
= 530.66 cm²

OXFORD CIRCLES 132

Textbook 6 P132

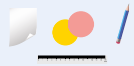
Let's Learn 3 to 5 offer opportunities for pupils to apply the formula to find the area of a circle. Remind pupils that the formula uses the radius and not the diameter.

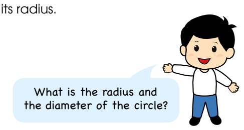
ACTIVITY TIME

Work in pairs.

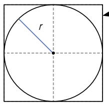
1. Fold a circle cut-out into half and then unfold it. Mark out its radius.

What you need:



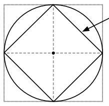


2. Put the circle on a piece of paper and draw a square that fits outside the circle.



3. Take r as the radius of the circle. Find the area of the outside square in terms of r. What do you notice about the area of the circle as compared to the area of the outside square?

4. Draw a square that fits inside the circle as shown.



5. Find the area of the inside square in terms of r. What do you notice about the area of the circle as compared to the area of the inside square?

6. Repeat 1 to 5 for circle cut-outs of different sizes. Estimate the area of each circle by comparing it with the areas of the outside square and inside square. How is this related to finding the value of $\pi \times r \times r$?

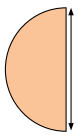
133 CHAPTER 6 OXFORD

Textbook 6 P133

ACTIVITY TIME

This activity allows pupils to draw connections between the area of a circle (of radius r) and the area of a square that fits outside of it as well as inside of it. Guide pupils to see that the area of the circle would be less than $4r^2$ and more than $2r^2$, thus reinforcing the formula of πr^2.

6. A pie has a diameter of 14 cm. Find the area of half of the pie. (Take $\pi = \frac{22}{7}$)

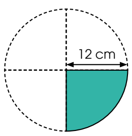


Area of the semicircle $= \frac{1}{2} \times$ area of the circle

$= \frac{1}{2} \times \pi \times 7 \times 7$

$=$ 77 cm²

7. What is the area of a quarter circle with radius 12 cm? (Take $\pi = 3.14$)



Area of the quarter circle $= \frac{1}{4} \times$ area of the circle

$= \frac{1}{4} \times \pi \times 12 \times 12$

$=$ 113.04 cm²

8. Find the area of each figure. Give your answers correct to 2 decimal places. (Take $\pi = 3.14$)

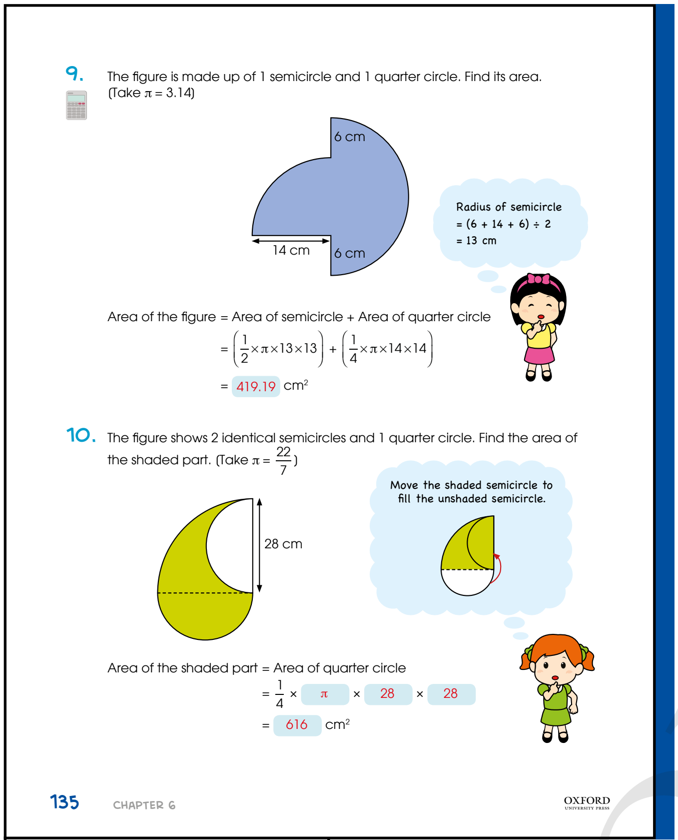
(a) A quarter circle of radius 31 cm 754.39 cm²

(b) A semicircle of diameter 44 cm 759.88 cm²

OXFORD CIRCLES 134

Textbook 6 P134

Let's Learn 6 to 8 require pupils to apply the formula to semicircles and quarter circles. Ensure that pupils have no misconceptions of area.



9. The figure is made up of 1 semicircle and 1 quarter circle. Find its area. (Take $\pi = 3.14$)

Area of the figure = Area of semicircle + Area of quarter circle

$= \left(\frac{1}{2}\times\pi\times13\times13\right) + \left(\frac{1}{4}\times\pi\times14\times14\right)$

$= 419.19$ cm²

10. The figure shows 2 identical semicircles and 1 quarter circle. Find the area of the shaded part. (Take $\pi = \frac{22}{7}$)

Area of the shaded part = Area of quarter circle

$= \frac{1}{4} \times \pi \times 28 \times 28$

$= 616$ cm²

135 CHAPTER 6 OXFORD

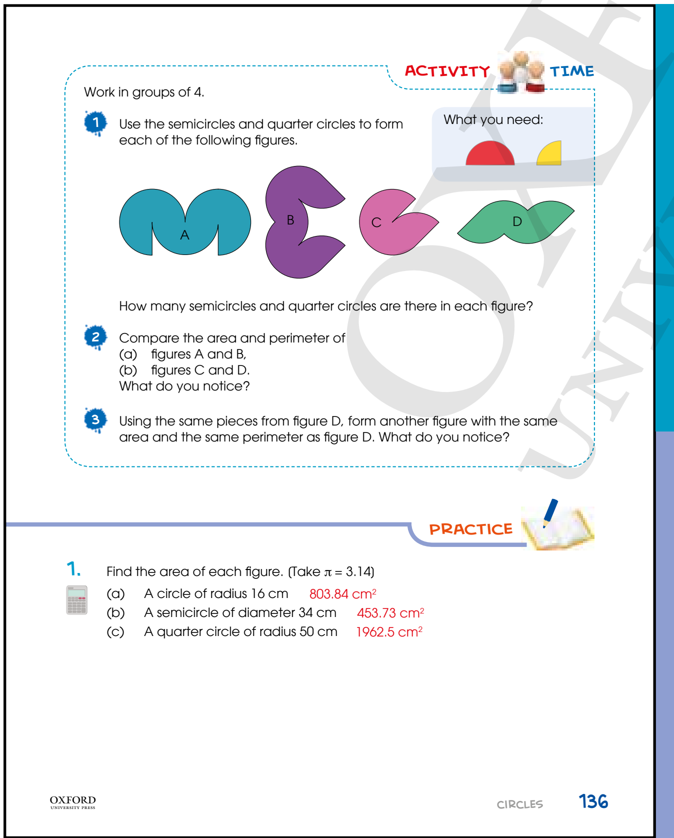
Textbook 6 P135

Let's Learn 9 and 10 introduce composite figures. Guide pupils through the problem-solving process.

i) Understanding the question:
   - Can you identify the familiar shapes that make up this figure?
   - Can you identify the hidden length, diameter or radius that is required to find the unknown area?

ii) Planning:
   - What are the steps you need to take?
   - What method would you use?
   - Can you visualise a way to move the parts to form another figure of the same area?

iii) Checking:
   - Is your answer reasonable?
   - Can you estimate to check it?



ACTIVITY TIME

Work in groups of 4.

1. Use the semicircles and quarter circles to form each of the following figures.

What you need:

How many semicircles and quarter circles are there in each figure?

2. Compare the area and perimeter of
   (a) figures A and B,
   (b) figures C and D.
   What do you notice?

3. Using the same pieces from figure D, form another figure with the same area and the same perimeter as figure D. What do you notice?

PRACTICE

1. Find the area of each figure. (Take $\pi = 3.14$)
   (a) A circle of radius 16 cm 803.84 cm²
   (b) A semicircle of diameter 34 cm 453.73 cm²
   (c) A quarter circle of radius 50 cm 1962.5 cm²

OXFORD CIRCLES 136

Textbook 6 P136

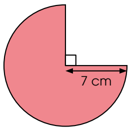
ACTIVITY TIME

In this hands-on activity, pupils create composite figures with the semicircles and quarter circles provided. Pupils would discover that the areas of two composite figures can be equal even though the diameters of the shapes they are made of are not. They should be able to conclude that a figure with a bigger area may not have a longer perimeter compared to another shape, and vice versa.

PRACTICE

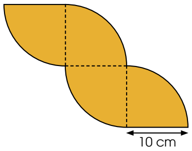
Pupils should be able to do questions 1 to 3 on their own. Get them to check their answers in pairs.

2. A figure is made up of 3 identical quarter circles. Find its area. (Take $\pi = \frac{22}{7}$)
115.5 cm²



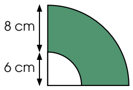
3. The figure is made up of 4 identical quarter circles. Find its area. (Take $\pi = 3.14$)

314 cm²



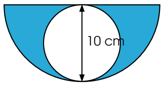
4. This figure is formed using 2 quarter circles. Find the area of the shaded part. (Take $\pi = 3.14$)

125.6 cm²



5. The figure shows a circle and a semicircle. Find the area of the shaded part. (Take $\pi = 3.14$)

78.5 cm²



Complete Workbook **6B**, Worksheet **2** • Pages **9 – 14**

Textbook 6 P137

Allow pupils to work in pairs for questions 4 and 5, where each pupil solves one question while explaining his steps to his partner. Partners should follow the explanations and clarify any steps if needed.

Independent seatwork

Assign pupils to complete Worksheet 2 (Workbook 6B P9 – 14).

Answers

Worksheet 2 (Workbook 6B P9 – 14)

1. (a) $3.14 \times 10 \times 10 = 314 \text{ cm}^2$

   (b) $\frac{22}{7} \times 7 \times 7 = 154 \text{ cm}^2$

   (c) $\frac{1}{2} \times 3.14 \times 2 \times 2 = 6.28 \text{ cm}^2$

   (d) $\frac{1}{2} \times \frac{22}{7} \times 17.5 \times 17.5 = 481.25 \text{ cm}^2$

   (e) $\frac{1}{4} \times \frac{22}{7} \times 21 \times 21 = 346.5 \text{ cm}^2$

   (f) $\frac{1}{4} \times 3.14 \times 40 \times 40 = 1256 \text{ cm}^2$

2. $\left(\frac{22}{7} \times 7 \times 7\right) + \left(\frac{1}{4} \times \frac{22}{7} \times 7 \times 7\right) = 192.5 \text{ cm}^2$

3. $\frac{1}{2} \times 3.14 \times 6 \times 6 = 56.52 \text{ cm}^2$

   $\frac{1}{2} \times 3.14 \times 2 \times 2 = 6.28 \text{ cm}^2$

   $\frac{1}{2} \times 3.14 \times 4 \times 4 = 25.12 \text{ cm}^2$

   $56.52 - 6.28 - 25.12 = 25.12 \text{ cm}^2$

4. $\frac{1}{2} \times \pi \times 6 \times 6 = 18\pi \text{ cm}^2$

   $\frac{1}{2} \times \pi \times 4 \times 4 = 8\pi \text{ cm}^2$

   $18\pi - 8\pi = 10\pi \text{ cm}^2$

5. $\pi \times 12 \times 12 = 144\pi \text{ cm}^2$

   $\pi \times 9 \times 9 = 81\pi \text{ cm}^2$

   $\pi \times 3 \times 3 = 9\pi \text{ cm}^2$

   $144\pi - 81\pi - 9\pi = 54\pi$
   $= 169.56 \text{ cm}^2$

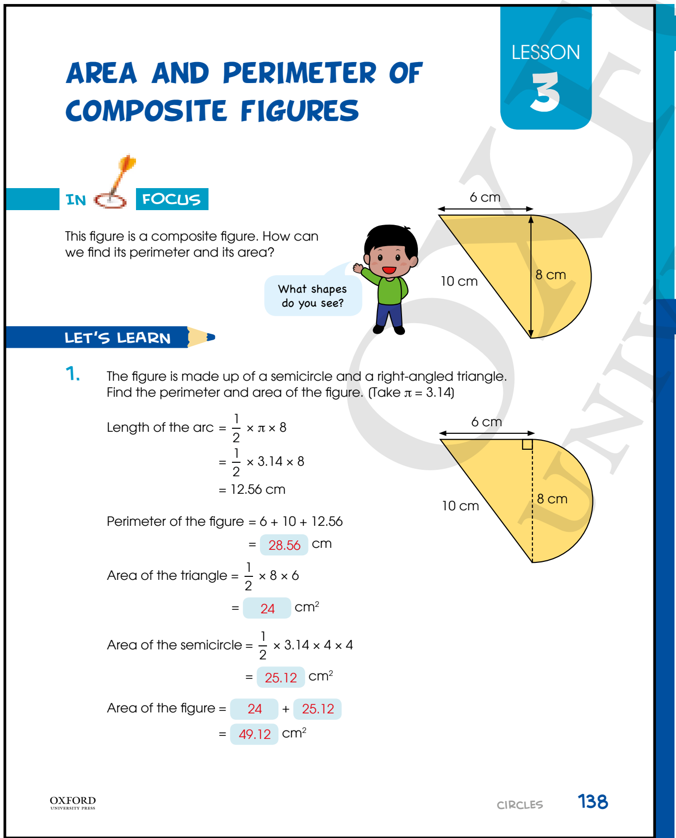
6. $\frac{1}{2} \times 3.14 \times 20 \times 20 = 628 \text{ cm}^2$

LESSON 3

AREA AND PERIMETER OF COMPOSITE FIGURES

LEARNING OBJECTIVE

1. Find the area and perimeter of figures made up of a variety of squares, rectangles, triangles, semicircles and quarter circles.



AREA AND PERIMETER OF COMPOSITE FIGURES

LESSON 3

IN FOCUS

This figure is a composite figure. How can we find its perimeter and its area?

LET'S LEARN

1. The figure is made up of a semicircle and a right-angled triangle. Find the perimeter and area of the figure. (Take $\pi = 3.14$)

Length of the arc $= \frac{1}{2} \times \pi \times 8$

$= \frac{1}{2} \times 3.14 \times 8$

$= 12.56$ cm

Perimeter of the figure $= 6 + 10 + 12.56$

$=$ 28.56 cm

Area of the triangle $= \frac{1}{2} \times 8 \times 6$

$=$ 24 cm^2

Area of the semicircle $= \frac{1}{2} \times 3.14 \times 4 \times 4$

$=$ 25.12 cm^2

Area of the figure $=$ 24 $+$ 25.12

$=$ 49.12 cm^2

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CIRCLES 138

Textbook 6 P138

IN FOCUS

Prompt pupils by asking:

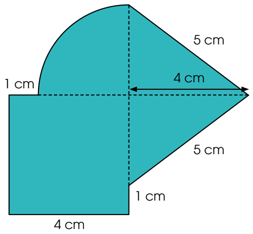
- To find the perimeter and area, what do we need to do first?
- Can we dissect the figure into more familiar shapes that will allow us to find the perimeter and area?

LET'S LEARN

Guide pupils to name the shapes the composite figure can be dissected into. Ask:

- Do you know the dimensions of the semicircle and the triangle?
- How do you find length of the arc of the semicircle?
- Now can you find the perimeter of the figure?
- What about the area? What steps do you take?

2. The figure is made up of a square, a quarter circle and an isosceles triangle. Find the perimeter and area of the figure. (Take $\pi = 3.14$)



Length of the arc $= \frac{1}{4} \times 2 \times \pi \times 3$

$= \frac{1}{4} \times 2 \times 3.14 \times 3$

$= 4.71$ cm

Perimeter of the figure $= 4.71 + 1 + 4 + 4 + 1 + 5 + 5$

$= 24.71$ cm

Area of the square $= 4 \times 4$

$= 16$ cm^2

Area of the triangle $= \frac{1}{2} \times 6 \times 4$

$= 12$ cm^2

Area of the quarter circle $= \frac{1}{4} \times \pi \times 3 \times 3$

$= 7.065$ cm^2

Area of the figure $= 16 + 12 + 7.065$

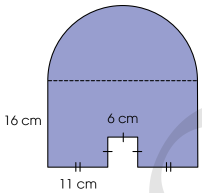
$= 35.065$ cm^2

139 CHAPTER 6 OXFORD UNIVERSITY PRESS

Textbook 6 P139

For Let's Learn 2, guide pupils to identify the shapes that make up the figure. Allow them to perform the calculations on their own.

3. Meiling had a semicircle and a rectangle. She cut out one part of the rectangle and formed a figure as shown. Find the perimeter and the area of the figure. (Take $\pi = \frac{22}{7}$)



Diameter of the semicircle $= 11 + 6 + 11$

$= 28$ cm

Length of the arc $= \frac{1}{2} \times \frac{22}{7} \times 28$

$= 44$ cm

Perimeter of the figure $= 44 + 16 \times 2 + 11 \times 2 + 6 \times 3$

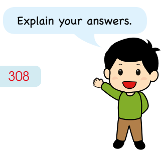
$= 116$ cm

Area of the semicircle $= \frac{1}{2} \times \frac{22}{7} \times 14 \times 14$

$= 308$ cm^2

Area of part that was cut out $= 6 \times 6$

$= 36$ cm^2



Area of the figure $= (16 \times 28 - 36) + 308$

$= 720$ cm^2

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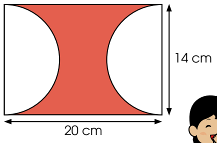
Textbook 6 P140

For Let's Learn 3, highlight to pupils the significance of the part of the rectangle that was cut out. Ask:

- Do we include this in the area of the figure?
- Do we include these sides in the perimeter of the figure?

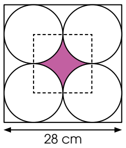
4. The figure shows 2 semicircles and 1 rectangle. Find the perimeter and area of the shaded part. (Take $\pi = \frac{22}{7}$)



Perimeter of the shaded part
$= 20 + 20 + \pi \times 14$
$=$ 84 cm

Area of the shaded part
= Area of rectangle – Area of circle
$=$ 280 – 154
$=$ 126 cm^2

5. The figure shows 1 small square and 4 identical circles inside a big square. Find the perimeter and area of the shaded part. (Take $\pi = \frac{22}{7}$)



Radius of each circle $= 28 \div 4 = 7$ cm

Perimeter of the shaded part = Circumference of circle
$= \frac{22}{7} \times 2 \times 7$
$=$ 44 cm

Area of the shaded part = Area of small square – Area of circle
$= (14 \times 14) - \left(\frac{22}{7} \times 7 \times 7\right)$
$=$ 42 cm^2

Textbook 6 P141

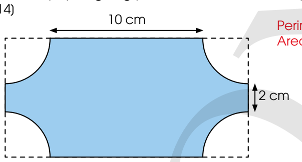
For Let's Learn 4, get pupils to discuss in pairs how they would approach the problem. Suggest to pupils that they can trace out the sides included in the perimeter to help with their calculations.

Let's Learn 5 may require more prompting. Ask:
- How do you find the radius of the circle?
- Do we simply subtract the area of the 4 circles from the area of the big square to find the shaded area? Why?
- What can you observe when the centres of the circles are joined together by the dotted lines to form a square?
- How do we go about finding the shaded area from here?

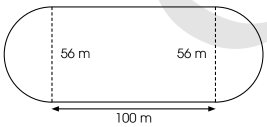
PRACTICE

1. Raju cut off 4 identical quarter circles with radius 3 cm from the corners of a rectangular piece of paper as shown. Find the perimeter and area of the remaining piece of paper, giving your answers to 1 decimal place. (Take $\pi = 3.14$)

Perimeter = 42.8 cm
Area = 99.7 cm^2

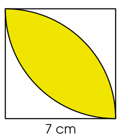


2. The figure shows a running track made up of 2 straight lines and 2 semicircles.



(a) Find the perimeter of the running track. 376 m
(b) The track surrounds a field. Find the area of the field. 8064 m^2
(Take $\pi = \frac{22}{7}$)

3. The figure shows 2 identical quadrants of radius 7 cm. Find the perimeter and area of the shaded part. (Take $\pi = \frac{22}{7}$)
Perimeter = 22 cm
Area = 28 cm^2

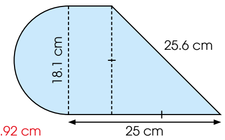


Textbook 6 P142

PRACTICE

Pupils may need some guidance for question 3. Hint to them that the figure can be divided diagonally into 2, and half of the shaded part can be viewed as the top portion of a quarter circle.

4. The figure is made up of a semicircle, a rectangle and an isosceles triangle. Find the perimeter and area of the figure giving your answers to 2 decimal places. (Take $\pi = 3.14$)

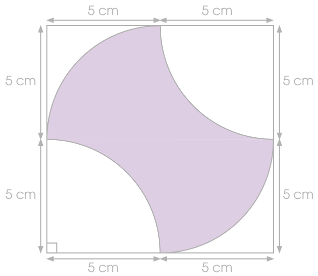


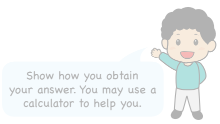
Perimeter = 85.92 cm
Area = 417.28 cm^2

Complete Workbook **6B**, Worksheet **3** • Pages **15 – 19**

MIND WORKOUT

Find the area of the shaded part. 50 cm^2





143 CHAPTER 6 OXFORD

Textbook 6 P143

Independent seatwork

Assign pupils to complete Worksheet 3 (Workbook 6B P15 – 19).

1 . Perimeter $= \left(\frac{1}{2} \times \frac{22}{7} \times 14\right) + 7 + 7 + 14$

$= 50$ cm

2. Area of shaded part $= \frac{1}{4} \times 3.14 \times 4 \times 4$

$= 12.56$ cm^2

3. (a) $2 \times \frac{22}{7} \times 14 = 88$ cm

(b) $14 \times 14 + \left(2 \times \frac{22}{7} \times 7 \times 7\right) = 504$ cm^2

4. (a) $\left(\frac{1}{2} \times 3.14 \times 8\right) + 10 + 6 + 18 + 6 = 52.56$ cm

(b) $\left(\frac{1}{2} \times 3.14 \times 4 \times 4\right) + (18 \times 6) = 133.12$ cm^2

5. Perimeter $= \left(\frac{1}{2} \times 3.14 \times 20\right) + \left(\frac{1}{2} \times 3.14 \times 16\right) + 12$

$= 68.52$ cm

Area $= \left(\frac{1}{2} \times 3.14 \times 10 \times 10\right) + \left(\frac{1}{2} \times 3.14 \times 8 \times 8\right) + \left(\frac{1}{2} \times 16 \times 12\right)$

$= 353.48$ cm^2

6. (a) $\left(\frac{1}{2} \times 3.14 \times 6\right) + \left(\frac{1}{2} \times 3.14 \times 8\right) + \left(\frac{1}{2} \times 3.14 \times 10\right) = 37.68$ cm

(b) $\frac{1}{2} \times 3.14 \times 5 \times 5 = 39.25$ cm^2

$39.25 - \left(\frac{1}{2} \times 6 \times 8\right) = 15.25$ cm^2

$\left(\frac{1}{2} \times 3.14 \times 3 \times 3\right) + \left(\frac{1}{2} \times 3.14 \times 4 \times 4\right) - 15.25 = 24$ cm^2

7. $18 \times 18 = 324$ cm^2

$\frac{1}{4} \times 3.14 \times 18 \times 18 = 254.34$ cm^2

$\frac{1}{2} \times 3.14 \times 9 \times 9 = 127.17$ cm^2

$\frac{1}{2} \times 18 \times 18 = 162$ cm^2

$(324 - 254.34) + 127.17 + 162 = 358.83$ cm^2

$= 358.8$ cm^2 (to 1 decimal place)

8. (a) $\frac{6}{4} \times 2 \times 3.14 \times 1 = 9.42$ cm

$9.42 + (6 \times 1) = 15.42$ cm

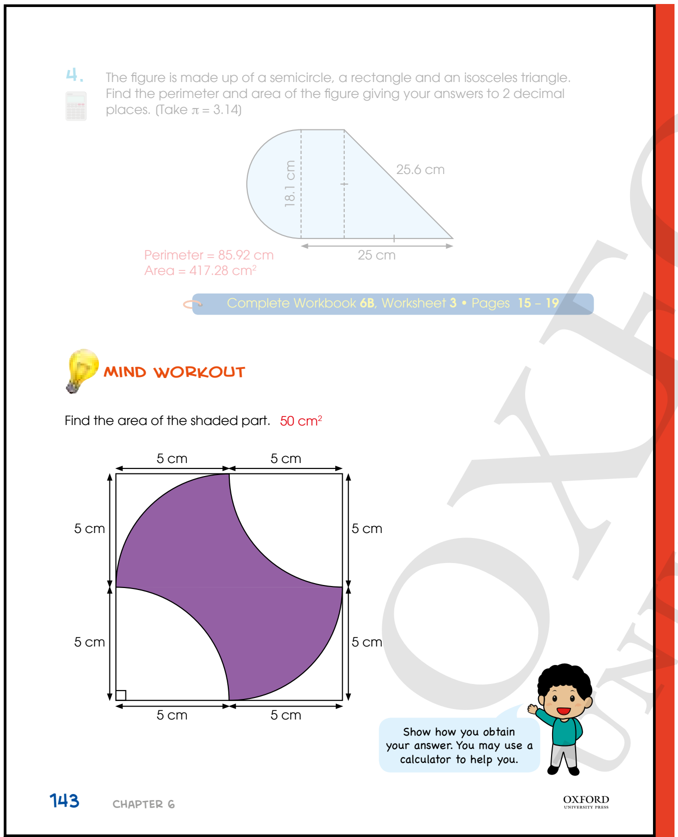
(b) $6 \times 1 = 6$ cm^2

$(2 \times 1) - \left(\frac{1}{2} \times 3.14 \times 1 \times 1\right) = 2 - 1.57$

$= 0.43$ cm^2

$6 + 0.43 = 6.43$ cm^2

PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW



4. The figure is made up of a semicircle, a rectangle and an isosceles triangle. Find the perimeter and area of the figure giving your answers to 2 decimal places. (Take π = 3.14)

Perimeter = 85.92 cm
Area = 417.28 cm²

Complete Workbook 6B, Worksheet 3 • Pages 15 – 19

MIND WORKOUT

Find the area of the shaded part. 50 cm²

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Textbook 6 P143

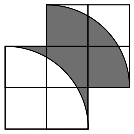
MIND WORKOUT

Give pupils a hint that it is possible to solve the question without a calculator and get the answer simply by calculating the area of squares.

Mind Workout

Date: ____________

The figure shows 2 quarter circles in 7 similar squares. The area of the shaded part is 48 cm². Find the perimeter of the shaded part, leaving your answer in terms of π.



$48 \div 3 = 16$

The area of one square is 16 cm².

Length of one side of a square $= \sqrt{16}$

$= 4$ cm

$\left(\frac{1}{2} \times \pi \times 16\right) + (4 \times 4) = (8\pi + 16)$ cm

The perimeter of the shaded part is $(8\pi + 16)$ cm.

20 Chapter 6

Workbook 6B P20

Mind Workout

Similar to the Mind Workout question in the Textbook, this requires visualisation to shift the parts around, to make up 3 squares in the grid. The area of one square can then be calculated, and subsequently, the length of one square, i.e. radius of the quarter circles, can be found.

MATHS JOURNAL

Tom has two identical wires of length 60 cm each. He bends one wire to form a square and bends the other wire to form a circle.

Which shape has a larger area? Explain.

SELF-CHECK

I know how to...

- identify and name the diameter, centre, radius and circumference of a circle.
- find the circumference and area of a circle.
- find the perimeter and area of a semicircle and a quarter circle.
- find the perimeter and area of figures made up of different shapes.

OXFORD UNIVERSITY PRESS CIRCLES 144

Textbook 6 P144

MATHS JOURNAL

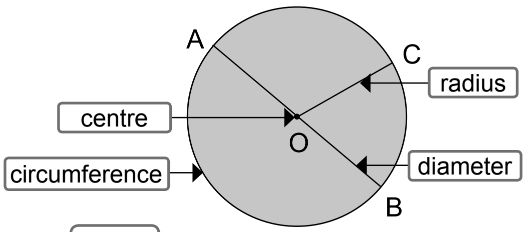
This task enables pupils to review the concept of the perimeter of a square in comparison to the circumference of a circle. They can apply the appropriate formulae to find the areas of each shape and compare their sizes.

SELF-CHECK

Before pupils proceed to do the self-check, review the parts of a circle, formulae to find its circumference and area, as well as the skills to apply them when solving questions involving composite figures.

The self-check can be done after pupils have completed **Review 6** (Workbook 6B P21 – 30).

