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### CHAPTER 1
**Algebra**

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<tr>
<td>1</td>
<td>6</td>
<td><strong>Simplifying and Evaluating Algebraic Expressions</strong>&lt;br&gt;• Solve problems involving the simplification and evaluation of algebraic expressions.</td>
<td>• Use concrete objects (e.g. cubes) or draw diagrams to model simple algebraic expressions.</td>
<td>Textbook 6 P1 – 6</td>
<td>Worksheet 1, Workbook 6A P1 – 6</td>
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<td>2</td>
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<td><strong>Solving Word Problems</strong>&lt;br&gt;• Solve word problems involving unknown quantities expressed in algebraic terms.</td>
<td>• Form and solve simple linear equations in word problems and make explicit link with model drawing.</td>
<td>Textbook 6 P7 – 15</td>
<td>Worksheet 2, Workbook 6A P7 – 14</td>
<td>Textbook 6 P13</td>
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Angles in Geometric Figures

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<th>Concrete Materials</th>
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<tr>
<td>1</td>
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<td>Finding Unknown Angles • Find unknown angles in geometric figures.</td>
<td>• Use the properties of triangles and special quadrilaterals to find unknown angles and explain how they obtain the answers.</td>
<td>Textbook 6 P16 – 32</td>
<td>Worksheet 1 Workbook 6A P22 – 30</td>
<td>Textbook 6 P28</td>
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Estimated number of periods: 12
## CHAPTER 3
Fractions

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</table>
| 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 | – | – | – | – |
## CHAPTER 4
### Ratio

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<th>Pupil-centred Activities</th>
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| 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**  
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  Workbook 6A P88 – 97 | Textbook 6 P91 – 92  
  Workbook 6A P87 | Recipes |
### CHAPTER 5

#### Percentage

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| 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 | – | – |
Workbook 6A P115 | – |
## CHAPTER 6

**Circles**

Estimated number of periods: 30

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<th>Workbook Practice</th>
<th>Pupil-centred Activities</th>
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| 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  
\[
\pi = \frac{\text{circumference}}{\text{diameter}}
\]
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 circles, scissors, strings, rulers, coins, paper plates, markers |
<table>
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<th>Lesson Number</th>
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<th>Learning Objectives</th>
<th>Learning Experiences</th>
<th>Textbook</th>
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<td>Parts of a Circle</td>
<td>• 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 $\pi \approx \frac{22}{7}$.</td>
<td>Textbook 6 P118 – 129 Worksheet 1 Workbook 6B P1 – 8</td>
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<td>2</td>
<td>12</td>
<td>Area of a Circle</td>
<td>• 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 $3r^2$</td>
<td>Textbook 6 P130 – 137 Worksheet 2 Workbook 6B P9 – 14</td>
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<td>3</td>
<td>6</td>
<td>Area and Perimeter of Composite Figures</td>
<td>• Find the area and perimeter of figures made up of a variety of squares, rectangles, triangles, semicircles and quarter circles</td>
<td>Textbook 6 P138 – 144 Worksheet 3 Workbook 6B P15 – 19</td>
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1-cm square grid paper, paper cut-outs of circles, semicircles and quarter circles, scissors, glue
## CHAPTER 7
### Speed

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<th>Workbook Practice</th>
<th>Pupil-centred Activities</th>
<th>Concrete Materials</th>
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</table>
| 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  
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<th>Learning Experiences</th>
<th>Textbook</th>
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<td>Speed, Distance and Time</td>
<td>• 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.</td>
<td>Textbook 6 P145 – 152 Workbook 6B P31 – 34</td>
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<td>3.10</td>
<td>Solving Word Problems</td>
<td>• 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.</td>
<td>Textbook 6 P157 – 165 Workbook 6B P35 – 38</td>
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<td>2.2</td>
<td>Problem Solving, Maths Journal and Pupil Review</td>
<td>• Find average speed by dividing total distance by total time.</td>
<td>Textbook 6 P164 – 165 Workbook 6B P44</td>
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<td>Average Speed</td>
<td>• Define average speed.</td>
<td>Worksheet 2 Workbook 6B P35 – 38</td>
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<td>3</td>
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<td>• Find average speed by dividing total distance by total time.</td>
<td>Worksheet 3 Workbook 6B P39 – 43</td>
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<td>4</td>
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<td>• Solve up to 3-step word problems involving speed and average speed.</td>
<td>Review 7 Workbook 6B P45 – 50</td>
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**Notes:**
- Lesson 1 to 4: These lessons are part of the Scheme of Work. Each lesson is supported by specific textbooks and workbooks.
- Lesson 5 to 10: These lessons focus on specific learning objectives related to speed, distance, and time. They include activities such as defining speed, relating distance, time, and speed, and solving word problems.
- Lesson 11 to 14: These lessons are intended to reinforce the concepts learned in the previous lessons, with a focus on problem-solving and journaling.
## CHAPTER 8
Volume of Cubes and Cuboids

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Number of Periods</th>
<th>Learning Objectives</th>
<th>Learning Experiences</th>
<th>Textbook Learning</th>
<th>Workbook Practice</th>
<th>Pupil-centred Activities</th>
<th>Concrete Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td><strong>Volume of Cubes and Cuboids</strong></td>
<td>- 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.</td>
<td>Textbook 6 P166 – 179</td>
<td>Worksheet 1 Workbook 6B P51 – 58</td>
<td>Textbook 6 P177</td>
<td>1-cm cubes</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td><strong>Solving Word Problems</strong></td>
<td>- Solve word problems involving volume of a cube/cuboid.</td>
<td>-</td>
<td>Textbook 6 P180 – 192</td>
<td>Worksheet 2 Workbook 6B P59 – 69</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td><strong>Problem Solving, Maths Journal and Pupil Review</strong></td>
<td>-</td>
<td>-</td>
<td>Review 8 Workbook 6B P71 – 80</td>
<td>Textbook 6 P191 – 192 Workbook 6B P70</td>
<td>-</td>
</tr>
<tr>
<td>Lesson</td>
<td>Number of Periods</td>
<td>Learning Objectives</td>
<td>Learning Experiences</td>
<td>Textbook Learning</td>
<td>Workbook Practice</td>
<td>Pupil-centred Activities</td>
<td>Concrete Materials</td>
</tr>
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<td>--------</td>
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<td>----------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
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<td>--------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>Reading Pie Charts</td>
<td>• 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</td>
<td>Textbook 6 P193 – 199</td>
<td>Worksheet 1 6B P81 – 84</td>
<td>Textbook 6 P198</td>
<td>Software to construct pie chart</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Problem Solving, Maths Journal and Pupil Review</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

**Estimated number of periods: 12**

**CHAPTER 9**

**Pie Charts**
## CHAPTER 10
### Solid Figures

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Number of Periods</th>
<th>Learning Objectives</th>
<th>Learning Experiences</th>
<th>Textbook Learning</th>
<th>Workbook Practice</th>
<th>Pupil-centred Activities</th>
<th>Concrete Materials</th>
</tr>
</thead>
</table>
| 1      | 4                 | **Solid Figures**   | • 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** | • 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.  
|        | 2                 | **Problem Solving, Maths Journal and Pupil Review** | – | – | – | – | – |
### Chapter 10

Estimated number of periods: 12

<table>
<thead>
<tr>
<th>Lesson of Learning</th>
<th>Practice</th>
<th>Materials</th>
<th>Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solid Figures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Look for examples of</td>
<td>Worksheet 1</td>
<td>Textbook 6</td>
<td></td>
</tr>
<tr>
<td>• Describe the</td>
<td>Workbook 6B</td>
<td>P210 – 216</td>
<td></td>
</tr>
<tr>
<td>characteristics of solid</td>
<td>P213 – 214</td>
<td>Workbook 6B</td>
<td></td>
</tr>
<tr>
<td>figures: cube, cuboid,</td>
<td></td>
<td>P99 – 104</td>
<td></td>
</tr>
<tr>
<td>cone, cylinder, prism and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pyramid.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>• Draw 3D objects that are</td>
<td></td>
<td></td>
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<tr>
<td>in the shape of prisms or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pyramids.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nets of Solid Figures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Visualise and draw the</td>
<td>Textbook 6</td>
<td>Worksheet 2</td>
<td></td>
</tr>
<tr>
<td>• Identify and draw 2D</td>
<td>Workbook 6B</td>
<td>P217 – 229</td>
<td></td>
</tr>
<tr>
<td>net of a cube, and justify</td>
<td>P219, 224</td>
<td>Workbook 6B</td>
<td></td>
</tr>
<tr>
<td>that it is a net of the</td>
<td></td>
<td>P105 – 111</td>
<td></td>
</tr>
<tr>
<td>cube.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Work in groups to make</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nets of 3D shapes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Identify the nets of 3D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cube.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Identify the solid which can</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>be formed by a given net.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Problem Solving, Maths</strong></td>
<td></td>
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<td>– –</td>
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<td>– –</td>
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</tr>
</tbody>
</table>

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**SYLLABUS MATCHING GRID**

**CAMBRIDGE PRIMARY MATHEMATICS STAGE 6**

<table>
<thead>
<tr>
<th>Learning Objective</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Number</strong></td>
<td></td>
</tr>
<tr>
<td>Numbers and the number system</td>
<td></td>
</tr>
<tr>
<td>Know what each digit represents in whole numbers up to a million.</td>
<td>Chapter 1</td>
</tr>
<tr>
<td>Know what each digit represents in one- and two-place decimal numbers.</td>
<td>Book 4 Chapter 8</td>
</tr>
<tr>
<td>Multiply and divide any whole number from 1 to 10 000 by 10, 100 or 1000 and explain the effect.</td>
<td>Book 5 Chapter 2</td>
</tr>
<tr>
<td>Multiply and divide decimals by 10 or 100 (answers up to two decimal places for division).</td>
<td>Book 5 Chapter 8</td>
</tr>
<tr>
<td>Find factors of two-digit numbers.</td>
<td>Book 5 Chapter 1</td>
</tr>
<tr>
<td>Find some common multiples, e.g. for 4 and 5.</td>
<td>Book 5 Chapter 1</td>
</tr>
<tr>
<td>Round whole numbers to the nearest 10, 100 or 1000.</td>
<td>Book 4 Chapter 1</td>
</tr>
<tr>
<td>Round a number with two decimal places to the nearest tenth or to the nearest whole number.</td>
<td>Book 4 Chapter 8</td>
</tr>
<tr>
<td>Make and justify estimates and approximations of large numbers.</td>
<td>Book 5 Chapter 1</td>
</tr>
<tr>
<td>Use the &gt;, &lt; and = signs correctly.</td>
<td>Across the series</td>
</tr>
<tr>
<td>Estimate where four-digit numbers lie on an empty 0 –10 000 line.</td>
<td>Book 4 Chapter 1</td>
</tr>
<tr>
<td>Order numbers with up to two decimal places (including different numbers of places).</td>
<td>Book 4 Chapter 8</td>
</tr>
<tr>
<td>Recognise and extend number sequences.</td>
<td>Across the series</td>
</tr>
<tr>
<td>Recognise and use decimals with up to three places in the context of measurement.</td>
<td>Book 5 Chapter 8</td>
</tr>
<tr>
<td>Recognise odd and even numbers and multiples of 5, 10, 25, 50 and 100 up to 1000.</td>
<td>Book 4 Chapter 2</td>
</tr>
<tr>
<td>Make general statements about sums, differences and multiples of odd and even numbers.</td>
<td>Across the series</td>
</tr>
<tr>
<td>Recognise prime numbers up to 20 and find all prime numbers less than 100.</td>
<td>Book 5 Chapter 1</td>
</tr>
<tr>
<td>Recognise the historical origins of our number system and begin to understand how it developed.</td>
<td>Book 4 Chapter 1</td>
</tr>
<tr>
<td>Compare fractions with the same denominator and related denominators, e.g. ( \frac{3}{4} ) with ( \frac{7}{8} ).</td>
<td>Book 4 Chapter 3</td>
</tr>
<tr>
<td>Recognise equivalence between fractions, e.g. between ( \frac{1}{100} ), ( \frac{1}{10} )s and ( \frac{1}{2} )s.</td>
<td>Book 5 Chapter 4</td>
</tr>
<tr>
<td>Recognise and use the equivalence between decimal and fraction forms.</td>
<td>Book 4 Chapter 8</td>
</tr>
<tr>
<td>Order mixed numbers and place between whole numbers on a number line.</td>
<td>Book 4 Chapter 3</td>
</tr>
<tr>
<td>Change an improper fraction to a mixed number, e.g. ( \frac{17}{8} ) to ( \frac{21}{8} ).</td>
<td>Book 5 Chapter 4</td>
</tr>
<tr>
<td>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.</td>
<td>Book 4 Chapter 3</td>
</tr>
<tr>
<td>Begin to convert a vulgar fraction to a decimal fraction using division.</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>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.</td>
<td>Chapter 5</td>
</tr>
<tr>
<td>Find simple percentages of shapes and whole numbers.</td>
<td>Chapter 5</td>
</tr>
<tr>
<td>Solve simple problems involving ratio and direct proportion.</td>
<td>Chapter 4</td>
</tr>
</tbody>
</table>

**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. \( 3127 + 4988; 5678 – 1996 \). | Book 3 Chapter 2 |
| Use place value and multiplication facts to multiply/divide mentally, e.g. \( 0.8 \times 7; 4.8 \times 6 \). | Book 4 Chapter 9 |
| Multiply pairs of multiples of 10, e.g. \( 30 \times 40 \), or multiples of 10 and 100, e.g. \( 600 \times 40 \). | 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**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Book Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add two- and three-digit numbers with the same or different numbers of digits/decimal places.</td>
<td>Book 3 Chapter 2, Book 4 Chapter 9</td>
</tr>
<tr>
<td>Add or subtract numbers with the same and different numbers of decimal places, including amounts of money.</td>
<td>Book 4 Chapter 9</td>
</tr>
</tbody>
</table>

**Multiplication and division**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Book Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiply pairs of multiples of 10, e.g. 30 × 40, or multiples of 10 and 100, e.g. 600 × 40.</td>
<td>Book 5 Chapter 2</td>
</tr>
<tr>
<td>Multiply near multiples of 10 by multiplying by the multiple of 10 and adjusting.</td>
<td>Book 5 Chapter 2</td>
</tr>
<tr>
<td>Multiply by halving one number and doubling the other, e.g. calculate 35 × 16 with 70 × 8.</td>
<td>Book 5 Chapter 2</td>
</tr>
<tr>
<td>Use number facts to generate new multiplication facts, e.g. the 17 × table from 10 × + 7 × tables.</td>
<td>Book 5 Chapter 2</td>
</tr>
<tr>
<td>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.</td>
<td>Book 5 Chapter 2</td>
</tr>
<tr>
<td>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.</td>
<td>Book 5 Chapter 2</td>
</tr>
<tr>
<td>Give an answer to division as a mixed number, and a decimal (with divisors of 2, 4, 5, 10 or 100).</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>Relate finding fractions to division and use them as operators to find fractions including several tenths and hundredths of quantities.</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>Know and apply the arithmetic laws as they apply to multiplication (without necessarily using the terms commutative, associative or distributive).</td>
<td>Book 5 Chapter 2</td>
</tr>
</tbody>
</table>

**3. Geometry**

**Shapes and geometric reasoning**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Book Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visualise and describe the properties of 3D shapes, e.g. faces, edges and vertices.</td>
<td>Chapter 8</td>
</tr>
<tr>
<td>Identify and describe properties of quadrilaterals (including the parallelogram, rhombus and trapezium), and classify using parallel sides, equal sides, equal angles.</td>
<td>Chapter 2</td>
</tr>
<tr>
<td>Recognise and make 2D representations of 3D shapes including nets.</td>
<td>Chapter 10</td>
</tr>
<tr>
<td>Estimate, recognise and draw acute and obtuse angles and use a protractor to measure to the nearest degree.</td>
<td>Book 4 Chapter 5</td>
</tr>
<tr>
<td>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.</td>
<td>Book 5 Chapter 13</td>
</tr>
</tbody>
</table>

**Position and movement**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Book Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read and plot co-ordinates in all four quadrants.</td>
<td>Book 3 Chapter 12</td>
</tr>
<tr>
<td>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.</td>
<td>Book 4 Chapter 6</td>
</tr>
</tbody>
</table>

**4. Measure**

**Length, mass and capacity**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Book Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select and use standard units of measure. Read and write to two or three decimal places.</td>
<td>Book 5 Chapter 8</td>
</tr>
<tr>
<td>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.</td>
<td>Book 5 Chapter 8</td>
</tr>
<tr>
<td>Interpret readings on different scales, using a range of measuring instruments.</td>
<td>Book 5 Chapter 8</td>
</tr>
<tr>
<td>Draw and measure lines to the nearest centimetre and millimetre.</td>
<td>Book 5 Chapters 13 and 14</td>
</tr>
</tbody>
</table>

**Time**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Book Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>Book 4 Chapter 12</td>
</tr>
<tr>
<td>Tell the time using digital and analogue clocks using the 24-hour clock.</td>
<td>Book 4 Chapter 12</td>
</tr>
<tr>
<td>Compare times on digital and analogue clocks, e.g. realise quarter to four is later than 3:40.</td>
<td>Book 4 Chapter 12</td>
</tr>
<tr>
<td>Read and use timetables using the 24-hour clock.</td>
<td>Book 4 Chapter 12</td>
</tr>
<tr>
<td>Calculate time intervals using digital and analogue times</td>
<td>Book 4 Chapter 12</td>
</tr>
</tbody>
</table>
### Area and perimeter
- Measure and calculate the perimeter and area of rectilinear shapes.
- Estimate the area of an irregular shape by counting squares.
- Calculate perimeter and area of simple compound shapes that can be split into rectangles.

