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TEACHER'S MANUAL

MASTERY IN MATHEMATICS THROUGH THE CONCRETE PICTORIAL ABSTRACT (CPA) APPROACH

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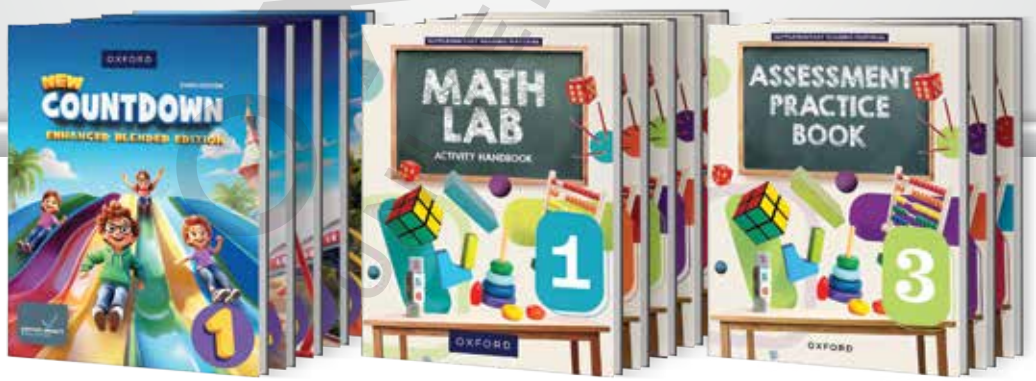


Contents

Our Core Philosophy

This Teacher's Manual has been designed to promote good teaching practices for teachers to implement the National Curriculum of Pakistan. This series provides teachers with the flexibility to choose the elements that are right for their learners.

Teachers must create a conducive environment for learning mathematics in the class that rewards creativity and enjoyment. When introducing a concept, teachers need to ensure that pupils can relate mathematical activities and problems. Therefore, teaching mathematical concepts with real-life context and providing hands-on experience facilitates the learning process, so long as the context is comprehensible to the class. Pupils should be able to find solutions to real-life situations based on what they have learnt in class. This series engages pupils by providing interactive hands-on activities, as well as individual exercises. Each unit in the book ends with a class discussion, inviting pupils to share their perspective, and all concepts are supported by real-life tie ins. This approach begins by each pupil having an opinion, and at each unit's end, they can discuss how their opinions have changed, and whether they see the importance of what they learnt. The heavy focus on inquiry-based learning, demonstration approach, and cooperative learning allows the teacher to expose the class to different teaching styles, which ultimately help pupils to better understand their own needs as learners. The Teachers' Manual provides instructions on the use of resources to help them carry out the above-mentioned objectives. If a concept is taught in a comprehensive manner with clear instructions along 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 manual serves as a support for teachers regardless of what series they use.

The Teacher's Manual supports a meaningful and holistic approach to teaching the strands of mathematics. The build-up of concepts throughout this series is progressive and thorough. 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, in the form of games, standard and non-standard materials, and resources, are implemented through activities. The Teacher's Manual facilitates teachers to implement this aspect of the series proficiently. It also 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 Manual provides the following elements:

- **Aligned with the National Curriculum of Pakistan** – SLOs listed at the start of each unit, as well as next to each activity in the margins.
- **Unit Guides** – Detailed lesson plans for each lesson to keep the teaching approach organised and accessible for the teachers. It encompasses prior learning, pre-emptive pitfalls, introduction, and problem solving.
- **Inclusivity in the Class** – An essay detailing some of the most prevalent disabilities in schools. How to see the signs, and how to make sure your class is a good learning environment for all your pupils.
- **Tackling Math Anxiety and Avoidance** – Math should be taught in a fun and inviting way, and to do it right, one must understand what not to do. This write-up discusses all the contributors of Mathphobia, as well as how to see the signs of it in pupils.
- **Let's Begin** – An introductory paragraph to start a class discussion, preparing the class to break into a new unit.
- **Activities** – Structured activities designed to make sure that pupils learn everything they need to know in an interactive on way.

- **Let's Try It** – Class exercises for pupils' individual or pair work so they can practice concepts as they learn them.
- **Let's Talk Math** – Mathematical communication support. Real-life connections are necessary for pupils to really appreciate the math that they are learning. This will help you start a conversation at each unit is end, bringing the topic to conclusion, as well as leading pupils to reflect on what they learnt.
- **Let's Get Practical** – An end-of-unit activity that incorporates a real-life connection, including as many SLOs as possible.
- **Confusion Bar** – A bar that ranks confusion levels from 1 to 5, both reminding the teacher to check in, as well as allowing them to track the number of pupils whose understanding is not up to par.
- **Math Lab** – Alongside our activities, we list page numbers from Math Lab; an activity handbook that might help struggling pupils, and help all pupils practice their concepts.
- **Self Assessment** – Given at the end of each unit, a page for the teacher to assess how well the class has understood the lesson, in accordance with the NCP's "Role of a Teacher".