1. (a)



(b) AB = $\boxed{2}$ × OB

(c) OA = $\boxed{OB}$ = $\boxed{OC}$

(d) Circumference of the circle = $\pi \times \boxed{AB}$

$= \pi \times \boxed{2} \times OC$

(e) Area of the circle = $\pi \times \boxed{OA/OB/OC} \times \boxed{OA/OB/OC}$

2. (a) Perimeter = 3.14 × 24
= 75.36 cm

Area = 3.14 × 12 × 12
= 452.16 cm^2

(b) Perimeter = $\left(\frac{1}{2} \times 2 \times 3.14 \times 13\right) + 13 + 13$
= 66.82 cm

Area = $\frac{1}{2} \times 3.14 \times 13 \times 13$
= 265.33 cm^2

(c) Perimeter = $\left(\frac{1}{4} \times 2 \times 3.14 \times 16\right) + 16 + 16$
= 57.12 cm

Area = $\frac{1}{4} \times 3.14 \times 16 \times 16$
= 200.96 cm^2

3. Distance travelled = $4 \times \frac{22}{8} \times 35$
= 440 cm

4. Area = $\frac{1}{2} \times \pi \times 8 \times 8$
= 32π cm^2

5. Perimeter = (3.14 × 42) + 21 + 21
= 173.9 cm (to 1 decimal place)

Area = 3.14 × 21 × 21
= 1384.7 cm^2 (to 1 decimal place)

6. Perimeter = $\left(\frac{3}{4} \times 2 \times 3.14 \times 30\right) + 30 + 30$
= 201.3 cm

Area = $\frac{3}{4} \times 3.14 \times 30 \times 30$
= 2119.5 cm^2

7. (a) $\frac{1}{4} \times 2 \times 3.14 \times 8 = 12.56$ cm

$\frac{1}{4} \times 2 \times 3.14 \times 16 = 25.12$ cm

Perimeter = 12.56 + 25.12 + 24 + 8 + 32
= 101.68 cm

(b) $\frac{1}{4} \times 3.14 \times 8 \times 8 = 50.24$ cm^2

$\frac{1}{4} \times 3.14 \times 16 \times 16 = 200.96$ cm^2

(40 × 16) – 50.24 – 200.96 = 388.8 cm^2

8. $\left(\frac{22}{7} \times 7 \times 7\right) - \left(2 \times \frac{22}{7} \times 3.5 \times 3.5\right) = 77$ cm^2

9. Diameter of smaller semicircle = 10 cm

Diameter of larger semicircle = 20 cm

$\frac{1}{2} \times 3.14 \times 5 \times 5 = 39.25$ cm^2

$\frac{1}{2} \times 3.14 \times 10 \times 10 = 157$ cm^2

(30 × 20) – 39.25 – 157 = 403.75 cm^2

10. $\frac{1}{2} \times \frac{22}{7} \times 7 \times 7 = 77$ cm^2

$\frac{1}{2} \times 7 \times 7 = 24.5$ cm^2

77 + 24.5 = 101.5 cm^2

11. The length of the rectangle is twice its breadth.

Breadth = 10 cm

Length = 20 cm

Perimeter of shaded part = $\left(\frac{1}{2} \times 3.14 \times 20\right) + 20$
= 51.4 cm

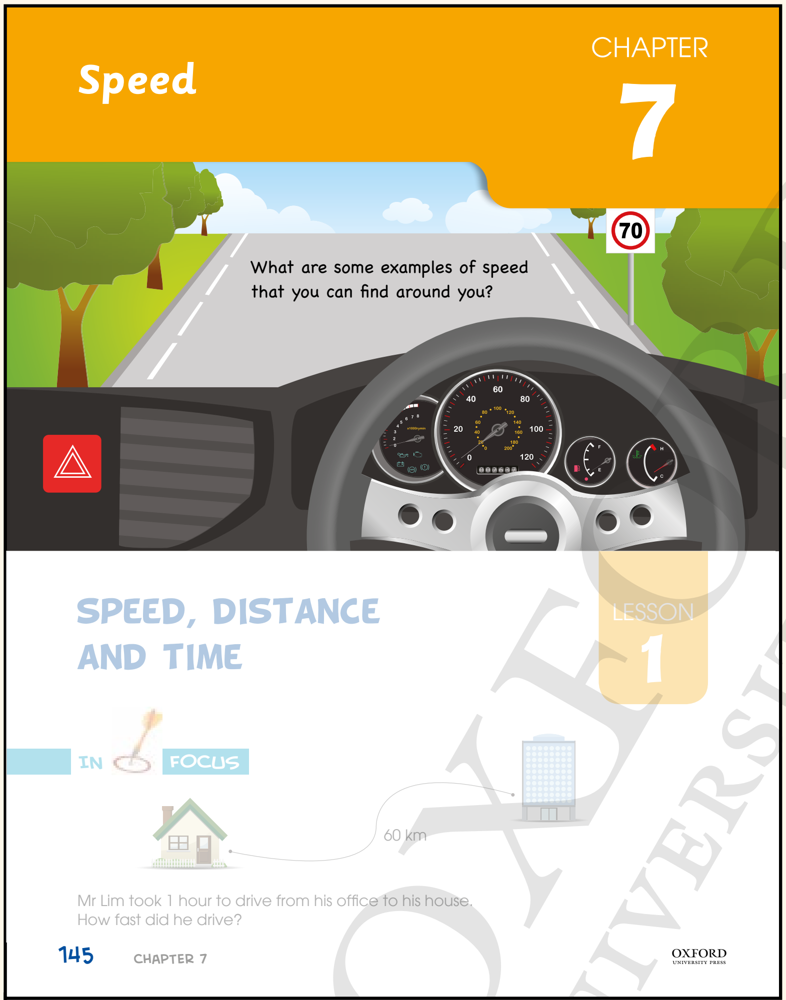
Area of shaded part = $200 - \left(\frac{1}{2} \times 3.14 \times 10 \times 10\right)$
= 43 cm^2

12. 1232 ÷ (π × 56) ≈ 7

It made 7 complete turns.

SPEED

CHAPTER 7


Speed
CHAPTER 7
What are some examples of speed that you can find around you?
70
SPEED, DISTANCE AND TIME
LESSON 1
IN FOCUS
60 km
Mr Lim took 1 hour to drive from his office to his house. How fast did he drive?
145 CHAPTER 7
OXFORD

Textbook 6 P145

Related Resources
NSPM Textbook 6 (P145 – 165)
NSPM Workbook 6B (P31 – 50)

Materials
Stopwatch, measuring tape

Lesson

Lesson 1	Speed, Distance and Time
Lesson 2	Average Speed
Lesson 3	Solving Word Problems

Problem Solving, Maths Journal and Pupil Review

INTRODUCTION

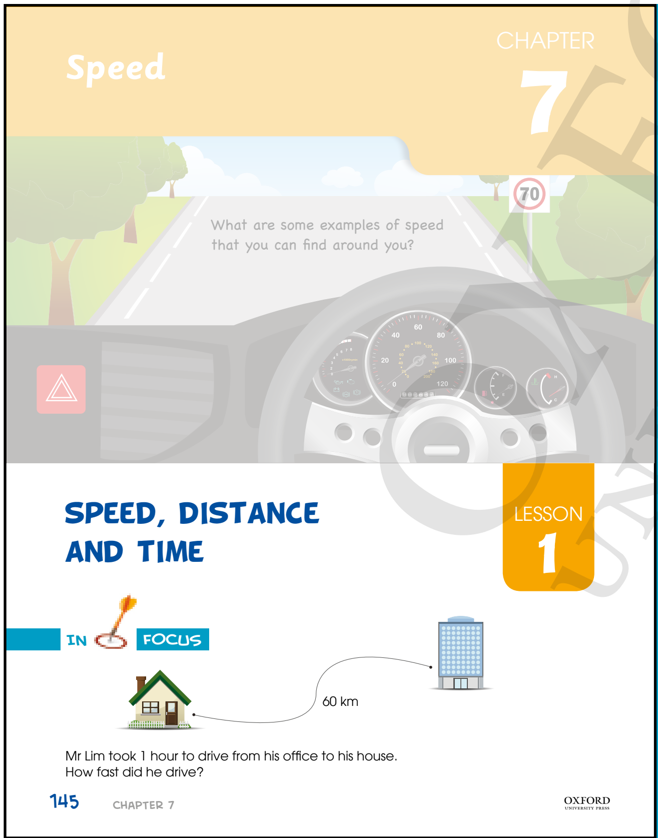
In this chapter, pupils are introduced to the concept of speed. They will learn how the three variables of speed, distance and time are related. In Grade Five, pupils were taught the concept of average. It is important that pupils understand how to find average speed correctly so that they can apply this information in real-world contexts.

LESSON 1

SPEED, DISTANCE AND TIME

LEARNING OBJECTIVES

1. Define speed.
2. Relate distance, time and speed with a formula.
3. Write speed in different units such as km/hr, m/min, m/s and cm/s.



Speed

CHAPTER 7

What are some examples of speed that you can find around you?

70

SPEED, DISTANCE AND TIME

LESSON 1

IN FOCUS

60 km

Mr Lim took 1 hour to drive from his office to his house.
How fast did he drive?

145 CHAPTER 7

OXFORD

Textbook 6 P145

IN FOCUS

Use the chapter opener to discuss examples of speed in real life. Ask pupils if they have observed a speed limit sign on roads and get them to explain what the sign '70' means. Subsequently, get pupils to think whether Mr Lim exceeded the speed limit if the speed limit was 70 km/hr.

LET'S LEARN

1. Mr Lim drove a distance of 60 km in 1 hour.

We say that he drove at a **speed** of **60 kilometres per hour**.
The speed can be written as **60 km/hr**.

2. The table shows the distance four animals can cover in 1 hour. Find the speed of each animal.

Animal	Distance covered	Speed
Horse	45 km	45 km/hr
Cheetah	110 km	110 km/hr
Ostrich	60 km	60 km/hr
Kangaroo	25 km	25 km/hr

Arrange the animals in order, from the fastest to the slowest. Explain.

Cheetah, Ostrich, Horse, Kangaroo

3. A bus took 2 hours to travel 140 km. Find the speed of the bus.

$140 \div 2 = 70$

The bus travelled 70 km in 1 hour.
So, the speed of the bus was 70 km/hr.

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Textbook 6 P146

4. Raju ran 40 m in 10 seconds. What was his running speed?

$40 \div 10 = 4$

Raju ran 4 m in 1 second.

So, his running speed was 4 m/s.

$$\text{Speed} = \text{Distance} \div \text{Time} = \frac{\text{Distance}}{\text{Time}}$$

5. A toy car moves from Point A to Point B in 30 s. The distance between Point A and Point B is 6 m. What is the speed of the toy car?

Method 1

$30 \text{ s} \rightarrow 6 \text{ m}$

$1 \text{ s} \rightarrow \frac{6}{30} \text{ m} = 0.2 \text{ m}$

The speed of the toy car is 0.2 m/s.

Method 2

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{6}{30} = 0.2 \text{ m/s}$$

The speed of the toy car is 0.2 m/s.

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Textbook 6 P147

LET'S LEARN

Explain to pupils that "per hour" means "in 1 hour" and that 60 km per hour can be written as 60 km/hr. Go through the definition of speed, and state that in this case, the distance travelled is measured in km while the unit time is in hr.

For Let's Learn 2, guide pupils to see that since the distance given is what each animal travels in one hour, this is the per hour distance, which is equivalent to the speed. Get pupils to explain how they arranged the animals.

In Let's Learn 3, the distance given was covered in 2 hr. Ensure that pupils are clear with the concept of speed, whereby they need to find the distance travelled in 1 hr.

Let's Learn 4 uses different units, but highlight to pupils that the concept is still the same. Go through the speed formula and point out that the above examples all tally with this formula.

For Let's Learn 5, pupils can either use the unitary method or the formula to arrive at the answer. Guide pupils to see that both km/hr and m/s are units of speed, but km/hr means how many kilometres are travelled in 1 hour while m/s means how many metres are travelled in 1 second.

6. An aeroplane is travelling at a speed of 800 km/hr. How far can it travel in 4 hours?

Method 1

1 hr → 800 km

4 hr → 800 × 4 = 3200 km

800 × 4 = 3200 km

Speed, Time, Distance

It can travel 3200 km in 4 hours.

Distance = Speed × Time

Method 2

Speed = 800 km/hr

Time = 4 hr

Distance = Speed × Time
= 800 × 4
= 3200 km

7. A cyclist is travelling at a speed of 15 km/hr. Find the distance he travels in 2 hours.

Method 1

1 hr → 15 km

2 hr → 15 × 2 = 30 km

He travels 30 km in 2 hours.

Method 2

Distance = Speed × Time
= 15 × 2
= 30 km

He travels 30 km in 2 hours.

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SPEED 148

Textbook 6 P148

For Let's Learn 6, the speed and time have been given. Pupils can be shown the unitary method of obtaining the answer first as the unitary method is familiar to them. From the unitary method, guide pupils to see that 800 km/hr refers to the speed and 4 hours represents the time. Thus, what they have done was to multiply the speed by the time to obtain the distance. This leads to the formula: distance = speed × time (method 2).

Let's Learn 7 is similar to example 6. Get pupils to fill in the blanks on their own to test their understanding.

8. Siti walks at a speed of 80 m/min. How far can she walk in 15 minutes?

Method 1

1 min → 80 m

15 min → 80 × 15 = 1200 m

She can walk 1200 m in 15 minutes.

Method 2

Distance = Speed × Time
= 80 × 15
= 1200 m

She can walk 1200 m in 15 minutes.

9. A train is travelling at a speed of 75 km/hr. How long does it take to travel 675 km?

Method 1

75 km → 1 hr

1 km → $\frac{1}{75}$ hr

675 km → $\frac{1}{75} \times 675 = \frac{675}{75}$

= 2 hr

675 ÷ 75 = ___ hr

Distance, Speed, Time

The train takes 2 hr to travel 675 km.

Time = Distance ÷ Speed
= $\frac{\text{Distance}}{\text{Time}}$

Method 2

Distance = 675 km

Speed = 75 km/hr

Time = Distance ÷ Speed
= 675 ÷ 75
= 2 hr

The train takes 2 hr to travel 675 km.

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Textbook 6 P149

In Let's Learn 8, another unit is introduced. Get pupils to explain the difference between m/s and m/min.

In Let's Learn 9, the speed and distance are given. Go through method 1 first to help pupils visualise that time taken can be obtained from the formula: distance ÷ speed.

10. An athlete runs a 800-m race at a constant speed of 400 m/min. How much time does he take to complete the race?

Method 1

400 m → 1 min

800 m → 800 ÷ 400 = 2 min

He takes 2 min to complete the race.

Method 2

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$= \frac{800}{400}$$

$$= 2 \text{ min}$$

He takes 2 min to complete the race.

11. A snail is crawling at a speed of 1.3 cm/s. How long will it take to crawl a distance of 26 cm?

Method 1

1.3 cm → 1 s

26 cm → 26 ÷ 1.3 = 20 s

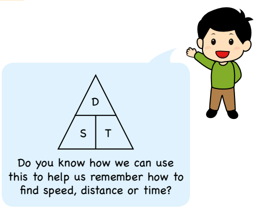
It will take 20 s.

Method 2

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$= 20 \text{ s}$$

It will take 20 s.



OXFORD

SPEED 150

Textbook 6 P150

For Let's Learn 10 and 11, allow pupils to fill in the blanks on their own to ensure that they are able to grasp the concept of finding the time taken when given distance and speed.

Get pupils to explain how the triangle in the speech bubble shows the relationship between the three variables.

12. A car travels at a speed of 80 km/hr. How many minutes will it take to travel a distance of 12 km?

Method 1

80 km → 1 hr

1 km → $\frac{1}{80}$ hr

12 km → $\frac{1}{80} \times 12 = \frac{3}{20}$ hr

$= 9$ min

It will take 9 min.

Method 2

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$= \frac{12}{80} \text{ hr}$$

$$= \frac{3}{20} \text{ hr}$$

$$= 9 \text{ min}$$

It will take 9 min.

$\frac{3}{20}$ hr $= \frac{3}{20} \times 60$ min

$= 9$ min

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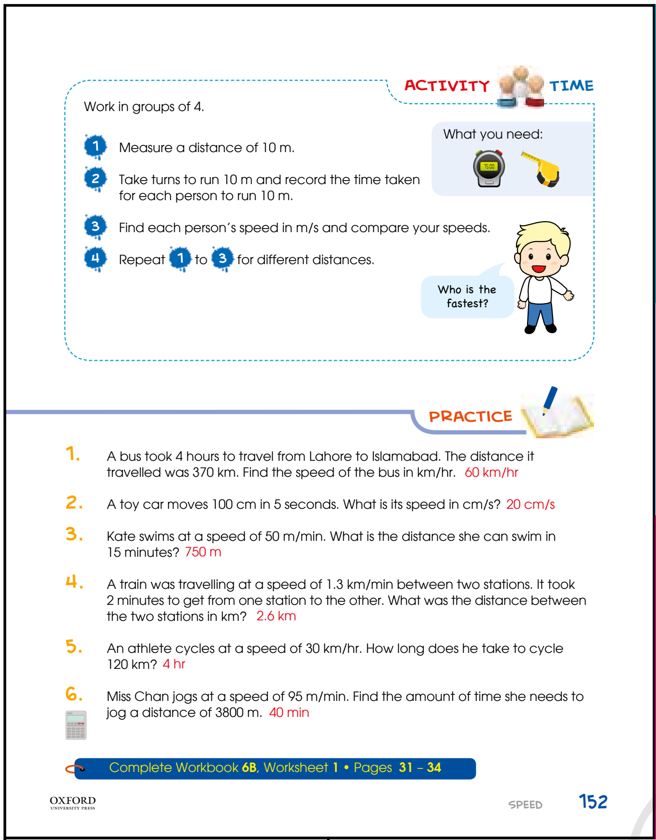
OXFORD

Textbook 6 P151

For Let's Learn 12, highlight to pupils that they are required to express the time taken in minutes. Since the speed is given in per unit hour, remind pupils that they will need to convert the answer to minutes.



ACTIVITY TIME

Work in groups of 4.

What you need:

1. Measure a distance of 10 m.
2. Take turns to run 10 m and record the time taken for each person to run 10 m.
3. Find each person's speed in m/s and compare your speeds.
4. Repeat 1 to 3 for different distances.

Who is the fastest?

PRACTICE

1. A bus took 4 hours to travel from Lahore to Islamabad. The distance it travelled was 370 km. Find the speed of the bus in km/hr. 60 km/hr
2. A toy car moves 100 cm in 5 seconds. What is its speed in cm/s? 20 cm/s
3. Kate swims at a speed of 50 m/min. What is the distance she can swim in 15 minutes? 750 m
4. A train was travelling at a speed of 1.3 km/min between two stations. It took 2 minutes to get from one station to the other. What was the distance between the two stations in km? 2.6 km
5. An athlete cycles at a speed of 30 km/hr. How long does he take to cycle 120 km? 4 hr
6. Miss Chan jogs at a speed of 95 m/min. Find the amount of time she needs to jog a distance of 3800 m. 40 min

Complete Workbook **6B**, Worksheet **1** • Pages **31 – 34**

OXFORD

SPEED 152

Textbook 6 P152

ACTIVITY TIME

This activity should be carried out in an open area. Remind pupils of the formula they need to use as well as to pay attention to the units of measurement, i.e. m and s.

PRACTICE

Allow pupils to work in pairs on the practice questions. Give them sufficient time to complete them before going through.

Independent seatwork

Assign pupils to complete Worksheet 1 (P31 – 34).

Answers Worksheet 1 (Workbook 6B P31 – 34)

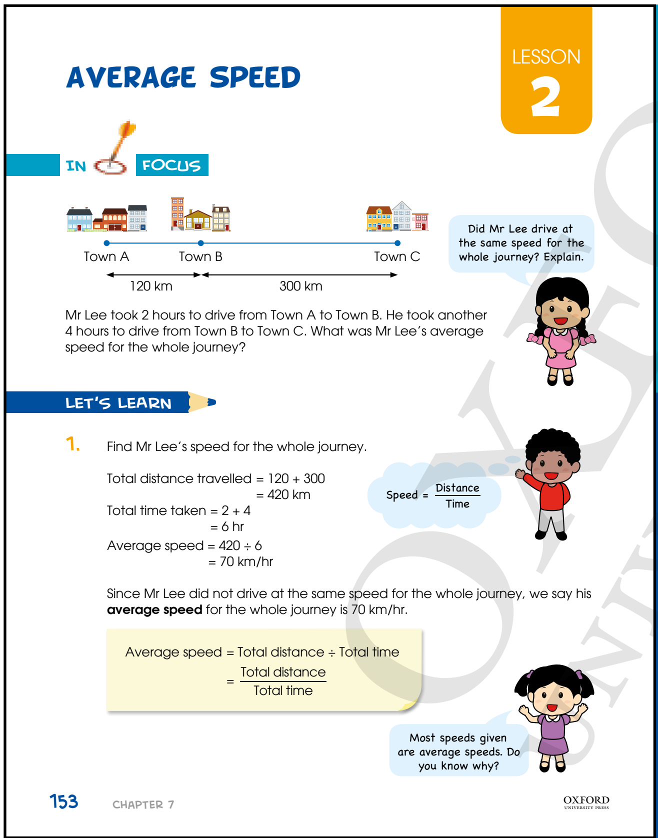
1. $90 \div 2 = 45$ km/hr
2. $100 \div 20 = 5$ m/s
3. $50 \times 15 = 750$ m
4. $40 \times 14 = 560$ km
5. $9000 \div 750 = 12$ min
6. $385 \div 70 = 5\frac{1}{2}$ hr
7. $1.6 \times 30 = 48$ km
8. $2400 \div 150 = 16$ min
9. $20 \div \frac{1}{4} = 80$ km/hr
10. Distance between Raju's home and the beach
$= 200 \times 20$
$= 4000$ m
Distance between Nora's home and the beach
$= 160 \times 36$
$= 5760$ m
Distance between Xinyi's house and the beach
$= 1800 \times 25$
$= 4500$ m
Nora's home is the furthest from the beach.

LESSON 2

AVERAGE SPEED

LEARNING OBJECTIVES

1. Define average speed.
2. Find average speed by dividing total distance by total time.


AVERAGE SPEED

LESSON 2

IN FOCUS

Town A Town B Town C

120 km 300 km

Did Mr Lee drive at the same speed for the whole journey? Explain.

Mr Lee took 2 hours to drive from Town A to Town B. He took another 4 hours to drive from Town B to Town C. What was Mr Lee's average speed for the whole journey?

LET'S LEARN

1. Find Mr Lee's speed for the whole journey.

Total distance travelled = 120 + 300
= 420 km

Total time taken = 2 + 4
= 6 hr

Average speed = 420 ÷ 6
= 70 km/hr

$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$

Since Mr Lee did not drive at the same speed for the whole journey, we say his **average speed** for the whole journey is 70 km/hr.

Average speed = Total distance ÷ Total time
$= \frac{\text{Total distance}}{\text{Total time}}$

Most speeds given are average speeds. Do you know why?

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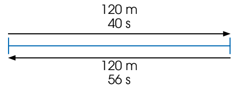
IN FOCUS

Get pupils to find his speed for each part of the journey and to see that he did not drive at the same speed for the whole journey.
Some pupils may erroneously add the two speeds and then divide this by two. Correct this misconception by pointing out that the duration of each part of the journey was different, so they cannot simply take the average of the two speeds.

LET'S LEARN

Go through Let's Learn 1 with pupils and highlight that the formula for average speed requires the total distance and the total time. Point out to pupils that throughout a journey, speeds tend to fluctuate, hence average speed is a convenient way to express the speed one is travelling at.

2. Xinyi jogged from one end of a field to the other in 40 s. She then jogged back to her starting point in 56 s. The distance from one end of the field to the other end is 120 m. What was her average jogging speed for the whole distance?



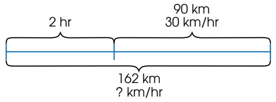
Total distance jogged = 120 + 120 = 240 m

Total time taken = 40 + 56 = 96 s

Average speed = 240 ÷ 96 = 2.5 m/s

Her average jogging speed was 2.5 m/s.

3. A ship travelled the first part of a journey in 2 hours. It travelled the remaining 90 km of the journey at an average speed of 30 km/hr. The total distance travelled by the ship was 162 km. Find the average speed of the ship for the whole journey.

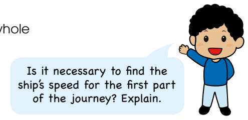


Time taken for second part of journey = 90 ÷ 30 = 3 hr

Total time taken = 2 + 3 = 5 hr

Average speed = 162 ÷ 5 = 32.4 km/hr

The average speed of the ship for the whole journey was 32.4 km/hr.



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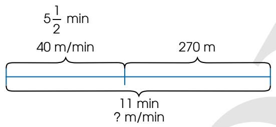
Textbook 6 P154

For Let's Learn 2, allow pupils to fill in the blanks on their own and ensure that they are able to identify the correct values to use in their calculations.

In Let's Learn 3, pupils are not given the time for the second part of the journey explicitly. Remind pupils that since the formula requires the total time taken, they will first have to find the time taken for the second part of the journey. Get pupils to make use of the diagram to see what information they can extract to perform their calculations.

4. A radio controlled helicopter flies at a speed of 40 m/min for $5\frac{1}{2}$ minutes. It then flies another 270 m. The total flight time of the helicopter is 11 minutes. Find the average speed of the radio controlled helicopter in m/min, giving your answer to 1 decimal place.



Distance helicopter flies during first part of journey = $40 \times 5\frac{1}{2}$

= 220 m

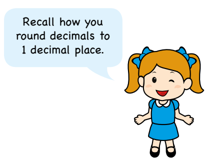
Total distance = 220 + 270

= 490 m

Average speed = 490 ÷ 11

= 44.5 m/min (to 1 decimal place)

The average speed of the helicopter is 44.5 m/min.

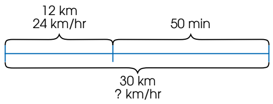


155 CHAPTER 7 OXFORD UNIVERSITY PRESS

Textbook 6 P155

Similarly for Let's Learn 4, the diagram would be helpful for pupils to consolidate the given information. In this case, they will first have to find the distance of the first part of the journey.

5. A professional skater was training for a competition and skated a total distance of 30 km. Her speed for the first 12 km was 24 km/hr and she took 50 minutes to complete the remaining distance. What was her average speed for the whole journey?

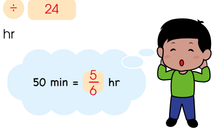


Time taken for first part of journey = 12 ÷ 24

= $\frac{1}{2}$ hr

Total time taken = $\frac{1}{2}$ + $\frac{5}{6}$

= $1\frac{1}{3}$ hr



Average speed = 30 ÷ $1\frac{1}{3}$

= 22.5 km/hr

The skater's average speed for the whole journey was 22.5 km/hr.

PRACTICE

1. A bus travelled at a speed of 80 km/hr for 1 hour. It then travelled at a speed of 90 km/hr for the next 2 hours. Find the average speed of the bus for the whole journey. Express your answer in km/hr. $86\frac{2}{3}$ km/h

2. Farhan ran a distance of 2400 m. He took 4 minutes to run the first 800 m and he ran the remaining distance at a speed of 160 m/min. Find Farhan's average speed for the whole distance in m/min, giving your answer to the nearest whole number. 171 m/min

3. A bullet train took 3 hours to travel from one city to another city. After it travelled a distance of 380 km, it took $1\frac{2}{3}$ hours to travel the remaining distance at a speed of 300 km/hr. What was the average speed of the bullet train for the whole journey? Give your answer to the nearest whole number in km/hr. 293 km/h

Complete Workbook **6B**, Worksheet **2** • Pages **35 – 38**

Textbook 6 P156

For Let's Learn 5, remind pupils to pay attention to the units of measurement. If average speed is to be found in km/hr, the times they calculate have to be expressed in hr and not min.

PRACTICE

Guide pupils through the practice questions and ensure that they apply the formula correctly.

Independent seatwork

Assign pupils to complete Worksheet 2 (Workbook 6B P35 – 38).

Answers

Worksheet 2 (Workbook 6B P35 – 38)

1. Total distance = 50 + 50
   = 100 m

   Total time taken = 58 + 62
   = 120 s

   Average speed = $\frac{100}{120}$ m/s
   = $\frac{5}{6}$ m/s

2. Time taken for second part of journey = 1500 ÷ 750
   = 2 hr

   Total time taken = 3 + 2
   = 5 hr

   Average speed = 3900 ÷ 5
   = 780 km/hr

3. Time taken = 3 hr

   Average speed = 255 ÷ 3
   = 85 km/hr

4. Total time taken = $\frac{1}{2} + \frac{3}{4}$
   = $1\frac{1}{4}$ hr

   Average speed = 85 ÷ $1\frac{1}{4}$
   = 68 km/hr

5. Time taken = 14 hr

   Total distance = 245 + 665
   = 910 km

   Average speed = 910 ÷ 14
   = 65 km/hr

6. Total time taken = $5\frac{2}{3}$ hr

   Average speed = 360 ÷ $5\frac{2}{3}$
   = 63.5 km/hr (to 1 decimal place)

7. Time taken for first 1000 m = 1000 ÷ 125
   = 8 min

   Total time taken = 8 + 27
   = 35 min

   Average speed = 3200 ÷ 35
   = 91.43 m/min (to 2 decimal places)

8. Distance covered for the first part = 5 × $\frac{3}{4}$
   = $3\frac{3}{4}$ km
   = 3.75 km

   Total distance covered = 3.75 + 6.75
   = 10.5 km

   Average speed = 10.5 ÷ 4
   = 2.625 km/hr

LESSON 3

SOLVING WORD PROBLEMS

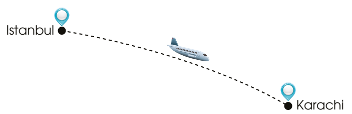
LEARNING OBJECTIVE

1. Solve up to 3-step word problems involving speed and average speed.

SOLVING WORD PROBLEMS

LESSON 3

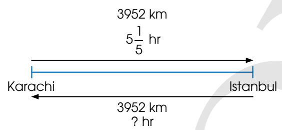
IN FOCUS



An aeroplane took $5\frac{1}{5}$ hours to travel from Karachi to Istanbul. On the return journey, the average speed of the aeroplane was faster by 25 km/hr. The distance between Karachi and Istanbul is 3952 km. Find the flight time of the return journey. Give your answer to the nearest whole number.

LET'S LEARN

1.



Average speed from Karachi to Istanbul = Distance ÷ Time

$= 3952 \div 5\frac{1}{5}$

= 760 km/hr

Average speed from Istanbul to Karachi = 760 + 25

= 785 km/hr

Time taken for return journey = Distance ÷ Speed

= 3952 ÷ 785

= 5 hr

The flight time of the return journey was 5 hr.