#### 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.
- Explore how statistics are used in everyday life.

##### Probability
- Use the language associated with probability to discuss events, to assess likelihood and risk, including those with equally likely outcomes.

#### 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.
- Understand everyday systems of measurement in length, weight, capacity, temperature and time and use these to perform simple calculations.
- Check addition with a different order when adding a long list of numbers; check when subtracting by using the inverse.
- Recognise 2D and 3D shapes and their relationships, e.g. a cuboid has a rectangular cross-section.
- Estimate and approximate when calculating, e.g. use rounding, and check working.

##### Using understanding and strategies in solving problems
- Explain why they chose a particular method to perform a calculation and show working.
- Deduce new information from existing information and realise the effect that one piece of information has on another.
- Use logical reasoning to explore and solve number problems and mathematical puzzles.
- Use ordered lists or tables to help solve problems systematically.
- 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°.
- 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.
- Solve simple word problems involving ratio and direct proportion.
- Solve simple word problems involving percentages, e.g. find discounted prices.
- Make, test and refine hypotheses, explain and justify methods, reasoning, strategies, results or conclusions orally.
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:

- ALGEBRA
- NUMBER
- MEASURES
- DATA AND CHANCE
- SHAPE AND SPACE

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.
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.
Chapter 1

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

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

**LEARNING OBJECTIVE**

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?

   \[ x + 4 \]

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

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

   \[ 9 - y \]

   They have \( 9 - y \) apples left.

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

   \[ 2p \]

   There are \( 2p \) bowls.

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

   \[ \frac{q}{7} \]

   Each child gets \( \frac{q}{7} \) biscuits.

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?

   \[ p + 3p = 4p \]

   They have \( 4p \) cookies altogether.

2. Simplify \( 2q + 4q \).

   \[ 2q + 4q = 6q \]

3. Simplify \( 3r + 5r \).

   \[ 3r + 5r = 8r \]

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.
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.

Other pointers for the pupils are:

\[ w - w = 0 \text{ and not } 0w; \]
\[ 2w - w = w \text{, and not } 1w. \]

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

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

10. Bina has $2w$ cupcakes. How many cupcakes does she have left?
    She gives away $3$ cupcakes. She gives away $w$ cupcakes. How many cupcakes does she have left?

11. The perimeter of the rectangle is $(2x + 2u)$ cm. Remind pupils to group variables of the same type.
    
12. Find the value of $a - 1$ when $a = 4$.
    Substitute $a$ with $4$.
    $a - 1 = 3$
    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 $c = 1$.
    $3c + 15 = 3 	imes 1 + 15$
    = $18$

17. Find the value of $20 - 2d$ when $d = 3$.
    $20 - 2d = 20 - 2 	imes 3$
    = $14$

18. Find the value of $10 - 6$ when $a = 6$.
    Substitute $a$ with $6$.
    $10 - 6 = 4$
    $\frac{4}{1} = 4$

19. Find the value of each of the following expressions when $r = 4$.
    (a) $r^2 + 9$
    (b) $\frac{r}{4} - 4$
    (c) $3r - 8$
    (d) $\frac{1}{2} + 2$

1. Simplify.
   (a) $a + a + a + a$
   (b) $4b + 3b$
   (c) $6a + 2c + 3c$
   (d) $6a - 3a$
   (e) $12a - 3a - 8a$
   (f) $5x + 8y - 9y$
   (g) $2y + 3 + 4g$
   (h) $8 - 12h + 12$
   (i) $5i + 7 - 3i + 6$
   (j) $15 + 10i - 12 + 6j$
   (k) $15 + 3$

2. Find the value of each of the following expressions when $p = 5$.
   (a) $p + 5$
   (b) $p - 4$
   (c) $3p$
   (d) $\frac{6}{1}$
   (e) $2p + 8$
   (f) $6p + 3$
   (g) $6p$
   (h) $39 - 4p$
   (i) $12 + 7p$
   (j) $\frac{p + 3}{2}$
   (k) $12 - \frac{20}{9}$

3. Find the value of each of the following.
   (a) $4q - 3$ when $q = 4$
   (b) $8 - 2r$ when $r = 3$
   (c) $6a$ when $a = 8$
   (d) $7 \frac{1}{2}$ when $r = 4$

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.

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
LEARNING OBJECTIVE

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

SOLVING WORD PROBLEMS

RECAP

1. Find the number represented by each shape.
   (a) \[ \triangle + 12 = 40 \]
   \[ \triangle = \text{???} \]
   (b) \[ \square - 30 = 3 \]
   \[ \square = \text{???} \]
   (c) \[ 9 \times \bigcirc = 27 \]
   \[ \bigcirc = \text{???} \]
   (d) \[ 24 \div \bigtriangleup = 3 \]
   \[ \bigtriangleup = \text{???} \]

2. Solve each of the following.
   (a) \[ 5 + \bigdiamond = 15 \]
   \[ \bigdiamond = \text{???} \]
   (b) \[ 2 + 49 = 61 \]
   (c) \[ 100 - 25 = 27 \]
   \[ 25 = \text{???} \]
   (d) \[ 83 - 25 = 38 \]
   (e) \[ 6 \times \bigcirc = 18 \]
   \[ \bigcirc = \text{???} \]
   (f) \[ 5 \times 9 = 45 \]
   (g) \[ 22 + \bigtriangleup = 11 \]
   \[ \bigtriangleup = \text{???} \]
   (h) \[ 6 + 7 = 14 \]

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?

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 = $m \times 3$

Cost of the pair of shoes = $m + 20$

Amount Priya spent = $3m + m + 20$

Priya spent $(3m + 20)$. 

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

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

$= 32 + 20$

$= 52$

Priya spent $52$.

Substitute $m$ with 8.

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

The perimeter of the figure is 30 cm.

Substitute $n$ with.

3.

Tom bought 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 = $4 \times p$

= $40$

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

= $36$

Amount of change received = $50 - $36$

= $14$

Tom received $14 in change.

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.
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.

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.
Independent seatwork

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

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

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.
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 \(\$2(x + 1)\) altogether on Monday and Tuesday.
   (c) \(2x + 1 = 2 \times 3 + 1\)
       \[= 7\]
    Farhan 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) \(3y + 290 = 2000\)
       \(3y = 2000 - 290\)
       \[= 1710\]
       \(y = 1710 \div 3\)
       \[= 570\]
       \(y + 500 = 1070\)
       \(y - 210 = 360\)
    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

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.

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 his younger brother’s height. 137 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?

3. There were $m$ pupils in a class at first. After a week, 4 more pupils joined the class.
   (a) Find the number of pupils in the class after a week in terms of $m$. $m + 4$
   (b) There were 40 pupils in the class after a week. How many pupils were there in the class at first? 36

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 $n$. $\frac{2n + 9}{20}$ litres
   (b) There were 2 litres of mango syrup in each bottle. How much mango drink did Xinyi make in all? 13 litres

What are some methods you can use to find the answer?

14
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 ÷ 12 = 3p
   3p × 4 = 12p
   The perimeter of each square is 12p cm.
(b) 18 × 3p = 54p
   The perimeter of the figure formed is 54p cm.

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.

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) $3a + 4$ is the same as $4a + 3$.
   No

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

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

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

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).

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.

Maths Journal

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

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).

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### Maths Journal

**Date:** _______________

1. (a) \( 2a + 1 \) is the same as \( 1 + 2a \).
   (b) \( 3b + 4 \) is the same as \( 4b + 3 \).
   (c) \( c \times c \) is the same as \( 2c \).
   (d) \( 5d + 2 \) is the same as \( 7d \).
   (e) \( 6e \div 5 \) is the same as \( \frac{6e}{5} \).

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**Textbook 6** P15

Chapter 1

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

\[ 2x = 14 \quad \text{and} \quad 7x + 1 = 50 \]

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

I know how to...

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

---

**SELF–CHECK**

| 1. (a) \( 11a + 12 \)     | Yes     |
| (b) \( 8b + 10 \)     | Yes     |
| (c) \( 10c + 35 \)   | No      |
| (d) \( 6d + 3 \)    | No      |
| (e) \( 6e +11 \)   | Yes     |
| (f) \( f \)          | No      |

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) \( 12 + 7y = 12 + 7 \times 9 \)
   \[ = 12 + 63 \]
   \[ = 75 \]
   Ann had 75 stickers at first.

7. (a) \( 2z + 3 \)
   There are \( (2z + 3) \) green marbles.
   (b) \( 2z + 3 = 19 \)
   \[ 2z = 19 - 3 \]
   \[ = 16 \]
   \[ z = 16 + 2 \]
   \[ = 8 \]
   There are 8 red marbles.
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).
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).

### RECAP

1. Find unknown angles in geometric figures.

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.
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°.
\[ \angle A = 90° \]

(c) In an isosceles triangle, the angles opposite the two equal sides are equal.
\[ \angle A = \angle B \]

(d) In an equilateral triangle, all the angles are equal to 60°.
\[ \angle A = \angle B = \angle C = 60° \]

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.

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.
4. ABC is an isosceles triangle and BCD is a right-angled triangle. Find \( \angle x \).

\[
\begin{align*}
\angle ACB &= \angle ABC \\
&= (180 - 40) \div 2 \\
&= 70 \\
\angle DCB &= 180 - 90 - 55 \\
&= 35 \\
\angle x &= 70 - 35 \\
&= 35
\end{align*}
\]

Sum of angles in a triangle = 180°

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?

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?
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°.

\[ \angle a = \angle d, \quad \angle a + \angle d = 180° \]

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

\[ \angle a + \angle d = 180° \quad \text{and} \quad \angle b + \angle c = 180° \]

We can use the angles in triangles and quadrilaterals to help us find unknown angles in geometric figures.

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 \( \angle DCF \). What information does he need to find first?

Let's Learn

1. ABCD is a square. BECF is a rhombus and \( \angle BEC = 64^\circ \). Find \( \angle DCF \).

\[ \angle BFC = \angle BEC = 64^\circ \]

Since BF = FC, BFC is an isosceles triangle.

\[ \angle BCF = \frac{180^\circ - 64^\circ}{2} = 58^\circ \]

Since ABCD is a square, \( \angle BCD = 90^\circ \).

\[ \angle DCF = 90^\circ - \angle BCF \]

\[ = 90^\circ - 58^\circ = 32^\circ \]

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 \( \angle BEC = 64^\circ \)?

Allow time for pupils to think through the questions.

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 \( \angle BEC = 64^\circ \) to find the size of each angle in the rhombus?
- Can you find the unknown \( \angle DCF \) in the square if you know \( \angle BCF \)?

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 \( \angle ACB \) related to \( \angle ACD \) and \( \angle BCD \)? 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 \( \angle ABC = 35^\circ \) in the process?

For Let's Learn 3, guide pupils by asking:
- What is the unknown angle?
- How is the unknown \( \angle ACD \) related to \( \angle ACB \) and \( \angle BCD \)? Can we find these angles first?
- How can we use the properties of isosceles triangle ACD and parallelogram BCDE to find these angles?
- How do we make use of the given \( \angle ABC = 41^\circ \) and \( \angle CDE = 38^\circ \) in the process?
4. ABCD is a parallelogram. ADF and ECF are isosceles triangles and $\angle ADF = 36^\circ$. Find $\angle AEB$.

Sum of angles in a triangle
Vertically opposite angles
Think of another method to find the unknown angle.

$\angle BCF = \angle AFD = \angle ADF = 36^\circ$
$\angle CEF = 180^\circ - 36^\circ - 36^\circ = 108^\circ$
So, $\angle AEB = \angle CEF = 108^\circ$

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 $\angle ADF = 36^\circ$. Get pupils to think about why this is so before they proceed to find the other angles using the hints provided.

For Let’s Learn 5, provide the following hints:
- How is $\angle x$ related to $\angle BEA$? Can we find $\angle BEA$ first?
- If ABEF is a rhombus, what is triangle ABE?
- If ABCD is a parallelogram, what is BCDE?
- Mark the parallel lines. How is $\angle y$ related to $\angle x$? What property would apply?

Sum of angles in a triangle
Vertically opposite angles
Think of another method to find the unknown angle.

$\angle BEA = (180^\circ - 62^\circ) + 2$
$= 60^\circ$
$\angle x = 180^\circ - 60^\circ = 121^\circ$
$\angle y = 180^\circ - 121^\circ = 59^\circ$

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

Angles on a straight line
Angles between parallel lines
6. ABCF is a trapezium and AEF is an equilateral triangle. AB // FC and \( \angle ADF = 80 \).

(a) Find \( \angle BAD \).
(b) Find \( \angle DFE \).

![Diagram of triangle AEF with angles labeled.

(c) \( \angle ADC = 180 - 80 = 100^\circ \)

\( \angle BAD = 180 - 100 = 80^\circ \)

\( \angle AFE = \angle FAE = 60^\circ \)

\( \angle AFD = 180 - 80 - 60 = 40^\circ \)

\( \angle DFE = \angle AFE - \angle AFD = 60 - 40 = 20^\circ \)

Think of another method to find the unknown angles.

For Let’s Learn 6, provide the following hints:
(a) If ABCF is a trapezium and AB // FC, how is the unknown \( \angle BAD \) related to \( \angle ADC \)? Can we find \( \angle ADC \) first?
(b) How is the unknown \( \angle DFE \) related to \( \angle AFD \) and \( \angle AFE \)? 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 \( x \), \( y \) and \( z \).

![Diagram of square ABCD with triangles ADE and BCF.

(a) \( \angle EDA = 60 \)
\( \angle ADC = 90 \)
\( \angle ECD = \angle EDA + \angle ADC = 60 + 90 = 150 \)
\( x = (180 - 150) \div 2 = 15 \)

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

(c) \( \angle BCA = \angle DCA = 45 \)
\( \angle BCF = 180 - 30 - 45 = 105 \)
\( z = (150 - 105) \div 2 = 22.5 \)

Label the figure by marking out angles that you know.

CDE is an isosceles triangle. ED = CD.

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 \( \angle x \) in?
(b) How is \( \angle y \) related to \( \angle DCA \) and \( \angle DCE \)? What is triangle DCA?
(c) What kind of triangle is \( \angle z \) in? Do we know the size of \( \angle BCF \)?
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.

**What you need:**
- 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.

   (a) $\triangle ACDE$ is a rhombus and $\triangle BCD$ is a straight line.
   (b) $\triangle ABCD$ is a rectangle.
   (c) $\triangle ABC$ is an isosceles triangle, $\square BFEG$ is a parallelogram and $\triangle DEF$ is a straight line.
   (d) $\square ABCD$ is a parallelogram and $\square ACED$ is a rhombus.

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

   How many possible ways are there to find each unknown angle?

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.
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.

What you need:
Work in pairs.

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

(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.

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

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.

Practice

1. ADCE is a rhombus and ABC is an equilateral triangle. \( \angle ADC = 110^\circ \). Find \( \angle ECB \).

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

3. ABCD is a trapezium. EFG and DEAH are straight lines. Find \( \angle AEF \).

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

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

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) \( \angle ECF = 40^\circ \)
   \( \angle s = (180^\circ - 40^\circ) + 2 \)
   \[ = 70^\circ \]

4. \( \angle FDE = \angle ADC \)
   \[ = 180^\circ - 123^\circ \]
   \[ = 57^\circ \]
   \( \angle DEF = 180^\circ - 90^\circ - 57^\circ \)
   \[ = 33^\circ \]

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

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) \( \angle FCJ = 180^\circ - 80^\circ - 60^\circ \)
   \[ = 40^\circ \]
   \( \angle ACB = 180^\circ - 40^\circ \)
   \[ = 140^\circ \]
   \( \angle BAC = (180^\circ - 140^\circ) + 2 \)
   \[ = 20^\circ \]
   \( \angle q = 180^\circ - 60^\circ - 20^\circ \)
   \[ = 100^\circ \]

*8. \( \angle a + \angle b = \angle c + \angle d = \angle e + \angle f = 180^\circ - 100^\circ \)
   \[ = 80^\circ \]
   \( \angle a + \angle b + \angle c + \angle d + \angle e + \angle f = 3 \times 80^\circ \)
   \[ = 240^\circ \]
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:

- \( \angle a + \angle b = 180^\circ - 65^\circ \)
- \( \angle c + \angle d = 180^\circ \)
- \( \angle e + \angle f = 180^\circ - 70^\circ \)

\( \angle a + \angle b + \angle c + \angle d + \angle e + \angle f = 540^\circ \)
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).
Chapter 2

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).

Mind Workout

Date: _______________

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

- $\angle DEC = \angle FEC = 72^\circ$
- $\angle AEF = 180^\circ - 72^\circ - 72^\circ = 36^\circ$

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 $\angle DEC = \angle FEC$. They can then make use of the property of sum of angles on a straight line to find $\angle AEF$.

Mind Workout

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.

Textbook 6 P32

ANGLES IN GEOMETRIC FIGURES

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.
  2. EFGH is a rhombus.
  3. EFG and EHG are isosceles triangles.
  4. $\angle DCF + \angle CFE = 180^\circ$
  5. $\angle CBD + \angle BDE = 180^\circ$
  6. $\angle FEG = \angle EGH$

I know how to...

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

SELF–CHECK

<table>
<thead>
<tr>
<th></th>
<th>True</th>
<th>False</th>
<th>True</th>
<th>False</th>
<th>True</th>
<th>True</th>
</tr>
</thead>
</table>
| 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) $\angle CDE = 90^\circ + 60^\circ$
    $= 150^\circ$
    $\angle CED = (180^\circ - 150^\circ) \div 2$
    $= 15^\circ$
    $\angle AHC = \angle DHE$
    $= 180^\circ - 60^\circ - 15^\circ$
    $= 105^\circ$

Answers

Review 2 (Workbook 6A P32 – 39)
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.
DIVIDING A FRACTION BY A WHOLE NUMBER

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

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

\[ \frac{1}{2} \div 3 = \frac{1}{6} \]

We can draw a bar model to represent the problem.