A user-friendly guide to the NCP to help teachers perform to the best of their abilities, and to remind pupils that there is a place for creativity in math. It is crucial that children build a good relationship with the subject at early stages, given that there is so much of it in day-to-day life, and a solid foundation would be very helpful for later years.

Tackling Math Anxiety and Avoidance

The fact that it is common for students to struggle with math is often written off as nothing more than a difficult subject being neglected by unmotivated students. Surely, if children put in the necessary practice time, they would succeed at whatever they tried. Or perhaps some children just aren't able to comprehend ideas so complex because they're not smart enough.

Researchers believe that about 20% of people suffer from "math anxiety" and some psychologists believe it to be a diagnosable condition. Math anxiety will most likely lead to "math avoidance". Students will often appear unfocused and like they are looking for reasons to leave the class. It might look like they would prefer anything to actually trying to learn the material. It will seem like they are lazy or naughty, but the fact is, these children are likely just looking for an escape from a stressful situation. They don't ask for help or guidance because they don't believe that they have any chance of doing better, and because they feel unable to confront their fears. The stress that they feel during class also impacts their ability to learn. Children are already so susceptible to distractions that a high stress situation can almost entirely block their working memory. Furthermore, these feelings are not simple enough for young children to be able to explain to adults, even if they are offered help. What they understand is that they are low achievers, they are bad at math, and they will always be bad at math.

When trying to understand how to fix or avoid this in the class, here are some things you should keep in mind:

Math Anxiety is Contagious

As a teacher, if you start seeing math avoidance ask yourself what might have triggered it. Is the overall class attitude toward math negative? How did it become that way? It is not uncommon for the idea to be picked up from the teacher. That's why it is important to never present the subject as something that students should worry about. Don't tell your students that the next unit is hard. Instead, give them the lesson, and let them ask questions so they know that it is not a big deal to need help.

Do Not Promote the Idea That Some People are Just Not Good at Math

Also, be sure to reassure your students that everyone is different, but everyone can do math. Remind them that it is not their fault if something did not make sense the first time because all people have different ways of learning. Or better yet, tackle new topics by catering to multiple learning styles. Incorporate some activities and some creativity so that at the end of the introduction, they will all have a clearer idea of the concept.

Avoid Shame in the Class

One of the bigger roots of stress in the class is the fear of failure. Instead of calling out children by name and asking them to answer a question in front of the class, ask the question and allow them to raise their hands. If you notice some children that tend not to volunteer, check their written work to see how they're performing. If they're doing well, then they're simply not comfortable speaking up in front of their classmates and maybe just need a confidence boost. If they're not performing well, then you are likely dealing with avoidance.

Group Weaker Students with Students that Could Help Them

When doing group exercises in the class make sure the students who are struggling are evenly distributed. Often, they will feel more comfortable approaching their peers for help, or might even learn from watching them, because they won't be feeling as though they are the ones faced with the problem. Furthermore, children have a better idea of what was challenging about a subject than an adult. They may be able to clear up some confusion for their friends that the teacher was not aware of.

Students Who Experience Math Anxiety Can Actually Be Good at Math

Do not think of these children as underachievers. Instead, think of them as students who have something crucial missing from their learning process. Instead of repeating the same explanation, try to use different language, or better yet, design an experience that will show them what you're trying to explain. Keep in mind that anxieties are impacting students' comprehension skills, so your approach must be something that helps students feel like their is less pressure to succeed.

Inclusivity in the Class

Every student is differently abled, and as teachers, we try multiple approaches to cater to each one of them. However, some students need special consideration. Below are some examples of students who could be held back in the class due to their special needs, and small considerations that could be made that might make all the difference without compromising on learning objectives. Be sure to be aware of exactly how severe the impact is before deciding what changes to make. The goal here is to create an environment where the children can adapt to life amongst abled people, and learn to be as independent as possible, which is why one should try to avoid extra attention. Children should never believe that they are not able to do things, and instead be given the tools to find ways to do things.

Sight

While it is commonly believed that visually impaired, or blind students need constant help, teachers should keep expectations high, while still making it clear that it is always alright to ask for help, as is for regular students. Any changes or adaptations should apply to the entire class, to avoid singling anyone out.