Textbook 6 P157

IN FOCUS

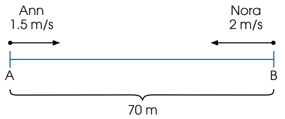
Get pupils to draw a diagram to illustrate the given information. Point out to pupils that a diagram would be useful to pick out the information given in a word problem.

LET'S LEARN

From the diagram, pupils should be able to see that they can find the average speed from Singapore to Taipei. They will then be able to calculate the average speed of the return journey followed by the time taken.

2. Ann walked at a speed of 1.5 m/s from Point A to Point B. Nora walked from Point B to Point A. The distance between Point A and Point B is 70 m. Ann and Nora started walking at the same time. After 5 seconds, Nora walked a distance of 10 m. How far apart were Ann and Nora after 5 seconds?

What was Ann's speed? What was Nora's speed? How far did each girl walk in 5 seconds?



Distance Ann walked in 5 s = 1.5 × 5
= 7.5 m

Distance apart after 5 s = 70 − 7.5 − 10
= 52.5 m

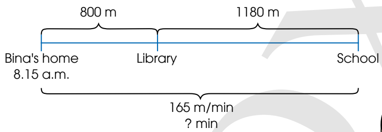
They were 52.5 m apart after 5 seconds.

Explain how you can check your answer.

Textbook 6 P158

In Let's Learn 2, there is an alternative method that can be used. Guide pupils to see that in 1 second, the girls would cover a distance of 3.5 m. Hence, in 5 seconds, they would cover 17.5 m. The distance apart can be found by subtracting 17.5 m from 70 m.

3. At 8.15 a.m., Bina started cycling from her home to school. Along the way, she passed by the library. The distance between her home and the library was 800 m and the distance between the library and the school was 1180 m. Bina's average cycling speed from her home to the school was 165 m/min. Find the time at which Bina arrived in school.



Total distance from Bina's home to school
= 800 + 1180
= 1980 m

First, find the total distance that Bina travelled.

Time taken by Bina to cycle from her home to school
= Distance ÷ Speed
= 1980 ÷ 165
= 12 min

Bina arrived in school 12 min after 8.15 a.m.

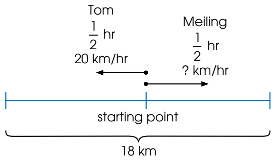
Bina arrived in school at 8.27 a.m.

Check your answer.

Textbook 6 P159

For Let's Learn 3, get pupils to ensure all the information in the question is represented in the diagram. Remind pupils that the question asks for the time at which Bina arrived in school, and not simply the time taken.

4. Tom and Meiling started at the same place and cycled in opposite directions along a straight path. After they cycled at a constant speed for $\frac{1}{2}$ hr, they were 18 km apart. Tom cycled at a constant speed of 20 km/hr. What was Meiling's cycling speed?



Distance cycled by Tom = Speed × Time
= 20 × $\frac{1}{2}$
= 10 km

Distance cycled by Meiling = 18 − 10
= 8 km

Meiling's cycling speed = 8 ÷ $\frac{1}{2}$
= 16 km/hr

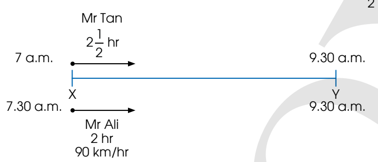
Meiling's cycling speed was 16 km/hr.

Textbook 6 P160

For Let's Learn 4, guide pupils to see that the distance apart from Tom and Meiling is equal to the total distance that the two of them cycled.

5. Mr Tan and Mr Ali drove from Town X to Town Y. Mr Tan left Town X at 7 a.m. and reached Town Y at 9.30 a.m. Mr Ali left Town X at 7.30 a.m. and reached Town Y at the same time as Mr Ali. Mr Ali drove at an average speed of 90 km/hr for the whole journey. Find Mr Tan's average speed for the journey.

Time taken by Mr Ali = 2 hr   Time taken by Mr Tan = $2\frac{1}{2}$ hr



Distance travelled by Mr Ali = 90 × 2 = 180 km

Mr Tan's average speed = 180 ÷ $2\frac{1}{2}$ = 72 km/hr

Mr Tan's average speed was 72 km/hr.

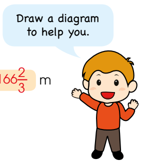
6. Bala and Sam took part in a 400-m race. During the race, Bala ran at a constant speed of 6 m/s and Sam ran at a constant speed of 2.5 m/s. When Bala completed the race, how far away from the finishing point was Sam? Give your answer to the nearest metre.

Time taken by Bala = 400 ÷ 6 = $66\frac{2}{3}$ s

Distance Sam ran in that time = 2.5 × $66\frac{2}{3}$ = $166\frac{2}{3}$ m

Distance Sam needed to run to complete the race
= 400 − $166\frac{2}{3}$
= $233\frac{1}{3}$ m
= 233 m (to the nearest metre)

Sam still needed to run 233 m more.

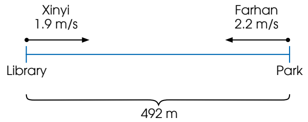


Textbook 6 P161

For Let's Learn 5, point out to pupils that Mr Tan and Mr Ali travelled the same distance, although the duration was different.

In Let's Learn 6, a diagram has not been provided. Get pupils to draw one to help them visualise what information is given and what else needs to be found.

7. Xinyi and Farhan started jogging towards each other at the same time. Xinyi jogged at a constant speed of 1.9 m/s from the library to the park. Farhan jogged at a constant speed of 2.2 m/s from the park to the library. The distance between the library and the park is 492 m. When Xinyi and Farhan met, how far from the park were they?



Distance covered by both Xinyi and Farhan in 1 s

= 1.9 + 2.2

= 4.1 m

Amount of time they took to jog 492 m

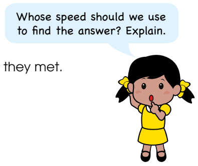
= 492 ÷ 4.1

= 120 s

Distance from the park when they met

= 2.2 × 120

= 264 m



They were 264 m away from the park when they met.

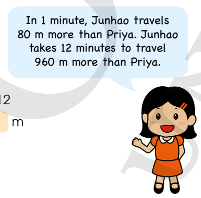
Textbook 6 P162

In Let's Learn 7, guide pupils to see that when Xinyi and Farhan met, they would have covered a distance of 492 m in total. Hence, they first have to find the total distance both of them would cover in 1 s and proceed to find the time taken. Encourage pupils to explain why Farhan's speed should be used instead of Xinyi's. Show that if they found Xinyi's distance, they would still need to subtract the distance from 492 m. However, they can use the latter method to check their answer.

***8.** Junhao ran from Point A to B at a constant speed of 200 m/min. Priya walked from Point A to Point B at a constant speed of 120 m/min. Junhao and Priya left Point A at the same time. When Junhao reached Point B, Priya was 960 m away from Point B. What is the distance between Point A and Point B?

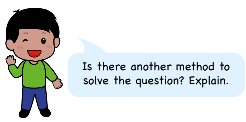
Difference in speeds = 200 − 120
= 80 m/min

80 m more when running → 1 min
960 m more when running → 960 ÷ 80 = 12 min



Distance between Point A and Point B = 200 × 12
= 2400 m

The distance between A and B is 2400 m.



Textbook 6 P163

For Let's Learn 8, point out to pupils that in the time Junhao took to reach Point B, he travelled 960 m more than Priya. Pupils should be familiar with the formula to find the time taken. Guide them to see that in this case, the speed used should be how much faster Junhao is, i.e. the difference in their speeds, since the distance given is how much more Junhao has travelled.
Get pupils to think of other possible methods to solve the question, such as the use of proportion.

PRACTICE

Solve.

1. Weiming jogged a distance of 1400 m at an average speed of 80 m/min and a distance of 2400 m at an average speed of 60 m/min. How long did he jog altogether? $57\frac{1}{2}$ min

2. Two marbles were rolled from the same starting point along a straight path in the same direction. The marbles were rolled at the same time. When they stopped rolling 4 seconds later, the marbles were 80 cm apart. One marble rolled at an average speed of 8 cm/s. What was the average speed of the other marble? Express your answer in cm/s. 28 cm/s

3. A red car and a blue car were travelling towards each other. The red car was travelling at a constant speed of 65 km/hr and the blue car was travelling at a constant speed of 75 km/hr. At 4 p.m., the two cars were 70 km apart. At what time will the two cars meet? 4.30 p.m.

Complete Workbook **6B**, Worksheet **3** • Pages **39 – 43**

MIND WORKOUT

Ahmad and Kate skated from Point A to Point B at the same time. Ahmad travelled at a constant speed of 200 m/min and Kate travelled at a constant speed of 180 m/min. Ahmad reached Point B 30 seconds before Kate. What is the distance between the two points? 900 m

What are some methods you can use to help you solve the problem? Explain.

OXFORD

SPEED 164

Textbook 6 P164

PRACTICE

Get pupils to work in pairs or individually on the practice questions.

Independent seatwork

Assign pupils to complete Worksheet 3 (Workbook 6B P39 – 43)

 Worksheet 3 (Workbook 6B P39 – 43)

1. Time taken = 500 ÷ 25
   = 20 min
   She started walking from her house at 7.10 a.m.

2. Time taken from house to office = 20 ÷ 50
   $= \frac{2}{5}$ hr
   Time taken for return journey = 20 ÷ 60
   $= \frac{1}{3}$ hr
   Total time taken $= \frac{2}{5} + \frac{1}{3}$
   $= \frac{11}{15}$ hr
   Mr Lee took $\frac{11}{15}$ hr altogether.

3. Distance Sam jogged = 150 × 20
   = 3000 m
   Distance Raju jogged = 5400 – 3000
   = 2400
   Raju's jogging speed = 2400 ÷ 20
   = 120 m/min
   Raju's jogging speed was 120 m/min.

4. Time taken by car = 240 ÷ 90
   $= 2\frac{2}{3}$ hr
   Time taken by van = 240 ÷ 80
   = 3 hr
   Difference in amount of time $= 3 - 2\frac{2}{3}$
   $= \frac{1}{3}$ hr
   The difference in the amount of time they took to arrive at their destination was $\frac{1}{3}$ hr.

5. Distance covered in 1 s = 1.2 + 1.8
   = 3 m
   Time need = 90 ÷ 3
   = 30 s
   It took them 30 s to meet each other.

6. Time taken by bus = 340 ÷ 60
   $= 5\frac{2}{3}$ hr
   Time taken by car $= 5\frac{2}{3} - 1$
   $= 4\frac{2}{3}$ hr
   Average speed of car $= 340 \div 4\frac{2}{3}$
   = 72.9 km/hr
   (to 1 decimal place)
   The average speed of the car was 72.9 km/hr.

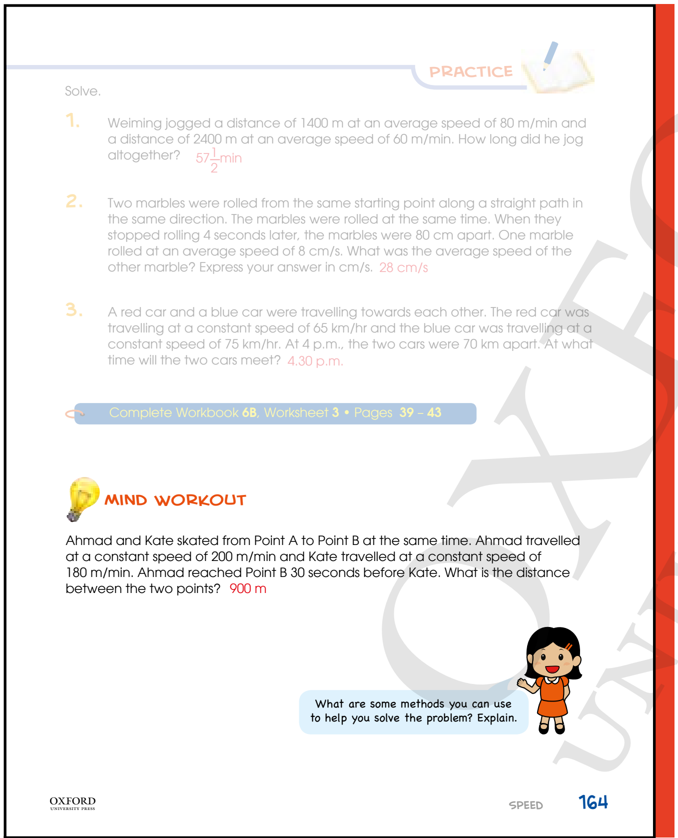
7. Speed for journey from Singapore to Malacca
   = 243 ÷ 4
   = 60.75 km/hr
   Time taken for return journey = 243 ÷ (60.75 + 15)
   = 243 ÷ 75.75
   = 3 hr 12 min (to the nearest minute)
   Mr Ali took 3 hr 12 min for his return journey.

8. Difference in speeds = 75 – 60
   = 15 km/hr

   15 km → 1 hr
   5 km → 60 ÷ 3 = 20 min
   $75 \times \frac{1}{3} = 25$ km

   The distance between Malir and Clifton is 25 km.

PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW


PRACTICE

Solve.

1. Weiming jogged a distance of 1400 m at an average speed of 80 m/min and a distance of 2400 m at an average speed of 60 m/min. How long did he jog altogether? $57\frac{1}{2}$ min

2. Two marbles were rolled from the same starting point along a straight path in the same direction. The marbles were rolled at the same time. When they stopped rolling 4 seconds later, the marbles were 80 cm apart. One marble rolled at an average speed of 8 cm/s. What was the average speed of the other marble? Express your answer in cm/s. 28 cm/s

3. A red car and a blue car were travelling towards each other. The red car was travelling at a constant speed of 65 km/hr and the blue car was travelling at a constant speed of 75 km/hr. At 4 p.m., the two cars were 70 km apart. At what time will the two cars meet? 4.30 p.m.

Complete Workbook 6B, Worksheet 3 • Pages 39 – 43

MIND WORKOUT

Ahmad and Kate skated from Point A to Point B at the same time. Ahmad travelled at a constant speed of 200 m/min and Kate travelled at a constant speed of 180 m/min. Ahmad reached Point B 30 seconds before Kate. What is the distance between the two points? 900 m

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SPEED 164

Textbook 6 P164

MIND WORKOUT

This question involves the same concept that pupils have encountered in Let's Learn 8. However, they will have to extract an additional piece of information since no distance is given. Guide pupils to see that for Kate to reach Point B in 30 seconds, the remaining distance she has to skate is $\frac{1}{2} \times 180 = 90$ m. From there, pupils can work out the distance between the two points like they did in Let's Learn 8.

Mind Workout

Date: ____________

Siti and Xinyi ran a 50-m race. When Siti completed the race, Xinyi was 10 m behind. They then ran a 80-m race and each girl ran at the same speed as they did in the 50-m race. When Siti finished running 80 m, how far from the finishing line was Xinyi?

For every 50 m Siti ran, the difference was 10 m.

For every 1 m Siti ran, the difference was $\frac{10}{50}$ m.

$\frac{10}{50} \times 80 = \frac{1}{5} \times 80$

$= 16$ m

When Siti finished running 80 m, Xinyi was 16 m away from the finishing line.

44 Chapter 7

Workbook 6B P44

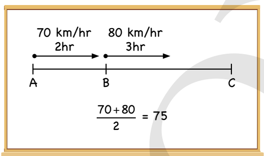
Mind Workout

Guide pupils to answer this question using proportion. Since it is not possible to find their individual speeds, highlight to pupils that they are able to calculate the difference in distance covered between the two girls for every 1 m Siti runs.

MATHS JOURNAL

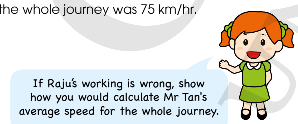
Mr Tan travelled at an average speed of 70 km/hr for 2 hours from Point A to Point B. He then travelled at an average speed of 80 km/hr for 3 hours from Point B to Point C.

To find Mr Tan's average speed for his whole journey, Raju did the working below.



Raju said Mr Tan's average speed for the whole journey was 75 km/hr.

Is Raju correct? Explain.



SELF-CHECK

I know how to...

- find the speed given the distance and the time.
- find the distance given the speed and the time.
- find the time given the distance and the speed.
- find average speed.
- solve word problems involving speed.

165 CHAPTER 7

Textbook 6 P165

MATHS JOURNAL

Get pupils to discuss whether Raju's solution was correct. Remind them that they cannot add the speeds and divide the result by 2 because the duration for both parts of the journey was different. Get pupils to find the correct average speed.

SELF-CHECK

Before pupils proceed to do the self-check, review the important concepts by asking for examples learnt for each objective.

The self-check can be done after pupils have completed **Review 7** (Workbook 6B P45 – 50)

1. 1600 ÷ 20 = 80 m/min

2. $3 \times \frac{7}{12} = \frac{7}{4}$ km
   $= 1\frac{3}{4}$ km

3. $200 \div 80 = 2\frac{1}{2}$ hr
   The train arrived at its destination at 11 a.m.

4. Total time taken = 2 + 3
   = 5 hr

   Total distance = 1600 + 2250
   = 3850 km

   Average speed = 3850 ÷ 5
   = 770 km/hr

5. Distance = 2 × 200
   = 400 m

   Farhan's speed = 400 ÷ 250
   = 1.6 m/s

6. They travelled for 21 min before they met.

   Distance travelled by Bina = 72 × 21
   = 1512 m

   Distance travelled by Sam = 90 × 21
   = 1890 m

   1512 + 1890 = 3402 m

   The distance between the food centre and the library is 3402 m.

7. Distance travelled for second part of journey
   = 90 × 2
   = 180 km

   Time taken for first part of journey = 180 ÷ 80
   $= 2\frac{1}{4}$ hr

   Total time taken $= 2\frac{1}{4} + 2$
   $= 4\frac{1}{4}$ hr
   = 4 hr 15 min

   Mrs Ali reached her destination at 11.15 a.m.

8. Distance covered in second part of journey
   = 3800 – 2400
   = 1400 km

   Time taken for second part of journey
   = 1400 ÷ 850
   $= 1\frac{11}{17}$ hr

   Time taken for the whole journey $= 3 + 1\frac{11}{17}$
   $= 4\frac{11}{17}$ hr

   The number of hours taken for the whole journey was $4\frac{11}{17}$ hr.

9. Distance travelled in first part of journey = 240 ÷ 2
   = 120 km

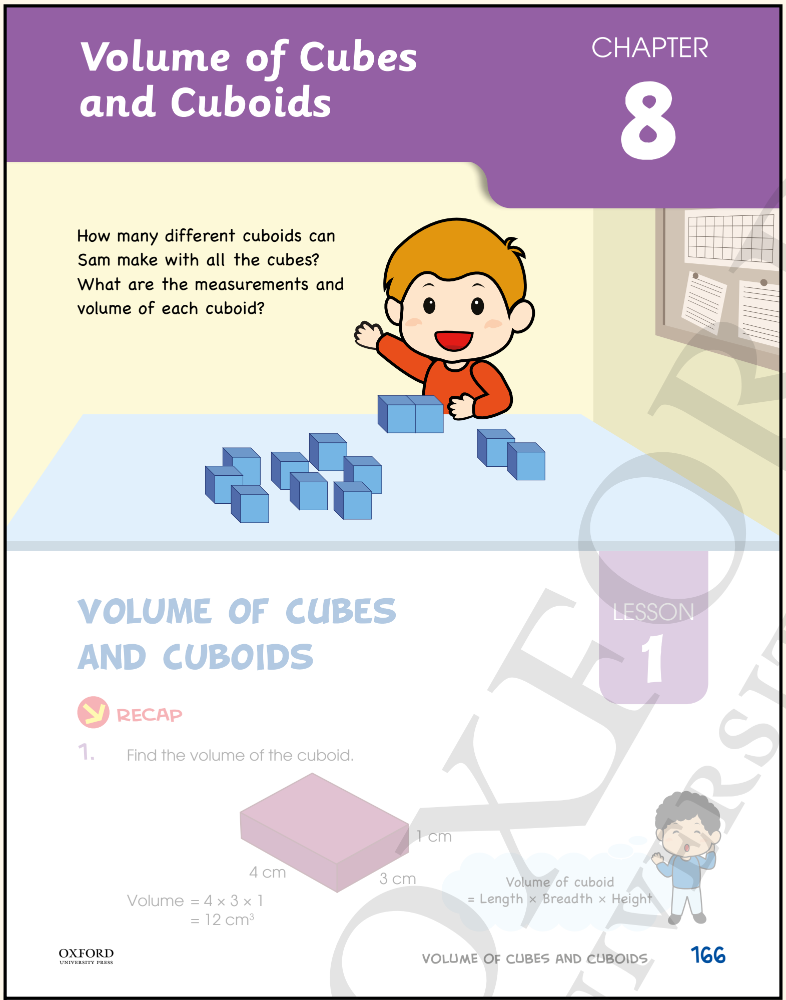
   Time taken for first part of journey = 120 ÷ 50
   $= 2\frac{2}{5}$ hr

   Time taken for second part of journey $= 6 - 2\frac{2}{5}$
   $= 3\frac{3}{5}$ hr

   He took to $3\frac{3}{5}$ hr complete the second part of his journey.

VOLUME OF CUBES AND CUBOIDS

CHAPTER 8


Volume of Cubes and Cuboids

CHAPTER 8

How many different cuboids can Sam make with all the cubes? What are the measurements and volume of each cuboid?

VOLUME OF CUBES AND CUBOIDS

LESSON 1

RECAP

1. Find the volume of the cuboid.

4 cm

3 cm

1 cm

Volume = 4 × 3 × 1
= 12 cm³

Volume of cuboid
= Length × Breadth × Height

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VOLUME OF CUBES AND CUBOIDS 166

Textbook 6 P166

Related Resources

NSPM Textbook 6 (P166 – 192)

NSPM Workbook 6B (P51 – 80)

Materials

1-cm cubes

Lesson

Lesson 1	Volume of Cubes and Cuboids
Lesson 2	Solving Word Problems

Problem Solving, Maths Journal and Pupil Review

INTRODUCTION

Pupils have already learnt the concept of volume in Grade Five, i.e. Length × Breadth × Height. They have encountered questions that require them to find the volume of cubes, cuboids and liquid in rectangular containers. In this chapter, they will build on current knowledge and learn to find other variables, such as the length of a side of a cuboid given its volume and the other two sides. They will be exposed to bigger values of perfect squares and perfect cubes and as such, learn to use a scientific calculator to obtain the square roots and cube roots of these numbers.

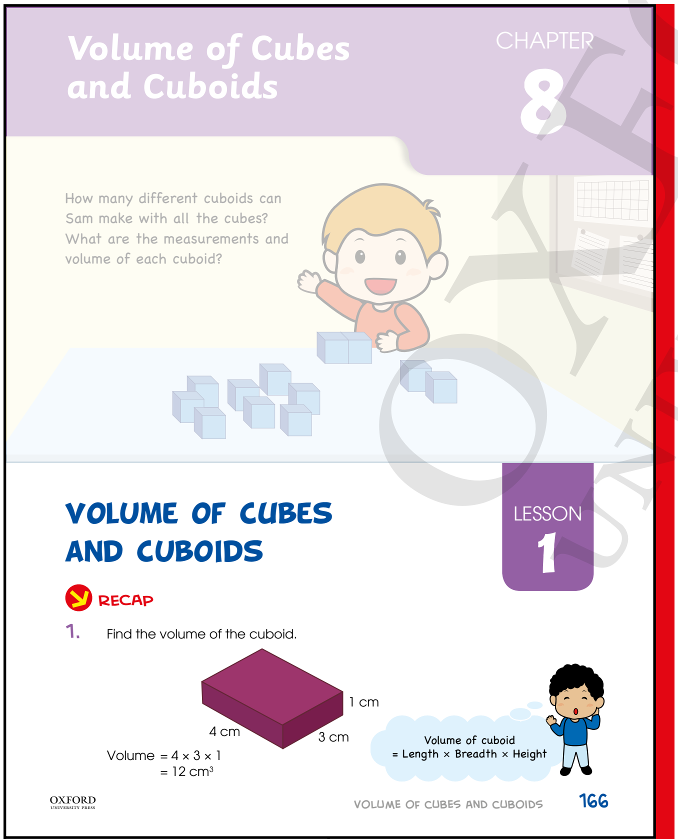
LESSON

1

VOLUME OF CUBES AND CUBOIDS

LEARNING OBJECTIVES

1. Find one dimension of a cuboid given its volume and the other dimensions.
2. Find the length of one edge of a cube given its volume.
3. Find the height of a cuboid given its volume and base area.
4. Find the area of a face of a cuboid given its volume and one dimension.
5. Use of the symbols: $\sqrt{\ }$ and $\sqrt[3]{\ }$.


Volume of Cubes and Cuboids

CHAPTER 8

How many different cuboids can Sam make with all the cubes? What are the measurements and volume of each cuboid?

VOLUME OF CUBES AND CUBOIDS

LESSON 1

RECAP

1. Find the volume of the cuboid.

Volume $= 4 \times 3 \times 1$
$= 12\ cm^3$

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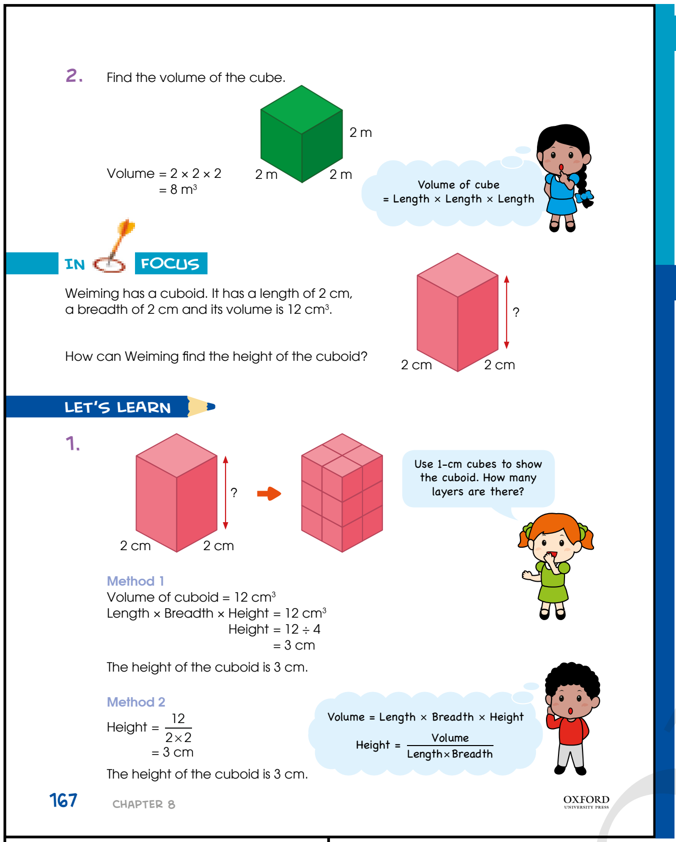
RECAP

Recap with pupils how to find the volume of a cuboid and cube.



2. Find the volume of the cube.

Volume = $2 \times 2 \times 2$
= $8\ m^3$

2 m 2 m 2 m

Volume of cube = Length × Length × Length

IN FOCUS

Weiming has a cuboid. It has a length of 2 cm, a breadth of 2 cm and its volume is $12\ cm^3$.

How can Weiming find the height of the cuboid?

2 cm 2 cm ?

LET'S LEARN

1.

2 cm 2 cm ?

Use 1-cm cubes to show the cuboid. How many layers are there?

Method 1

Volume of cuboid = $12\ cm^3$

Length × Breadth × Height = $12\ cm^3$

Height = $12 \div 4$

= 3 cm

The height of the cuboid is 3 cm.

Method 2

Height = $\frac{12}{2 \times 2}$

= 3 cm

The height of the cuboid is 3 cm.

Volume = Length × Breadth × Height

Height = $\frac{\text{Volume}}{\text{Length} \times \text{Breadth}}$

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IN FOCUS

Guide pupils to recall that the volume of a cuboid is equal to Length (2 cm) × Breadth (2 cm) × Height. Ask pupils what variables they have been given which can be used to find the height.

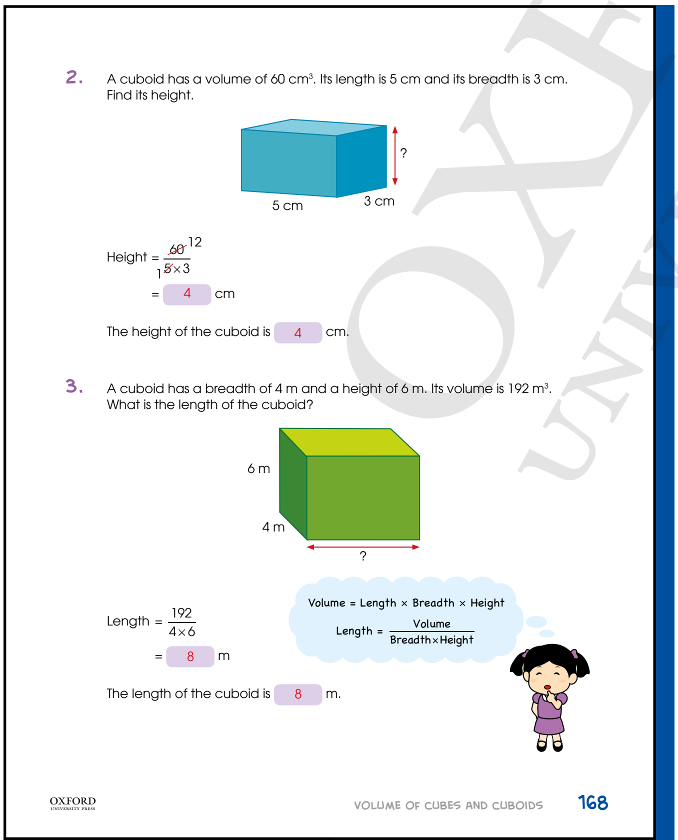
LET'S LEARN

Prompt pupils to solve the question by asking:

- How many 1-cm cubes are needed to make a 12-cm^3 cuboid?
- Given that the length and breadth are 2 cm each, how many cubes do we put in the first layer?
- How many layers should we have?