Divide \( \frac{1}{2} \) into 3 equal parts.

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

Method 2

\[ \frac{1}{2} \times \frac{1}{3} = \frac{1}{6} \]

\[ \frac{1}{2} \times \frac{3}{6} = \frac{1}{6} \]

Which method do you prefer? Why?

IN FOCUS

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

What fraction of the pizza did each girl receive?

Discuss some methods you can use to find the answer.

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’:

\[ \frac{1}{2} \div \frac{3}{1} = \frac{1}{2} \times \frac{1}{3} \].
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.

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.
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.

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) $\frac{1}{6}$
   (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
DIVIDING A WHOLE NUMBER BY A FRACTION

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

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

DIVIDING A WHOLE NUMBER BY A FRACTION

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:
     \[
     \frac{5}{2} \times 10 = 25
     \]

2. Find the value of \( \frac{5}{2} \times 33 \). Express your answer as a mixed number in its simplest form.
   - Method 1:
     \[
     \frac{5}{2} \times 33 = \frac{5 \times 33}{2} = \frac{165}{2} = 82 \frac{1}{2}
     \]
   - Method 2:
     \[
     \frac{5}{2} \times 34 = 85
     \]

Divide the denominator and the whole number by their common factor.
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.

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

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

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.

For Let’s Learn 7, get pupils to conclude the basic rule for division involving fractions, i.e. ‘change and invert’.
8. What is \( \frac{3}{4} \div \frac{2}{3} \)? Express your answer as a mixed number in its simplest form.

\[
4 = 3 \times \frac{2}{3} = \frac{8}{3}
\]

How many \( \frac{2}{3} \)'s are there in \( \frac{8}{3} \) wholes?

What does your answer mean? Explain.

9. Find the value of \( 2 \div \frac{5}{6} \). Express your answer as a mixed number in its simplest form.

\[
2 = 3 \times \frac{5}{6} = \frac{15}{6} = \frac{5}{2}
\]

Dividing by \( \frac{5}{6} \) is the same as multiplying by \( \frac{6}{5} \).

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

(a) \( 5 \div \frac{1}{2} \)
(b) \( 8 \div \frac{4}{7} \)
(c) \( 2 \div \frac{4}{7} \)
(d) \( 12 \div \frac{9}{10} \)

What you need:

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) \( 8 \div \frac{4}{7} \)
(c) \( 2 \div \frac{4}{7} \)
(d) \( 12 \div \frac{9}{10} \)

2. Check each other’s answers.

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’.

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.

Practice

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

(a) \( 2 \div \frac{1}{10} \)
(b) \( 5 \div \frac{1}{36} \)
(c) \( 9 \div \frac{3}{12} \)
(d) \( 8 \div \frac{4}{10} \)
(e) \( 7 \div \frac{3}{12} \)
(f) \( 11 \div \frac{3}{12} \)

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

Assign pupils to complete Worksheet 2 (Workbook 6A P44 – 47)
Chapter 3

Independent seatwork

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

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

Practice

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’.

ACTIVITY  TIME

Textbook 6

P44

Fractions

1. \( 4 \div \frac{1}{2} \)
   \( = 4 \times 2 \)
   \( = 8 \)

   What does your answer mean? Explain.

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

2. \( 5 \div \frac{1}{5} \)
   \( = 5 \times 5 \)
   \( = 25 \)

   \( \frac{1}{7} \)

3. \( 9 \div \frac{3}{4} \)
   \( = 9 \times \frac{4}{3} \)
   \( = 12 \)

   \( \frac{1}{2} \)

4. \( 12 \div \frac{9}{10} \)
   \( = 12 \times \frac{10}{9} \)
   \( = \frac{40}{3} \)

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

5. \( 2 \div \frac{6}{7} \)
   \( = 2 \times \frac{7}{6} \)
   \( = \frac{14}{6} \)

   \( \frac{7}{3} \)

6. \( 3 \)

   \( \frac{15}{3} \)

   \( 5 \)

   \( 8 \)

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
LEARNING OBJECTIVE

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

Prompt pupils by asking:

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

Pupils are introduced to the concept of division of a fraction by a fraction using fraction discs.
1. Divide a proper fraction by a proper fraction without a calculator.

LEARNING OBJECTIVE

Prompt pupils by asking:

• How many quarters are there in \( \frac{3}{4} \)?

• How many children can there be if each child gets \( \frac{1}{4} \)?

IN FOCUS

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

LET'S LEARN

1. **Divide** \( \frac{3}{4} \) by \( \frac{1}{4} \).

\[
\frac{3}{4} \div \frac{1}{4} = \frac{3}{4} \times \frac{4}{1} = 3
\]

She has 3 pieces of cloth.

For 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.

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.
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.

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

\[
\begin{array}{c}
\text{Dividing by } \frac{1}{11} \text{ is the same as multiplying by } \frac{11}{1}.
\end{array}
\]

\[
\frac{8}{11} \times 11 = \frac{8}{1} = 8
\]

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

\[
\begin{array}{c}
\text{Dividing by } \frac{5}{9} \text{ is the same as multiplying by } \frac{9}{5}.
\end{array}
\]

\[
\frac{7}{5} \times \frac{9}{5} = \frac{63}{25} = 2 \frac{13}{25}
\]

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

(a) \(\frac{3}{5} \div \frac{1}{3}\)
(b) \(\frac{5}{12} \div \frac{1}{4}\)
(c) \(\frac{5}{8} \div \frac{3}{8}\)
(d) \(\frac{7}{12} \div \frac{1}{12}\)

9. What is \(\frac{1}{2} - \frac{1}{3}\)?

Method 1

\[
\begin{array}{c}
\text{How many } \frac{1}{3} \text{'s are there in } \frac{1}{2}?
\end{array}
\]

\[
\frac{1}{2} \div \frac{1}{3} = \frac{1}{2} \times \frac{3}{1} = \frac{3}{2} = 1 \frac{1}{2}
\]

Method 2

\[
\begin{array}{c}
\text{Dividing by } \frac{1}{3} \text{ is the same as multiplying by } \frac{3}{1}. \text{ So we keep the first fraction, change the } \div \text{ to } \times \text{ and invert the second fraction to find the answer.}
\end{array}
\]

\[
\frac{1}{2} \div \frac{1}{3} = \frac{1}{2} \times \frac{3}{1} = \frac{3}{2} = 1 \frac{1}{2}
\]

10. Find the value of \(\frac{3}{4} - \frac{1}{8}\)

Method 1

\[
\begin{array}{c}
= 2
\end{array}
\]

Method 2

\[
\begin{array}{c}
= 2
\end{array}
\]

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) \( \frac{1}{2} \div \frac{1}{3} \)
   (b) \( \frac{2}{3} \div \frac{4}{7} \)
   (c) \( 3 \div 3 \frac{1}{2} \)
   (d) \( 5 \div 1 \frac{3}{4} \)

12. Divide \( \frac{2}{3} \) by \( \frac{1}{2} \).

   \[ \frac{2}{3} \div \frac{1}{2} = \frac{2}{3} \times \frac{2}{1} = \frac{4}{3} \]

13. Find the value of \( 2 \div 4 \)

   \[ \frac{2}{4} = \frac{1}{2} \]

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

   \[ \frac{3}{4} \div \frac{3}{10} = \frac{10}{4} \times \frac{4}{3} = \frac{5}{2} \]

15. Find the value of \( \frac{5}{6} + \frac{4}{3} \). Express your answer as a mixed number in its simplest form.

   \[ \frac{5}{6} + \frac{4}{3} = \frac{5}{6} + \frac{8}{6} = \frac{13}{6} = 2 \frac{1}{6} \]

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

   (a) \( \frac{1}{2} \div \frac{1}{3} \)
   (b) \( \frac{2}{3} \div \frac{4}{7} \)
   (c) \( 3 \div 3 \frac{1}{2} \)
   (d) \( 5 \div 1 \frac{3}{4} \)

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

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

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

**Practice**

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

**Independent seatwork**

Complete Worksheet 6A, Worksheet 3 • Pages 48 – 51
Answers

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
LEARNING OBJECTIVE

1. Solve word problems involving the four operations.

SOLVING WORD PROBLEMS

LESSON 4

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

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.

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

How many more glasses does she need?

**LET’S LEARN**

1. Total number of glasses needed = $6 \div \frac{3}{8} = 6 \times \frac{8}{3} = \frac{48}{3} = 16$

Number of glasses needed = 16

12

She needs $16 - 12 = 4$ more glasses.

How can you check whether the answer is correct?
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.

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.
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.

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.
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.

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?
6. 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 \( \frac{2}{3} \) 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.

**Table:**

<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pink</td>
<td>?</td>
</tr>
<tr>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

2 units = \( \frac{3}{2} \) m
1 unit = \( \frac{3}{4} \) + 2

6 units = \( \frac{3}{4} \) + 6

The length of the pink ribbon at first was \( \frac{9}{2} \) m.

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?

In Let's Learn 9, pupils have to consider five 20-cent coins and four 50-cent coins 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.
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 $11 + 25$.

In groups of 4, pupils can try different methods to solve the problem. Check that each method will give the same final answer.
1. \( \frac{3}{4} \) of the spectators at a football match are male. \( \frac{1}{2} \) of the males are boys and \( \frac{2}{5} \) 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, \( \frac{2}{5} \) of the beads were red, \( \frac{1}{2} \) of the remaining beads were green and the rest were blue. After \( \frac{2}{3} \) of the blue beads and 5 green beads were used, 128 beads were left. How many beads were there in the box at first?

3. Ahmad wants to buy an encyclopaedia and a storybook. \( \frac{2}{3} \) of the cost of an encyclopaedia is equal to \( \frac{3}{4} \) of the cost of a storybook. The encyclopaedia costs $14 more than the storybook. How much does Ahmad have to pay for both books?

\[ \text{Answers} \]

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 \times 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 = \( 2 \frac{7}{10} + 9 \times 17 \)

= \( 5 \frac{1}{10} \) 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) \( \frac{1}{2} \times \frac{3}{5} \times \frac{1}{4} = \frac{3}{8} \)

The area of the shaded triangle is \( \frac{3}{8} \) m².

4. \( \frac{7}{10} + \frac{1}{9} = 6 \frac{3}{10} \)

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 \( \rightarrow 4 \)

\( \frac{2}{3} \) of the tank \( \rightarrow 4 \times 2 = 8 \)

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

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

Independent seatwork

Assign pupils to complete Worksheet 4 (Workbook 6A P52 – 60)
7. \[
\begin{align*}
\frac{2}{9} &= \frac{14}{63} \\
\frac{7}{10} &= \frac{14}{20} \\
249 \times 83 &= 3 \\
3 \times 63 &= 189
\end{align*}
\]
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 = \(\frac{5}{12} \times \frac{4}{9}\) = \(\frac{5}{27}\)
\[
\frac{1}{3} - \frac{5}{27} = \frac{4}{27}
\]
34 of the visitors = 300
\[
\frac{27}{28} \text{ of the visitors} = 300 \div 4 \times 27 = 2025
\]
There were 2025 visitors on that day.

9. \[
\begin{align*}
\frac{2}{7} &= \frac{16}{56} \\
\frac{1}{8} &= \frac{7}{56}
\end{align*}
\]
9 units = $13.50
1 unit = $1.50
112 units = $1.50 \times 112 = $168
They had $168 altogether at first.

10. \[
\frac{7}{10} - \frac{3}{10} = \frac{4}{10}
\]
\[
\frac{4}{10} \text{ of cost} = $13.80
\]
\[
\frac{3}{10} \text{ of cost} = $13.80 \div 4 \times 3 = $10.35
\]
$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.
\[
\frac{3}{4} \times \frac{2}{7} = \frac{6}{28}
\]
\[
\frac{6}{28} - \frac{5}{28} = \frac{1}{28}
\]
\[
\frac{1}{28} \text{ of the original number of cookies} = 9
\]
Number of cookies baked = 9 \times 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 \div 2 = 48
There are 48 sheep at the farm.
Get pupils to draw bar models and hint to them to work backwards.
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.

Mind Workout

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

(a) $3 \times \frac{1}{4} = 18$
(b) $3 \div \frac{1}{2} = 6$
(c) $3 \div \frac{1}{3} = 2$

Maths Journal

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

Example

Mr Ho spent $\frac{1}{4}$ of his salary on transport and $\frac{3}{4}$ on food. He saved $\frac{2}{3}$ of the remainder and divided the rest equally among his 4 children. What fraction of Mr Ho’s salary did each child get?

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

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.

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 $\frac{3}{4}$ on food. He saved $\frac{2}{3}$ of the remainder and divided the rest equally among his 4 children. What fraction of Mr Ho’s salary did each child get?

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

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

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

(a) \[ \frac{1}{3} \times 3 = 18 \]
(b) \[ \frac{1}{2} \times 3 = 6 \]
(c) \[ \frac{2}{3} \times 2 = 2 \]

Maths Journal

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

Maths Journal

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

\[ \begin{array}{c c c}
\frac{1}{3} & \times & \frac{1}{3} \\
\frac{1}{3} & \div & 3 \\
\frac{1}{3} & \times & \frac{1}{3}
\end{array} \]

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?

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.

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) \( \frac{1}{3} \)
   (d) \( \frac{2}{5} \)
   (e) \( \frac{2}{3} \)
   (f) \( \frac{2}{3} \)
   (g) \( \frac{7}{9} \)
   (h) \( \frac{27}{32} \)

2. 12

3. 10 days

4. \( 3 \frac{1}{5} \)

5. \( \frac{4}{9} = \frac{12}{27} \)
   \( \frac{2}{11} = \frac{12}{22} \)
   \( 27 + 22 = 49 \)
   \( 343 ÷ 49 = 7 \)
   \( 7 \times 27 = 189 \)
   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.
   \( \frac{2}{5} = \frac{6}{15} \)
   \( \frac{3}{5} = \frac{6}{10} \)
   \( 15 + 10 = 25 \)
   \( $450 ÷ 25 \times 10 = $180 \)
   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.
   \( 71 - 6 = 65 \)
   \( \frac{7}{16} - \frac{1}{8} = \frac{5}{16} \)
   \( 65 ÷ 5 \times 16 = 208 \)
   He had 208 coins at first.

8. \( \frac{5}{12} \) of amount of water \( \rightarrow 30 ÷ 2 = 15 \)
   \( \frac{5}{12} \) 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.
   \( 15 ÷ 5 \times 7 = 21 \)
   He made 21 cups of tea.
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.
LEARNING OBJECTIVE
1. Relate ratio and fraction.

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.

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.
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.

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?

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

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?
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.

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.
1. Weiming has 6 tennis balls and 2 basketballs.

<table>
<thead>
<tr>
<th>Tennis balls</th>
<th>Basketball</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

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 \( \frac{2}{3} \) of the number of tennis balls.
(c) The number of tennis balls is \( \frac{3}{2} \) 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.

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 \( \frac{1}{6} \) the mass of white rice.
(c) The mass of the white rice Mrs Ali bought is \( \frac{5}{6} \) 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.

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

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.

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.

<table>
<thead>
<tr>
<th>Pupils who wear glasses</th>
<th>Pupils who do not wear glasses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(a) What is the ratio of the number of pupils who wear glasses to the number of pupils who do not wear glasses?
(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?
(d) Express the number of pupils who wear glasses as a fraction of the total number of pupils in the class.
(e) Express the number of pupils who do not wear glasses as a fraction of the total number of pupils in the class.

**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) $\frac{3}{8}$
1. Find the ratio of two quantities in direct proportion and use it to solve direct proportion problems.

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.

2. Express each ratio in its simplest form.
   (a) $15 : 18 = \frac{5}{6}
   (b) $24 : 12 = \frac{2}{1}$
   (c) $4 : 8 : 16 = \frac{1}{2} : 1$
   (d) $21 : 63 : 54 = \frac{7}{21} : 18$

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.
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.

In Let's Learn 1(b), pupils can make use of equivalent ratios or the bar modelling method to obtain the answer.

---

### Ingredients for lemonade

- 1 cup white sugar
- 5 cups water
- 1/2 cup lemon juice

### Let's Learn 1.

A recipe for lemonade is shown.

#### (a) Xinyi uses 4 cups of white sugar. How many cups of water does she need?

<table>
<thead>
<tr>
<th>Number of cups of white sugar</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cups of water</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

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.

$1 : 5 = 2 : 10 = 3 : 15 = 4 : 20$

When Xinyi uses 4 cups of white sugar, she needs 20 cups of water.

---

### Let's Learn 2.

#### (b) How many cups of white sugar does Xinyi need when she uses 30 cups of water?

<table>
<thead>
<tr>
<th>Number of cups of white sugar</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cups of water</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
</tbody>
</table>

- **Method 1**

  $1 : 5 = x : 30$

  She needs $x$ cups of white sugar.

- **Method 2**

  - Sugar
  - Water
  - 30

  5 units = 30
  1 unit = 30 ÷ 5
  = 6

  She needs 6 cups of white sugar.
2. Roju uses the same recipe to make lemonade.

<table>
<thead>
<tr>
<th>Number of cups of white sugar</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cups of lemon juice</td>
<td>(\frac{1}{2})</td>
<td>1</td>
<td>(\frac{1}{3})</td>
<td>(\frac{1}{5})</td>
</tr>
</tbody>
</table>

(c) He uses 4 cups of white sugar. How many cups of lemon juice does he need?