Some good practices to incorporate are being more verbal, especially when writing on the board, and always calling children by their names rather than pointing. When the illustrations in the book are pertinent to the lesson, describe them aloud to the entire class so that no one misses out. If possible, use tangible objects as counters, so that the class is not entirely reliant on images. If you do see these students struggling, instead of rushing in to help, offer information to the entire class, for example, if the child is having trouble finding a book, describe the shape instead of getting it for him or her.

Hard of Hearing

Depending on when these children lost their hearing, they may be lacking in vocabulary, and have trouble speaking.

Seat these students near to the front of the class since they will be almost entirely reliant on the blackboard, and they may be able to lipread if they have clear sight of the teacher. Therefore, the teacher should always face the class when speaking, and also, keep in mind that hearing-impaired students cannot listen and take notes simultaneously, especially if watching an interpreter. If possible, make sure important information is also available as handouts, including class announcements about deadlines and scheduling. Furthermore, any videos or documentaries screened at school should have subtitles.

Speech

These students will need some facilitation when encountering new vocabulary. It might be helpful if before starting a new unit, there is five-minute class discussion about the unfamiliar terminology that might pop up so that they can make note of it. Always ask students if they need help before assuming that they do. If they can successfully complete a task that involves communication, praise them, but do not draw too much attention as if it was unexpected. It might seem necessary to eliminate verbal assessments for these students but be cautious about this. There should always be an opportunity for the student to attempt to improve, or practice their communication abilities, and they should feel comfortable doing so. Small improvements should be acknowledged, and the goal should remain to meet the learning objectives however possible.

Memory

To help these students, one must understand the difference between working short-term and long-term memory. When a student learns new information, it is initially stored in working memory, as he or she uses it, and with time, as it stops being pertinent to their actions, it shifts to long term memory. If the child can recall concepts that were taught within the last 24 hours, but struggling to remember information from two weeks ago, then the issue lies with their long-term memory. If it is the other way around, like if they are forgetting instructions they were just given, then it is their working memory that is the problem.

While it has a bad reputation, rote learning can be very helpful for these students. Even employing repetition to really drill things into their minds might be helpful. The more modern approaches like project-based learning will certainly help them grasp concepts, but those concepts need to stick in their minds, so constantly relating new material to what was learned previously, and revising will help achieve this. Also, encourage active reading when assigning homework. Ask students to make notes while doing reading so that they can engage more with the text and have a personalized reference point when they need to revise. Lastly, create associations. Make games out of math activities, sing songs, use acronyms, and relate math to real-life. These students will likely have to work slightly harder on their own time, but these small changes to the class will both encourage and facilitate this.

Dyslexia, Dyscalculia, and Dysgraphia

While these learning disabilities are estimated to affect 5 to 20% of people globally, they often go undiagnosed. Since students are not aware that the way they perceive things is different, as a teacher, one must be aware of the signs.

a) Dyslexia

causes problems with reading, writing, and spelling. Some signs to look out for are delayed speech development, trouble pronouncing words, for example, saying "taplop" instead of laptop, trouble with sentence construction, even verbally, and lack of appreciation for rhymes. These children will often seem disinterested in learning the alphabet as they won't comprehend it as well as their peers.

b) Dyscalculia

a range of difficulties with maths. Students may not immediately understand the meaning of numbers and applying mathematical principals. To identify students suffering from it, look out for children who lose track when counting, and rely heavily on visual aides, like fingers when counting. Placing objects in order, and connected numerals (7) with written out words, like seven will be a struggle for these children.

c) Dysgraphia

affects the act of writing that requires a set of motor and information processing skills. The signs include problems with spelling, handwriting, and expressing thoughts on paper, because students will not be able to think and write at the same time. Their writing will show an inconsistency in spacing, and missing words and letters. An unusual hand position while writing or keeping the paper at an angle is also a symptom.

All these learners will be different. Some may be able to get by in a normal class environment, while some will need special allowances. For instance, allowing the student to bring in an audio recording device would be very helpful. Furthermore, providing a multisensory learning experience will make it less likely that they will miss certain things entirely. It is imperative that these allowances are only made where necessary, and that, as often as possible, they apply to the entire class, as opposed to just one or two students.

Autism

When dealing with Autism, one must keep in mind that it is a spectrum, and that it will be different in every student. Some children are diagnosed early on as their Autism affects their every day lives, but some are not diagnosed until quite late in life, as the symptoms vary both in nature and in visibility.