Pupils should be able to see that when the cuboid is 3 layers tall, its height is 3 cm.

Explain to pupils that based on the formula for volume, the formula for height can be easily derived.



2. A cuboid has a volume of $60\ cm^3$. Its length is 5 cm and its breadth is 3 cm. Find its height.

5 cm 3 cm ?

Height = $\frac{\cancel{60}^{12}}{{}_1\cancel{5} \times 3}$

= 4 cm

The height of the cuboid is 4 cm.

3. A cuboid has a breadth of 4 m and a height of 6 m. Its volume is $192\ m^3$. What is the length of the cuboid?

6 m 4 m ?

Length = $\frac{192}{4 \times 6}$

= 8 m

The length of the cuboid is 8 m.

Volume = Length × Breadth × Height

Length = $\frac{\text{Volume}}{\text{Breadth} \times \text{Height}}$

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For Let's Learn 2, go through with pupils how to substitute the relevant values into the formula.

In Let's Learn 3, pupils have to find the unknown length instead of the unknown height. Guide pupils to see that the same formula can be used, replacing length with height.

Ensure that pupils are clear that in general, unknown sides can be calculated accordingly:

$$\text{Height} = \frac{\text{Volume}}{\text{Length} \times \text{Breadth}},$$

$$\text{Length} = \frac{\text{Volume}}{\text{Breadth} \times \text{Height}},$$

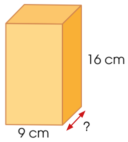
$$\text{Breadth} = \frac{\text{Volume}}{\text{Length} \times \text{Height}}.$$

4\. The volume of a cuboid is 900 cm³. Its length is 9 cm and its height is 16 cm. Find its breadth, giving your answer to the nearest whole number.

$\text{Breadth} = \dfrac{900}{9 \times 16}$

$= 6$ cm (to the nearest whole number)

The breadth of the cuboid is 6 cm.



5\. The capacity of a rectangular tank with a length of 21 m and a breadth of 9 m is 2268 m³. What is the height of the tank?

$\text{Height} = \dfrac{2268}{21 \times 9}$

$= 12$ m

The height of the tank is 12 m.

6\. A cuboid with a breadth of 4 cm and a height of 6 cm has a volume of 350 cm³. Find the length of the cuboid, giving your answer to 1 decimal place.

$\text{Length} = \dfrac{350}{4 \times 6}$

$= 14.6$ cm (to 1 decimal place)

The length of the cuboid is 14.6 cm.

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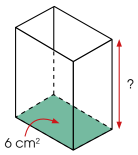
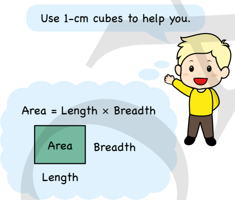
Let's Learn 4 to 6 offer more practice for pupils. Remind them to be careful when keying in numbers into the calculator and to round off answers to the correct place values.

7\. The volume of a cuboid is 24 cm³ and its base area is 6 cm². What is the height of the cuboid?





Length × Breadth × Height = Volume

Base area × Height = 24

$\text{Height} = \dfrac{24}{6}$

$= 4$ cm

The height of the cuboid is 4 cm.

8\. A rectangular tank has a capacity of 5 litres and a base area of 500 cm². Find the height of the tank.

Volume of tank = 5 ℓ

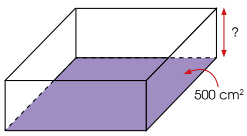
= 5000 cm³

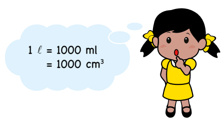
Base area × Height = 5000

$\text{Height} = \dfrac{5000}{500}$

$= 10$ cm

The height of the tank is 10 cm.





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For Let's Learn 7, check for pupils' understanding of base area. Referring to the diagram, point out that the base area is the area of the rectangle at the bottom of the cuboid. Elicit from pupils that based on the formula:

$$\text{Height} = \frac{\text{Volume}}{\text{Length} \times \text{Breadth}},$$

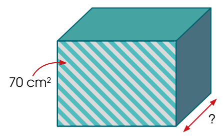
they can get:

$$\text{Height} = \frac{\text{Volume}}{\text{Base area}}.$$

For Let's Learn 8, check for pupils' understanding of the problem. Ask:

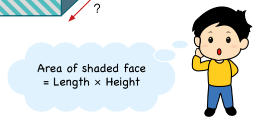
- What does capacity of the tank mean? Do we know the volume of tank?
- Can we use 5 litres directly in the calculation? Why not?

9. The volume of a cuboid is 420 cm³. The area of the shaded face is 70 cm². Find the breadth of the cuboid.



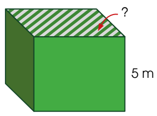
Breadth $= \frac{420}{70}$

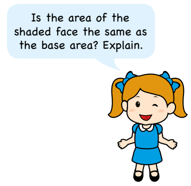
$= 6$ cm



The breadth of the cuboid is 6 cm.

10. A cuboid has a volume of 120 m³ and a height of 5 m. Find the area of the shaded face.





Area of shaded face $= \frac{120}{5}$

$= 24$ m²

The area of the shaded face is 24 m².

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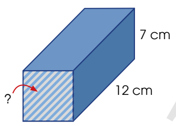
Let's Learn 9 differs from the two previous examples as the area of the face given is not the base area. Explain to pupils that the same concept can still be applied. Guide pupils to conclude that in general, an unknown edge of a cuboid can be found by dividing the volume by the area of the given face.

In Let's Learn 10, allow pupils to discuss in pairs how the area of the shaded face can be found.
Ask:

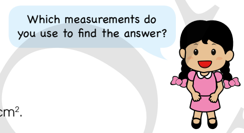
- Is the area of shaded face equal to the base area?
- From the formula of Height $= \frac{\text{Volume}}{\text{Base area}}$, how can we swap the values around to find the base area?

11. The volume of the cuboid is 504 cm³. Find the area of the shaded face.



Area of shaded face $= \frac{504}{12}$

$= 42$ cm²

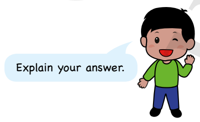


The area of the shaded face is 42 cm².

12. A cuboid has a volume of 858 cm³. Its breadth is 11 cm and its base area is 143 cm². What is the height of the cuboid?

Height of cuboid $= \frac{858}{143}$

$= 6$ cm



The height of the cuboid is 6 cm.

13. The volume of a cuboid is 240 cm³ and its height is 7 cm. Find the area of the base of the cuboid, giving your answer correct to the nearest cm².

Area of base $= \frac{240}{7}$

$= 34$ cm² (to the nearest cm²)

The area of the base of the cuboid is 34 cm².

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For Let's Learn 11, allow pupils to discuss the question in pairs. Hint to them that only one of the given sides is necessary for the calculation. Some pupils might not be able to correctly identify the edge to use. Emphasise that

Unknown area of face

$$= \frac{\text{Volume}}{\text{Length of edge perpendicular to face}},$$

which in this case is the length of 12 cm.

For Let's Learn 12 and 13, get pupils to draw out the cuboids if they are unable to visualise which values to use in their calculation.

14. The area of a square is 16 cm². What is the length of one side of the square?

Area = 16 cm²
?

Length × Length = Area
$4 \times 4 = 16$
Length of one side = 4 cm

All the sides of a square have the same length.

We can also find the **square root** of 16, which is written as $\sqrt{16}$.

Length × Length = Area
Length = $\sqrt{\text{Area}}$
= $\sqrt{16}$
= 4 cm

$4 \times 4 = 16$
We say the square root of 16 is 4.
$\sqrt{16} = 4$

15. Find the square root of 36.

$36 = 6 \times 6$
$\sqrt{36} = 6$

16. Find the missing values.

(a) $\sqrt{144} = 12$
$144 = 12 \times 12$

(b) $\sqrt{1024} = 32$
$1024 = 32 \times 32$

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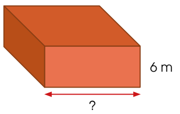
Let's Learn 14 introduces the concept of square root. Explain how the square root of a number is written and its meaning with respect to area of a square and its length.

Use Let's Learn 15 to go through with pupils simple numbers that do not require the use of a calculator. For Let's Learn 16, show pupils how to use the calculator to find the square root of bigger numbers.

17. A cuboid has a square base and a volume of 1176 m³. Its height is 6 m. Find the length of one side of the square base.



Area of square base × Height = Volume

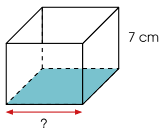
Area of square base = $\dfrac{\text{Volume}}{\text{Height}}$
= $\dfrac{1176}{6}$
= 196 m²

Length of one side of square base = $\sqrt{196}$
= 14 m

The length of one side of the square base is 14 m.

How can you check whether your answer is correct?

18. A rectangular tank has a square base and a height of 7 cm. Its capacity is 567 cm³. Find the length of one side of the square base.



Area of square base × 7 = 567

Area of square base = $\dfrac{567}{7}$
= 81 cm²

Length of one side of square base = $\sqrt{81}$
= 9 cm

The length of one side of the square base is 9 cm.

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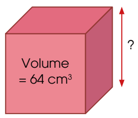
For Let's Learn 17 and 18, allow pupils to work in pairs and guide them through the problem-solving process.

i) Understanding the question:
- What information is given?
- What do we need to find?
- How is the information about the square base helpful?
- Is there a hidden unknown we need to find first?

ii) Planning:
- What are the steps you need to take?
- What method would you use?

iii) Checking:
- Have you answered the question?
- Is your answer reasonable? How can you estimate to check it?

19. A cube has a volume of 64 cm³. Find the length of one edge of the cube.



All the edges of the cube have the same length.

Length × Length × Length = Volume
$4 \times 4 \times 4 = 64$
Length of one edge of the cube = 4 cm

We can also find the **cube root** of 64, which is written as $\sqrt[3]{64}$.
Length × Length × Length = Volume
Length = $\sqrt[3]{\text{Volume}}$
= $\sqrt[3]{64}$
= 4 cm

$4 \times 4 \times 4 = 64$
We say the cube root of 64 is 4.
$\sqrt[3]{64} = 4$

20. Find the cube root of 8.
$8 = 2 \times 2 \times$ 2
$\sqrt[3]{8} =$ 2

21. Find the missing values.
(a) $\sqrt[3]{125} =$ 5
$125 =$ 5 × 5 × 5

(b) $\sqrt[3]{1331} =$ 11
$1331 =$ 11 × 11 × 11

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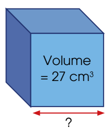
Let's Learn 19 introduces the concept of cube root. Point out to pupils that in a cube, all the lengths are equal. Explain to pupils that based on the volume of a cube as a product of the three equal lengths, we can in turn find the length using cube root.

For Let's Learn 20, work together with pupils to find the cube root of small numbers.

For Let's Learn 21, show pupils how to use the calculator to find the cube root of bigger numbers.

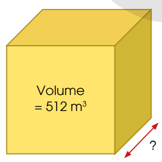
22. The volume of a cube is 27 cm³. Find the length of each edge.



Volume = 27 cm³
Length of each edge = $\sqrt[3]{27}$
= 3 cm

The length of each edge of the cube is 3 cm.

23. The volume of a cube is 512 m³. Find the length of each edge.



Volume = 512 m³
Length of each edge = $\sqrt[3]{512}$
= 8 m

The length of each edge of the cube is 8 m.

How can you check whether your answers are correct?

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Let's Learn 22 and 23 are straightforward and offer pupils opportunities to practise finding the cube root of a perfect cube. Highlight that to check their answers, pupils can use the length they found to calculate the volume they will get using this value.

ACTIVITY TIME

Work in pairs.

1. Look at the table below. Use the 1-cm cubes given to make four cubes with the given base areas.
2. For each cube made, find its volume by counting the number of cubes used.
3. Copy and complete the table.

What you need:

Base area of cube	Volume of cube	Length of edge
1 × 1 = 1 cm²	1 × 1 × 1 = 1 cm³	1 cm
2 × 2 = 4 cm²		
3 × 3 = ▭ cm²		
4 × 4 = ▭ cm²		

4. With your partner, discuss how the length of an edge of a cube is related to its base area and volume.
5. Complete the following sentences:
The length of the edge of a cube is equal to the ▭ root of its base area.
The length of the edge of a cube is equal to the ▭ root of its volume.

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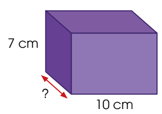
ACTIVITY TIME

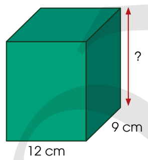
This activity enables pupils to relate the concepts of square root and cube root in a concrete way using 1-cm cubes. Pupils should observe that the length of an edge of a cube is equal to the square root of its base area or the cube root of its volume.

PRACTICE

1. Find the length of the unknown edge of each cuboid.
(a) Volume = 420 cm³ (b) Volume = 1620 cm³

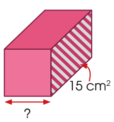


6 cm

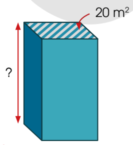


15 cm

2. For each cuboid, find the length of the unknown edge.
(a) Volume = 45 cm³ (b) Volume = 180 m³

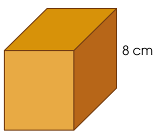


3 cm

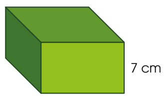


9 m

3. Find the base area of each cuboid.
(a) Volume = 504 cm³ (b) Volume = 1001 cm³



63 cm²



143 cm²

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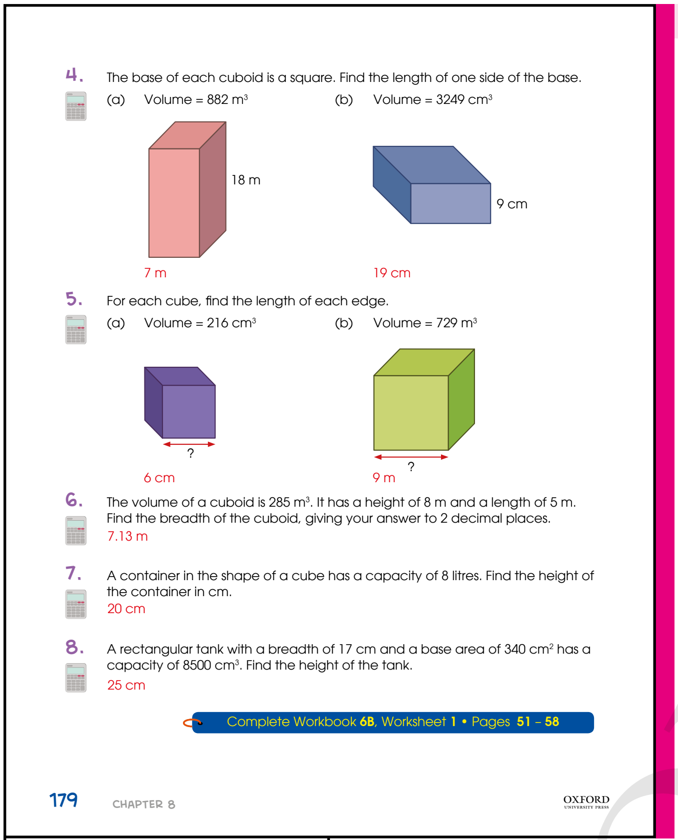
PRACTICE

Allow pupils to work individually or in pairs on the practice questions.


4. The base of each cuboid is a square. Find the length of one side of the base.
(a) Volume = 882 m^3 (b) Volume = 3249 cm^3

5. For each cube, find the length of each edge.
(a) Volume = 216 cm^3 (b) Volume = 729 m^3

6. The volume of a cuboid is 285 m^3. It has a height of 8 m and a length of 5 m. Find the breadth of the cuboid, giving your answer to 2 decimal places.
7.13 m

7. A container in the shape of a cube has a capacity of 8 litres. Find the height of the container in cm.
20 cm

8. A rectangular tank with a breadth of 17 cm and a base area of 340 cm^2 has a capacity of 8500 cm^3. Find the height of the tank.
25 cm

Complete Workbook 6B, Worksheet 1 • Pages 51 – 58

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Independent seatwork

Assign pupils to complete Worksheet 1 (Workbook 6B P51 – 58)

Answers

Worksheet 1 (Workbook 6B P51 – 58)

1. (a) 108
   (b) 128
   (c) 216
   (d) 27

2. (a) 13
   (b) 10
   (c) 15
   (d) 5

3. (a) 6
   (b) 7
   (c) 8
   (d) 7

4. (a) 65
   (b) 72
   (c) 120
   (d) 300

5. (a) 8 m
   (b) 9 m
   (c) 11 m

6. (a) 7 m
   (b) 11 cm

7. $2025 \div 9 = 225$ m^2
   $\sqrt{225} = 15$ m

8. $40\,000 \div 80 = 500$ cm^2

9. $3000 \div (23 \times 8) = 16$ cm (to the nearest whole number)

10. (a) $\sqrt[3]{5832} = 18$ cm
    (b) $18 \times 18 = 324$ cm^2

11. $\sqrt[3]{729} = 9$
    Total area of painted faces $= 6 \times 9 \times 9$
    $= 486$ cm^2

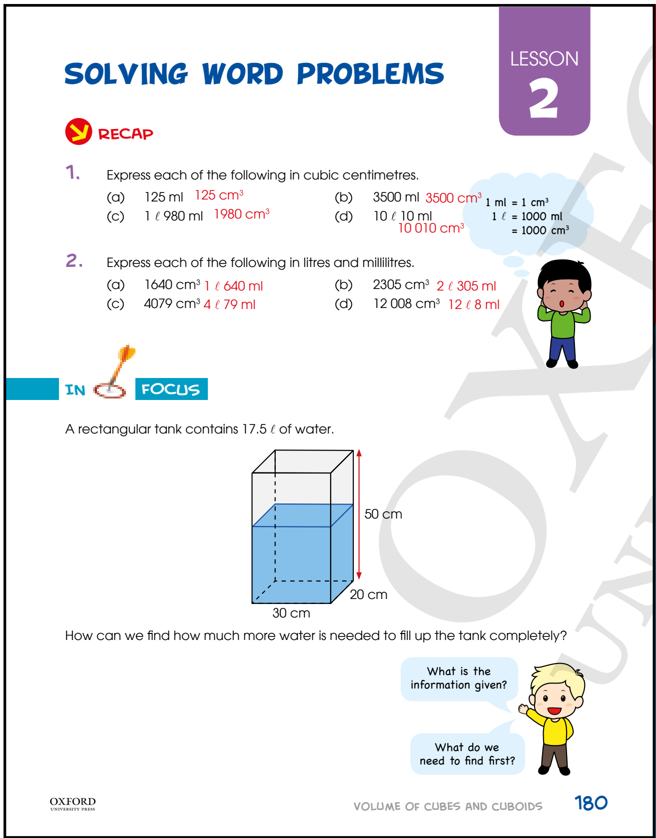
12. Volume of cube $= 5 \times 5 \times 5$
    $= 125$ cm^3
    Height of cuboid $= 125 \div (10 \times 10)$
    $= 1.25$ cm

LESSON 2

SOLVING WORD PROBLEMS

LEARNING OBJECTIVE

1. Solve word problems involving volume of a cube/ cuboid.


SOLVING WORD PROBLEMS

LESSON 2

RECAP

1. Express each of the following in cubic centimetres.

(a) 125 ml 125 cm³ (b) 3500 ml 3500 cm³
(c) 1 ℓ 980 ml 1980 cm³ (d) 10 ℓ 10 ml 10 010 cm³

2. Express each of the following in litres and millilitres.

(a) 1640 cm³ 1 ℓ 640 ml (b) 2305 cm³ 2 ℓ 305 ml
(c) 4079 cm³ 4 ℓ 79 ml (d) 12 008 cm³ 12 ℓ 8 ml

IN FOCUS

A rectangular tank contains 17.5 ℓ of water.

How can we find how much more water is needed to fill up the tank completely?

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VOLUME OF CUBES AND CUBOIDS 180

Textbook 6 P180

RECAP

In this lesson, pupils will apply what they have learnt previously to solve 2-step word problems. Recap with pupils on the conversion of units as they will need to make calculations in the appropriate units later on.

IN FOCUS

Help pupils understand the word problem. Ask:
- What are the dimensions of the tank?
- Which part of the tank represents the water it is filled with?
- How much water is in the tank? Are we given the volume of water?
- What are we required to find? What do we need to find first?

LET'S LEARN

1. A rectangular tank measuring 30 cm by 20 cm by 50 cm contains 17.5 ℓ of water. How much more water is needed to fill up the tank completely?

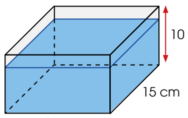
Capacity of tank = 30 × 20 × 50
= 30 000 cm^3
= 30 ℓ

Amount of water needed = 30 − 17.5
= 12.5 ℓ

12.5 more litres of water is needed to fill the tank completely.

How can we check the answer?

2. Junhao has a rectangular container with a length of 18 cm, a breadth of 15 cm and a height of 10 cm. It contains 2.16 ℓ of water. Find the amount of water that Junhao needs to add to fill up the tank completely, giving your answer in cubic centimetres.



Why do we convert the volume of the water in the tank to cubic centimetres first?

Amount of water in tank = 2.16 ℓ
= 2160 cm^3

Capacity of tank = 18 × 15 × 10
= 2700 cm^3

Amount of water needed = 2700 − 2160
= 540 cm^3

Junhao needs to add 540 cm^3 of water to fill up the tank completely.

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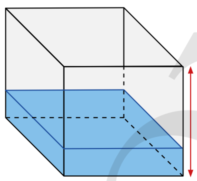
Textbook 6 P181

LET'S LEARN

To solve the In Focus problem, guide pupils along the steps. Remind pupils to convert the capacity of the tank to litres in order to subtract the amount of water present.

For Let's Learn 2, allow pupils to work in pairs and fill in the blanks. Point out to them that in this case, the question asks for the amount of water in cm^3.

3. A rectangular tank with a square base of side 30 cm contains 6.3 ℓ of water. The tank is $\frac{1}{4}$ full. Find the height of the tank.



Method 1

Volume of water = 6.3 ℓ
= 6300 cm^3

Height of water = $\frac{6300}{30 \times 30}$
= 7 cm

Height of tank = 7 × 4
= 28 cm

Why do we mutiply the height of the tank by 4?

The height of the tank is 28 cm.

Method 2

Volume of water = 6300 cm^3

Capacity of tank = 6300 × 4
= 25 200 cm^3

Height of tank = $\frac{25\ 200}{30 \times 30}$
= 28 cm

The height of the tank is 28 cm.

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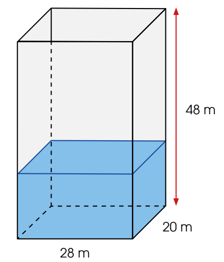
Textbook 6 P182

For Let's Learn 3, highlight to pupils that although the length of only one side is given, they are able to find the base area since it is a square base. Guide pupils and ask:

- Are we able to use the volume of water to find the height of the water?
- If the tank is $\frac{1}{4}$ full, what does this say about the height of the water compared to the height of the tank?

Go through method 2 as well and point out that the capacity of the tank can be found by multiplying the volume of water by 4, since the water takes up $\frac{1}{4}$ of its capacity.

4. A tank measuring 28 m by 20 m by 48 m is $\frac{1}{3}$ filled with water. Find the amount of water needed to fill the tank completely.



Method 1

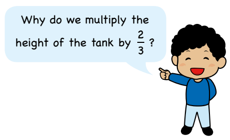
Capacity of tank = 28 × 20 × 48
= 26 880 m³

Amount of water needed = $\frac{2}{3}$ × 26 880 m³
= 17 920 m³

The amount of water needed to fill the tank completely is 17 920 m³.

Method 2

Height of water needed = $\frac{2}{3}$ × 48
= 32 m



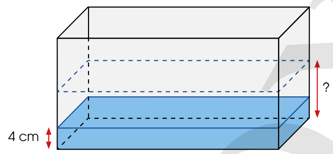
Amount of water needed = 28 × 20 × 32
= 17 920 m³

The amount of water needed to fill the tank completely is 17 920 m³.

Textbook 6 P183

Let's Learn 4 is similar to Let's Learn 3. Allow pupils to work in pairs and ensure that they are able to interpret the information correctly.

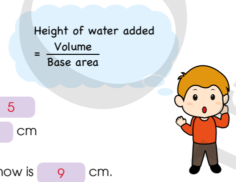
5. The height of the water in a rectangular container with a base area of 500 cm² is 4 cm. Meiling adds 2.5 ℓ of water into the container. What is the height of the water in the container now?



Method 1

Volume of water added = 2.5 ℓ
= 2500 cm³

Height of water added = $\frac{2500}{500}$
= 5 cm

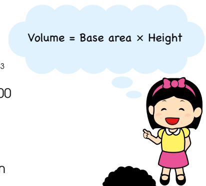


New height of water in container = 4 + 5
= 9 cm

The height of the water in the container now is 9 cm.

Method 2

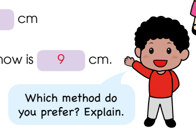
Volume of water in container at first = 500 × 4
= 2000 cm³



New volume of water in container = 2000 + 2500
= 4500 cm³

New height of water in container = $\frac{4500}{500}$
= 9 cm

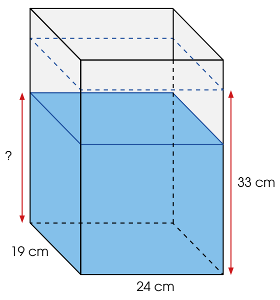
The height of the water in the container now is 9 cm.



Textbook 6 P184

Let's Learn 5 presents the problem in a different way whereby pupils work with two volumes of water. Guide pupils to break down the information given and recap that since the base area is given, the height of water added can be found.

6. A rectangular tank has a breadth of 19 cm and a length of 24 cm. It contains some water to a height of 33 cm. After 5016 cm³ of water is poured out of the tank, what is the height of the water left in the tank?



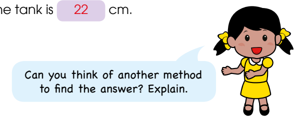
Height of water poured out $= \frac{5016}{24 \times 19}$

$= 11$ cm

Height of water left in tank $= 33 - 11$

$= 22$ cm

The height of the water left in the tank is 22 cm.



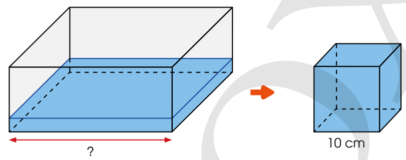
Textbook 6 185

Get pupils to note the difference between Let's Learn 6 and Let's Learn 5. The problems are the opposite of each other, where water is removed instead of added. However, the basic concepts involved are the same and pupils should be able to solve for the answer.

7. A rectangular container with a square base area of 625 cm² was $\frac{1}{5}$ filled with water. When the water from the container was poured into a cubical tank of edge 10 cm, the tank was completely filled.

(a) Find the length of the rectangular tank.

(b) Find the capacity of the rectangular container.



(a) Length of rectangular container $= \sqrt{625}$

$= 25$ cm

The length of the rectangular container is 25 cm.

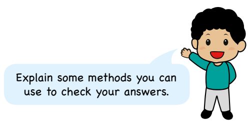
(b) Capacity of cubical tank $= 10 \times 10 \times 10$

$= 1000$ cm³

Capacity of rectangular container $= 1000 \times 5$

$= 5000$ cm³

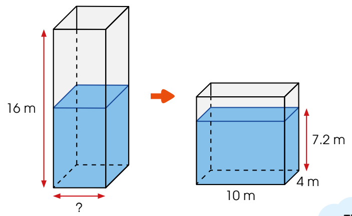
The capacity of the rectangular container is 5000 cm³.



Textbook 6 P186

Let's Learn 7 helps pupils break down the information through a 2-part question. For part (b), point out to pupils that the volume of water does not change when the water is transferred. Get pupils to see that since the water fills up the cubical tank, the volume of water is equal to the capacity of the cubical tank.

8. A rectangular container with a square base and a height of 16 m is $\frac{1}{2}$ filled with water. When all the water from the container is poured into an empty rectangular tank, the height of the water in the tank is 7.2 m. The length of the tank is 10 m and its breadth is 4 m. Find the length of one side of the base of the rectangular container.



The amount of water remains the same. It is half the capacity of the rectangular container.

Capacity of container = 10 × 4 × 7.2 × 2
= 576 m^3

Area of square base of container = 576 ÷ 16
= 36 m^2

Length of one side of base = $\sqrt{36}$
= 6 m

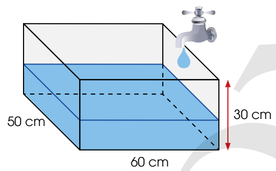
The length of one side of the base of the rectangular container is 6 m.

Is there another method to find the answer? Explain.

Textbook 6 P187

Let's Learn 8 requires pupils to apply the same process as Let's Learn 7. Point out to pupils that half the capacity of the container is equal to the amount of water in the tank.

9. An empty rectangular tank measures 50 cm by 60 cm by 30 cm. Water flows from a tap into the tank at a rate of 15 litres per minute. How long will it take to fill the tank completely?



Capacity of tank = 50 × 60 × 30
= 90 000 cm^3
= 90 ℓ

Why do we divide to find the amount of time?

Time taken = 90 ÷ 15
= 6 min

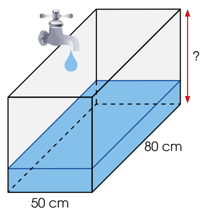
It will take 6 minutes to fill the tank completely.