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.

\[2 : 1 = 4 : \text{2} \]

He needs \(\text{2 cups of lemon juice.}\)

Method 2

\[\text{Sugar} : \text{Lemon juice} \times 4 = 2 \]

He needs \(\text{2 cups of lemon juice.}\)

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.

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
- 2 cup lemon juice

Number of cups of white sugar needed = \( \frac{2}{1} \times 1 = 2 \)
Number of cups of water needed = \( \frac{2}{5} \times 5 = 2 \)
Number of cups of lemon juice needed = \( \frac{2}{2} \times \frac{1}{2} = 1 \)

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?

Number of egg whites needed = \( \frac{40}{8} \times 3 = 15 \)
Number of cups of white sugar needed = \( \frac{40}{8} \times \frac{1}{4} = \frac{5}{2} \)
Number of cups of confectioner’s sugar needed = \( \frac{40}{8} \times \frac{1}{2} = \frac{5}{2} \)
Number of cups of fine ground almonds needed = \( \frac{40}{8} \times 1 = 5 \)

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 ÷ 10
= 7 cm
4 units = 7 × 4
= 28 cm

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.

Blue paint

Red paint

108 ml

\( \frac{6}{5} \times 108 \) ml

6 units = 108 ml
1 unit = 108 ÷ 6
= 18 ml
11 units = 18 × 11
= 198 ml

Meiling made 198 ml of purple paint.
1. At a fruit stall, apples are sold at 3 for $1.
   (a) Complete the table.
<table>
<thead>
<tr>
<th>Amount of money ($)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of apples</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>15</td>
</tr>
</tbody>
</table>
   (b) How many apples can Xinny 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.
   
   Mrs Lim wants to make 24 servings of tuna pasta. How much of each ingredient does she need?
   
<table>
<thead>
<tr>
<th>3 cups macaroni</th>
<th>1 can tuna</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 can condensed cream of chicken soup</td>
<td>1/2 cup French fried onions</td>
</tr>
</tbody>
</table>

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

---

Work with pupils on the practice questions.

**Independent seatwork**

Assign pupils to complete 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) $125 \div 5 \times 3 = 75$  
   There are 75 hens at the farm.  
   (b) $125 \div 5 \times 8 = 200$  
   There are 200 hens and ducks altogether.

7. 2 units $= 26$  
   1 unit $= 26 \div 2$  
     $= 13$  
   16 units $= 13 \times 16$  
     $= 208$  
   Their total height is 208 cm.

8. At first  
   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.
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?

Let's learn

1. How many onions does the chef need when he uses 8 carrots?

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

4 : 2

\[ \times 2 \]

\[ 8 : 4 \]

Potatoes : Onions

2 : 1

\[ \times 2 \]

\[ 4 : 2 \]

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.

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).

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.
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?

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?
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.

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.
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.

---

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.
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.

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.
Let pupils work in pairs or individually on the practice questions.

**Independent seatwork**

Assign pupils to complete Worksheet 3 (Workbook 6A P78 – 86)

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? 46 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

---

**Answers**

Worksheet 3 (Workbook 6A P78 – 86)

1. 3 units = 15
   
   1 unit = $15 \div 3$
   
   = 5

   4 units = 5 \times 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

   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 \times 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 \times $1

   = $45

   Siti has $45.
4. **After**

| English | | | | | | 50 |
| Chinese | | | | | | 50 |

(a) 1 unit = 50
8 units = 50 \times 8 = 400
There were 400 English books in the library.
(b) 14 units = 50 \times 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 \times 40
= $80
Primary 6B collected $80.

6. **Nora**

| | | | | | | 3 |

$3
1 unit = $3
22 units = $3 \times 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 \times 7
= 49
49 pencils were left.

8. **Now**

| Miss Chen | | | | 8 |
| Father | | | | | | 8 |

In 8 years’ time
Miss Chen
Father

1 unit = 8
5 units = 8 \times 5
= 40
Miss Chen’s father is 40 years old now.

9. **Initial ratio**

Priya : Xinyi
40 : 28
10 : 7
1 unit = 40 + 10
= 4
Priya gave Xinyi $4.

10. **Before**

| Men | | | | | | 48 |
| Women | | | | | | |

| After | | | | | | 48 |
| Men | | | | | | 75 |
| Women | | | | | | |

3 units = 75 – 48
= 27
13 units = 27 + 3 \times 13
= 117
117 + 48 + 75 = 240
There are 240 men and women in the hall now.

11. **Initial ratio**

Number of blue balls : Number of red balls
4 : 1
Ratio in the end
Number of blue balls : Number of red balls
3 : 1
6 : 2
2 units = 8
4 units = 8 \times 2
= 16
There were 16 blue balls at first.
12. Before
Roses
Tulips
Others 112

After
Roses
Tulips
Others 112

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

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? 46 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 6 : 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? 250 g

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? 36

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?
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.
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.

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.

Mind Workout

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.

Textbook 6

P92

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.

How many servings does each recipe make?

Do you need to multiply or divide to find each amount?

I know how to...

compare quantities using fraction and ratio.

find unknown quantities in a given ratio.

solve word problems involving ratios.

SELF–CHECK

Workbook 6A P92

87

Ratio

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)

<table>
<thead>
<tr>
<th>Amount saved ($)</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount received ($)</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

(b) $120 ÷ 10 \times 2 = $24
He received $24.

5.

<table>
<thead>
<tr>
<th>Number of apples</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of carrots</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
</tr>
</tbody>
</table>

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. \(36 ÷ 9 = 4\)
\(4 \times 17 = 68\)
There are 68 pupils in Class 6A and 6B altogether.

9. \(\$156 ÷ 12 = \$13\)
\(\$13 \times 2 = \$26\)
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

| Mangoes | | | |
|---------|---|---|
| Plums   | | | |

After

<table>
<thead>
<tr>
<th>Mangoes</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plums</td>
<td></td>
</tr>
</tbody>
</table>

1 unit = 15
6 units = 15 \times 6
= 90
There were 90 plums.

12. Before

| Bina | | | |
|------|---|---|
| Siti | | | |

After

<table>
<thead>
<tr>
<th>Bina</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siti</td>
<td></td>
</tr>
</tbody>
</table>

1 unit = 2
6 units = 2 \times 6
= 12
Bina had 12 stickers at first.
13. **Now**

Mother’s age : Raju’s age

\[
\begin{align*}
2 & : 1 \\
10 & : 5
\end{align*}
\]

In 10 years’ time

Mother’s age : Raju’s age

\[
\begin{align*}
12 & : 7
\end{align*}
\]

Difference in number of units = 2

\[
\begin{align*}
2 & \text{ units} = 10 \\
1 & \text{ unit} = 5 \\
5 & \text{ units} = 5 \times 5 \\
& = 25 \\
\end{align*}
\]

Raju is 25 years old now.

14. **Before**

\[
\begin{array}{|c|c|}
\hline
\text{Boys} & \hline
\text{Girls} & \hline
\end{array}
\]

\[
\begin{array}{|c|c|}
\hline
\text{Boys} & 12 \\
\text{Girls} & 36 \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|}
\hline
\text{Boys} & 12 \\
\text{Girls} & 36 \\
\hline
\end{array}
\]

1 unit = 36 – 25

= 11

4 units = 11 \times 4

= 44

There were 44 girls at the party at first.
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.
FINDING THE WHOLE GIVEN A PART AND THE PERCENTAGE

LEARNING OBJECTIVE
1. Find the whole given a part and the percentage.

RECAP

Revisit the definition of percentage (% means out of 100), expressing percentage as a fraction and finding a percentage of a whole.

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

1. What percentage of the squares are not shaded?

\[
\frac{40}{100} = 40\% \\
40\% \text{ of the squares are not shaded.}
\]
Chapter 5

1. Find the whole given a part and the percentage.

2. Express 45% as a fraction.
   \[ 45\% = \frac{45}{100} = \frac{9}{20} \]

3. What is 25% of 92?
   \[ 25\% \times 92 = \frac{25}{100} \times 92 = 23 \]

Nutrition Facts

Serving Size 1 cup (228g)

Amount Per Serving

- Calories: 200
- Total Fat: 13g
- Cholesterol: 30mg
- Sodium: 660mg
- Total Carbohydrate: 31g
- Sugars: 5g
- Dietary Fiber: 0g
- Protein: 5g

Percentage

- 50% SUGAR
- 60% CACAO
- 80% CHOCOLATE

RECAP

- 100% = \% of the squares are not shaded.
- \% of the squares are not shaded.
- \%

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% \rightarrow 31. The arrow refers to “represents”.

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.
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.

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.
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.

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) \( \frac{56}{7} \times 100 = 800 \text{ ml} \)
   
   (d) \( \frac{24}{80} \times 100 = 30 \)

2. \( \frac{63}{90} \times 100 = 70 \)

3. \( \frac{60}{40} \times 100 = 150 \text{ km} \)

4. \( \frac{1360}{85} \times 100 = 1600 \)

5. \( \frac{1440}{18} \times 100 = 80 \)

6. \( \frac{27}{75} \times 25 = 9 \)

7. \( \frac{42}{70} \times 100 = 60 \)

8. \( \frac{2448}{68} \times 100 = 3600 \)
LEARNING OBJECTIVE

1. Find percentage increase or decrease based on the original quantity.

PERCENTAGE INCREASE AND DECREASE

LESSON 2

1. What is the percentage increase in the number of chairs?

Percentage increase = \( \frac{2}{10} \times 100\% \)

= 20\%

The number of chairs increases by 2.

Percentage increase = \( \frac{\text{Increase}}{\text{Original quantity}} \) \times 100\%

Try working backwards to check whether the answer is correct.

Get pupils to express the increase as a fraction first. Guide them by asking what value the denominator should take.

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\%.

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?

What percentage should we use to represent the original number of chairs?
1. Find percentage increase or decrease based on the original quantity.

**LEARNING OBJECTIVE**

Textbook 6

**Chapter 5**

**Lesson 2**

**Percentage Increase and Decrease**

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?

**IN FOCUS**

What percentage should we use to represent the original number of chairs?

**LET'S LEARN**

1. What is the percentage increase in the number of chairs?

   Percentage increase = \( \frac{\text{Increase}}{\text{Original quantity}} \times 100\% \)

   The original number of chairs in the row is 10.
   The number of chairs increases by 2.

   Percentage increase = \( \frac{2}{10} \times 100\% = 20\% \)

   Try working backwards to check whether the answer is correct.

Get pupils to express the increase as a fraction first. Guide them by asking what value the denominator should take.

**IN FOCUS**

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 = \( \frac{\text{Decrease}}{\text{Original quantity}} \times 100\% \)

   The number of chairs decreases by 3.

   Percentage decrease = \( \frac{3}{10} \times 100\% = 30\% \)

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?

   **Before**
   - Old bus fare: $80
   - New bus fare: $100

   Increase = $100 - $80 = $20

   Percentage increase = \( \frac{20}{80} \times 100\% = 25\% \)

   The percentage increase in the bus fare was 25%.

   Why do we use $80 as the original quantity, and not $100? Explain.

25

25

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?

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?

<table>
<thead>
<tr>
<th>Month</th>
<th>Amount Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>$30</td>
</tr>
<tr>
<td>June</td>
<td>$45</td>
</tr>
</tbody>
</table>

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 cents. 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?

Price now = $1.50

20% of the price = 50 cents
100% of the price = $2.50

Each plate of chicken rice cost $2.50 at first.

For Let’s Learn 6, 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 7 involves rounding off the answer. Explain to pupils that it is the same as rounding off to the nearest whole number.

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.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Pupils</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>40</td>
</tr>
<tr>
<td>2016</td>
<td>34</td>
</tr>
</tbody>
</table>

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 $1660. Its price decreased to $1569 in February. Find the percentage decrease in the price of the computer, giving your answer correct to the nearest 1%.

<table>
<thead>
<tr>
<th>Month</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>$1660</td>
</tr>
<tr>
<td>February</td>
<td>$1569</td>
</tr>
</tbody>
</table>

Decrease = $1660 - $1569 = $91

Percentage decrease = \( \frac{91}{1660} \times 100\% = 5.5\% \) (to the nearest 1%)

The percentage decrease in the price of the computer was 6%.

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.

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.
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?

\[
\text{Percentage increase} = \left( \frac{\text{Increase}}{\text{May}} \right) \times 100\%
\]

\[
= \left( \frac{\$15}{\$30} \right) \times 100\% = 50\%
\]

The percentage increase was 50%.

7. The price of a plate of chicken rice increased by 50 cents. 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?

\[
\text{20% of Price at first} = 50\text{ cents}
\]

\[
\text{Price at first} = \frac{50\text{ cents}}{20\%} = \frac{50}{20} = 2.50\text{ dollars}
\]

Each plate of chicken rice cost $2.50 at first.

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.

\[
15\% \text{ of } 40 = \frac{15}{100} \times 40 = 6
\]

\[
\text{Number of pupils who went in 2016} = 40 - 6 = 34
\]

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%.

\[
\text{Decrease} = 1650 - 1559 = 91
\]

\[
\text{Percentage decrease} = \left( \frac{91}{1650} \right) \times 100\% = 5.5\% \text{ (to the nearest 1%)}
\]

The percentage decrease in the price of the computer was 5.5%.

10. The table shows the monthly salary of a bank officer over two years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Monthly Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>$3100</td>
</tr>
<tr>
<td>2017</td>
<td>$3300</td>
</tr>
</tbody>
</table>

Find the percentage increase in his salary, giving your answer correct to the nearest 0.1%.

\[
\text{Increase} = 3300 - 3100 = 200
\]

\[
\text{Percentage increase} = \left( \frac{200}{3300} \right) \times 100\% = 6.1\% \text{ (to the nearest 0.1%)}
\]

The percentage increase in his salary was 6.1%.

Rounding to the nearest 0.1% is the same as rounding 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?

\[
100\% - 22.5\% = 77.5\%
\]

\[
77.5\% \text{ of price in June} = 46.50\text{ dollars}
\]

\[
1\% \text{ of price in June} = \frac{46.50}{77.5} = 0.60\text{ dollars}
\]

\[
100\% \text{ of price in June} = 0.60 \times 100 = 60\text{ dollars}
\]

The price of each barrel of oil in June was $60.

The price of each barrel of oil in October was 77.5% of the price in June.

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.

For Let’s Learn 11, remind pupils to ensure that they place the decimal point correctly when using the calculator.
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.

**Activity**

1. Play in groups of 4.
2. Roll a 10-sided die and record the number in a table.
3. Roll the die again and record the second number.
4. Calculate the increase or decrease.
5. Use a calculator to find the percentage increase or decrease. The first player to get the correct answer gets 1 point.
6. Repeat 1 to 5. The first player to get 10 points wins!

**Practice**

**Worksheet 2 (Workbook 6A P102 – 105)**

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. \( \frac{400000}{100} \times 88 = \$352 000 \)
LEARNING OBJECTIVE

1. Solve word problems involving percentage.

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).

Two methods to find out how much land was used to plant tomatoes:

Method 1

Percentage of remaining land = 100% - 50% = 50%  
Percentage of land used for tomatoes = 80% + 50%  
= 80% × 50%  
= 80% × 0.5  
= 40%  
Area of land used for tomatoes = 40% × 20  
= 8 m²

8 m² of land was used to plant tomatoes.
Method 2

We can show this using a bar model.

\[ \text{Strawberries} \]

\[ \text{Tomatoes} \]

\[ \text{Lettuce} \]

Fraction of land used for tomatoes = \( \frac{4}{5} \times \frac{1}{2} \)

Area of land used for tomatoes = \( \frac{2}{5} \times 20 = 8 \text{ m}^2 \)

8 m\(^2\) of land was used to plant tomatoes.

For pupils who have difficulties with the concept of percentage, using fractions would likely be more familiar to them.

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%.

2. Nora’s weekly allowance is $12. Last week, she spent 60% of her allowance on food, \( \frac{1}{2} \) of the remaining amount on stationery and saved the rest. How much did Nora save last week?

\[ \text{Percentage of allowance remaining} = 100\% - 60\% = 40\% \]

\[ \text{Amount of allowance remaining} = \frac{40}{100} \times 12 = 4.80 \]

\[ \text{Amount saved} = \frac{2}{3} \times 4.80 = 3.20 \]

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?

\[ \text{Percentage of blue marbles now} = \frac{2}{3} \times 100\% = 66\frac{2}{3}\% \]

33\( \frac{1}{3} \)% of his marbles now are blue.
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 altogether?

Method 1

- Local stamps: 70% of stamps
- Foreign stamps: 30% of stamps

Difference in percentage = 70% - 30% = 40%

40% of stamps = 36

100% of stamps = \(\frac{36}{0.40} = 90\)

Raju has 90 stamps in all.

Method 2

- Local stamps: 70% of stamps
- Foreign stamps: 30% of stamps

4 units = 36
1 unit = 36 ÷ 4 = 9
10 units = 9 × 10 = 90

Raju has 90 stamps in all.

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 \(\frac{1}{6}\) 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?

- \(\frac{2}{3}\) of the remaining = 60% of the original number
- \(\frac{1}{3}\) of the remaining = 40% of the original number

100% = 20% + 80%
10% = 4
100% = 40
100% = 36

Mr Wong had 36 watches at first.

6. There are some books on a bookshelf. 16% of the books are science fiction books, 18% 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?

- Science fiction: 15% of books
- Mystery: 18% of books
- Non-fiction: 70% of books

100% - 15% - 18% = 70% of total number of books = \(\frac{165}{0.70} = 235\)

1% of total number of books = \(\frac{235}{100} = 2.35\)

100% of total number of books = \(\frac{224}{2.35} = 96\)

There are 320 books altogether.

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.
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.

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.