Students who make little or no eye contact, are not able to interact with others, repetitive movements (like flapping arms, or tapping), have low spatial awareness, and are extra sensitive to bright lights and sounds might be on the spectrum. While only a professional can make a diagnosis, proper medical help is not always accessible, and parents do not always notice the signs. Autistic children are often also prone to tantrums, and can come across as insensitive, and or, unemotional.

While this is a complicated disorder, small efforts can go a long way in helping these students thrive. Highly structured environments, following a routine, and giving plenty of warning before big changes will make these students feel more comfortable, and able to focus on subject matter. Limit class distractions and give written

instruction instead of long verbal announcements. These children express themselves differently, but often are very intelligent and passionate. Approaching their learning with a positive attitude will do wonders for them.

ADHD (Attention Deficit/Hyperactivity Disorder)

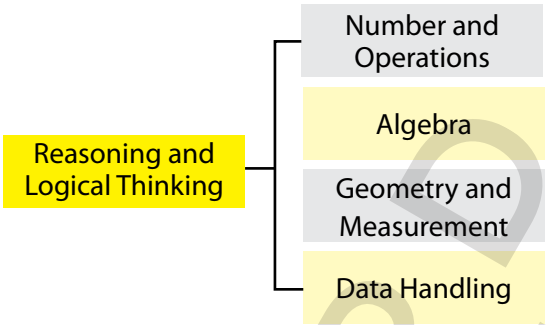
ADHD is a disorder that leads to problems paying attention, impulse control, and hyperactivity. While all children are easily distracted, it will be especially apparent in these children. Like Autism, a diagnosis can only be made by a professional, but since not all children will have that privilege, teachers can facilitate their learning by making the class environment as stable and predictable as possible.

The instructions given in class should always be clear, and if possible, consistent. All students should understand what is expected of them, and this should be repeated as often as seems necessary. Furthermore, instead of just verbally communicating them, also put them up in the room so that students can refer to them whenever they need to. A good tool is to have the children tell you what they understood was or is expected of them, as children often listen without absorbing, and children with this particular disorder may be skilled at appearing engaged, whereas their mind is actually elsewhere.

National Curriculum of Pakistan

The curriculum for Mathematics is comprised of the following four strands. The strands are intentionally kept broad to allow flexibility to the teachers to adapt their teaching styles in accordance with their students.

These strands include Numbers and Operations, Algebra, Geometry and Measurement and Data Handling. All of this content is underpinned by reasoning and logical thinking. All standards, benchmarks and students' learning outcomes are built around these strands.



Key Learning Strands	Standards
1. Numbers and Operations	• identify numbers, ways of representing numbers, comparing numbers and effects of number operations • compute fluently with fractions, decimals and percentages • examine real-life situations by identifying mathematically valid arguments and drawing conclusion to enhance their mathematical thinking
2. Algebra	• analyse number patterns • known facts, properties and relationships to analyse mathematical situations • examine real-life situations by identifying mathematically valid arguments and drawing conclusion to enhance their mathematical thinking
3. Geometry and Measurement	• identify measurable attributes of objects, construct angles and two-dimensional figures • analyse characteristics and properties of geometric shapes and develop arguments about their geometric relationships • examine real-life situations by identifying, mathematically valid arguments and drawing conclusion to enhance their mathematical thinking
4. Data Handling	• collect, organise, analyse, display and interpret data/ information • examine real-life situations by identifying mathematically valid arguments and drawing conclusion to enhance their mathematical thinking

The Mathematics Curriculum Standards and Benchmarks – NCP

The Standards for Mathematics are further sub-divided into the following Benchmarks for Grade I – V.

Standards	Benchmarks Grade I – III	Benchmarks Grade IV – V
Numbers and Operations • **identify numbers, ways of representing numbers, comparing numbers and effects of operations in various situations.** • **compute fluently with fractions, decimals and percentages** • **examine real-life situations by identifying mathematically valid arguments and drawing conclusion to enhance mathematical thinking**	The students will be able to: • identify, read and write whole numbers up to 10,000 • read and write Roman numbers up to 20 • identify and differentiate even and odd numbers up to 99 • arrange, compare numbers up to 3 digits using symbols (<, > or, =) • identify and recognise place values up to 5-digit numbers • represent and identify the given number on number line • round off a number to the nearest 10 and 100 • add, subtract numbers up to 4 digits • develop multiplication tables up to 10 • multiply number up to 2 digits with 1-digit numbers • recognise and use of division symbol, divide up to 2-digit numbers by 1-digit number • solve real-life situations involving addition, subtraction, multiplication, and division • recognise fractions and different forms of fractions with the help of objects and figures	The students will be able to: • read and write whole numbers up to 1,000,000 (1 million) in numerals and words • add and subtract numbers of different complexity and of arbitrary size • multiply and divide numbers, up to 6 digits, by 2 or 3-digit numbers and by 10,100 and 1000 • solve real-life situations involving operations of addition, subtraction, multiplication, and division • recognise and differentiate between factors and multiples of two or three 2-digit numbers • find highest common factor (HCF) and least common multiple (LCM) of two, three, or four numbers, up to 2-digits • solve real-life situations involving HCF and LCM • recognise and compare like and unlike fractions • arrange, convert and simplify fractions • add, subtract, multiply and divide fractions • solve real-life situations involving addition, subtraction, multiplication and division of fractions