10. An empty rectangular tank with a breadth of 50 cm and a length of 80 cm is filled with water at a rate of 12 litres per minute. It takes 18 minutes to fill the tank completely. Find the height of the tank.

Capacity of tank = 12 × 18
= 216 ℓ
= 216 000 cm^3

Height of the tank = $\frac{216\,000}{80 \times 50}$
= 54 cm

The height of the tank is 54 cm.



Textbook 6 P188

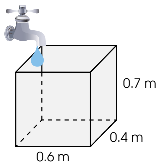
In Let's Learn 9, pupils are required to apply the concept of rate. Guide pupils through the problem-solving process and ask:

- Is there water in the tank at first? [Pupils may mistakenly assume there is, based on the diagram; however the question states "empty rectangular tank".]
- Are we given the dimensions of the tank? Can we find its capacity?
- What does rate mean?
- After finding the capacity of the tank, how can we use the rate given to find the time taken? What operation do we use?

For Let's Learn 10, hint to pupils that the problem requires a similar concept applied in Let's Learn 9. Ask:

- What information can we use to find the capacity of the tank if we do not have all the dimensions?

11. An empty rectangular tank measures 0.6 m by 0.4 m by 0.7 m. Water flows from a tap into the tank at a rate of 7 litres per minute. How many minutes will it take to fill $\frac{2}{3}$ of the tank?



1 m = 100 cm
What are the measurements of the tank in centimetres?

Capacity of tank = 60 × 40 × 70
= 168 000 cm³
= 168 ℓ

Time taken to fill the whole tank = 168 ÷ 7
= 24 min

Time taken to fill $\frac{2}{3}$ of the tank = $\frac{2}{3}$ × 24
= 16 min

Can you think of another method to find the answer? Explain.

It will take 16 minutes to fill $\frac{2}{3}$ of the tank.

ACTIVITY TIME

Work in groups of 4.

1. Create a word problem that involves the volume of water in a rectangular or cubical container.
2. Discuss the edges that need to be provided, and the different ways to solve for the unknowns in the question.
3. Present your problem for the rest of the class to solve.

What you need:

Textbook 6 P189

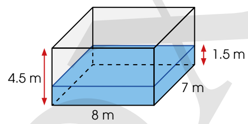
For Let's Learn 11, draw pupils' attention to the unit of measurement given in the problem. Explain to pupils that converting the measurements would be more convenient as they can then work with whole numbers. Since the rate is given in litres, it would also be easier to find the capacity in litres. Remind pupils that the question does not ask for the tank to be completely filled, unlike previous examples.

ACTIVITY TIME

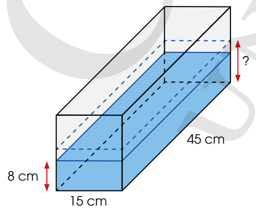
This activity enables pupils to apply the mathematical concepts and skills that they have acquired to generate word problems involving volumes. It enables them to gain insights about what information is needed and how to structure a question in order for it to be solved. Ensure that each group is able to solve their own question before they present it to the class.

PRACTICE

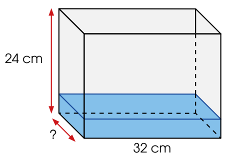
1. A rectangular tank measuring 8 m by 7 m by 4.5 m is filled with water to a height of 1.5 m. How much more water is needed to fill the tank completely? Give your answer in cubic metres.
168 m³



2. A rectangular container is 45 cm long and 15 cm wide. The height of the water in the container is 8 cm. Bala adds 1.35 ℓ of water into the container. What is the height of the water in the container now?
10 cm



3. An empty tank has a height of 24 cm and a length of 32 cm. When 1.2 ℓ of water is poured into it, it is $\frac{1}{8}$ full. Find the breadth of the container.
12.5 cm



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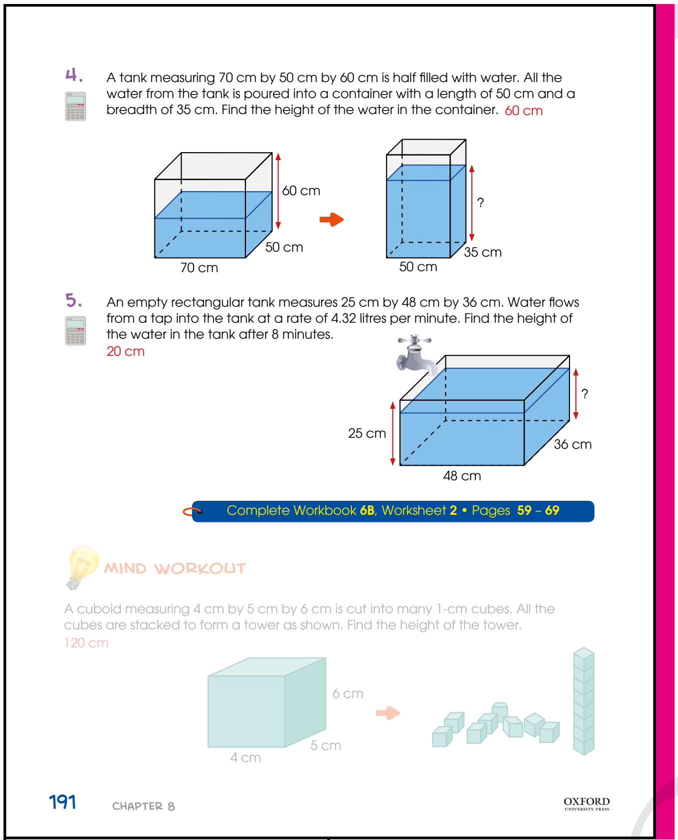
PRACTICE

Let pupils work individually or in pairs on the practice questions.



4. A tank measuring 70 cm by 50 cm by 60 cm is half filled with water. All the water from the tank is poured into a container with a length of 50 cm and a breadth of 35 cm. Find the height of the water in the container. 60 cm

5. An empty rectangular tank measures 25 cm by 48 cm by 36 cm. Water flows from a tap into the tank at a rate of 4.32 litres per minute. Find the height of the water in the tank after 8 minutes.
20 cm

Complete Workbook 6B, Worksheet 2 • Pages 59 – 69

MIND WORKOUT

A cuboid measuring 4 cm by 5 cm by 6 cm is cut into many 1-cm cubes. All the cubes are stacked to form a tower as shown. Find the height of the tower.
120 cm

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Textbook 6 P191

Independent seatwork

Assign pupils to complete Worksheet 2 (Workbook 6B P59 – 69).

Answers Worksheet 2 (Workbook 6B P59 – 69)

1. Height = 480 ÷ (10 × 6)
   = 8 m

2. Height = 2300 ÷ (25 × 12)
   = 7.7 cm (to 1 decimal place)

3. Height of water = 1280 ÷ (16 × 16)
   = 5 cm

   Height of container = 5 + 8
   = 13 cm

4. Height of water = 12 – 4
   = 8 m

   Volume of water = 7 × 3 × 8
   = 168 m^3

5. Height of water needed = 10 – 3
   = 7 m

   Amount of water needed = 15 × 5 × 7
   = 525 m^3

6. Capacity = 35 × 22 × 35
   = 26 950 cm^3

   Amount of water needed = 26 950 – 13 860
   = 13 090 ml
   = 13 ℓ 90 ml

7. Height of water = 8000 ÷ (40 × 30)
   = $6\frac{2}{3}$ cm

   Height of tank = $6\frac{2}{3}$ × 3
   = 20 cm

8. Height of water = 3456 ÷ (15 × 12)
   = 19.2 m

   Height of tank = 19.2 ÷ 3 × 5
   = 32 m

9. Increase in height = 12 000 ÷ (40 × 50)
   = 6 cm

   Height of water in tank now = 12 + 6
   = 18 cm

10. Decrease in height = 13 440 ÷ (120 × 35)
    = 3.2 cm

    Height of water left = 40 – 3.2
    = 36.8 cm

11. Volume of water = 50 × 45 × 42
    = 94 500 m^3

    Height of water = 94 500 ÷ (70 × 54)
    = 25 m

12. Volume of water = 50 × 50 × 57.6
    = 144 000 cm^3

    Height of water in container = 144 000 ÷ (80 × 60)
    = 30 cm

    Height of container = 30 ÷ 3 × 4
    = 40 cm

13. Capacity = 100 × 85 × 60
    = 510 000 cm^3
    = 510 ℓ

    Time needed to fill the tank completely
    = 510 ÷ 14
    = 36 min (to the nearest minute)

14. Volume of water = 60 × 70 × 80
    = 336 000 cm^3
    = 336 ℓ

    Time needed = 336 ÷ 24
    = 14 min

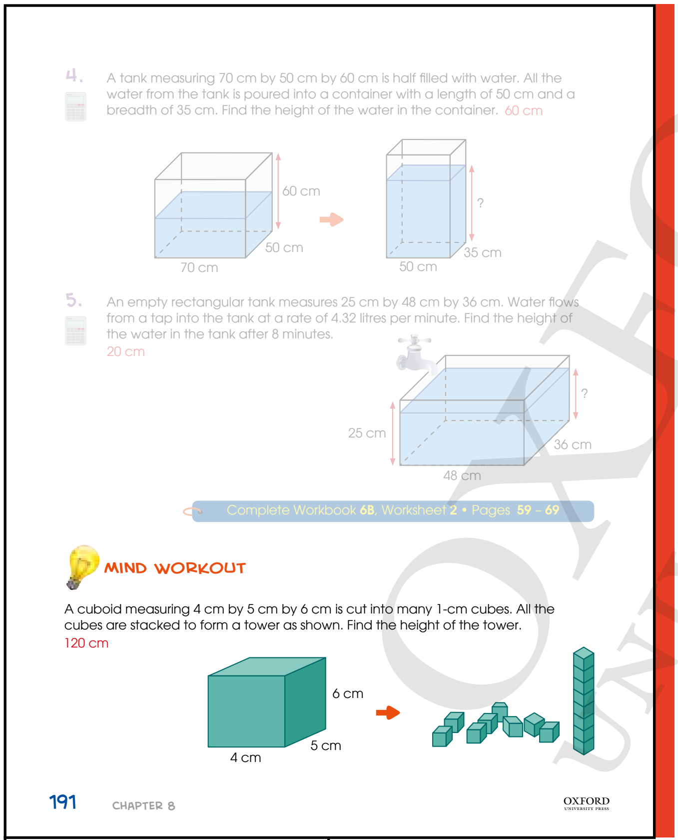
15. Volume of water in each tank = $\frac{1}{2}$ × 50 × 40 × 101
    = 101 000 cm^3

    Height of water in Tank B = 101 000 ÷ (80 × 45)
    = 28.06 cm (to 2 decimal places)

16. Volume of water = 36 × 250
    = 9000 ml
    = 9000 cm^3

    Height of water in tank at first = 9000 ÷ (32 × 25)
    = 11.25 cm

PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW


4. A tank measuring 70 cm by 50 cm by 60 cm is half filled with water. All the water from the tank is poured into a container with a length of 50 cm and a breadth of 35 cm. Find the height of the water in the container. 60 cm

5. An empty rectangular tank measures 25 cm by 48 cm by 36 cm. Water flows from a tap into the tank at a rate of 4.32 litres per minute. Find the height of the water in the tank after 8 minutes.
20 cm

Complete Workbook 6B, Worksheet 2 • Pages 59 – 69

MIND WORKOUT

A cuboid measuring 4 cm by 5 cm by 6 cm is cut into many 1-cm cubes. All the cubes are stacked to form a tower as shown. Find the height of the tower.
120 cm

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Textbook 6 P191

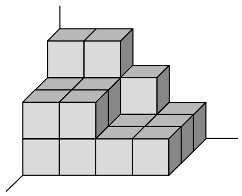
MIND WORKOUT

Pupils are expected to recognise that the number of 1-cm cubes the cuboid is made up of is equal to its volume, i.e. 120 cm^3. They should be able to conclude that since the cubes are stacked as shown with a square base of 1 cm by 1 cm, the height of the tower will be 120 cm.

Mind Workout

Date: ____________

Kate uses identical 1-cm cubes to form the solid shown.



Kate then uses the cubes to form other solids.

(a) Find the least number of 1-cm cubes she needs to remove to form a cuboid with a base area of 8 cm².

(b) Find the least number of 1-cm cubes she needs to add to form a cube.

(a) 5

(b) 6

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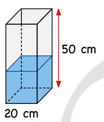
Workbook 6B P70

Mind Workout

This is a task based on deduction and visualisation. Guide pupils to see that there are a total of 21 cubes in the solid. Pupils may be confused and think that they have to find the number of cubes to remove from or add to this particular solid. Highlight to pupils that when Kate uses the cubes to form other solids, she can move the cubes around.

MATHS JOURNAL

Priya has a rectangular tank that is $\frac{2}{5}$ filled with water and an empty 2-litre beaker. The tank has a square base of side 20 cm and a height of 50 cm.



How many beakers of water does Priya need to add into the tank so that it is completely filled?

Ahmad says she needs 6 beakers of water and Junhao says she needs 4 beakers of water.

Who is correct? Explain.

Can you tell what error the other pupil made in his calculation?

SELF-CHECK

I know how to...

- find one edge of a cuboid given its volume and the other edges.
- find the height of a cuboid given its volume and base area.
- find the length of one edge of a cube given its volume.
- find the area of a face of a cuboid given its volume and one edge.
- use the symbols $\sqrt{\ }$ and $\sqrt[3]{\ }$.
- solve word problems involving volume of a cube or a cuboid.

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Textbook 6 P192

MATHS JOURNAL

This journal task requires pupils to spot an error in a solution. Guide them to work backwards and locate where and how the error was made.

SELF-CHECK

Before pupils do the self-check, review the concepts on volume and their applications in solving various word problems.

The self-check can be done after pupils have completed **Review 8** (Workbook 6B P71 – 80).

Answers Review 8 (Workbook 6B P71 – 80)

1. (a) 17 cm
   (b) 16 m
   (c) 5 cm

2. $1404 \div (13 \times 12) = 9$ cm

3. $2520 \div 420 = 6$ cm

4. $1215 \div 15 = 81$
   $\sqrt{81} = 9$ m

5. Height $= 225 \div (5 \times 5)$
   $= 9$ cm

6. $\sqrt[3]{2744} = 14$ m

7. Length of edge $= \sqrt[3]{3375}$
   $= 15$ cm
   Area of base $= 15 \times 15$
   $= 225$ cm^2

8. $\sqrt[3]{1331} = 11$ cm
   Total area of painted faces $= 6 \times 11 \times 11$
   $= 726$ cm^2

9. Volume of water $= 20 \times 15 \times 8$
   $= 2400$ cm^3

10. Height $= 1500 \div 140$
    $= 10.71$ cm (to 2 decimal places)

11. Height of water needed $= 18 - 10$
    $= 8$ cm
    Amount of water needed $= 24 \times 15 \times 8$
    $= 2880$ cm^3
    $= 2\ \ell\ 880$ ml

12. (a) Capacity $= 30 \times 50 \times 20$
    $= 30\,000$ cm^3
    $= 30\ \ell$

    (b) Volume of water after 2 min $= 12 \times 2$
    $= 24\ \ell$
    $= 24\,000$ cm^3
    Height of water $= 24\,000 \div (50 \times 30)$
    $= 16$ cm

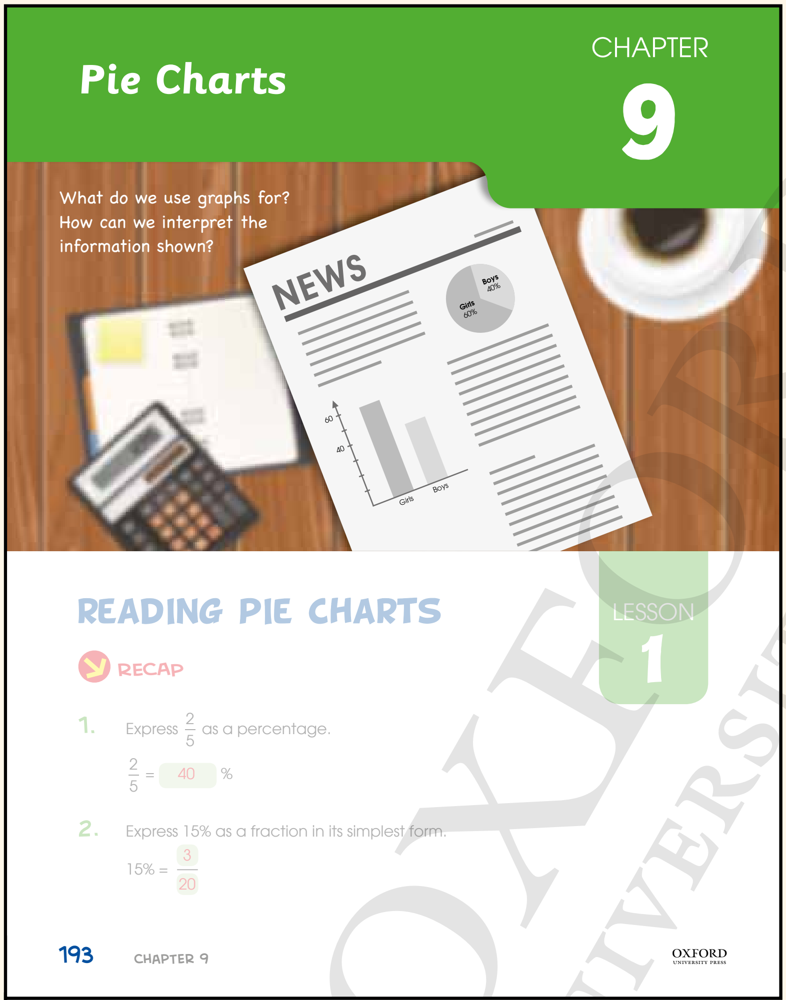
13. Decrease in height $= 720 \div (30 \times 12)$
    $= 2$ m
    Height of water left $= 7 - 2$
    $= 5$ m

14. Volume of water in Container A $= 40 \times 10 \times 30$
    $= 12\,000$ cm^3
    Increase in height in Container B
    $= 12\,000 \div (60 \times 25)$
    $= 8$ cm
    New height of water in Container B $= 18 + 8$
    $= 26$ cm

15. Amount of water poured into container
    $= \frac{1}{5} \times 50 \times 30 \times 40$
    $= 12\,000$ cm^3
    Increase in height $= 12\,000 \div (25 \times 20)$
    $= 24$ cm
    New height of water $= 4 + 24$
    $= 28$ cm

PIE CHARTS

CHAPTER 9


Pie Charts

CHAPTER 9

What do we use graphs for? How can we interpret the information shown?

READING PIE CHARTS

LESSON 1

RECAP

1. Express $\frac{2}{5}$ as a percentage.

$\frac{2}{5}$ = 40 %

2. Express 15% as a fraction in its simplest form.

15% = $\frac{3}{20}$

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Textbook 6 P193

Related Resources
NSPM Textbook 6 (P193 – 209)
NSPM Workbook 6B (81 – 98)

Materials
Software to construct pie chart

Lesson

Lesson 1	Reading Pie Charts
Lesson 2	Solving Word Problems

Problem Solving, Maths Journal and Pupil Review

INTRODUCTION

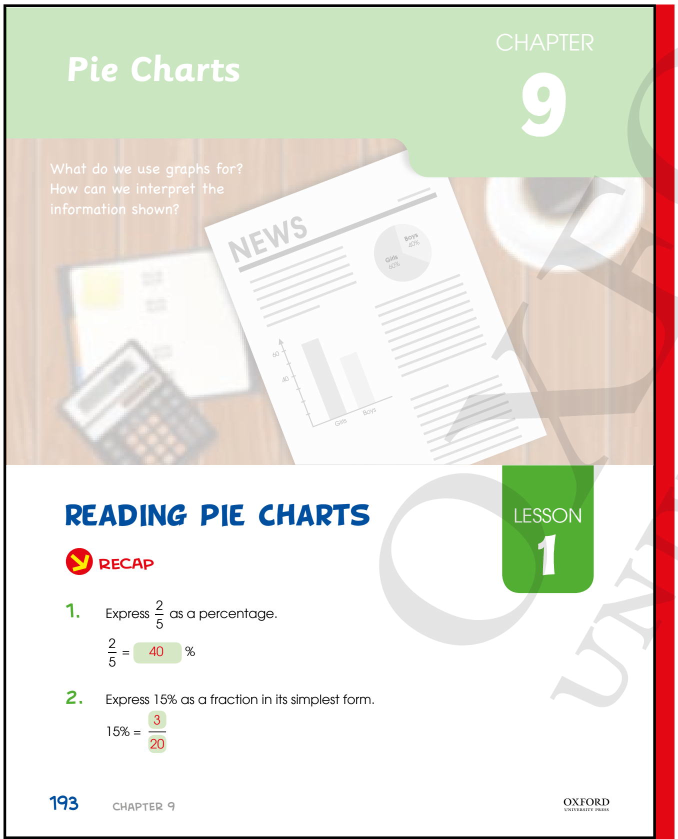
This chapter reinforces the use of graphs to display data and the need to interpret graphs to obtain useful information. A new representation, i.e. pie chart, is introduced. Pupils will be given opportunities to explore the advantages and disadvantages of the use of pie charts to display statistical information.

LESSON 1

READING PIE CHARTS

LEARNING OBJECTIVE

1. Interpret data from a pie chart.


Pie Charts

CHAPTER 9

What do we use graphs for? How can we interpret the information shown?

READING PIE CHARTS

LESSON 1

RECAP

1. Express $\frac{2}{5}$ as a percentage.

$\frac{2}{5} = \boxed{40}\ \%$

2. Express 15% as a fraction in its simplest form.

$15\% = \frac{\boxed{3}}{\boxed{20}}$

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Textbook 6 P193

RECAP

As interpreting pie charts involves calculations associated with fractions and percentages, revisiting the related concepts will help pupils with extracting the relevant information from pie charts.

3. Find the value of $\frac{3}{4} \times 32$.

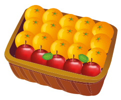
$\frac{3}{4} \times 32 =$ 24

4. Find the value of 60% of 900.

60% of 900 = 540

Explain the method you used to solve each question.

IN FOCUS

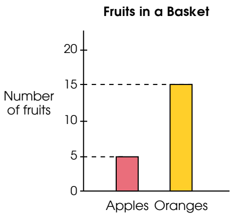


There are 5 apples and 15 oranges in a basket.

Fruits	Apples	Oranges
Number of fruits	5	15

We can use a table to show the information.

We can also represent the information using a bar graph.



What are some other ways we can represent the information?

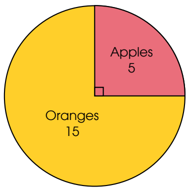
Textbook 6 P194

IN FOCUS

Get pupils to display the given information in a table and represent it in a bar graph. Get them to discuss other ways to represent the data.

LET'S LEARN

1. We can use a **pie chart** to represent the information.



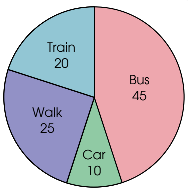
5 out of 20 fruits are apples and 15 out of 20 fruits are oranges.

$\frac{5}{20} = \frac{1}{4}$ $\frac{15}{20} = \frac{3}{4}$

So, we use $\frac{1}{4}$ of the circle to represent the number of apples and $\frac{3}{4}$ to represent the number of oranges.

The whole circle represents a whole, or 100%.

2. The pie chart shows how 100 pupils travel to school every day.



Study the pie chart and answer the questions.

(a) How many pupils walk to school?

25 pupils walk to school.

How do we tell?

(b) Which mode of transport is used by most of the pupils?

The mode of transport used by most of the pupils is bus.

Textbook 6 P195

LET'S LEARN

Introduce pupils to the concept of a pie chart. Guide pupils to see that based on its name, the chart can be divided into 'slices' that represent certain quantities proportionately. Explain to pupils that the whole circle represents 1 whole or 100%.

For Let's Learn 2, guide pupils to see that since the parts of a pie chart are proportional, a bigger part reflects a larger quantity. Remind pupils to pay attention to what the total quantity is when expressing a particular quantity as a fraction or percentage.

(c) What fraction of the pupils travel to school by car?

$\frac{10}{100} = \frac{1}{10}$

There are 100 pupils. 10 pupils travel to school by car.

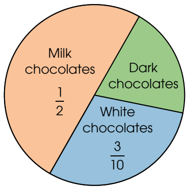
$\frac{1}{10}$ of the pupils travel to school by car.

(d) What percentage of the pupils travel to school by train?

$\frac{20}{100} = 20\%$

20 % of the pupils travel to school by train.

3. The pie chart represents the number of each type of chocolate in a bag.



Half of the pie means $\frac{1}{2}$ or 50%.

Study the pie chart and answer the questions.

(a) What fraction of the chocolates are milk chocolates?

$\frac{1}{2}$ of the chocolates are milk chocolates.

(b) What fraction of the chocolates are dark chocolates?

Method 1

$\frac{1}{2} - \frac{3}{10} = \frac{1}{5}$

Method 2

$1 - \frac{1}{2} - \frac{3}{10} = \frac{1}{5}$

The pie chart represents 1 whole.

$\frac{1}{5}$ of the chocolates are dark chocolates.

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PIE CHARTS 196

Textbook 6 P196

Let's Learn 3 represents the quantities in the pie chart in fractions. Remind pupils that the whole circle represents 1 whole. Guide pupils with the interpretation of the pie chart.

(c) What percentage of the chocolates in the bag are white chocolates?

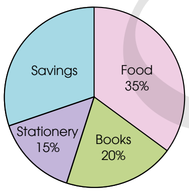
$\frac{3}{10} = 30\%$

$\frac{3}{10} = \frac{30}{100}$

30 % of the chocolates in the bag are white chocolates.

Can you think of other questions that we can ask based on the pie chart?

4. The pie chart shows how Farhan spent his pocket money in September.



Study the pie chart and answer the questions.

(a) What fraction of his pocket money did Farhan spend on stationery?

$15\% = \frac{3}{20}$

Farhan spent $\frac{3}{20}$ of his pocket money on stationery.

(b) What percentage of his pocket money did Farhan save?

100% − 35 % − 20 % − 15 % = 30 %

Farhan saved 30 % of his pocket money.

1 whole = 100%

197 CHAPTER 9

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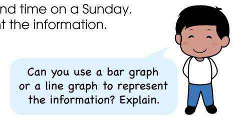
Textbook 6 P197

Let's Learn 4 represents the quantities using percentage. Remind pupils that the whole circle represents 100%. Allow pupils to discuss in pairs and fill in the blanks.

ACTIVITY TIME

Work in pairs.

1. Tell your partner how you usually spend time on a Sunday. Discuss some ways you can represent the information.

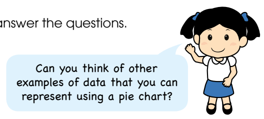


2. Create a spreadsheet to record the amount of time spent on different activities.

Example

	A	B	C	D
1				
2		**Activity**	**Number of hours**	
3		Sleeping	9	
4		Watching television	2	
5		Eating	5	
6		Doing homework	2	
7		Reading	4	
8		Playing	2	
9				

3. Use the tools in the software to construct a pie chart.
4. Look at the pie chart and write down some questions that you can ask.
5. Present your pie chart to the class.
6. Get your classmates to answer the questions.

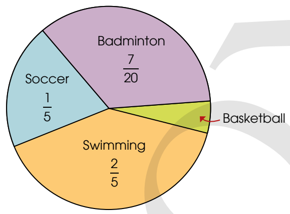


Textbook 6 P198

The use of ICT facilitates the ease of construction of a pie chart. Pupils can change the data input to observe how the pie chart varies with each change. Creating questions based on the pie chart helps pupils understand the effective use of pie charts to display certain information.

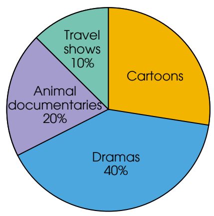
PRACTICE

1. A survey was carried out to find out the pupils' favourite sports. The pie chart shows the results of the survey.



(a) What percentage of the pupils chose badminton as their favourite sport? 35%
(b) What fraction of the pupils chose basketball as their favourite sport? $\frac{1}{20}$
(c) Which sport was more popular, badminton or swimming? Swimming

2. The pie chart shows the different types of television programmes that 30 pupils like.



(a) Which was more popular, dramas or animal documentaries? Dramas
(b) What fraction of the pupils chose travel shows? $\frac{1}{10}$
(c) What percentage of pupils chose cartoons? 30%

Complete Workbook **6B**, Worksheet **1** • Pages **81 – 84**

Textbook 6 P199

Allow pupils to discuss and work in pairs or groups. Then, go through the questions and solutions with the class. It is important that the pupils accurately grasp the concept and its applications before they are given independent work.

Independent seatwork

Assign pupils to complete Worksheet 1 (Workbook 6B P81 – 84).

Answers Worksheet 1 (Workbook 6B P81 – 84)

1. (a) Scouts
   (b) 50 + 28 + 24 + 18 = 120
   (c) 50 – 18 = 32
   There are 32 more pupils in Scouts than in Speech and Drama.