<table>
<thead>
<tr>
<th>Tuesday</th>
<th>Monday</th>
</tr>
</thead>
<tbody>
<tr>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>230</td>
</tr>
<tr>
<td></td>
<td>200</td>
</tr>
</tbody>
</table>

   He sold 200 pears on Monday.

<table>
<thead>
<tr>
<th>Tuesday</th>
<th>Monday</th>
<th>Wednesday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230</td>
<td>200</td>
<td>230</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15%</td>
<td>10%</td>
<td>50%</td>
</tr>
</tbody>
</table>

   Number of pears sold on Wednesday = 200 × 1/2 = 100

   Total number of pears sold = 200 + 200 + 100 = 530

   He sold a total of 530 pears over the three days.

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.

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 Saturday?

<table>
<thead>
<tr>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in number of adults = 40 ÷ 10 units = 1 unit + 4</td>
<td></td>
</tr>
<tr>
<td>Decrease in number of children = 10 ÷ 10 units = 1 unit</td>
<td></td>
</tr>
</tbody>
</table>

   20 units = 724 - 44 = 680

   1 unit = 680 ÷ 20 = 34

   9 units = 34 ÷ 4 = 8.5

   306 children attended the concert on Sunday.

   Which quantity is represented by 100%, the number sold on Monday or the number sold on Tuesday? Explain.

   Do you know why we use 10 units to represent 100%?
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?

<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>70%</td>
</tr>
<tr>
<td>Girls</td>
<td>30%</td>
</tr>
<tr>
<td>Boys</td>
<td>70/100 x 60 = 42</td>
</tr>
<tr>
<td>Girls</td>
<td>30/100 x 60 = 18</td>
</tr>
</tbody>
</table>

Number of girls at first = 50/100 x 60 = 30

Number of boys at first = 70/100 x 60 = 42

60% of new total = 42

1% of new total = 0.7

100% of new total = 70

Number of girls added = 70 - 60 = 10

10 girls were added to the team.

How can you check your answer?

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.

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.

Allow pupils to work in pairs or individually on the practice questions.
Assign pupils to complete Worksheet 3 (Workbook 6A P106 – 114)

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. A survey 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. 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.

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
   \( \frac{1}{4} \times 70\% = 17.5\% \)
   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.
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Independent seatwork

Assign pupils to complete Worksheet 3 (Workbook 6A P106 – 114)

Textbook 6 P116

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.

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?

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?

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?

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?

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?

*What are some methods you can use to find the answer? Discuss with your partner.*

Complete Workbook 6A, Worksheet 3 • Pages 106 – 114
PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW

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.

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?

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?

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 30,200 pens and markers at the factory. How many markers were there at first?

6. An event was held at the Night Safari on Friday and Saturday. On Friday, there were 80 more boys than girls. On Saturday, the number of boys increased by 20% and the number of girls increased by 10%. There were 2,500 boys and girls at the Night Safari on Saturday. How many girls were there on Friday?

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?

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%)

What are some methods you can use to find the answer? Discuss with your partner.
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   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | 154 |
| Bala    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Ann     |   |   |   | 10|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Siti    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

18 units = 154 – 10
= 144
1 unit = 144 ÷ 18
= 8
4 units = 8 x 4
= 32
Number of marbles Ann had at first = 32 + 10 – 14
= 28

Ann had 28 marbles at first.

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.

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% → $50.40
   10% → $50.40 ÷ 5 = $10.08
   20% → $10.08 × 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 → 14
   100% of the remainder → \( \frac{14}{7} \times 10 = 20 \)
   \( \frac{2}{5} \) of the cream puffs → 20
   \( \frac{5}{5} \) of the cream puffs → \( \frac{20}{2} \times 5 = 50 \)
   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% → 18
    10% → 18 ÷ 3 = 6
    100% → 6 × 10 = 60
    There are 60 chocolate balls in the box altogether.

13. Number of boys in the school = 144 × 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. Weiming

   Bala

   \( \$197 − \$45 \)
   = $152
   1 unit = $152 ÷ 16
   = $9.50
   Amount Bala had = $9.50 × 6 + $45
   = $102
   Bala had $102.
1. (a) \(6 \times 100 = 24\) kg
   (b) \(24 \times 100 = 60\) kg

2. \(28 \times 20 = 7\)

3. \(70 \times 100 = 20\)

4. \(100\% - 30\% - 20\% = 50\%\)

   \(50\% \times 50.40 = 25.20\)
   \(10\% \times 50.40 \div 5 = 10.08\)
   \(20\% \times 20.16 = 4.032\)

   Bina spent $20.16 on the dress.

5. \(10 \times 100\% = 20\%\)

6. \(36 \times 100 = 40\)

7. (a) Total distance = 3200 + 1800 = 5000 m

   \(3200 \div 5000 \times 100\% = 64\%\)

   The distance he jogged on Saturday is 64% of the total distance jogged on both days.

   (b) \(3200 - 1800 = 1400\)

   \(1400 \div 3200 \times 100\% = 43.75\%\)

   The percentage decrease is 43.75%.

8. \(80 \times 50 = 40\)

   \(70 \times 40 = 28\)

   Meiling saved $28.

9. 70% of the remainder

   \(14 \div 100 \times 7 = 20\)

   \(25 \times 5 = 125\)

   She made 125 cream puffs.

10. Number of blue pens = \(60 \div 100 \times 50 = 30\)

    Number of red pens at first = \(50 - 30 = 20\)

    Number of red pens left = \(10 \div 2 \times 30 = 15\)

    Number of red pens removed = \(20 - 15 = 5\)

    5 red pens were removed from the box.

11. \(100\% - 35\% = 65\%\)

    \(65\% - 35\% = 30\%\)

    \(30\% \times 18 \div 3 = 6\)

    \(100\% \times 6 \times 10 = 60\)

    There are 60 chocolate balls in the box altogether.

12. \(100\% - 35\% = 65\%\)

    \(65\% - 35\% = 30\%\)

    \(30\% \times 18 \div 3 = 6\)

    \(100\% \times 6 \times 10 = 60\)

    There are 60 chocolate balls in the box altogether.

13. \(144 \times 5 = 720\)

    45% of the pupils in the school = \(720 \div 100 \times 45 = 160\)

    There are 1600 pupils in the school.

14. Bala

    Weiming

    \(\$45\)

    \(\$197\)

    \(16 \times 16\)

    \(= \$197 - \$45\)

    \(= \$152\)

    \(1 \times 9.50\)

    \(= \$9.50\)

    \(6 \times \$9.50 + \$45\)

    \(= \$102\)

    Bala had $102.

15. \(\frac{1}{2}\)

16. \(\frac{1}{2}\)

17. \(\frac{1}{2}\)

18. \(\frac{1}{2}\)

19. \(\frac{3}{5}\)

20. \(\frac{3}{5}\)

21. \(\frac{3}{5}\)

22. \(\frac{3}{5}\)

23. \(\frac{3}{5}\)

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. \(\angle BCD = \angle BAD\)

    \(= 140^\circ\)

    \(\angle BDC = (180^\circ - 140^\circ) \div 2\)

    \(= 20^\circ\)

    \(\angle y = 90^\circ - 20\)

    \(= 70^\circ\)

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 = \(55 \times 31\)

    \(= 1705\) 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. \[ \frac{1}{2} - \frac{3}{4} = \frac{3}{4} \]
   \[ \frac{3}{4} + 2 = \frac{3}{8} \]
   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 \( \rightarrow \$108 \)
   6 novels and 9 colouring books \( \rightarrow \$108 \times 3 = \$324 \)
   3 novels and 2 colouring books \( \rightarrow \$117 \)
   6 novels and 4 colouring books \( \rightarrow \$117 \times 2 = \$234 \)
   5 colouring books \( \rightarrow \$324 - \$234 = \$90 \)
   1 colouring book \( \rightarrow \$90 \div 5 = \$18 \)
   1 novel \( \rightarrow \)\( \$108 - \$18 \times 3 \) \( \div 2 = \$27 \)
   \[ \frac{18}{27} = \frac{2}{3} \]
   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
   \[ \begin{array}{c}
   7 \\
   9
   \end{array} \]
   Ratio in the end
   Number of red marbles : Number of blue marbles
   \[ \begin{array}{c}
   2 \\
   3 \\
   6 \\
   9
   \end{array} \]
   1 unit = 5
   9 units = \( 5 \times 9 \)
   = 45
   There were 45 blue marbles in the box.

9. \[ \frac{40}{60} \times 100\% = 66\frac{1}{3}\% \]
   \[ 100\% - 66\frac{1}{3}\% = 33\frac{1}{3}\% \]
   \[ 33\frac{1}{3}\% \rightarrow \$2.50 \]
   \[ 100\% \rightarrow (\$2.50 + 33\frac{1}{3}) \times 100 = \$7.50 \]
   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 = \( 10 \times 60 \)
    = 600 ml
    Capacity of bottle = \( 4 \times 60 \)
    = 240 ml
    Number of bottles he can fill = \( 600 \div 240 \)
    = \( 2 \frac{1}{2} \)
    The most number of bottles he can fill is 2.
Section C

1. 70% \[\times 100 = 16.10\]  
   Its price before the discount was $23.

2. 18 \[\times 5 = 115\]  
   The length of the rectangle is 115 cm.

3. \[\frac{1}{2} - \frac{3}{4} = \frac{3}{4}\]  
   Each child received \(\frac{3}{8}\) of a pie.

4. Bina gave \(\frac{7}{2} - \frac{2}{2}\) apples to her friends.

5. \(\$1400 - \$1190 = \$210\)  
   \(\frac{100}{1400} \times 100\% = 15\%\)  
   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 \(\rightarrow \$108\)  
   6 novels and 9 colouring books \(\rightarrow \$108 \times 3 = \$324\)  
   3 novels and 2 colouring books \(\rightarrow \$117\)  
   6 novels and 4 colouring books \(\rightarrow \$117 \times 2 = \$234\)  
   5 colouring books \(\rightarrow \$324 - \$234 = \$90\)  
   1 colouring book \(\rightarrow \$90 \div 5 = \$18\)  
   1 novel \(\rightarrow \frac{\$108 - \$18 \times 3}{2} = \$27\)  
   \(\frac{18}{27} = \frac{2}{3}\)  
   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 \times 9 = 45
   There were 45 blue marbles in the box.

9. \(\frac{40}{60} \times 100\% = 66\frac{1}{3}\%\)  
   \(100\% - 66\frac{1}{3}\% = 33\frac{1}{3}\%\)  
   \(\frac{33\frac{1}{3}\%}{100\%} \times \$2.50 = \$7.50\)  
   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 = \(10 \times 60 = 600\) ml  
       Capacity of bottle = \(4 \times 60 = 240\) ml  
       Number of bottles he can fill = \(600 \div 240 = 2\frac{1}{2}\)  
       The most number of bottles he can fill is 2.

12. After giving away  
    Chocolate
    Banana
Before  
    Chocolate
    Banana
\[\begin{array}{c}
\text{1 unit = 60} \\
\text{2 units = 4 x 2} \\
\text{8 + 12 = 20} \\
\text{She had 20 banana muffins in the end.}
\end{array}\]

13. Before
    Xinyi
    Kate
    Kate
After
    Xinyi
    Kate
    Siti
\[\begin{array}{c}
\text{1 unit = 27} \\
\text{11 units = 27 x 11} \\
\text{= 297} \\
\text{The three girls had 297 stickers altogether.}
\end{array}\]

14. Number of people who attended on each day  
\[= 360 \div 3 \times 8 = 960\]  
Number of children who attended on Saturday  
\[= 960 \div 5 \times 2 = 384\]  
384 children attended the performance on Saturday.

15. (a) \(\angle FCD = 180\degree - 100\degree = 80\degree\)  
    \(\angle FCB = 180\degree - 80\degree = 100\degree\)  
    \(\angle FBC = (180\degree - 100\degree) + 2 = 40\degree\)  
    \(\angle DEF = 180\degree - 100\degree - 40\degree = 40\degree\)  
(b) \(\angle BFC = 40\degree\)  
    \(\angle AFB = 180\degree - 40\degree = 140\degree\)  
    \(\angle BAF = (180\degree - 140\degree) + 2 = 20\degree\)

16. Pens
    Erasers
\[\begin{array}{c}
\text{\$0.30} \\
\text{20\% \rightarrow 3} \\
\text{100\% \rightarrow} \frac{3}{20} \times 100 = 15
\end{array}\]  
15 erasers cost as much as 12 pens.  
12 \times \$0.30 = \$3.60  
3 erasers cost \$3.60.
\[\$3.60 + 3 = \$1.20\]  
\[\$1.20 + \$0.30 = \$1.50\]  
\[\$1.50 \times 12 + \$1.20 \times 3 = \$21.60\]  
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 \div \$1.70 = 6  
6 \times 2 = 12  
There were 12 more 50-cent coins than 20-cent coins.

18. (a) \(\angle ECD = 90\degree - 60\degree = 30\degree\)  
    Since ABCD is a square and BCE is an equilateral triangle,  
    \(\angle CDE = (180\degree - 30\degree) + 2 = 75\degree\)  
(b) \(\angle DEC = \angle AEB = 75\degree\)  
    \(\angle AED = 360\degree - 75\degree - 60\degree - 75\degree = 150\degree\)
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.

**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.

**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
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.

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.

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?
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?

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?
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.

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.
Pupils should observe that they got a constant value of 3.1 (correct to 1 d.p.). Introduce the symbol \( \pi \) 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 \( \pi \) is related to the circumference of a circle.

Get pupils to press the \( \pi \) 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.

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 \( \pi \). Go through with pupils what it means to leave their answers in terms of \( \pi \).
Semicircles and quarter circles
12. Find the perimeter of a semicircle with diameter 4 cm. (Take \( \pi = 3.14 \))

\[
\text{Perimeter of the semicircle} = \text{diameter} + \text{length of arc}
\]

\[
= 4 + \left( \frac{1}{2} \times \pi \times 4 \right)
\]

\[
= 4 + \left( \frac{1}{2} \times 3.14 \times 4 \right)
\]

\[
= 10.28 \text{ cm}
\]

13. A circle with radius 21 cm is divided into 4 identical quarter circles. What is the perimeter of one quarter circle? (Take \( \pi = \frac{22}{7} \))

\[
\text{Perimeter of one quarter circle} = \text{radius} + \text{radius} + \text{length of arc}
\]

\[
= 21 + 21 + \left( \frac{1}{4} \times \pi \times 2 \times 21 \right)
\]

\[
= 21 + 21 + \left( \frac{22}{7} \times 2 \times 21 \right)
\]

\[
= 42 + \frac{756}{7}
\]

\[
= 72 \text{ cm}
\]

14. Find the perimeter of each figure. Give your answers correct to 2 decimal places.
(a) A semicircle of radius 3.8 cm
(b) A circle with radius 5 cm
(c) A circle with radius 6 cm

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 \( \pi \) 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.

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.
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.

**Activity Time**

When a circle makes one complete turn, the distance that it travels is its circumference.

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.
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.

### Table

<table>
<thead>
<tr>
<th>Object</th>
<th>Distance travelled in one complete turn</th>
<th>Diameter</th>
<th>Circumference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper plate</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Compare the distance travelled by each object along the line and its circumference. What do you notice?

**Practice**

Allow pupils to work in pairs on the practice questions.

1. Find the circumference of each circle with centre O.
   - (a) [Take \( \pi = \frac{22}{7} \)]
   - (b) [Take \( \pi = 3.14 \)]
   - (c) [Take \( \pi = 3.14 \)]

2. Find the perimeter of each semicircle or quarter circle.
   - (a) [Take \( \pi = 3.14 \)]
   - (b) [Take \( \pi = \frac{22}{7} \)]
   - (c) [Take \( \pi = \frac{22}{7} \)]
   - (d) [Take \( \pi = 3.14 \)]

3. The figure is formed using 4 semicircles. Find the perimeter of the shaded part.
   - (Take \( \pi = \frac{22}{7} \))

**Textbook 6 P127**
4. The figure shows 2 identical quarter circles. Find the perimeter of the shaded part. (Take \( \pi = 3.14 \))

\[
\text{Perimeter} = 30.84 \text{ cm}
\]

5. The figure shows a circle inside a square. Find the perimeter of the shaded part. (Take \( \pi = 3.14 \))

\[
\text{Perimeter} = 32.13 \text{ cm}
\]

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 \( \pi = \frac{22}{7} \))

\[
\text{Length of wire} = 66 \text{ cm}
\]

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 \( \pi = 3.14 \))

\[
\text{Distance} = 778.72 \text{ cm}
\]

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.

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**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 \text{ cm}
   (b) 2 \times 3.14 \times 15 = 94.2 \text{ cm}

3. (a) 2 \times \frac{22}{7} \times 21 = 132 \text{ cm}
   (b) \frac{22}{7} \times 49 = 154 \text{ cm}

4. (a) \left( \frac{1}{2} \times 3.14 \times 6 \right) + 6 = 15.42 \text{ cm}
   (b) \left( \frac{1}{2} \times 3.14 \times 7.5 \right) + 7.5 = 19.28 \text{ cm}
   (c) \left( \frac{1}{2} \times 2 \times \frac{22}{7} \times 12 \right) + 24 = 61.71 \text{ cm}

5. (a) \left( \frac{1}{4} \times 2 \times 3.14 \times 100 \right) + 100 + 100 = 357 \text{ cm}
   (b) \left( \frac{1}{4} \times 2 \times \frac{22}{7} \times 35 \right) + 35 + 35 = 125 \text{ cm}
   (c) \left( \frac{1}{4} \times 2 \times \frac{22}{7} \times 17.5 \right) + 17.5 + 17.5 = 62.5 \text{ cm}

6. \left( \frac{1}{4} \times 2 \times \frac{22}{7} \times 7 \right) + \left( \frac{22}{7} \times 7 \right) = 33 \text{ cm}

7. (3.14 \times 10) + \left( \frac{1}{2} \times 3.14 \times 20 \right) = 62.8 \text{ 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 \text{ 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 \text{ cm}

10. \left( \frac{1}{2} \times 3.14 \times 24 \right) + 12 = 49.68 \text{ cm}

11. 2 \times \pi \times 16 = 100.5 \text{ cm}

12. (a) \frac{22}{7} \times 14 = 44 \text{ cm}
   - The wheel moves 440 cm in 10 complete turns.
   - The wheel will make 2 complete turns.
   (b) \frac{88}{44} = 2
LEARNING OBJECTIVES

1. Find the area of a circle.
2. Find the area of a composite figure made up of square(s), rectangle(s), triangle(s), semicircle(s) and quarter circle(s).