2. (a) Cricket
   (b) Tennis
   (c) $60\% = \frac{3}{5}$
   (d) $10\% = \frac{1}{10}$
   (e) 100% – 60% = 40%

3. (a) 5
   (b) $\frac{1}{4}$
   (c) $\frac{1}{2} - \frac{1}{3} = \frac{1}{6}$
   (d) Bamboo plant and bougainvillea
   (e) Croton

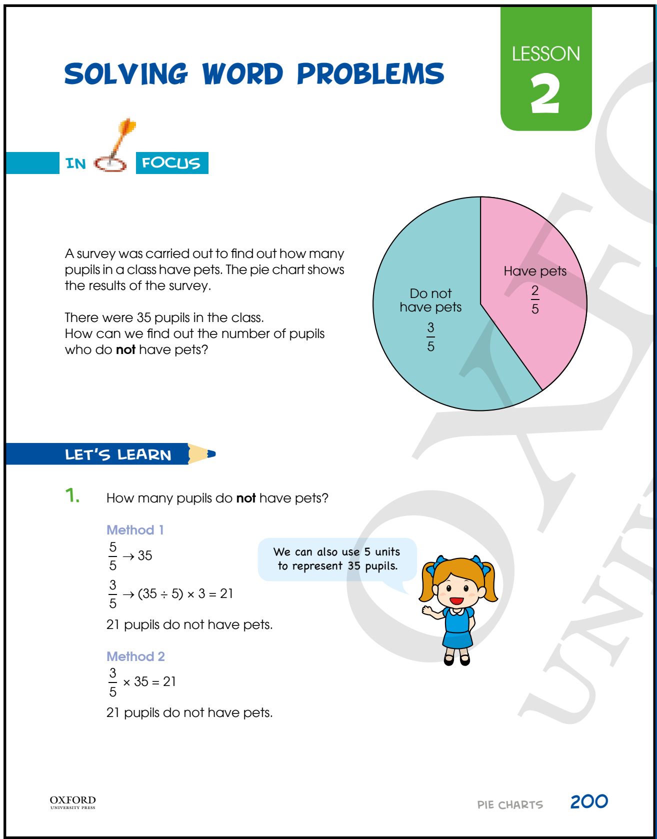
4. (a) $\frac{1}{10} + \frac{1}{4} = \frac{2}{20} + \frac{5}{20}$
   $= \frac{7}{20}$
   (b) $\frac{1}{5} = \frac{4}{20}$
   There are more green marbles than yellow marbles.
   (c) $1 - \frac{3}{20} = \frac{17}{20}$
   (d) $1 - \frac{3}{20} - \frac{1}{5} - \frac{1}{4} - \frac{1}{10} = \frac{3}{10}$

LESSON 2

SOLVING WORD PROBLEMS

LEARNING OBJECTIVE

1. Solve word problems involving pie charts.



SOLVING WORD PROBLEMS

LESSON 2

IN FOCUS

A survey was carried out to find out how many pupils in a class have pets. The pie chart shows the results of the survey.

There were 35 pupils in the class.
How many can we find out the number of pupils who do **not** have pets?

LET'S LEARN

1. How many pupils do **not** have pets?

Method 1

$\frac{5}{5} \rightarrow 35$

$\frac{3}{5} \rightarrow (35 \div 5) \times 3 = 21$

21 pupils do not have pets.

Method 2

$\frac{3}{5} \times 35 = 21$

21 pupils do not have pets.

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PIE CHARTS 200

Textbook 6 P200

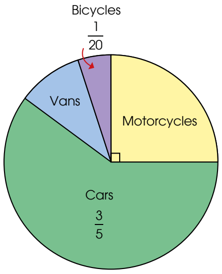
IN FOCUS

Get pupils to relate to finding the value of the parts of a pie chart, given the fractions of each part and the value of the whole. Ask pupils to suggest a method to answer the question, based on prior knowledge.

LET'S LEARN

Get pupils to recognise that each part, in fraction or percentage, represents a certain value or number that is proportional to its size. Therefore, pupils can find the value of each part by using the unitary method or directly using the fraction given.

2. There are 200 vehicles in a car park. The pie chart shows the different vehicles parked in the car park.



(a) How many motorcycles are there in the car park?

$\frac{1}{4} \times 200 =$ 50

There are 50 motorcycles in the car park.

The right angle marking shows that it is a quarter circle. So, $\frac{1}{4}$ of the vehicles in the car park are motorcycles.

(b) What percentage of the vehicles in the car park are vans?

$1 - \frac{1}{4} - \frac{3}{5} - \frac{1}{20} = \frac{1}{10}$

$\frac{1}{10} =$ 10 %

10 % of the vehicles in the car park are vans.

(c) How many bicycles are there in the car park?

$\frac{1}{20} \times 200 = 10$

There are 10 bicycles in the car park.

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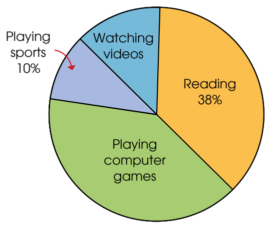
Textbook 6 P201

For Let's Learn 2, guide pupils to interpret the usage of angles in a pie chart. Show them that 90° represents a quarter circle and this reflects that $\frac{1}{4}$ of the vehicles are motorcycles.

3. A survey was conducted to find out the hobbies of some pupils. 50% of the pupils chose playing sports and playing computer games. The pie chart shows the results.



Based on the pie chart, do you think the pupils should be more active? Explain.

(a) What percentage of the pupils chose playing computer games as their hobby?

50% – 10% = 40 %

40 % of the pupils chose playing computer games as their hobby.

(b) What fraction of the pupils chose watching videos as their hobby? Express your answer in its simplest form.

50% – 38% = 12 %

$12\% = \frac{3}{25}$

$\frac{3}{25}$ of the pupils chose watching videos as their hobby.

(c) 57 pupils chose reading as their hobby. How many pupils took part in the survey?

$38\% \rightarrow 57$

$100\% \rightarrow (57 \div 38) \times 100 = 150$

150 pupils took part in the survey.

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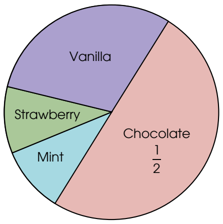
Textbook 6 P202

In Let's Learn 3, guide pupils to see that although there are two unknowns, the percentage of pupils who chose playing computer games and watching videos can each be found since the chart is split into two halves with each half corresponding to 50%.
For part (c), pupils should recognise that they have to solve a basic percentage question and find the total quantity of pupils, i.e. 100%.

4. The pupils in a class were asked about their favourite ice cream flavours. $\frac{1}{2}$ of the pupils chose chocolate and $\frac{3}{5}$ of the remaining pupils chose vanilla. The fraction of pupils who chose chocolate was $\frac{3}{10}$ more than the number of pupils who chose strawberry and mint.



(a) 20 pupils chose chocolate as their favourite ice cream flavour. How many pupils were there in the class?

20 × 2 = 40

There were 40 pupils in the class.

(b) What fraction of the pupils chose vanilla?

$\frac{3}{5} \times \frac{1}{2} = \frac{3}{10}$

$\frac{3}{10}$ of the pupils chose vanilla.

(c) What fraction of the pupils chose strawberry and mint? Express your answer in its simplest form.

$\frac{1}{2} - \frac{3}{10} = \frac{2}{10} = \frac{1}{5}$

$\frac{1}{5}$ of the pupils chose strawberry and mint.

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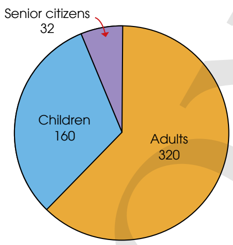
Textbook 6 P203

For Let's Learn 4, highlight to pupils to read the given information carefully. The fraction of pupils who chose vanilla was $\frac{3}{5}$ of the pupils who did not choose chocolate, i.e. of $\frac{1}{2}$, and not of the total. There is also insufficient information provided for pupils to deduce the individual values of strawberry and mint.

5. The pie chart shows the number of adults, children and senior citizens at a concert.



The table shows the prices of each ticket.

Category	Adult	Child	Senior Citizen
Price	\$34	\$25	\$30

Find the total amount collected from the sales of all the tickets.

Total amount collected = 320 × \$34 + 160 × \$25 + 32 × \$30
= \$ 10 880 + \$ 4000 + \$ 960
= \$ 15 840

A total of \$ 15 840 was collected from the sale of all the tickets.

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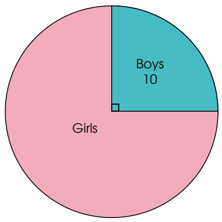
Textbook 6 P204

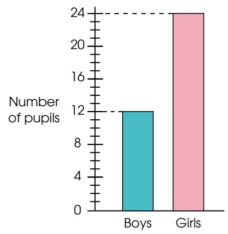
For Let's Learn 5, remind pupils to multiply the correct quantity with the corresponding price.

6. The pie chart shows the number of boys and girls in class 6A and the bar graph shows the number of boys and girls in class 6B.

Class 6A



Class 6B



(a) How many pupils are there in class 6A?

$\frac{1}{4} \rightarrow 10$

$\frac{4}{4} \rightarrow$ 4 × 10 = 40

There are 40 pupils in class 6A.

(b) Which class has more boys? How many more?

Number of boys in class 6A = 10

Number of boys in class 6B = 12

Class 6B has more boys.

12 − 10 = 2

There are 2 more boys in class 6B than in class 6A.

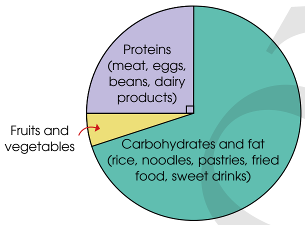
Textbook 6 P205

Let's Learn 6 requires pupils to interpret a different set of information from two charts. Allow pupils to obtain the relevant data individually and guide them if they have any misconceptions regarding the presentation of the data.

ACTIVITY TIME

Work in groups of 4.

The pie chart shows the amount of each type of food a 12-year-old boy eats every day.



1. Find out what is a healthy diet for a 12 year old boy. Write down your findings.
2. Look at the pie chart. Share what you think of the diet of the boy.

3. Write down some recommendations for the diet plan for the boy.
4. Present and explain your findings and recommendations to the class.

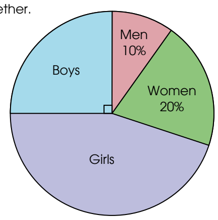
Textbook 6 P206

ACTIVITY TIME

The activity helps pupils apply their skills in interpreting a pie chart based on a real-life situation. In order to provide useful and valid recommendations, pupils may research and study information on a healthy diet obtained from the Internet.

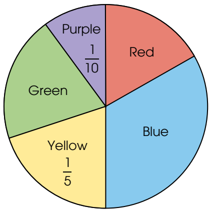
PRACTICE

1. The pie chart shows the number of people at a carnival. There are 500 people at the carnival altogether.



(a) What fraction of the people at the carnival are adults? Express your answer in its simplest form. $\frac{3}{10}$
(b) What percentage of the people at the carnival are girls? 45%
(c) How many boys are there at the carnival? 125

2. In a survey on their favourite colours, half of the pupils chose red and blue. The same number of pupils chose yellow and green, and the number of pupils who chose blue was twice the number of pupils who chose red. This information is shown in the pie chart.



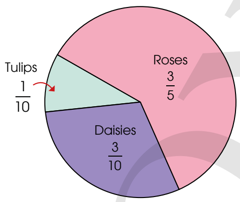
(a) What fraction of the pupils chose green and yellow? Express your answer in its simplest form. $\frac{2}{5}$
(b) 9 pupils chose purple. How many pupils chose yellow? 18
(c) What fraction of the pupils chose blue? $\frac{1}{3}$

Textbook 6 P207

PRACTICE

Allow pupils to discuss and work in pairs or groups. Then, go through the questions and solutions with the class.

3. At a florist shop, there is a total of 50 roses, daisies and tulips. The pie chart shows the fraction of each type of flowers.



The table shows the number of other types of flowers in the shop.

Types of flowers	Sunflowers	Carnations	Jasmine
Number of flowers	18	20	42

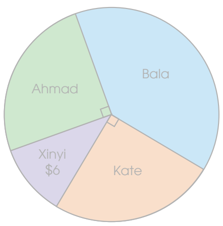
(a) How many daisies are there? 15
(b) Are there more roses or more Jasmine on display at the shop? Gerberas
(c) Which flower has the least number displayed at the shop? Tulips

Complete Workbook **6B**, Worksheet **2** • Pages **85 – 92**

MIND WORKOUT

The pie chart shows the amount of money each pupil has saved.

Xinyi and Bala saved $26 altogether.
How much did Ahmad save? $13



Textbook 6 P208

Independent seatwork

Assign pupils to complete Worksheet 2 (Workbook 6B P85 – 92).

Answers Worksheet 2 (Workbook 6B P85 – 92)

1. (a) 100% – 25% – 50% = 25%
   (b) 22 + 11 = 33
   (c) 66 × 2 = 132

2. (a) 10 + 18 = 28
   (b) 20 – 14 = 6
   (c) 14 + 18 = 32
   (d) 20 + 10 + 18 = 48

3. (a) 44 – 28 = 16
   (b) 120 – 44 – 28 = 48
   (c) 44 + 28 = 72
   $\frac{72}{120} = 60\%$
   (d) $\frac{5}{7} \times 28 = 20$

4. (a) $\frac{20}{100} \times 120 = 24$
   (b) $\frac{30}{100} \times 120 = 36$
   (c) 30% ÷ 2 = 15%
   $15\% = \frac{15}{100} = \frac{3}{20}$
   (d) 100% – 20% – 30% = 50%
   $50\% = \frac{1}{2}$

5. (a) $1 - \frac{1}{4} - \frac{1}{8} = \frac{5}{8}$
   (b) $\frac{1}{8} \times 50 = \$6.25$
   (c) $\frac{1}{4} \times 50 = \$12.50$
   (d) $\frac{1}{8} + \frac{1}{4} = \frac{3}{8}$
   $\frac{3}{8} = 37.5\%$

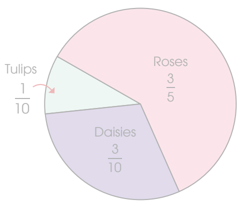
6. (a) Soft drinks
   (b) Fruit juice
   (c) $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$
   (d) 100% – 15% – 25% – 25% = 35%
   (e) 15% → 3 ℓ
   $25\% \rightarrow \frac{3}{15} \times 25 = 5\ \ell$

7. (a) Lion
   (b) $1 - \frac{4}{15} = \frac{11}{15}$
   (c) 40 ÷ 4 × 15 = 150
   (d) $54\% = \frac{54}{100} = \frac{27}{50}$
   $\frac{2}{3} \times \frac{27}{50} = \frac{18}{50} = \frac{9}{25}$

8. (a) 2 + 5 + 4 = 11
   Meiling has fewer coins.
   (b) 12 – 3 – 5 = 4
   Ahmad has more 10-cent coins.
   (c) Meiling

PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW

3. At a florist shop, there is a total of 50 roses, daisies and tulips. The pie chart shows the fraction of each type of flowers.



The table shows the number of other types of flowers in the shop.

Types of flowers	Sunflowers	Carnations	Jasmine
Number of flowers	18	20	42

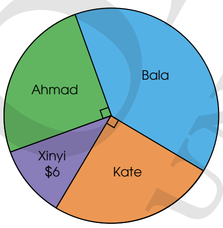
(a) How many daisies are there? 15
(b) Are there more roses or more Jasmine on display at the shop? Gerberas
(c) Which flower has the least number displayed at the shop? Tulips

Complete Workbook 6B, Worksheet 2 • Pages 85 – 92

MIND WORKOUT

The pie chart shows the amount of money each pupil has saved.

Xinyi and Bala saved $26 altogether.
How much did Ahmad save? $13



OXFORD

Textbook 6 P208

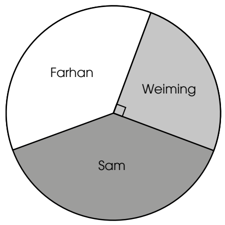
MIND WORKOUT

The Mind Workout provides as little information as possible to allow pupils to study the information and the pie chart carefully to answer the question. Guide pupils to see that the key to answering this question is to recognise that the total savings of Kate and Ahmad is equivalent to the total savings of Xinyi and Bala since

Kate's + Ahmad's savings = $\frac{1}{2}$ of the total.

Mind Workout Date: ____________

The pie chart shows the amount of money shared among three boys.



Sam received $84 and Farhan received $24 more than Weiming. What was the total sum of money shared among the three boys?

Total sum of money = ($84 + $24) × 2
= $216

The total sum of money shared among the three boys was $216.

Pie Charts 93

Workbook 6B P93

Mind Workout

Pupils are not able to obtain much information from the pie chart itself. Hint to pupils that since Farhan's share was $24 more than Weiming's, his portion of the pie chart

corresponds to $\frac{1}{4}$ + $24. If pupils can draw a dotted line

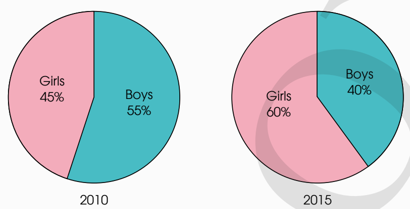
to divide Farhan's part into $\frac{1}{4}$ and an additional $24,

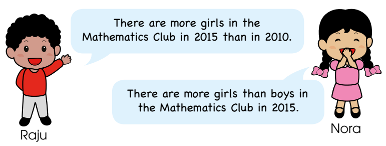
they should be able to visualise that Sam's share + $24 from Farhan forms half of the total sum of money.

MATHS JOURNAL

Look at the two pie charts shown.

Pupils in the Mathematics Club





Is each statement correct? Explain.

SELF-CHECK

I know how to...

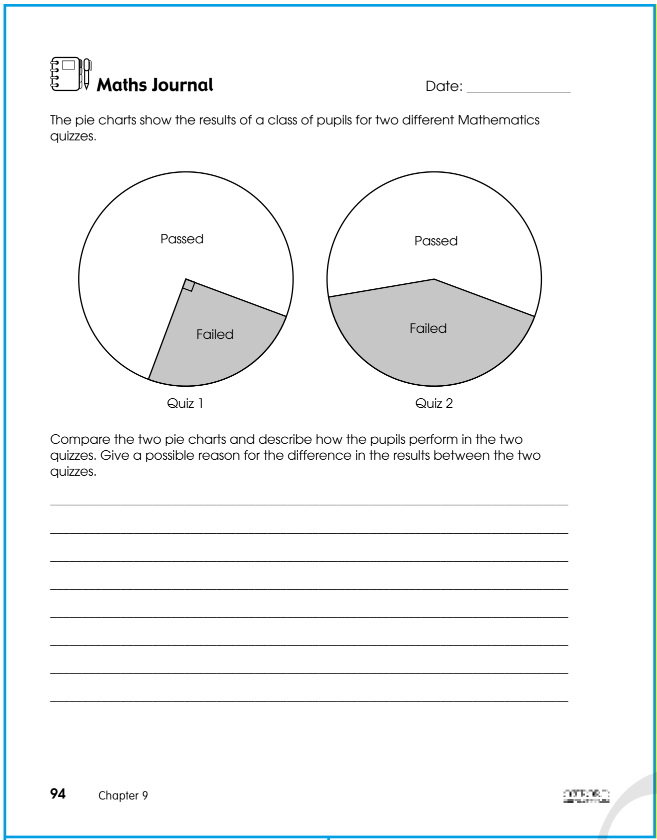
- read and interpret pie charts.
- solve problems using information from pie charts.

209 CHAPTER 9

Textbook 6 P209

MATHS JOURNAL

This Maths Journal provides the stage for exploration and discussion that the percentages or fractions represented in the pie chart do not provide much information without any amount or quantity attached to them.



Maths Journal Date: ____________

The pie charts show the results of a class of pupils for two different Mathematics quizzes.

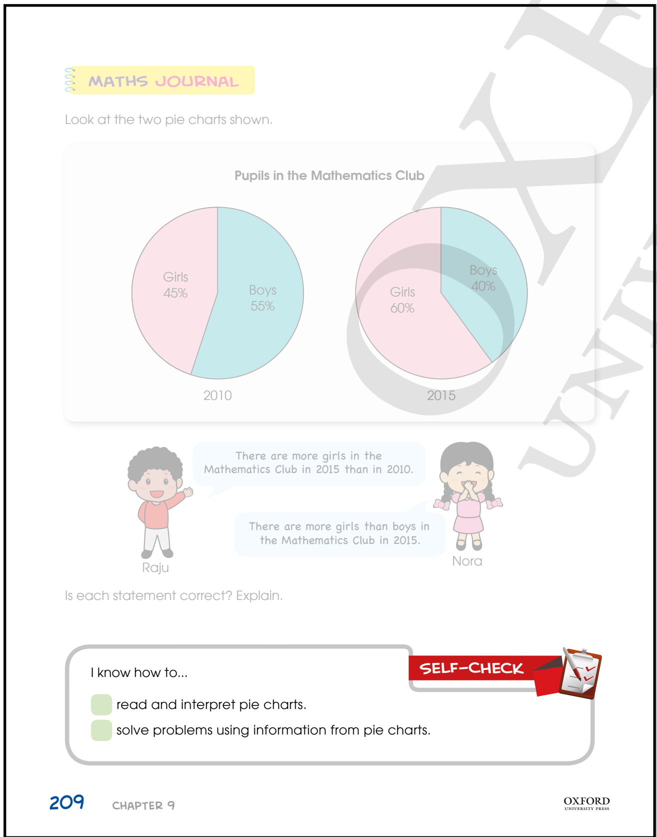
Compare the two pie charts and describe how the pupils perform in the two quizzes. Give a possible reason for the difference in the results between the two quizzes.

94 Chapter 9

Workbook 6B P94

Maths Journal

This Maths Journal gives pupils the opportunity to interpret information from pie charts based on the proportionate size of their respective parts. Pupils should be able to observe that a higher quantity of pupils failed Quiz 2 compared to Quiz 1 since the total number of pupils is the same.



MATHS JOURNAL

Look at the two pie charts shown.

Is each statement correct? Explain.

SELF-CHECK

I know how to...

- read and interpret pie charts.
- solve problems using information from pie charts.

209 CHAPTER 9 OXFORD

Textbook 6 P209

SELF-CHECK

Before pupils proceed to do the self-check, review the important concepts of the interpretation of pie charts.

The self-check can be done after pupils have completed **Review 9** (Workbook 6B P95 – 98).

1. (a) $\frac{1}{4}$

   (b) 100% – 25% – 55% = 20%

   (c) 150 × 4 = 600

   (d) 100% – 55% = 45%

   $45\% = \frac{45}{100} = \frac{9}{20}$

2. (a) December

   (b) $\frac{1}{5} \times 60 = 12$

   (c) $\frac{1}{2} \times 60 = 30$

   (d) $\frac{1}{2} - \frac{1}{5} = \frac{3}{10}$

   $\frac{3}{10} = 30\%$

3. (a) $1 - \frac{1}{4} = \frac{3}{4}$

   (b) $1 - \frac{1}{12} - \frac{1}{6} = \frac{3}{4}$

   $\frac{3}{4} = 75\%$

   (c) $1 - \frac{1}{12} - \frac{1}{6} - \frac{1}{4} - \frac{1}{3} = \frac{1}{6}$

   (d) 21 × 4 = 84

4. (a) Category D

   (b) Category E

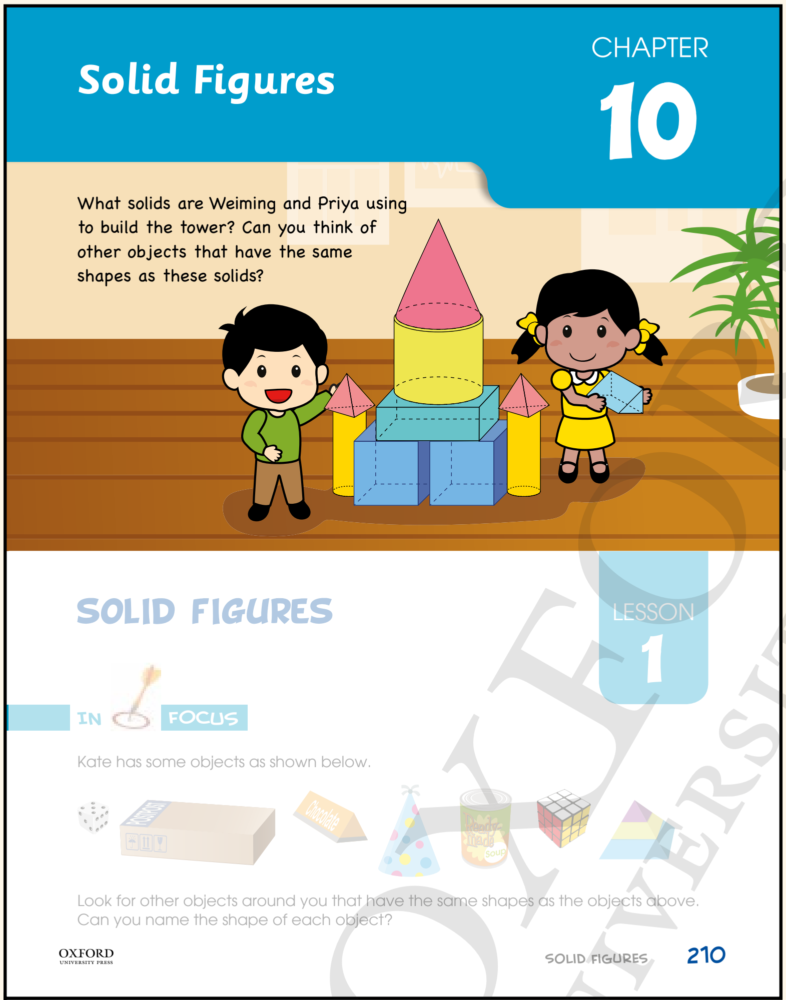
   (c) $\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$

   (d) $\frac{2}{3} \times 1800 = 1200$

SOLID FIGURES

CHAPTER

10



Textbook 6 P210

Related Resources
NSPM Textbook 6 (P210 – 229)
NSPM Workbook 6B (P99 – 118)

Materials
Paper, scissors, ruler, manipulatives

Lesson
Lesson 1 Solid Figures
Lesson 2 Nets of Solid Figures
Problem Solving, Maths Journal and Pupil Review

INTRODUCTION

This chapter gets pupils to identify solid figures, including cubes, cuboids, cones, cylinders, prisms and pyramids. Pupils will learn to describe the unique characteristics of each solid figure and to recognise their respective nets.

LESSON 1

SOLID FIGURES

LEARNING OBJECTIVE

1. Describe the characteristics of solid figures: cube, cuboid, cone, cylinder, prism and pyramid.

Solid Figures

CHAPTER 10

What solids are Weiming and Priya using to build the tower? Can you think of other objects that have the same shapes as these solids?

SOLID FIGURES

LESSON 1

IN FOCUS

Kate has some objects as shown below.

Look for other objects around you that have the same shapes as the objects above. Can you name the shape of each object?

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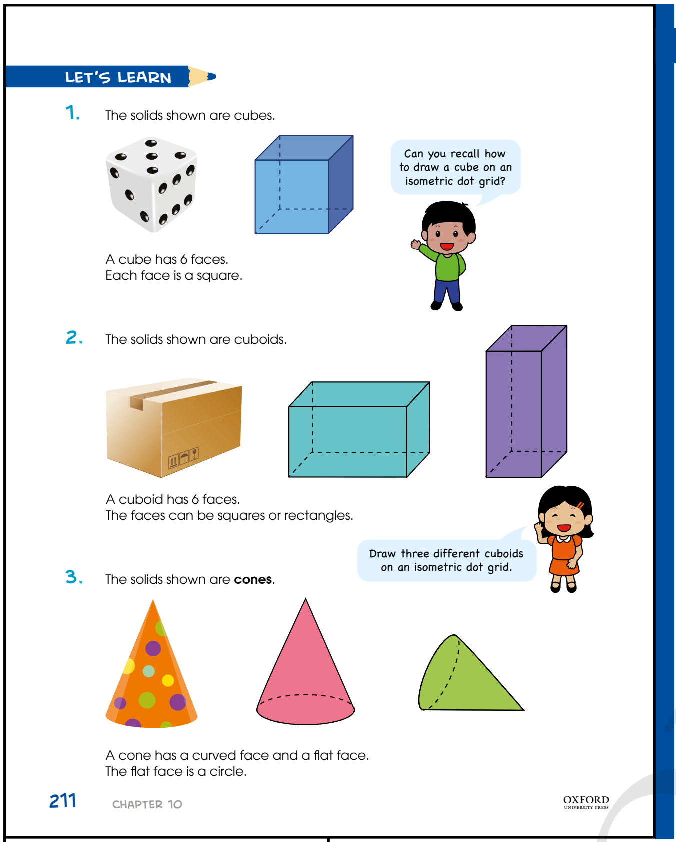
SOLID FIGURES 210

Textbook 6 P210

IN FOCUS

Get pupils to link their prior knowledge of solid figures to real-life objects around them, identifying those that share the same features. Get them to explain how they categorise these objects.


LET'S LEARN

1. The solids shown are cubes.

A cube has 6 faces.
Each face is a square.

2. The solids shown are cuboids.

A cuboid has 6 faces.
The faces can be squares or rectangles.

3. The solids shown are **cones**.

A cone has a curved face and a flat face.
The flat face is a circle.

211 CHAPTER 10 OXFORD

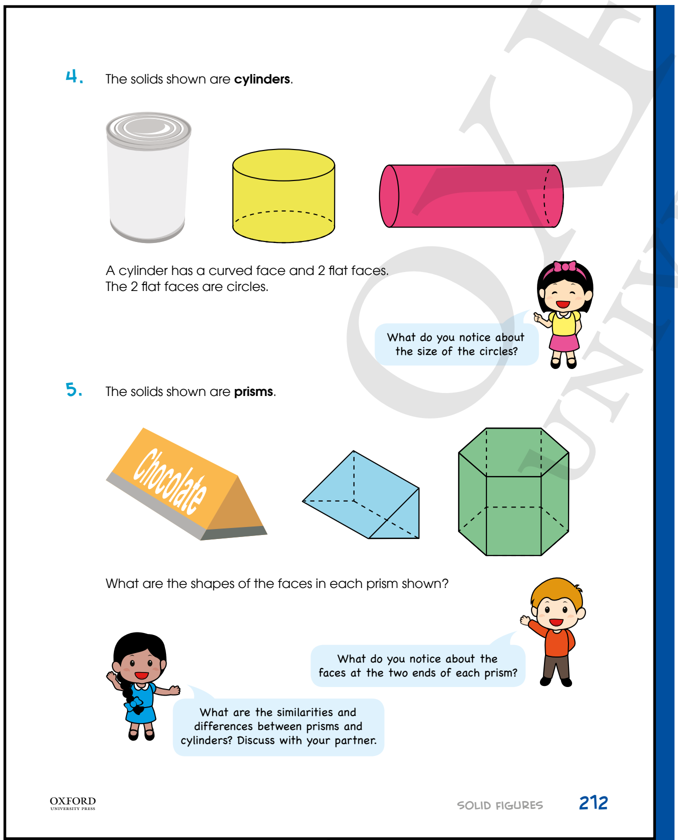
Textbook 6 P211

LET'S LEARN

In the following examples, get pupils to observe and study the various solid figures. They should learn how to describe the characteristics of each solid figure and to make comparisons between them.
For Let's Learn 1, go through with pupils that a cube has 6 square faces, i.e. the lengths of all of its sides are equal.

In Let's Learn 2, point out to pupils that a cuboid has 6 flat surfaces as well, but unlike a cube, not every length must be equal.

For Let's Learn 3, explain to pupils that a cone has a curved face with a pointed edge and a flat circular face.


4. The solids shown are **cylinders**.

A cylinder has a curved face and 2 flat faces.
The 2 flat faces are circles.

5. The solids shown are **prisms**.

What are the shapes of the faces in each prism shown?

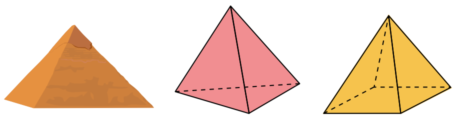
OXFORD SOLID FIGURES 212

Textbook 6 P212

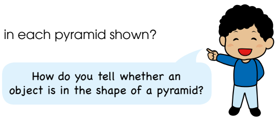
For Let's Learn 4, highlight to pupils that similar to a cone, a cylinder has a curved face. However instead of a pointed edge, a cylinder has 2 flat circular faces which are of equal sizes.

For Let's Learn 5, allow pupils to discuss in pairs the similarities between prisms and cylinders. They should see that both solid figures have two faces at the ends that are of the same size. However, a prism has sharp edges while a cylinder has circular faces.

6. The solids shown are **pyramids**.



What are the shapes of the faces in each pyramid shown?



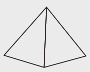
ACTIVITY TIME

Work in pairs.

What you need:

1. Look around you to find two objects that are prisms and two objects that are pyramids.
2. Draw these solids and describe each solid.

Example



This is a paperweight.
It is in the shape of a pyramid.

3. Explain to your partner how you tell that each solid is a prism or a pyramid.
4. Using the solids you have drawn, discuss the similarities and differences between prisms and pyramids.

213 CHAPTER 10 OXFORD

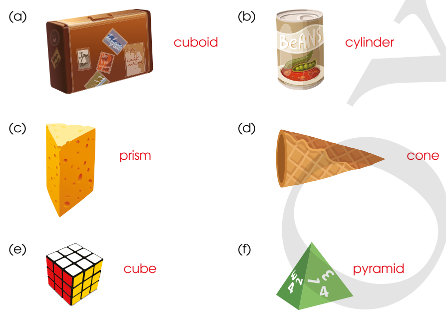
Textbook 6 P213

For Let's Learn 6, highlight to pupils that a pyramid resembles a cone, whereby it has a pointed edge and a flat face. However, the flat face is not a circle but an angular shape such as a triangle or square.

ACTIVITY TIME

In this activity, pupils will apply their knowledge and understanding of prisms and pyramids. They should be able to identify objects around them that take these shapes. They can then proceed to describe the solids as well as compare and contrast between the two.

7. On a piece of paper, draw and name the shape of each of the following objects.



ACTIVITY TIME

Work in groups of 4.

1. Search on the Internet to find different objects that are in the shape of a cube, cuboid, prism, pyramid, cylinder or cone.
2. Draw a table to list the objects that you have found.

Example

Object	Solid
eraser	cuboid

3. Take turns to pick two objects of different shapes from the list. Show your group members how you compare the solids.

OXFORD SOLID FIGURES 214

Textbook 6 P214

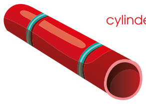
Let's Learn 7 requires pupils to visualise real-life objects. Drawing solid figures allows pupils to show a better understanding of the features of each solid figure. Provide pupils with isometric dot grids to facilitate the drawing of these shapes.

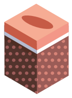
ACTIVITY TIME

Searching for real-life examples of each solid allows pupils to explore and be more aware of the shapes of objects around them. Being able to identify each shape accurately indicates that the pupils are able to recognise the characteristics of each shape.

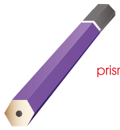
PRACTICE

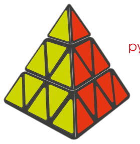
1. Name the shape of each object.

(a)  cylinder

(b)  cuboid

(c)  cone

(d)  prism

(e)  pyramid

(f) 

cuboid

(g)  prism

(h) 

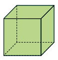
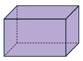
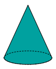
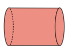
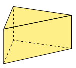
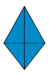
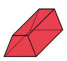
prism

Textbook 6 P215

PRACTICE

Allow pupils to work in pairs or individually on the practice questions.

2. Copy and complete the table.
(a) Name the solid figure.
(b) Find the number of faces.
(c) Name the shapes of the faces.

Solid figure	Name of solid figure	Number of faces	Shape(s) of faces
	cube	6	6 squares
	cuboid	6	2 squares, 4 rectangles
	cone	2	1 circle, 1 curved face
	cylinder	3	2 circles, 1 curved face
	prism	5	2 triangles, 3 rectangles
	pyramid	4	4 triangles
	prism	6	2 trapeziums, 4 rectangles

Complete Workbook **6B**, Worksheet **1** • Pages **99 – 104**

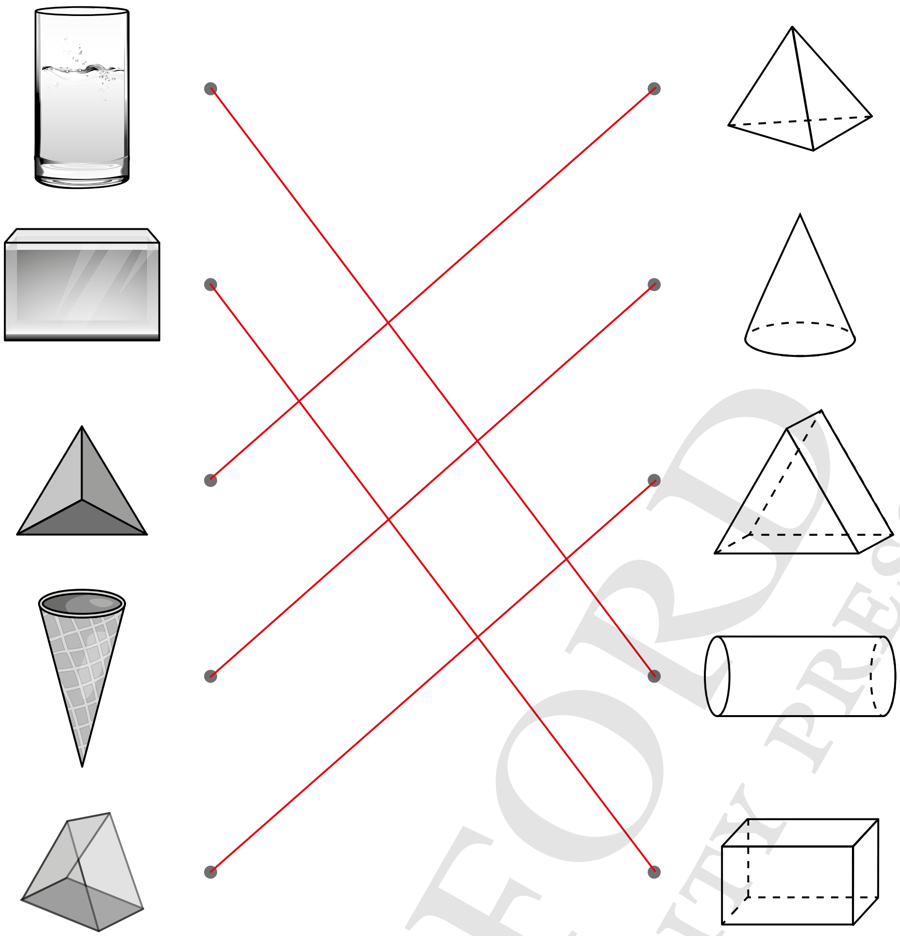
Textbook 6 P216

Independent seatwork

Assign pupils to complete Worksheet 1 (Workbook 6B P99 – 104)

Answers Worksheet 1 (Workbook 6B P99 – 104)

1.



2. (a) It is a cylinder. It has two circular faces and one curved face.
   (b) It is a prism. It has two faces that are in the shape of a trapezium and 4 rectangular faces.
   (c) It is a pyramid. It has a square base and 4 triangular faces.

3. (a) A
   (b) R
   (c) Y

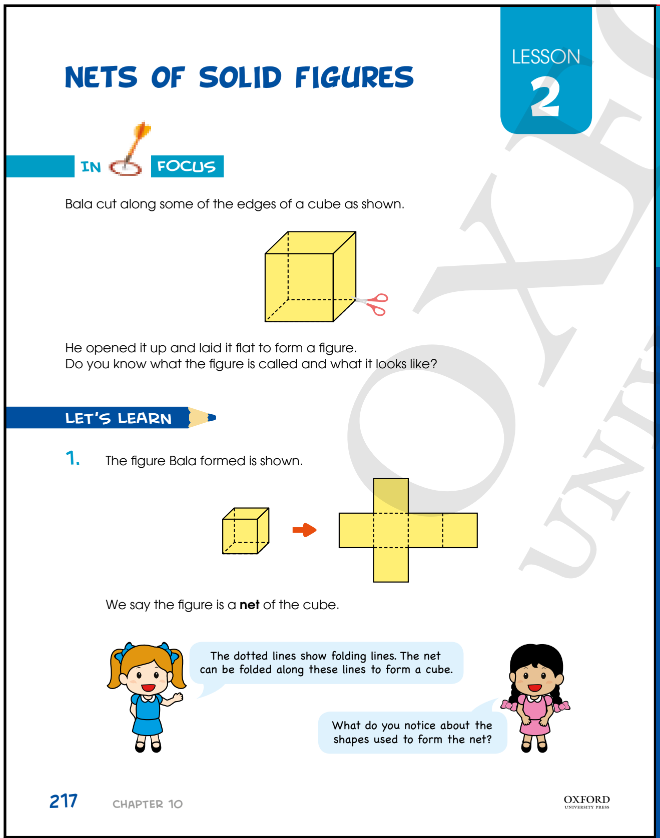
4. (a) cuboid
   (b) cylinder
   (c) pyramid
   (d) prism

LESSON 2

NETS OF SOLID FIGURES

LEARNING OBJECTIVES

1. Identify and draw 2D representations of a cube, cuboid, cone, cylinder, prism and pyramid.
2. Identify the nets of 3D solids: cube, cuboid, cone, cylinder, prism and pyramid.
3. Identify the solid which can be formed by a given net.


NETS OF SOLID FIGURES

LESSON 2

IN FOCUS

Bala cut along some of the edges of a cube as shown.

He opened it up and laid it flat to form a figure.
Do you know what the figure is called and what it looks like?

LET'S LEARN

1. The figure Bala formed is shown.

We say the figure is a **net** of the cube.

217 CHAPTER 10 OXFORD

Textbook 6 P217

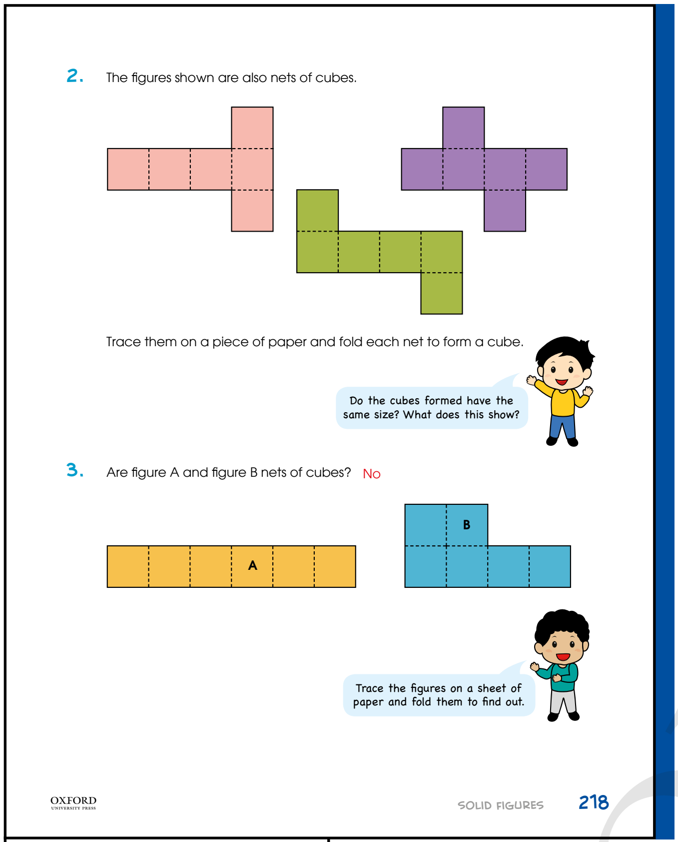
IN FOCUS

Demonstrate cutting a paper cube to enable pupils to visualise that a solid figure is made up of a formation of 2-D shapes that can be folded to form it.

LET'S LEARN

Introduce the term nets, and discuss the characteristics of a net. Ask:

- Must the sides of the squares be connected?
- Is this the only net that can form a cube when folded?



2. The figures shown are also nets of cubes.

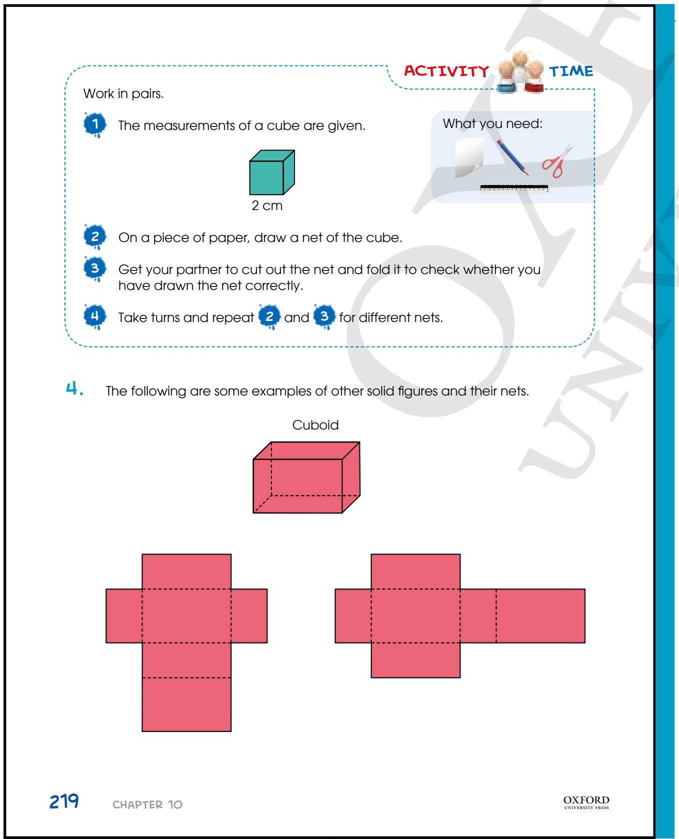
Trace them on a piece of paper and fold each net to form a cube.

3. Are figure A and figure B nets of cubes? No

Textbook 6 P218

Let's Learn 2 enables pupils to explore and recognise that the nets of a cube can take different forms. Using the nets to fold cubes will help them visualise how each net can be folded to form a cube.

In Let's Learn 3, pupils explore further to see that not all 2-D figures with 6 squares can form cubes. Cutting out the figures and folding them will help them visualise and explain why they are not nets of cubes.



ACTIVITY TIME

Work in pairs.

1. The measurements of a cube are given.

2. On a piece of paper, draw a net of the cube.
3. Get your partner to cut out the net and fold it to check whether you have drawn the net correctly.
4. Take turns and repeat 2 and 3 for different nets.

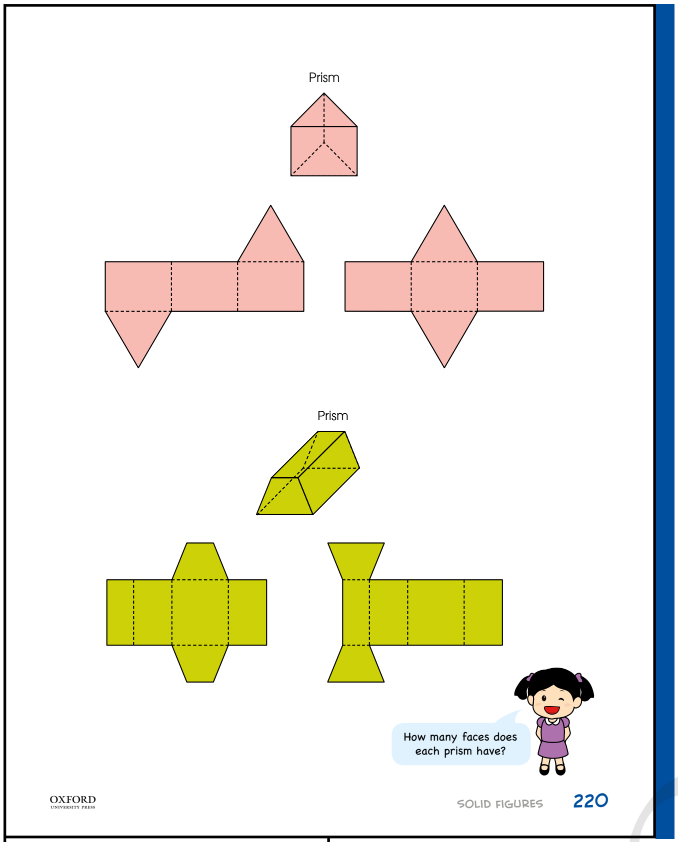
4. The following are some examples of other solid figures and their nets.

Textbook 6 P219

ACTIVITY TIME

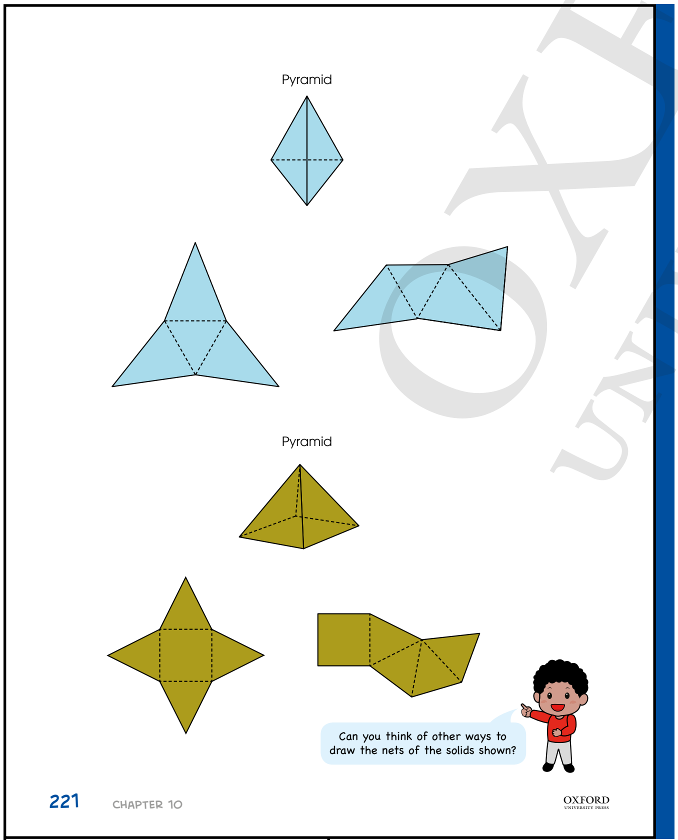
This is a hands-on activity where pupils draw a net of a cube, cut it out and fold it to form the solid. The concrete approach helps pupils to make sense of the concept of nets better and develop their ability to visualise the construction of nets of given solids. Pupils can explore different nets of a cube to recognise the fact that there are many ways to draw the net of a cube.

For Let's Learn 4, pupils are exposed to the nets of a cuboid, prism and pyramid. Pupils are to observe that there can be more than one net for each solid figure. Give them some time to draw and cut the nets out to visualise how they are folded to form the various solid figures.



Textbook 6 P220

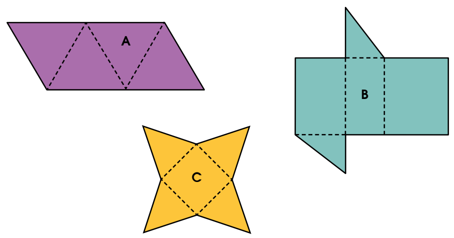
Highlight to pupils that the number of 2-D shapes a net of a solid figure has corresponds to the number of faces the solid figure has.



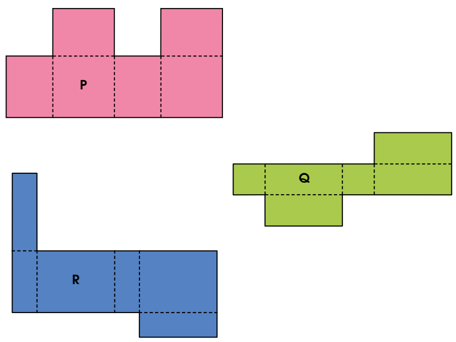
Textbook 6 P221

Get pupils to discuss and make nets of each solid which are different from what were shown in the examples.

5. Which of the following figures is a net of a prism? Explain your answer. B



6. Which of the following figures is **not** a net of a cuboid? Explain your answer. P



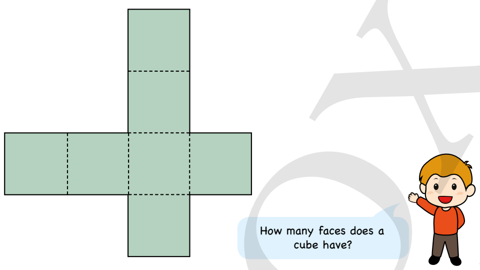
OXFORD UNIVERSITY PRESS SOLID FIGURES 222

Textbook 6 P222

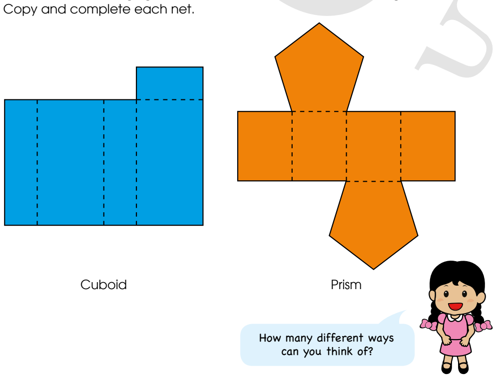
In Let's Learn 5, allow pupils to cut out the nets if they need to visualise the shapes that the nets form. They should see that A and C form pyramids while B forms a prism.

In Let's Learn 6, point out to pupils that at first glance, all the figures look like the nets of a cuboid. Get them to examine each figure closely and see that for P, when folded, one side will end up having two faces while the opposite side will not have a face.

7. A figure comprises of 7 squares. Is it a net of a cube? No



8. Each of the following figures shows a net of a solid with a missing face. Copy and complete each net.

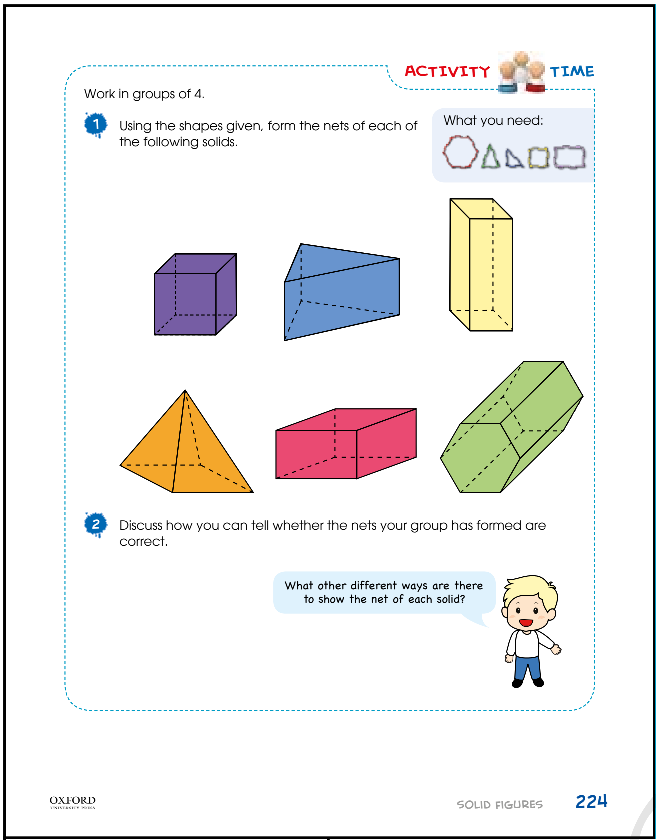


223 CHAPTER 10 OXFORD UNIVERSITY PRESS

Textbook 6 P223

For Let's Learn 7, guide pupils to recognise the total number of faces a cube has, and observe that an extra square has to be removed.

For Let's Learn 8, get pupils to discuss with their partners. They should identify the missing face of each net and explain how the net will be folded. In pairs, get them to explore all possible ways of positioning the missing face.



ACTIVITY TIME

Work in groups of 4.

1. Using the shapes given, form the nets of each of the following solids.

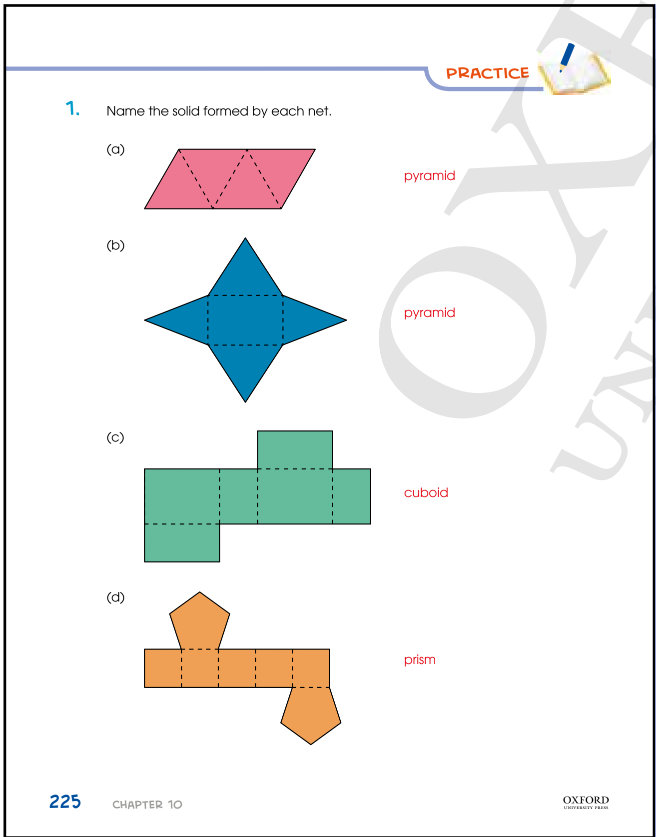
What you need:

2. Discuss how you can tell whether the nets your group has formed are correct.

Textbook 6 P224

ACTIVITY TIME

This activity is an extension of the previous one, where pupils now explore the nets of other solid figures using manipulatives.



PRACTICE

1. Name the solid formed by each net.

(a) pyramid

(b) pyramid

(c) cuboid

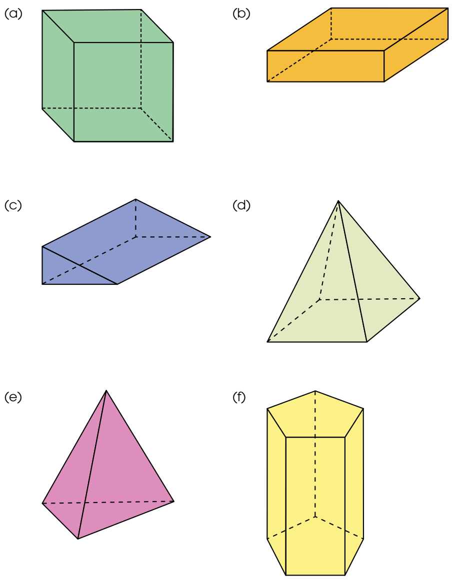
(d) prism

Textbook 6 P225

PRACTICE

Allow pupils to discuss in pairs before going through the solutions. Ensure that pupils have grasped the concept of identifying nets and their respective solid figures.

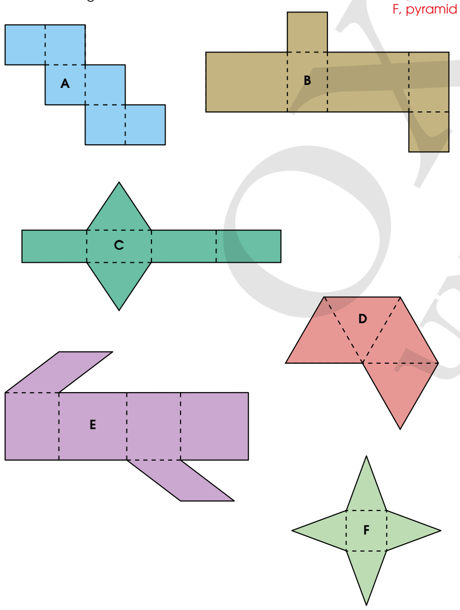
2. For each of the following solids, draw two different nets.