LET'S LEARN

How can we tell the area of a circle that has a radius of 4 cm?

1. Draw the circle on a 1-cm square grid. Estimate the area of the circle by counting the number of squares it covers.

Area of the circle ≈ 52 cm²

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?

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.
1. Find the area of a circle.

2. Find the area of a composite figure made up of square(s), rectangle(s), triangle(s), semicircle(s) and quarter circle(s).

**LEARNING OBJECTIVES**

- Textbook 6 P130

1. Draw the circle on a 1-cm square grid. Estimate the area of the circle by counting the number of squares it covers.

   \[ \text{Area of the circle} \approx \text{cm}^2 \]

**LESSON 2**

**area of a circle**

**LET'S LEARN**

- How can we tell the area of a circle that has a radius of 4 cm?
- How do we count squares that are not completely covered?

**IN FOCUS**

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.

**LET'S LEARN**

- Circles | 113
- Textbook 6 P132

3. Find the area of each circle with centre O.

   a. (Take \( \pi = 3.14 \))
   
   \[ \text{Area} = \pi \times 10 \times 10 \]
   
   \[ = 3.14 \times 100 \]
   
   \[ = 314 \text{ cm}^2 \]

   b. (Take \( \pi = \frac{22}{7} \))
   
   \[ \text{Area} = \pi \times 7 \times 7 \]
   
   \[ = \frac{22}{7} \times 7 \times 7 \]
   
   \[ = 154 \text{ cm}^2 \]

4. Find the area of a movie DVD that has a diameter of 12 cm. (Take \( \pi = 3.14 \))

   \[ \text{Area} = \pi \times 6 \times 6 \]
   
   \[ = 113.04 \text{ cm}^2 \]

5. Find the area of a pizza with radius 13 cm. (Take \( \pi = 3.14 \))

   \[ \text{Area} = \pi \times 13 \times 13 \]
   
   \[ = 530.66 \text{ cm}^2 \]

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?

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.
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 $\pi r^2$.

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.
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?

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.

Pupils should be able to do questions 1 to 3 on their own. Get them to check their answers in pairs.
Independent seatwork

Assign pupils to complete Worksheet 2 (Workbook 6B P9 – 14).

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.

Answers

1. (a) \(3.14 \times 10 \times 10 = 314\) cm\(^2\)
   
   (b) \(\frac{22}{7} \times 7 \times 7 = 154\) cm\(^2\)

   (c) \(\frac{1}{2} \times 3.14 \times 2 \times 2 = 6.28\) cm\(^2\)

   (d) \(\frac{1}{2} \times \frac{22}{7} \times 17.5 \times 17.5 = 481.25\) cm\(^2\)

   (e) \(\frac{1}{4} \times \frac{22}{7} \times 21 \times 21 = 346.5\) cm\(^2\)

   (f) \(\frac{1}{4} \times 3.14 \times 40 \times 40 = 1256\) cm\(^2\)

2. \(\left(\frac{22}{7} \times 7 \times 7\right) + \left(\frac{1}{4} \times \frac{22}{7} \times 7 \times 7\right) = 192.5\) cm\(^2\)

3. \(\frac{1}{2} \times 3.14 \times 6 \times 6 = 56.52\) cm\(^2\)

   \(\frac{1}{2} \times 3.14 \times 2 \times 2 = 6.28\) cm\(^2\)

   \(\frac{1}{2} \times 3.14 \times 4 \times 4 = 25.12\) cm\(^2\)

   \(56.52 - 6.28 - 25.12 = 25.12\) cm\(^2\)

4. \(\frac{1}{2} \times \pi \times 6 \times 6 = 18\pi\) cm\(^2\)

   \(\frac{1}{2} \times \pi \times 4 \times 4 = 8\pi\) cm\(^2\)

   \(18\pi - 8\pi = 10\pi\) cm\(^2\)

5. \(\pi \times 12 \times 12 = 144\pi\) cm\(^2\)

   \(\pi \times 9 \times 9 = 81\pi\) cm\(^2\)

   \(\pi \times 3 \times 3 = 9\pi\) cm\(^2\)

   \(144\pi - 81\pi - 9\pi = 54\pi\)

   \(= 169.56\) cm\(^2\)

6. \(\frac{1}{2} \times 3.14 \times 20 \times 20 = 628\) cm\(^2\)
LEARNING OBJECTIVE
1. Find the area and perimeter of figures made up of a variety of squares, rectangles, triangles, semicircles and quarter circles.

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?

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$^2$

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 = \( \frac{11}{2} + \frac{6}{2} + \frac{11}{2} \)
= 28 cm

Length of the arc = \( \frac{1}{2} \times \frac{22}{7} \times 28 \)
= 44 cm

Perimeter of the figure = 44 + 16 x 2 + 11 x 2 + 6 x 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 = \( \frac{6}{2} \times \frac{6}{2} \)
= 9 cm$^2$

Area of the figure = 16 \times 28 - 36 + 308
= 220 cm$^2$

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

$= 20 + 20 + 14$

$= \frac{84}{7}$ cm

Area of the shaded part

$= \frac{280}{7} - 154$

$= 126$ cm$^2$

Why do we subtract the area of a circle from the area of the rectangle?

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 = $28 ÷ 4 = 7$ 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$^2$

Why do we divide by 4 to find the radius of each circle?

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 we 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?

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.
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$^2$

Mind Workout
Find the area of the shaded part. 50 cm$^2$

Show how you obtain your answer. You may use a calculator to help you.
Answers  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 cm²

3. (a) \( 2 \times \frac{22}{7} \times 14 = 88 \) cm
   (b) \( 14 \times 14 + \left( 2 \times \frac{22}{7} \times 7 \times 7 \right) = 504 \) cm²

4. (a) \( \left( \frac{1}{2} \times 3.14 \times 8 \right) + 10 + 6 + 18 + 6 = 52.56 \) cm
   (b) \( \left( \frac{1}{2} \times 3.14 \times 4 \times 4 \right) + (18 \times 6) = 133.12 \) cm²

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 cm²

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) \( \frac{1}{2} \times 3.14 \times 5 \times 5 = 39.25 \) cm²

   \( 39.25 - \left( \frac{1}{2} \times 6 \times 8 \right) = 15.25 \) cm²

   \( \left( \frac{1}{2} \times 3.14 \times 3 \times 3 \right) + \left( \frac{1}{2} \times 3.14 \times 4 \times 4 \right) - 15.25 = 24 \) cm²

7. \( 18 \times 18 = 324 \) cm²

   \( \frac{1}{4} \times 3.14 \times 18 \times 18 = 254.34 \) cm²

   \( \frac{1}{2} \times 3.14 \times 9 \times 9 = 127.17 \) cm²

   \( \frac{1}{2} \times 18 \times 18 = 162 \) cm²

   \( (324 - 254.34) + 127.17 + 162 = 358.83 \) cm²

   = 358.8 cm² (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) \( 6 \times 1 = 6 \) cm²

   \( (2 \times 1) - \left( \frac{1}{2} \times 3.14 \times 1 \times 1 \right) = 2 - 1.57 \)

   = 0.43 cm²

   \( 6 + 0.43 = 6.43 \) cm²
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.
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

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 \( \pi \).

48 ÷ 3 = 16
The area of one square is 16 cm².
Length of one side of a square = \( \sqrt{16} = 4 \text{ cm} \)
\[ \frac{1}{2} \times \pi \times 16 \times 4 = (8 \pi + 16) \text{ cm} \]

The perimeter of the shaded part is \( (8 \pi + 16) \text{ cm} \).

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.

How do we find the area of each shape?

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.

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.

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) 
   - Centre 
   - Circumference 
   - Diameter 
   - Radius 

(b) \( AB = 2 \times OB \)

(c) \( OA = OB = OC \)

(d) Circumference of the circle = \( \pi \times 2 \times OC \)

(e) Area of the circle = \( \pi \times \frac{OA}{OB} \times \frac{OA}{OC} \)

2. (a) Perimeter = \( 3.14 \times 24 \) 
   = 75.36 cm 
   Area = \( 3.14 \times 12 \times 12 \) 
   = 452.16 cm² 

(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 cm² 

(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 cm² 

3. Distance travelled = \( 4 \times \frac{22}{8} \times 35 \) 
   = 440 cm 

4. Area = \( \frac{1}{2} \times \pi \times 8 \times 8 \) 
   = 32\pi \text{ cm}² 

5. Perimeter = \( (3.14 \times 42) + 21 + 21 \) 
   = 173.9 cm (to 1 decimal place) 
   Area = \( 3.14 \times 21 \times 21 \) 
   = 1384.7 cm² (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 cm² 

7. (a) \( \frac{1}{4} \times 2 \times 3.14 \times 8 = 12.56 \text{ cm} \) 
   \( \frac{1}{4} \times 2 \times 3.14 \times 16 = 25.12 \text{ cm} \) 
   Perimeter = 12.56 + 25.12 + 24 + 8 + 32 
   = 101.68 cm 

(b) \( \frac{1}{4} \times 3.14 \times 8 \times 8 = 50.24 \text{ cm}² \) 
   \( \frac{1}{4} \times 3.14 \times 16 \times 16 = 200.96 \text{ cm}² \) 
   (40 × 16) – 50.24 – 200.96 = 388.8 cm² 

8. \( \left( \frac{22}{7} \times 7 \times 7 \right) – \left( 2 \times \frac{22}{7} \times 3.5 \times 3.5 \right) = 77 \text{ cm}² \)

9. Diameter of smaller semicircle = 10 cm 
   Diameter of larger semicircle = 20 cm 
   \( \frac{1}{2} \times 3.14 \times 5 \times 5 = 39.25 \text{ cm}² \) 
   \( \frac{1}{2} \times 3.14 \times 10 \times 10 = 157 \text{ cm}² \) 
   (30 × 20) – 39.25 – 157 = 403.75 cm² 

10. \( \frac{1}{2} \times \frac{22}{7} \times 7 \times 7 = 77 \text{ cm}² \) 
    \( \frac{1}{2} \times 7 \times 7 = 24.5 \text{ cm}² \) 
    77 + 24.5 = 101.5 cm² 

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 cm² 

12. 1232 ÷ (\( \pi \times 56 \)) ≈ 7 
    It made 7 complete turns.
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.
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.

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.
LEARNING OBJECTIVES

LESSON 1
Textbook 6 P145
Chapter 7 1
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.

IN FOCUS

What are some examples of speed that you can find around you?

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.

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.
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.

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

\[ \text{Distance} = \text{Speed} \times \text{Time} \]
\[ 800 \text{ m} = 400 \text{ m/min} \times t \]
\[ t = \frac{800}{400} = 2 \text{ min} \]

He takes 2 min to complete the race.

Method 2

\[ \text{Time} = \frac{\text{Distance}}{\text{Speed}} \]
\[ t = \frac{800}{400} = 2 \text{ min} \]

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

\[ \text{Distance} = \text{Speed} \times \text{Time} \]
\[ 26 \text{ cm} = 1.3 \text{ cm/s} \times t \]
\[ t = \frac{26}{1.3} = 20 \text{ s} \]

It will take 20 s.

Method 2

\[ \text{Time} = \frac{\text{Distance}}{\text{Speed}} \]
\[ t = \frac{26}{1.3} = 20 \text{ s} \]

It will take 20 s.

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

\[ \text{Distance} = \text{Speed} \times \text{Time} \]
\[ 12 \text{ km} = 80 \text{ km/hr} \times t \]
\[ t = \frac{12}{80} = 0.15 \text{ hr} \]
\[ t = 0.15 \times 60 = 9 \text{ min} \]

It will take 9 min.

Method 2

\[ \text{Time} = \frac{\text{Distance}}{\text{Speed}} \]
\[ t = \frac{12}{80} = 0.15 \text{ hr} \]
\[ t = 0.15 \times 60 = 9 \text{ min} \]

It will take 9 min.

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.
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.

ACTIVITY

Who is the fastest?

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.

2. A toy car moves 100 cm in 5 seconds. What is its speed in cm/s?

3. Kate swims at a speed of 50 m/min. What is the distance she can swim in 15 minutes?

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?

5. An athlete cycles at a speed of 30 km/hr. How long does he take to cycle 120 km?

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.

Practice

Complete Workbook 6B, Worksheet 1 • Pages 31 – 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.
LEARNING OBJECTIVES

1. Define average speed.
2. Find average speed by dividing total distance by total time.

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 = \( \frac{420}{6} \) = 70 km/hr.

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 = \( \frac{\text{Total distance}}{\text{Total time}} \)

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?

\[
\begin{align*}
\text{Distance} & = 120 \text{ m} \\
\text{Time taken} & = 40 + 56 = 96 \text{ s}
\end{align*}
\]

\[
\text{Average speed} = \frac{120}{96} = 2.5 \text{ m/s}
\]

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.

\[
\begin{align*}
\text{Time taken for second part of journey} & = \frac{90}{30} = 3 \text{ hr} \\
\text{Total time taken} & = 2 + 3 = 5 \text{ hr} \\
\text{Average speed} & = \frac{162}{5} = 32.4 \text{ km/hr}
\end{align*}
\]

The average speed of the ship for the whole journey was 32.4 km/hr.

Is it necessary to find the ship’s speed for the first part of the journey? Explain.

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.

\[
\begin{align*}
\text{Distance helicopter flies during first part of journey} & = 40 \times 5 \frac{1}{2} \\
& = 220 \text{ m} \\
\text{Total distance} & = 220 + 270 = 490 \text{ m} \\
\text{Average speed} & = \frac{490}{11} = 44.5 \text{ m/min (to 1 decimal place)}
\end{align*}
\]

The average speed of the helicopter is 44.5 m/min.

Recall how you round decimals to 1 decimal place.

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.

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.
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.

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 = 100 / 120 m/s
   = 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 = 1/2 + 3/4
   = 1 1/4 hr
   Average speed = 85 + 1 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 2/3 hr
   Average speed = 360 ÷ 5 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 × 3/4
   = 3 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
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.

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.

An aeroplane took $\frac{51}{2}$ 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.

Solving word problems

LESSON 3

**LEARNING OBJECTIVE**

1. Solve up to 3-step word problems involving speed and average speed.

**LET'S LEARN**

1. Solve up to 3-step word problems involving speed and average speed.

An aeroplane took $\frac{51}{2}$ 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.

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?

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.

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?

\[
\begin{align*}
\text{Tom} & \quad \text{Meiling} \\
\text{Speed} & \quad 20 \text{ km/hr} & \quad ? \text{ km/hr} \\
\text{Time} & \quad \frac{1}{2} \text{ hr} & \quad \text{?} \text{ hr} \\
\text{Distance} & \quad 18 \text{ km} \\
\end{align*}
\]

Distance cycled by Tom = Speed × Time
\[= 20 \times \frac{1}{2} = 10 \text{ km} \]

Distance cycled by Meiling = \[= \frac{18}{10} \times \frac{1}{2} = 8 \text{ km} \]

Meiling’s cycling speed = \[= 8 \div \frac{1}{2} = 16 \text{ km/hr} \]

Meiling’s cycling speed was 16 km/hr.

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 Tan. Mr Ali drove at an average speed of 90 km/hr for the whole journey. Find Mr Tan’s average speed for the journey.

\[
\begin{align*}
\text{Time taken by Mr Ali} & \quad \text{Time taken by Mr Tan} \\
\text{7 a.m.} & \quad \frac{1}{2} \text{ hr} & \quad 2 \text{ hr} \\
\text{7.30 a.m.} & \quad \text{9.30 a.m.} & \quad \text{9.30 a.m.} \\
\text{Distance travelled by Mr Ali} & \quad 90 \text{ km/hr} \\
\text{Mr Ali’s average speed} & \quad = \frac{90}{2} = 45 \text{ km/hr} \\
\text{Mr Tan’s average speed} & \quad = \frac{180}{3} = 72 \text{ km/hr} \\
\end{align*}
\]

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.

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.

\[
\begin{align*}
\text{Time taken by Bala} & \quad \text{Distance Sam needed to run to complete the race} \\
\text{400 m} & \quad \text{166\frac{2}{3} m} \\
\text{6 m/s} & \quad \text{223 m} \\
\text{Distance Sam ran in that time} & \quad \text{Sam still needed to run} \quad \text{233 m more.} \\
\text{288\frac{1}{3} m} & \quad \text{to the nearest metre) } \\
\end{align*}
\]

Draw a diagram to help you.
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**
  - \(\frac{492}{4.1} = 120\) s

- **Distance from the park when they met**
  - \(\frac{492}{2.2} = 223\) m

- **They were 223 m away from the park when they met.**

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 A. What is the distance between Point A and Point B?

- **Junhao**
  - Speed: 200 m/min

- **Priya**
  - Speed: 120 m/min

- **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.**

---

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.

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

Independent seatwork

Assign pupils to complete Worksheet 3 (Workbook 6B P39 – 43)
Answers  Worksheet 3 (Workbook 6B P39 – 43)

1. Time taken = $500 \div 25$
   \[= 20 \text{ min}\]
   She started walking from her house at 7.10 a.m.

2. Time taken from house to office = $20 \div 50$
   \[= \frac{2}{5} \text{ hr}\]
   Time taken for return journey = $20 \div 60$
   \[= \frac{1}{3} \text{ hr}\]
   Total time taken = \(\frac{2}{5} + \frac{1}{3}\)
   \[= \frac{11}{15} \text{ hr}\]
   Mr Lee took \(\frac{11}{15}\) hr altogether.

3. Distance Sam jogged = $150 \times 20$
   \[= 3000 \text{ m}\]
   Distance Raju jogged = $5400 - 3000$
   \[= 2400 \text{ m}\]
   Raju’s jogging speed = $2400 \div 20$
   \[= 120 \text{ m/min}\]
   Raju’s jogging speed was 120 m/min.

4. Time taken by car = $240 \div 90$
   \[= 2\frac{2}{3} \text{ hr}\]
   Time taken by van = $240 \div 80$
   \[= 3 \text{ hr}\]
   Difference in amount of time = $3 - 2\frac{2}{3}$
   \[= \frac{1}{3} \text{ hr}\]
   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 = $1.2 + 1.8$
   \[= 3 \text{ m}\]
   Time need = $90 \div 3$
   \[= 30 \text{ s}\]
   It took them 30 s to meet each other.

6. Time taken by bus = $340 \div 60$
   \[= 5\frac{2}{3} \text{ hr}\]
   Time taken by car = $5\frac{2}{3} - 1$
   \[= 4\frac{2}{3} \text{ hr}\]
   Average speed of car = $340 \div 4\frac{2}{3}$
   \[= 72.9 \text{ km/hr}\]
   (to 1 decimal place)
   The average speed of the car was 72.9 km/hr.

7. Speed for journey from Singapore to Malacca
   \[= 243 \div 4\]
   \[= 60.75 \text{ km/hr}\]
   Time taken for return journey = $243 \div (60.75 + 15)$
   \[= 243 \div 75.75\]
   \[= 3 \text{ hr 12 min (to the nearest minute)}\]
   Mr Ali took 3 hr 12 min for his return journey.

8. Difference in speeds = $75 - 60$
   \[= 15 \text{ km/hr}\]
   15 km $\rightarrow$ 1 hr
   5 km $\rightarrow$ $60 \div 3 = 20 \text{ min}$
   $75 \times \frac{1}{3} = 25 \text{ km}$
   The distance between Malir and Clifton is 25 km.
Problem Solving, Maths Journal and Pupil Review

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

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.
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

Textbook 6

Practice

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?

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.

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. 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?

What are some methods you can use to help you solve the problem? Explain.

For every 50 m Siti ran, the difference was 10 m.
For every 1 m Siti ran, the difference was \( \frac{10}{50} = 0.2 \) m.

For every 1 m Siti ran, the difference was \( \frac{10}{50} = 0.2 \) m.

When Siti finished running 80 m, Xinyi was 16 m away from the finishing line.

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.

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. \[1600 \div 20 = 80 \text{ m/min}\]

2. \[3 \times \frac{7}{12} = \frac{7}{4} \text{ km} = 1\frac{3}{4} \text{ km}\]

3. \[200 \div 80 = 2\frac{1}{2} \text{ hr}\]
   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 \div 5 = 770 \text{ km/hr}

5. Distance = 2 \times 200 = 400 \text{ m}
   Farhan’s speed = 400 \div 250 = 1.6 \text{ m/s}

6. They travelled for 21 min before they met.
   Distance travelled by Bina = 72 \times 21 = 1512 \text{ m}
   Distance travelled by Sam = 90 \times 21 = 1890 \text{ m}
   1512 + 1890 = 3402 \text{ m}
   The distance between the food centre and the library is 3402 m.

7. Distance travelled for second part of journey = 90 \times 2 = 180 \text{ km}
   Time taken for first part of journey = 180 \div 80 = 2\frac{1}{4} \text{ hr}
   Total time taken = 2\frac{1}{4} + 2 = 4\frac{1}{4} \text{ hr} = 4 \text{ hr 15 min}
   Mrs Ali reached her destination at 11.15 a.m.

8. Distance covered in second part of journey = 3800 \div 2400 = 1400 \text{ km}
   Time taken for second part of journey = 1400 \div 850 = 1\frac{11}{17} \text{ hr}
   Time taken for the whole journey = 3 + 1\frac{11}{17} = 4\frac{11}{17} \text{ hr}
   The number of hours taken for the whole journey was 4\frac{11}{17} \text{ hr}.

9. Distance travelled in first part of journey = 240 \div 2 = 120 \text{ km}
   Time taken for first part of journey = 120 \div 50 = 2\frac{2}{5} \text{ hr}
   Time taken for second part of journey = 6 - 2\frac{2}{5} = 3\frac{3}{5} \text{ hr}
   He took to 3\frac{3}{5} \text{ hr complete the second part of his journey.}
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.
Recap with pupils how to find the volume of a cuboid and cube.

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: $\sqrt{\mathstrut}$ and $\sqrt[3]{\mathstrut}$.
Recap with pupils how to find the volume of a cuboid and cube.

**RECAP**

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.

**LEARNING OBJECTIVES**

Textbook 6 P166

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 8**

**RECAP**

1. Find the volume of the cuboid.

Volume of cuboid = Length × Breadth × Height

3 cm
1 cm
4 cm

Volume = 4 × 3 × 1
= 12 cm³

**Volume of Cubes and Cuboids**

**LESSON 1**

**1.**

A cuboid has a volume of 60 cm³. Its length is 5 cm and its breadth is 3 cm. Find its height.

Height = 
= 4 cm

The height of the cuboid is 4 cm.

**2.**

A cuboid has a volume of 80 cm³. Its length is 5 cm and its breadth is 3 cm. Find its height.

Height = 
= 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 m³. What is the length of the cuboid?

Length = 
= 8 m

The length of the cuboid is 8 m.

**LET’S LEARN**

1. Use 1-cm cubes to show the cuboid. How many layers are there?

2. Find the volume of the cube.

Volume = 2 × 2 × 2
= 8 m³

**LET’S LEARN**

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.

Prompt pupils to solve the question by asking:
- How many 1-cm cubes are needed to make a 12-cm³ 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.

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:

Height = \( \frac{\text{Volume}}{\text{Length} \times \text{Breadth}} \),

Length = \( \frac{\text{Volume}}{\text{Breadth} \times \text{Height}} \),

Breadth = \( \frac{\text{Volume}}{\text{Length} \times \text{Height}} \).
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.

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?
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?

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**

\[
\text{Length of edge perpendicular to face} = \frac{\text{Volume}}{\text{Area of face}}
\]

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.
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.

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?
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.

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.
What you need:

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.

<table>
<thead>
<tr>
<th>Base area of cube</th>
<th>Volume of cube</th>
<th>Length of edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 1 = 1 cm²</td>
<td>1 x 1 x 1 cm³</td>
<td>1 cm</td>
</tr>
<tr>
<td>2 x 2 = 4 cm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 x 3 = cm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 x 4 = cm²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 square root of its base area.
   - The length of the edge of a cube is equal to the cube root of its volume.

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

2. For each cuboid, find the length of the unknown edge:
   (a) Volume = 45 cm³
   (b) Volume = 180 m³

3. Find the base area of each cuboid:
   (a) Volume = 564 cm³
   (b) Volume = 1001 cm³

Allow pupils to work individually or in pairs on the practice questions.
What you need:

1. Work in pairs.
2. Look at the table below. Use the 1-cm cubes given to make four cubes with the given base areas.
3. For each cube made, find its volume by counting the number of cubes used.
4. Copy and complete the table.

<table>
<thead>
<tr>
<th>Base area of cube</th>
<th>Volume of cube</th>
<th>Length of edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 × 1 = 1 cm²</td>
<td>1 × 1 × 1 = 1 cm³</td>
<td>1 cm</td>
</tr>
<tr>
<td>2 × 2 = 4 cm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 × 3 =</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 × 4 =</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. With your partner, discuss how the length of an edge of a cube is related to its base area and volume.
6. Complete the following sentences:

   - The length of the edge of a cube is equal to the square root of its base area.
   - The length of the edge of a cube is equal to the cube root of its volume.

**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. \(2025 \div 9 = 225 \text{ m}^2\)
   \(\sqrt{225} = 15 \text{ m}\)

8. \(40000 \div 80 = 500 \text{ cm}^2\)

9. \(3000 + (23 \times 8) = 16\) cm (to the nearest whole number)

10. (a) \(\sqrt{5832} = 18 \text{ cm}\)
    (b) \(18 \times 18 = 324 \text{ cm}^2\)

11. \(\sqrt{729} = 9\)

   Total area of painted faces = \(6 \times 9 \times 9 = 486 \text{ cm}^2\)

12. Volume of cube = \(5 \times 5 \times 5 = 125 \text{ cm}^3\)
    Height of cuboid = \(125 \div (10 \times 10) = 1.25 \text{ cm}\)
LEARNING OBJECTIVE

1. Solve word problems involving volume of a cube/cuboid.

SOLVING WORD PROBLEMS

**RECAP**

1. Express each of the following in cubic centimetres:
   - (a) 125 ml = 125 cm³
   - (b) 500 ml = 500 cm³
   - (c) 1 l = 1000 ml = 1000 cm³
   - (d) 10 l = 10000 ml = 10000 cm³

2. Express each of the following in litres and millilitres:
   - (a) 1 610 cm³ = 1.61 l = 610 ml
   - (b) 2 305 cm³ = 2.305 l = 2305 ml
   - (c) 4 079 cm³ = 4.079 l = 4079 ml
   - (d) 12 008 cm³ = 12.008 l = 12008 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?

What is the information given?
- The current volume of water in the tank.

What do we need to find first?
- The volume of the tank.

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?
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 cm³
   = 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.

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.

   Amount of water in tank = 2.16 l
   = 2160 cm³

   Capacity of tank = 18 × 15 × 10
   = 2700 cm³

   Amount of water needed = 2700 – 2160
   = 540 cm³

   Junhao needs to add 540 cm³ of water to fill up the tank completely.

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 cm³

   Height of water = 6300
   = 7 cm

   Height of tank = 7 × 4
   = 28 cm

   The height of the tank is 28 cm.

   Method 2
   Volume of water = 6300 cm³

   Capacity of tank = 6300 × 4
   = 25 200 cm³

   Height of tank = 25 200
   = 28 cm

   The height of the tank is 28 cm.

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 cm³.

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.
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.

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.
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.

**Method 1**

Volume of water added = 2.5 \( \text{cm} \)

\[ \text{Height of water added} = \frac{2500}{500} = 5 \text{ cm} \]

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 \times 4 = 2000 \( \text{cm}^3 \)

New volume of water in container = 2000 + 2500 = 4500 \( \text{cm}^3 \)

New height of water in container = \[ \frac{4500}{500} = 9 \text{ cm} \]

The height of the water in the container now is 9 cm.

Which method do you prefer? Explain.

Volume = Base area \times Height

Height of water added = \[ \frac{\text{Volume}}{\text{Base area}} \]

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.

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.
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.

8. A rectangular container with a square base and a height of 16 m is 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.

Capacity of container = \(10 \times 4 \times 7.2 \times \frac{1}{2}\)

= \(576 \text{ m}^3\)

Area of square base of container = \(576 \div 16\)

= \(36 \text{ m}^2\)

Length of one side of base = \(\sqrt{36}\)

= \(6 \text{ m}\)

The length of one side of the base of the rectangular container is \(6 \text{ m}\).

9. An empty rectangular tank measures 60 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 = \(60 \times 60 \times 30\)

= \(90,000 \text{ cm}^3\)

= \(90 \text{ litres}\)

Time taken = \(90 \div 15\)

= \(6 \text{ min}\)

It will take \(6 \text{ minutes}\) 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 = \(12 \times 18\)

= \(216 \text{ litres}\)

= \(216,000 \text{ cm}^3\)

Height of the tank = \(\frac{216 \times 100}{80}\)

= \(54 \text{ cm}\)

The height of the tank is \(54 \text{ cm}\).

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?

\[
\text{Capacity of tank} = 0.6 \times 0.4 \times 0.7 = 60 \times 40 \times 70 = 168000 \text{ cm}^3
\]

\[
\text{Time taken to fill the whole tank} = \frac{168000}{7} = 24 \text{ min}
\]

\[
\text{Time taken to fill } \frac{2}{3} \text{ of the tank} = \frac{2}{3} \times 24 = 16 \text{ min}
\]

It will take 16 minutes to fill \( \frac{2}{3} \) of the tank.

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.

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.

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. \( \text{cm} \)

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. \( \text{cm} \)

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. \( \text{cm} \)
1. Height = $480 \div (10 \times 6)$
   = 8 m

2. Height = $2300 \div (25 \times 12)$
   = 7.7 cm (to 1 decimal place)

3. Height of water = $1280 \div (16 \times 16)$
   = 5 cm
   Height of container = $5 + 8$
   = 13 cm

4. Height of water = $12 - 4$
   = 8 m
   Volume of water = $7 \times 3 \times 8$
   = 168 m³

5. Height of water needed = $10 - 3$
   = 7 m
   Amount of water needed = $15 \times 5 \times 7$
   = 525 m³

6. Capacity = $35 \times 22 \times 35$
   = 26 950 cm³
   Amount of water needed = $26 950 - 13 860$
   = 13 090 ml
   = 13 ℓ 90 ml

7. Height of water = $8000 \div (40 \times 30)$
   = 6$\frac{2}{3}$ cm
   Height of tank = $6\frac{2}{3} \times 3$
   = 20 cm

8. Height of water = $3456 \div (15 \times 12)$
   = 19.2 m
   Height of tank = $19.2 \div 3 \times 5$
   = 32 m

9. Increase in height = $12 000 \div (40 \times 50)$
   = 6 cm
   Height of water in tank now = $12 + 6$
   = 18 cm

10. Decrease in height = $13 440 \div (120 \times 35)$
    = 3.2 cm
    Height of water left = $40 - 3.2$
    = 36.8 cm

11. Volume of water = $50 \times 45 \times 42$
    = 94 500 m³
    Height of water = $94 500 \div (70 \times 54)$
    = 25 m

12. Volume of water = $50 \times 50 \times 57.6$
    = 144 000 cm³
    Height of water in container = $144 000 \div (80 \times 60)$
    = 30 cm
    Height of container = $30 \div 3 \times 4$
    = 40 cm

13. Capacity = $100 \times 85 \times 60$
    = 510 000 cm³
    = 510 ℓ
    Time needed to fill the tank completely
    = $510 \div 14$
    = 36 min (to the nearest minute)

14. Volume of water = $60 \times 70 \times 80$
    = 336 000 cm³
    = 336 ℓ
    Time needed = $336 \div 24$
    = 14 min

15. Volume of water in each tank = $\frac{1}{2} \times 50 \times 40 \times 101$
    = 101 000 cm³
    Height of water in Tank B = $101 000 \div (80 \times 45)$
    = 28.06 cm (to 2 decimal places)

16. Volume of water = $36 \times 250$
    = 9000 ml
    = 9000 cm³
    Height of water in tank at first = $9000 + (32 \times 25)$
    = 11.25 cm
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. $120 \text{ cm}^3$. 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.
PROBLEM SOLVING, MATHS JOURNAL AND PUPIL REVIEW

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 cm³. 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

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.

? 35 cm 50 cm 60 cm 50 cm 70 cm

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.

48 cm 25 cm 36 cm ?

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.

4 cm 5 cm 6 cm

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).
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
1. (a) 17 cm
(b) 16 m
(c) 5 cm

2. $1404 \div (13 \times 12) = 9 \text{ cm}$

3. $2520 \div 420 = 6 \text{ cm}$

4. $1215 \div 15 = 81$

5. $\sqrt{81} = 9 \text{ m}$

6. \[3\sqrt{2744} = 14 \text{ m}\]

7. Length of edge = \[3\sqrt{3375} = 15 \text{ cm}\]
Area of base = $15 \times 15 = 225 \text{ cm}^2$

8. \[3\sqrt{1331} = 11 \text{ cm}\]
Total area of painted faces = $6 \times 11 \times 11 = 726 \text{ cm}^2$

9. Volume of water = $20 \times 15 \times 8 = 2400 \text{ cm}^3$

10. Height = $1500 \div 140 = 10.71 \text{ cm}$ (to 2 decimal places)

11. Height of water needed = $18 - 10 = 8 \text{ cm}$
Amount of water needed = $24 \times 15 \times 8 = 2880 \text{ cm}^3 = 2880 \text{ ml}$

12. (a) Capacity = $30 \times 50 \times 20 = 30000 \text{ cm}^3 = 30 \text{ l}$
(b) Volume of water after 2 min = $12 \times 2 = 24000 \text{ cm}^3 = 24000 \text{ ml}$
Height of water = $24000 \div (50 \times 30) = 16 \text{ cm}$

13. Decrease in height = $720 \div (30 \times 12) = 2 \text{ m}$
Height of water left = $7 - 2 = 5 \text{ m}$

14. Volume of water in Container A = $40 \times 10 \times 30 = 12000 \text{ cm}^3$
Increase in height in Container B = $12000 \div (60 \times 25) = 8 \text{ cm}$
New height of water in Container B = $18 + 8 = 26 \text{ cm}$

15. Amount of water poured into container = $\frac{1}{5} \times 50 \times 30 \times 40 = 12000 \text{ cm}^3$
Increase in height = $12000 \div (25 \times 20) = 24 \text{ cm}$
New height of water = $4 + 24 = 28 \text{ cm}$

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.
LEARNING OBJECTIVE
1. Interpret data from a pie chart.