Textbook 6 P226

3. Which of the following nets can be folded to form solid figures? Name the solid figures formed.

A, cube
E, prism
F, pyramid



Complete Workbook **6B**, Worksheet **2** • Pages **105 – 111**

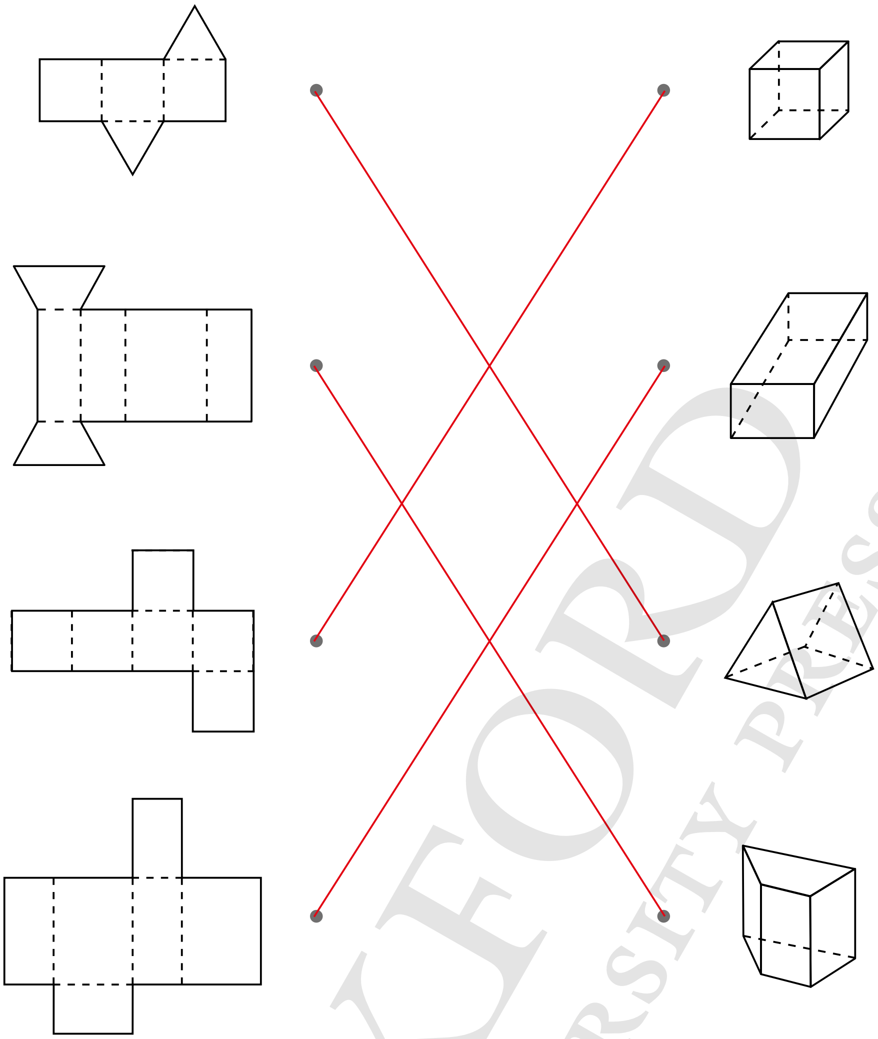
Textbook 6 P227

Independent seatwork

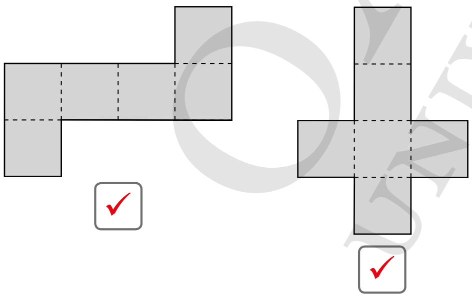
Assign pupils to complete Worksheet 2 (Workbook 6B P105 – 111).

Answers Worksheet 2 (Workbook 6B P105 – 111)

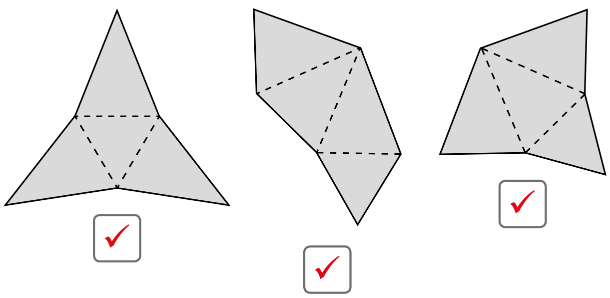
1.



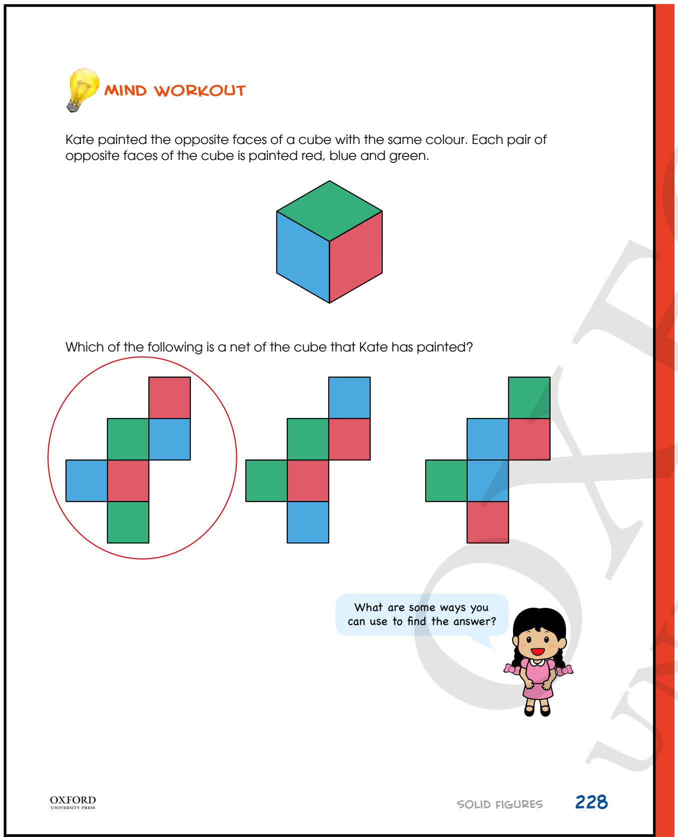
2. (a)



(b)



PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW


MIND WORKOUT

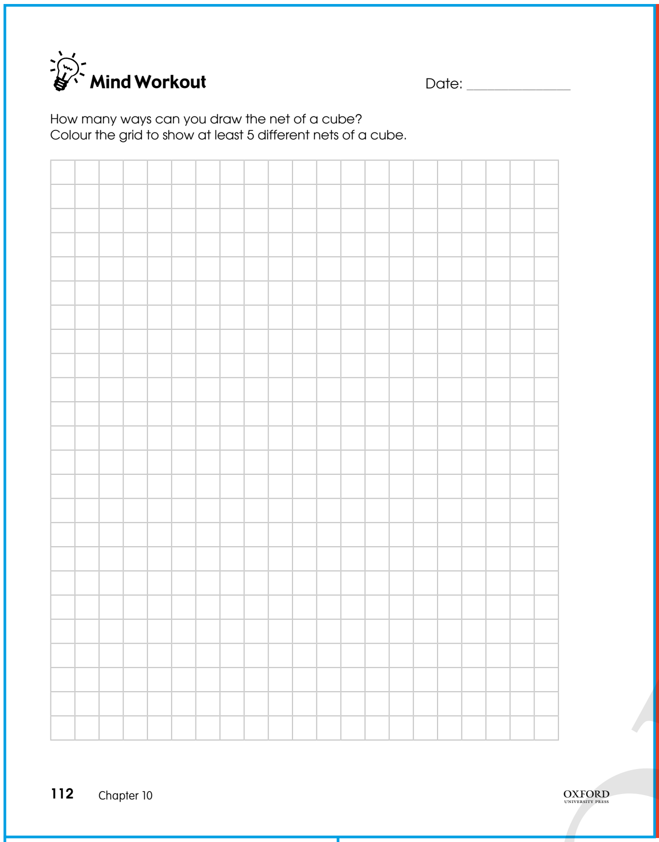
Kate painted the opposite faces of a cube with the same colour. Each pair of opposite faces of the cube is painted red, blue and green.

Which of the following is a net of the cube that Kate has painted?

Textbook 6 P228

MIND WORKOUT

The Mind Workout requires pupils to identify the position of each face of the cube with regards to its net. Pupils need to visualise which position each face will be in when the nets are folded to form the cubes. Hint to pupils that two faces with the same colour cannot be directly next to each other when the net is folded.


Mind Workout Date: ____________

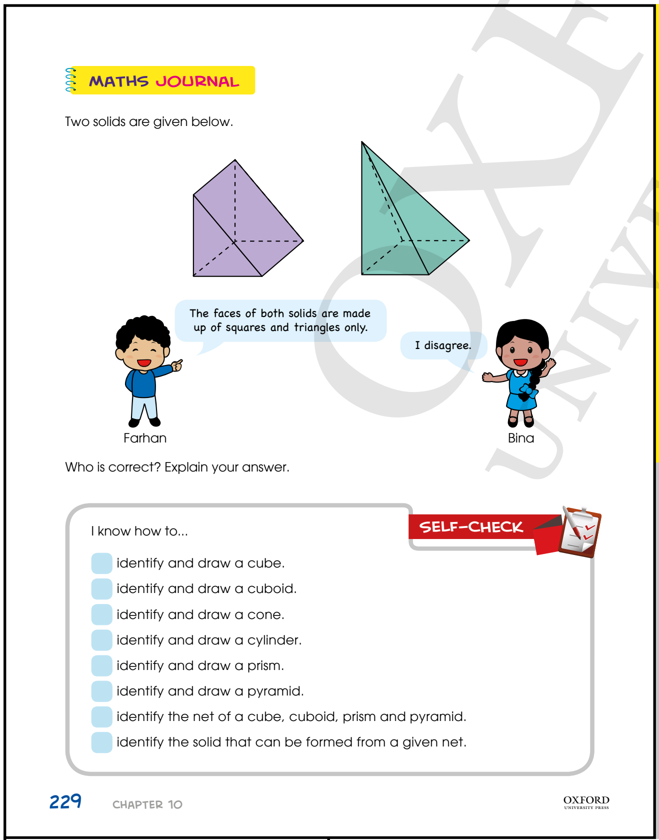
How many ways can you draw the net of a cube?
Colour the grid to show at least 5 different nets of a cube.

112 Chapter 10 OXFORD

Workbook 6B P112

Mind Workout

This Mind Workout is an extension of Let's Learn 1 and 2. Get pupils to recall that they have come across many ways to draw the nets of a cube and think of others.


MATHS JOURNAL

Two solids are given below.

Who is correct? Explain your answer.

I know how to... SELF-CHECK

- identify and draw a cube.
- identify and draw a cuboid.
- identify and draw a cone.
- identify and draw a cylinder.
- identify and draw a prism.
- identify and draw a pyramid.
- identify the net of a cube, cuboid, prism and pyramid.
- identify the solid that can be formed from a given net.

229 CHAPTER 10 OXFORD

Textbook 6 P229

MATHS JOURNAL

This Maths Journal tests pupils' understanding of the characteristics of a prism and a pyramid. Ask:

- What makes a prism a prism and a pyramid a pyramid?
- Are their faces made up of squares and triangles?
- Are there any other shapes that their faces can be made of?

Get pupils to see that based on the figures shown, the solids may have rectangular faces instead of square faces.

SELF-CHECK

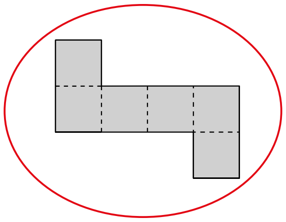
Before pupils proceed to do the self-check, review the important characteristics of each solid figure.

The self-check can be done after pupils have completed **Review 10** (Workbook 6B P113 – 118).

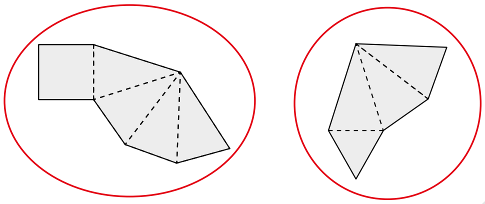
Answers Review 10 (Workbook 6B P113 – 118)

1. (a) cuboid
   (b) pyramid
   (c) cone
   (d) cube
   (e) prism
   (f) cylinder

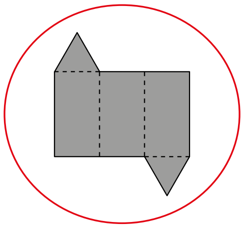
2. (a)



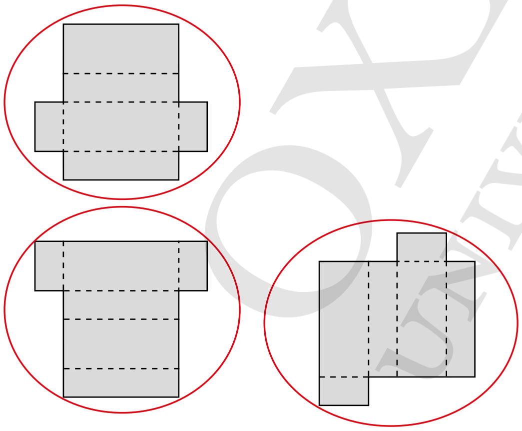
(b)



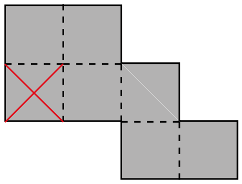
(c)



(d)

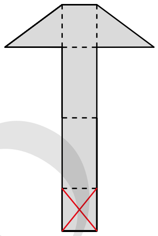


3. (a)



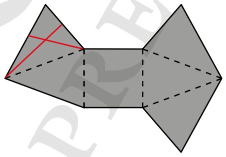
cube

(b)



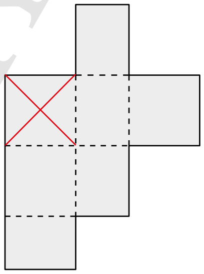
prism

(c)



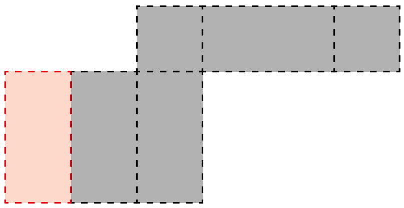
pyramid

(d)

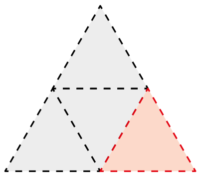


cuboid

4. (a)



(b)



Answers Revision 2 (Workbook 6B P119 – 144)

Section A

1. 2

2. 2

3. 3

4. 1

5. 3

6. 2

7. 4

8. 4

9. 2

10. 3

11. 3

12. 2

13. 2

14. 1

15. 3

Section B

16. 1, 2, 4

17. 752

18. 0.43

19. 9

20. (6 + 5x)

21. RS, QP

22. 16

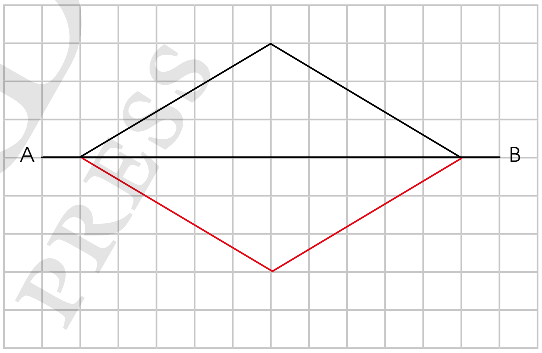
23. $\frac{1}{4}$

24. $\frac{2}{3}$

25. 75

26. Father's age = 4m years old
Mother's age = (4m – 3) years old
Bina's mother will be (4m + 7) years old in 10 years' time.

27. (a)



(b) rhombus

28. \$12 – \$4 = \$8
\$8 ÷ \$3 = $2\frac{2}{3}$
Maximum amount of time = 1 + 2
= 3 hr

29. $\frac{2}{3} \times \frac{1}{2} \times 12 \times 9 = 36\ \text{cm}^2$

30. Volume of water = 20 × 20 × 20
= 8000 cm^3
Capacity of tank = 8000 × 5
= 40 000 cm^3

Section C

1. A and D

2. 75% → \$60
100% → $\frac{60}{75} \times 100$ = \$80

3. Average increase = $\frac{9-2}{3}$
= $2\frac{1}{3}$ cm

4. 17 units = 204
1 unit = 204 ÷ 17
= 12

4 units = 12 × 4
= 48

9 units = 12 × 9
= 108

108 – 48 = 60

There are 60 more apples than oranges.

5. $(10 \times 10) - \left(\frac{1}{3} \times 3.14 \times 10 \times 10\right) = 21.5 \text{ cm}^2$

$\left(\frac{1}{2} \times 10 \times 10\right) + 21.5 = 71.5 \text{ cm}^2$

6. 72 ÷ 4 = 18
18 = 3 × 6
The breadth of each small rectangle is 3 cm.

7. 810 ÷ 81 = 10
81 = 9 × 9
10 × 9 = 90
The area of the shaded face is 90 cm^2.

8. (a) ∠ABD = 110° – 90°
= 20°

∠ADB = 180° – 90° – 20°
= 70°

(b) ∠ABC = (180° – 90°) ÷ 2
= 45°

∠DBG = 45° – 20°
= 25°

∠CGE = ∠BGD
= 180° – 90° – 25°
= 65°

9. Length of rectangle = 30 ÷ 3 × 5
= 50 cm

Area of unshaded part = $\frac{1}{2} \times 30 \times (50 - 15)$
= 525 cm^2

Area of shaded parts = 50 × 30 – 525
= 975 cm^2

10. Cost of a notebook after discount
= $\frac{90}{100}$ × \$2
= \$1.80

Amount paid for notebooks on Monday
= \$2 × 15
= \$30

Amount paid for notebooks on Tuesday
= \$102 – \$30
= \$72

Number of notebooks bought on Tuesday
= \$72 ÷ \$1.80
= 40

She bought 40 notebooks on Tuesday.

11. Cost of 10 magnets = \$0.45 × 10
= \$4.50

Since one magnet is given free with every 10 magnets bought, he can get 11 magnets for \$4.50.

Cost of 33 magnets = \$4.50 × 3
= \$13.50

Cost of 7 magnets = \$0.45 × 7
= \$3.15

Amount of money needed = \$13.50 + \$3.15
= \$16.65

He needs \$16.65.

12. (a) Mass of 2 blue marbles and 3 red marbles
= 532 – 392
= 140 g

Mass of box = 392 – (2 × 140)
= 112 g

The mass of the empty box is 112 g.

(b) 392 – 112 = 280 g

280 ÷ 10 = 28 g

The average mass of each marble is 28 g.

13. Time taken by Priya = 10 min
Distance from school to library = 200 × 10
= 2000 m

When Priya was at the midpoint after 5 min, Weiming had travelled 1250 m.

Weiming's speed = 1250 ÷ 5
= 250 m/min

Weiming's speed for the whole journey was 250 m/min.

14. (a) Capacity of tank = 50 × 40 × 45

= 90 000 cm^3

= 90 ℓ

Amount of water in tank after first 4 minutes
= 3.5 × 4
= 14 ℓ

Length of time Tap B was turned on
= (90 – 14) ÷ (3.5 + 4.5)
= 76 ÷ 8
= 9.5 min

Tap B was turned on for 9.5 min.

(b) Total length of time that Tap A was turned on
= 4 + 9.5
= 13.5 min

Amount of water that flowed from Tap A
= 3.5 × 13.5
= 47.25 ℓ

The total amount of water that flowed from Tap A was 47.25 ℓ.

15. (a) Area of shaded part

$= \left(\frac{1}{2} \times 3.14 \times 5 \times 5\right) - \left(\frac{1}{2} \times 3.14 \times 2.5 \times 2.5\right)$

= 39.25 – 9.8125

= 29.4375 cm^2

(b) Perimeter of the shaded part

$= \left(\frac{1}{2} \times 3.14 \times 10\right) + \left(\frac{1}{2} \times 3.14 \times 5\right) + 5$

= 15.7 + 7.85 + 5

= 28.55 cm

16. Number of butter cookies : Number of chocolate cookies

3	:	4
12	:	16

Number of cookies sold $= \frac{1}{4} \times 12 + \frac{1}{4} \times 16$

= 7 units

Number of cookies sold = 269 – 213

= 56

7 units = 56

1 unit = 56 ÷ 7

= 8

28 units = 8 × 28

= 224

Number of almond cookies = 269 – 224

= 45

There were 45 almond cookies.

17. Amount at first : Amount in the end

3	:	1
15	:	5

Amount remaining after spending $= \frac{1}{4} \times \frac{4}{5} \times 15$

= 3 units

Difference = 5 – 3

= 2 units

2 units = $4

15 units = $4 ÷ 2 × 15

= $30

Ahmad had $30 at first.

18. 9 × 4 = 36

36 – 19 = 17

She had 17 packets of 5 sweets each.

17 × 5 + 19 = 85 + 19

= 104

Xinyi packed 104 sweets altogether in the end.

Answers Review A (Textbook 6 P230 – 234)

1. 90 000
2. Six million, eight hundred and seven thousand, nine hundred and forty-three
3. 3.5, $3\frac{1}{5}$, 3.05
4. 30.75
5. 7924
6. 19
7. 4
8. 3795
9. 7
10. 24
11. 28 January
12. 63, 81
13. $1\frac{7}{12}$ hr
14. $2\frac{5}{6}$
15. $5\frac{1}{20}$
16. $\frac{1}{8}$
17. 24.0
18. $0.16
19. 16
20. 43
21. 6
22. 44
23. 11
24. 32
25. 30
26. 228
27. 819
28. $312
29. $42
30. 26
31. 175
32. 244
33. 672
34. $1.20
35. 13
36. 5
37. 243
38. (a) $418
    (b) 160
39. 9
40. $90

Review B (Textbook 6 P235 – 241)

1. 210 ml
2. 2.81 m
3. 2.6 cm

4. 3 kg 200 g

5. 6.30 a.m.

6. (a) 8 cm
   (b) 127°

7. 36 cm

8. 38 m^2

9. 66 cm^2

10. 1000 cm^3

11. 94 cm

12. 102 cm

13. $11.40

14. 175 000

15. 180 min

16. 512 cm^3

17. 217.75 cm^2

18. 16 min

19. 180 cm

20. 800 cm^2

21. 105 cm^2

22. 17 408 cm^3

23. 557 cm^2

24. 324 cm^2

25. 120 cm^3

Review C (Textbook 6 P242 – 249)

1. $4

2. 26 kg

3. 15

4. 378

5. 24

6. 81

7. 40%

8. 2013 and 2014

9. 88

10. 36

11. 22 cm

12. 15%

13. 35%

14. $500

15. 2

16. 8

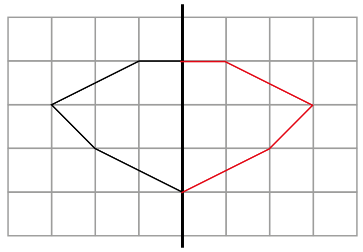
17. (a) 25 ℓ
    (b) $\frac{2}{5}$
    (c) 9 min

18. 36

Review D (Textbook 6 P250 – 259)

1. Petrol station

2.



3. 3

4. Yes

5. S

6. D

7. EF and GH

8. 8 o'clock

9. 60°

10. 59°

11. 72°

12. 180°

13. 150°

14. 121°

15. 84°

16. 83°

17. 118°

18. 82°

19. 227°

20. 18°

21. (a) 75°
(b) 30°

22. (a) 52°
(b) 76°

23. (a) 29°
(b) 151°

24. 138°

25. 84°

Review E (Textbook 6 P260 – 261)

1. 160%

2. $875

3. 60%

4. 108 cm

5. $45.60

6. 7 : 17

7. $19.50

8. 2 : 3

9. 120%

10. 19 : 26

11. 375

12. 132

13. 144

14. 1575

15. (a) $229.20
(b) 50%

16. 70

Review F (Textbook 6 P262)

1. 9 km/hr

2. 495 km

3. 6 m/s

4. 16 min

5. 16 km/hr

6. 150 m/min

7. 45 s

8. (a) 8 a.m.
   (b) 8 hr

Review G (Textbook 6 P263 – 264)

1. $\$5a$

2. 7

3. $4c + 5$

4. $10d – 2$

5. $30f – 5$

6. 148 cm

7. $\dfrac{750 - k}{20}$

8. (a) $(2p + 39)$ cm
   (b) 51 cm

9. 413

10. (a) $\left(\dfrac{12y + 18}{4}\right)$ cm
    (b) 812.25 cm^2

NAVIGATING THROUGH THE ASSESSMENT EXERCISES AND ACTIVITIES

For teachers to assess pupils' achievement of the learning objectives, the Teacher's Resource Book provides direction for teachers on how to use the following assessment and exercises. Summarising the evaluative aspect of this series, the following exercises can be utilised optimally.

TEXTBOOK

CHAPTER OPENER

Chapter Opener consists of familiar events or occurrences that serve as an introduction of the topic to pupils.

IN FOCUS

Questions related to the lesson objectives are asked as an introductory activity for pupils. The activity allows pupils to explore different ways to solve the problem.

LET'S LEARN

Main concepts are introduced in Let's Learn. The consolidation and formalising of concepts are achieved. The exercises can be used by teachers to test their pupils' prior knowledge. Teachers can provide valuable assessment-based feedback to pupils. Having pupils attempt these exercises will help teachers identify the focus of each lesson and the adjustments they need to make to their teaching in order to help pupils meet the intended learning outcomes.

ACTIVITY TIME

Most of the activities in the book are to be carried out in pairs or groups. Pupils explore mathematical concepts in a fun way through games. Observing pupils' approach and dexterity while doing the activity will give a clear indication to teachers on how the lesson should be conducted.

PRACTICE

The questions in Practice enable teachers to gauge if pupils have grasped the concepts. Practice can be done as an independent exercise in class or as homework.

Through the questions, teachers get to understand what their pupils have learned. They will be able to find the answers to the following questions:

(i) Are there any common gaps in my pupils' knowledge of the topic which I need to revisit?
(ii) In which aspects of my pupils' learning of the topic did they achieve mastery?
(iii) What are the strengths and weaknesses in my planning for teaching?

MIND WORKOUT

Pupils' critical and problem-solving skills are enhanced when working on the Mind Workout. Teachers can use the exercises to challenge advanced learners. It is advisable to use the exercise as an independent assignment for pupils.

MATHS JOURNAL

Maths Journal enhances pupils' skills such as mathematical communication, reasoning, organisation and tabulation of data. The exercises can be done in a group or individually in class or at home.

SELF-CHECK

Key concepts required in the syllabus that must be learnt are highlighted in Self-Check. It would be beneficial for pupils when teachers revise the key concepts in class as this allows pupils to assess their own learning at the end of each chapter and facilitates their revision in preparation for the examination.

WORKBOOK

Worksheets
Well-structured questions covering all the concepts taught in each lesson, are found in each worksheet. A suggested approach would be to have pupils do alternate questions from each worksheet or do the questions that will build their foundation of the concepts. The skipped questions can be revisited during revision before the examination. The worksheets in the workbooks can be done as a complimentary practice exercise to augment the concepts learnt.

Maths Journal
Maths Journal tests pupils' understanding of the mathematical concepts learnt in the chapter and further enhances their learning of the concepts.

Mind Workout
Mind Workout consists of higher-order thinking tasks which enable pupils to apply relevant heuristics and extend the concepts and skills learnt.

Revision
Revision exercises at the end of a set of chapters consist of questions that enable pupils to apply all the concepts and skills taught. The exercises can be done before an examination or a test. They serve as good revision exercises for pupils to do in class or as homework with guidance from their parents when necessary. They also enable teachers to evaluate the pupils' understanding of the concepts across strands and topics and can be used as an effective preparatory exercise for examinations.

Review
The Review Exercise consists of questions that requires the application of a consolidation of concepts learnt in the chapter. The exercises can be done as a group assignment for teachers to gauge the pupils' ability to grasp the consolidated concepts learnt in the chapter. Group assignments help pupils to learn together as they gather feedback from one another. Teachers can also get pupils to submit their completed exercises and mark them as a form of informal assessment.

Mid-Year and **End-of-Year Revisions**
These are assessment exercises with multiple choice questions, short-answer questions and word problems. Teachers can use the revision exercises as mock examinations to help pupils prepare for the examinations. Feedback provided to pupils will be extremely beneficial as they will be aware of the areas that they are weak in and work on them. The revision exercises test pupils' ability to recall the concepts taught and apply them. They also allow teachers to analyse the effectiveness of their spiral approach of teaching concepts. Teaching concepts by revisiting, re-linking to other concepts and creating a mind map help pupils do their examinations in a more effective way. A good evaluative assessment should not consist of questions that encourage rote learning, but should consist of questions that encourage learning by the spiral approach.

Examination papers should not be considered by teachers as the only means of evaluation. Informal evaluation involves classroom discussions, participation, exchange of ideas, multiple strategies, activities, group assignments, presentations and above all, mind-mapping, before they embark on independent work. It is essential for the pupils to receive feedback on their work which provides an important opportunity for reflection on what they have learnt. Similarly, teachers should be able to diagnose the progress and achievement of the pupils and decide on the future course of action, which is where the assessment activities and exercises come in.

Notes