RECAP
1. Express \( \frac{2}{5} \) as a percentage.
   \( \frac{2}{5} = 40\% \)
2. Express 15% as a fraction in its simplest form.
   15% = \( \frac{3}{20} \)

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.
### RECAP
1. Express $\frac{2}{5}$ as a percentage.
   -$\frac{2}{5} = 40\%$
2. Express 15% as a fraction in its simplest form.
   - $15\% = \frac{3}{4}$

### In Focus

There are 5 apples and 15 oranges in a basket.

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Apples</th>
<th>Oranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of fruits</td>
<td>5</td>
<td>15</td>
</tr>
</tbody>
</table>

**Fruits in a Basket**

![Bar Graph of Fruits in a Basket]

We can use a table to show the information.

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Number of fruits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>5</td>
</tr>
<tr>
<td>Oranges</td>
<td>15</td>
</tr>
</tbody>
</table>

We can also represent the information using a bar graph.

What are some other ways we can represent the information?

### Let's Learn

1. We can use a **pie chart** to represent the information.

   ![Pie Chart of Apples and Oranges]

   The whole circle represents a whole, or 100%.

2. The pie chart shows how 100 pupils travel to school every day.

   ![Pie Chart of Transport Modes]

   Study the pie chart and answer the questions.
   (a) How many pupils walk to school?
   - 25 pupils walk to school.
   (b) Which mode of transport is used by most of the pupils?
   - The mode of transport used by most of the pupils is **bus**.

### 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

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.
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 fraction of the pupils travel to school by car?

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?

\[
\frac{20}{100} = 20\%
\]

10% of the pupils travel to school by train.

3. The pie chart represents the number of each type of chocolate in a bag.

Study the pie chart and answer the questions.

(a) What fraction of the chocolates are milk chocolates?

\[
\frac{3}{10}
\]

of the chocolates are milk chocolates.

(b) What fraction of the chocolates are dark chocolates?

Method 1

\[
\frac{1}{2} - \frac{3}{10} = \frac{1}{20}
\]

of the chocolates are dark chocolates.

Method 2

\[
1 - \frac{1}{2} - \frac{3}{10} = \frac{1}{5}
\]

The pie chart represents 1 whole.

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.

(c) What percentage of the chocolates in the bag are white chocolates?

\[
\frac{3}{10} = 30\%
\]

30% of the chocolates in the bag are white chocolates.

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?

Food 35%

Savings 18%

Stationery 18%

Books 20%

\[
\frac{18}{100} = \frac{9}{50}
\]

Farhan spent \[
\frac{9}{50}
\]

of his pocket money on stationery.

(b) What percentage of his pocket money did Farhan save?

\[
100\% - 35\% - 18\% - 20\% = 30\%
\]

Farhan saved 30% of his pocket money.
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.

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).

---

**Textbook 6 P198**

**Activity**

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**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<tbody>
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<td>9</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

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.

---

**Practice**

1. A survey was carried out to find out the pupils’ favourite sports. The pie chart shows the results of the survey.

   ![Pie Chart: Badminton 25%, Soccer 10%, Swimming 20%, Basketball 15%]

   (a) What percentage of the pupils chose badminton as their favourite sport? 25%
   (b) What fraction of the pupils chose basketball as their favourite sport? \( \frac{1}{4} \)
   (c) Which sport was more popular, badminton or swimming? Swimming

2. The pie chart shows the different types of television programmes that 30 pupils liked.

   ![Pie Chart: Travel Shows 20%, Animal Documentaries 10%, Cartoons 15%, Dramas 45%]

   (a) Which was more popular, dramas or animal documentaries? Dramas
   (b) What fraction of the pupils chose travel shows? \( \frac{1}{3} \)
   (c) What percentage of pupils chose cartoons? 30%
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) \(1 - \frac{3}{20} - \frac{1}{5} - \frac{1}{4} - \frac{1}{10} = \frac{3}{10}\)
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) 1
(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) $1 - \frac{3}{10} - \frac{1}{5} - \frac{1}{4} - \frac{1}{10} = \frac{3}{10}$

**LEARNING OBJECTIVE**
1. Solve word problems involving pie charts.
2. There are 200 vehicles in a car park. The pie chart shows the different vehicles parked in the car park.

(c) How many motorcycles are there in the car park?
\[
\frac{1}{4} \times 200 = 50
\]
There are 50 motorcycles in the car park.

(b) What percentage of the vehicles in the car park are vans?
\[
1 - \frac{1}{4} - \frac{3}{5} = \frac{1}{20} = 5\%
\]
5% 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.

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.

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. \( \frac{1}{3} \) of the pupils chose chocolate and \( \frac{1}{2} \) of the remaining pupils chose vanilla. The fraction of pupils who chose chocolate was \( \frac{3}{5} \) more than the number of pupils who chose strawberry and mint.

\[
\text{Vanilla: } \frac{1}{3} \\
\text{Strawberry: } \frac{1}{2} \\
\text{Chocolate: } \frac{3}{5} \\
\text{Mint: } \frac{2}{5} 
\]

(a) 20 pupils chose chocolate as their favourite ice cream flavour. How many pupils were there in the class?

\[
20 \times \frac{3}{5} = 12
\]

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?

\[
\frac{1}{2} \times \frac{2}{5} = \frac{1}{5}
\]

\( \frac{1}{5} \) of the pupils chose strawberry and mint.

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.

\[
\text{Adults: } 320 \\
\text{Children: } 160 \\
\text{Senior Citizens: } 52
\]

The table shows the prices of each ticket.

<table>
<thead>
<tr>
<th>Category</th>
<th>Adult</th>
<th>Child</th>
<th>Senior Citizen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>$34</td>
<td>$25</td>
<td>$30</td>
</tr>
</tbody>
</table>

Find the total amount collected from the sales of all the tickets.

\[
\text{Total amount collected} = 320 \times $34 + 160 \times $25 + 52 \times $30
\]

\[
= 10,880 + 4,000 + 1,560
\]

\[
= 16,440
\]

A total of $16,440 was collected from the sale of all the tickets.

For Let’s Learn 5, remind pupils to multiply the correct quantity with the corresponding price.
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.

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.

   Boys
   Girls
   Men 12%
   Women 20%
   Women 18%

(a) What fraction of the people at the carnival are adults? Express your answer in its simplest form.
(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.

   Purple 10%
   Red 20%
   Green 15%
   Yellow 10%
   Blue 30%

(a) What fraction of the pupils chose green and yellow? Express your answer in its simplest form.
(b) 9 pupils chose purple. How many pupils chose yellow? 4
(c) What fraction of the pupils chose blue? 3

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.

   Roses
   Daisies
   Tulips
   Gerberas
   Carnations

(a) How many daisies are there?
(b) Are there more roses or more Carnations at the florist shop?
(c) Which flower has the least number displayed at the florist shop?

Complete Workbook 6B, Worksheet 2, Pages 85 – 92.

Independent seatwork

Assign pupils to complete Worksheet 2 (Workbook 6B Pages 85 – 92).

Allow pupils to discuss and work in pairs or groups. Then, go through the questions and solutions with the class.
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 \ell
   \[ 25\% \rightarrow \frac{3}{15} \times 25 = 5 \ell \]

7. (a) Lion
   (b) \( 1 - \frac{4}{15} = \frac{11}{15} \)
   (c) \( 40 \div 4 \times 15 = 150 \)
   (d) \( \frac{54}{100} = \frac{27}{50} \)
   \[ \frac{2}{3} \times \frac{27}{50} = \frac{18}{25} \]

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 pie chart shows the amount of money each pupil has saved.

Xinyi and Bala saved $26 altogether. How much did Ahmad save? $13

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

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.

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.

Is each statement correct? Explain.

Raju

There are more girls in the Mathematics Club in 2015 than in 2010.

Nora

There are more girls than boys in the Mathematics Club in 2015.

SELF-CHECK

I know how to...

- read and interpret pie charts.
- solve problems using information from pie charts.
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.

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) \(150 \times 4 = 600\)

(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) \(21 \times 4 = 84\)

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

Solid Figures

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?

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?

In Focus

SOLID FIGURES

210

Lesson 1 Solid Figures
Lesson 2 Nets of Solid Figures
Problem Solving, Maths Journal and Pupil Review

Related Resources
NSPM Textbook 6 (P210 – 229)
NSPM Workbook 6B (P99 – 118)

Materials
Paper, scissors, ruler, manipulatives

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

LEARNING OBJECTIVE
1. Describe the characteristics of solid figures: cube, cuboid, cone, cylinder, prism and pyramid.

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.
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.

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.
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.

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.

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.

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.

6. The solids shown are pyramids.

What are the shapes of the faces in each pyramid shown?

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.

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.

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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

**1.** Name the shape of each object.

(a) [Cylinder]

(b) [Cuboid]

(c) [Cone]

(d) [Prism]

(e) [Pyramid]

(f) [Cuboid]

(g) [Prism]

(h) [Cone]

(i) [Cuboid]

(j) [Prism]

2. Copy and complete the table.

(a) Name the solid figure.
(b) Find the number of faces.
(c) Name the shapes of the faces.

<table>
<thead>
<tr>
<th>Solid figure</th>
<th>Name of solid figure</th>
<th>Number of faces</th>
<th>Shape(s) of faces</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Cube" /></td>
<td>Cube</td>
<td>6</td>
<td>6 squares</td>
</tr>
<tr>
<td><img src="image" alt="Cuboid" /></td>
<td>Cuboid</td>
<td>6</td>
<td>2 squares, 4 rectangles</td>
</tr>
<tr>
<td><img src="image" alt="Cone" /></td>
<td>Cone</td>
<td>2</td>
<td>1 circle, 1 curved face</td>
</tr>
<tr>
<td><img src="image" alt="Cylinder" /></td>
<td>Cylinder</td>
<td>3</td>
<td>2 circles, 1 curved face</td>
</tr>
<tr>
<td><img src="image" alt="Prism" /></td>
<td>Prism</td>
<td>5</td>
<td>2 triangles, 3 rectangles</td>
</tr>
<tr>
<td><img src="image" alt="Pyramid" /></td>
<td>Pyramid</td>
<td>4</td>
<td>4 triangles</td>
</tr>
<tr>
<td><img src="image" alt="Prism" /></td>
<td>Prism</td>
<td>6</td>
<td>2 trapeziums, 4 rectangles</td>
</tr>
</tbody>
</table>

### INDEPENDENT SEATWORK

Assign pupils to complete Worksheet 1 (Workbook 6B P99 – 104)
1. (a) 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.

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
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.

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.

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.

3. Are figure A and figure B nets of cubes? No

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.

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.
2. The figures shown are also nets of cubes. Trace them on a piece of paper and fold each net to form a cube. Do the cubes formed have the same size? What does this show?

3. Are figure A and figure B nets of cubes? Trace the figures on a sheet of paper and fold them to find out.

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.

What you need:

Work in pairs.

1. The measurements of a cube are given. 2 cm
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.

ACTIVITY  TIME

4. The following are some examples of other solid figures and their nets.

| Solid Figures | 187 |

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.

Get pupils to discuss and make nets of each solid which are different from what were shown in the examples.
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.

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.
This activity is an extension of the previous one, where pupils now explore the nets of other solid figures using manipulatives.

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.

(a) 

(b) 

(c) 

(d) 

(e) 

(f) 

3. Which of the following nets can be folded to form solid figures? Name the solid figures formed.

A, cube  
B, prism  
C, pyramid

A, cube  
B, prism  
C, pyramid

D, pyramid

E, pyramid

F, pyramid

Assign pupils to complete Worksheet 2 (Workbook 6B P105 – 111).
1. (a)
(b)
2. (a) 
(b)
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.

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?

What are some ways you can use to find the answer?
**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.

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**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.

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).
1. (a) cuboid  
   (b) pyramid  
   (c) cone  
   (d) cube  
   (e) prism  
   (f) cylinder

2. (a)  
   (b)  
   (c)  
   (d)  

3. (a)  
   (b)  
   (c)  
   (d)  

4. (a)  
   (b)  

Answers
Review 10 (Workbook 6B P113 – 118)
Answers

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 \(\times\) 20 \(\times\) 20
    = 8000 \text{ cm}^3
   Capacity of tank = 8000 \(\times\) 5
    = 40 000 \text{ cm}^3

Section C
1. A and D
2. 75% \(\rightarrow\) $60
   100% \(\rightarrow\) \(\frac{60}{75} \times 100 = \$80\)
3. Average increase = \(\frac{9 - 2}{3}\)
    = 2\frac{1}{3} \text{ 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. \[72 ÷ 4 = 18\]
   \[18 = 3 \times 6\]
   The breadth of each small rectangle is 3 cm.

7. \[810 ÷ 81 = 10\]
   \[81 = 9 \times 9\]
   \[10 \times 9 = 90\]
   The area of the shaded face is 90 cm².

8. (a) \[\angle ABD = 110° - 90°\]
   \[= 20°\]
   \[\angle ADB = 180° - 90° - 20°\]
   \[= 70°\]
   (b) \[\angle ABC = (180° - 90°) ÷ 2\]
   \[= 45°\]
   \[\angle DBG = \angle BGD\]
   \[= \angle ABC\]
   \[= 25°\]
   \[\angle CGE = \angle BGD\]
   \[= 180° - 90° - 25°\]
   \[= 65°\]

9. Length of rectangle = \[30 ÷ 3 \times 5\]
   = 50 cm
   Area of unshaded part = \[\frac{1}{2} \times 30 \times (50 - 15)\]
   = 525 cm²
   Area of shaded parts = \[50 \times 30 - 525\]
   = 975 cm²

10. Cost of a notebook after discount
    \[
    = \frac{90}{100} \times 2 \]
    \[-= 1.80\]
    Amount paid for notebooks on Monday
    \[-= 2 \times 15 \]
    \[-= 30\]
    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 = \[0.45 \times 10\]
    \[-= 4.50\]
    Since one magnet is given free with every 10 magnets bought, he can get 11 magnets for $4.50.
    Cost of 33 magnets = \[4.50 \times 3\]
    \[-= 13.50\]
    Cost of 7 magnets = \[0.45 \times 7\]
    \[-= 3.15\]
    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 = \[392 - (2 \times 140)\]
    \[-= 112 g\]
    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 = \[200 \times 10\]
    = 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 = $50 \times 40 \times 45$
   \[= 90\,000 \text{ cm}^3\]
   \[= 90\,\ell\]

   Amount of water in tank after first 4 minutes
   \[= 3.5 \times 4\]
   \[= 14\,\ell\]

   Length of time Tap B was turned on
   \[= (90 - 14) + (3.5 + 4.5)\]
   \[= 76 + 8\]
   \[= 9.5\,\text{min}\]

   Tap B was turned on for 9.5 min.

(b) Total length of time that Tap A was turned on
   \[= 4 + 9.5\]
   \[= 13.5\,\text{min}\]

   Amount of water that flowed from Tap A
   \[= 3.5 \times 13.5\]
   \[= 47.25\,\ell\]

   The total amount of water that flowed from
   Tap A was 47.25 \ell.

15. (a) Area of shaded part
   \[= \left(\frac{1}{2} \times 3.14 \times 5 \times 5\right) - \left(\frac{1}{2} \times 3.14 \times 2.5 \times 2.5\right)\]
   \[= 39.25 - 9.8125\]
   \[= 29.4375\,\text{cm}^2\]

(b) Perimeter of the shaded part
   \[= \left(\frac{1}{2} \times 3.14 \times 10\right) + \left(\frac{1}{2} \times 3.14 \times 5\right) + 5\]
   \[= 15.7 + 7.85 + 5\]
   \[= 28.55\,\text{cm}\]

16. Number of butter cookies : Number of chocolate cookies
   \[3 : 4\]
   \[12 : 16\]

   Number of cookies sold
   \[= \frac{1}{4} \times 12 + \frac{1}{4} \times 16\]
   \[= 7\,\text{units}\]

   Number of cookies sold
   \[= 269 - 213\]
   \[= 56\]

   7 units = 56
   1 unit = $56 \div 7$
   \[= 8\]
   28 units = $8 \times 28$
   \[= 224\]

   Number of almond cookies
   \[= 269 - 224\]
   \[= 45\]

   There were 45 almond cookies.

17. Amount at first : Amount in the end
   \[\frac{3}{15} \quad : \quad \frac{1}{5}\]

   Amount remaining after spending
   \[= \frac{1}{4} \times \frac{4}{5} \times 15\]
   \[= 3\,\text{units}\]

   Difference
   \[= 5 - 3\]
   \[= 2\,\text{units}\]

   2 units = $4$
   15 units = $4 \div 2 \times 15$
   \[= 30\]

   Ahmad had $30 at first.

18. $9 \times 4 = 36$

   $36 - 19 = 17$

   She had 17 packets of 5 sweets each.
   \[17 \times 5 + 19 = 85 + 19\]
   \[= 104\]

   Xinyi packed 104 sweets altogether in the end.
Answers

1. 90 000
2. Six million, eight hundred and seven thousand, nine hundred and forty-three
3. 3.5, 3 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 7/12 hr
14. 2 5/6
15. 5 1/20
16. 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

Review A (Textbook 6 P230 – 234)
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 \( \ell \)

(b) \( \frac{2}{5} \)

(c) 9 min

18. 36
Review D (Textbook 6 P250 – 259)

1. Petrol station

2.

\[ \begin{array}{c}
X \\
Y \\
\end{array} \]

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. $\frac{750 - k}{20}$
8. (a) $(2p + 39)$ cm
   (b) 51 cm
9. 413
10. (a) $\left(\frac{12y + 18}{4}\right)$ cm
    (b) 812.25 cm²
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.

### 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.

### 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?

### 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.

### 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.
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.