Standards	Benchmarks Grade I – III	Benchmarks Grade IV – V
	• express and match fractions in figures and compare fractions with same denominators using symbols <, > or, = • identify and write equivalent fractions for a given fraction • add and subtract two fractions with same denominators	• apply unitary method for solving real-life situations • identify and recognise decimal numbers • convert decimal numbers into fractions and vice versa • add and subtract numbers up to 3 decimal places • multiply and divide decimal numbers with whole numbers • round off decimal numbers up to specified number of decimal places • solve real-life situations involving decimal numbers (up to 3 decimal places) • convert percentage to fraction and to decimal and vice versa
Algebra • **analyse number patterns** • **known facts, properties and relationships to analyse mathematical situations** • **examine real-life situations by identifying mathematically valid arguments and drawing conclusion to enhance mathematical thinking**	• develop the concept of equality using addition and subtraction of numbers • identify and complete geometrical patterns on square grid according to attributes like shape, size and orientation	• develop the concept of equality using addition, subtraction, multiplication, and division of numbers • identify and describe repeating pattern using relationship between consecutive terms and generate number patterns

Standards	Benchmarks Grade I – III	Benchmarks Grade IV – V
Geometry and Measurement • **identify measurable attributes of objects, construct angles and two-dimensional figures** • **analyse characteristics and properties of geometric shapes and develop arguments about their geometric relationships** • **examine real-life situations by identifying, mathematically valid arguments and drawing conclusion to enhance mathematical thinking**	• use language to compare heights/ lengths, masses and capacity of different objects • read, recognise and use units of length (kilometre, metre and centimetre), mass (kilogram and gram) and capacity (litre and millilitre) and time (minute and second) • add and subtract in units of length, mass, capacity and time for solving real-life situations • use solar and Islamic calendar to find a particular date/ day • recognise and identify two- and three-dimensional figures • determine perimeter of square, rectangle, and triangle • identify and differentiate straight line and curved line • identify and draw points, lines, line segments, and rays • identify and describe symmetrical shapes	• convert standard units of length, mass, capacity, and time • solve the real-life situations involving addition and subtraction of units of distance/ length, mass, capacity, and time • distinguish parallel and non-parallel lines • identify, classify and construct different types of angles • describe and classify 2-D figures and 3-D geometrical objects • determine perimeter and area of square and rectangle • describe and complete symmetric figures with respect to given line of symmetry and point of rotation

Standards	Benchmarks Grade I – III	Benchmarks Grade IV – V
Data Handling • **collect, organize, analyse, display and interpret data/ information** • **examine real-life situations by identifying mathematically valid arguments and drawing conclusion to enhance mathematical thinking**	• read, interpret and represent data using Carroll diagrams, picture graphs and tally charts	• read and interpret bar graphs, line graphs and pie charts • represent real-life situations using pie chart • find an average of given quantities in the data • draw and read simple bar graphs both in horizontal and vertical form • solve real-life situations using simple bar graphs

Note: Lifted from NCP document. To learn more about the NCP go to mofept.gov.pk.

Unit 1

Whole Numbers and Operations

1.1 Numbers up to One Million

i. Read numbers up to 1,000,000 (one million) in numerals and words.
ii. Write numbers up to 1,000,000 (one million) in numerals and words.

1.2 Addition and Subtraction

i. Add numbers up to 6-digit numbers.
ii. Subtract numbers up to 6-digit numbers.

1.3 Multiplication and Division

i. Multiply numbers, up to 5-digit, by 10, 100, and 1000.
ii. Multiply numbers, up to 5-digit, by a number up to 3-digit numbers.
iii. Divide a number up to 5 -digit numbers by 10,100 and 1000.
iv. Divide numbers up to 5-digit numbers by a number up to 2-digit numbers.
v. Solve real-life situations involving operations of addition, subtraction, multiplication, and division.

1.4 Number Patterns

i. Identify and apply a pattern rule to determine missing elements for a given pattern.
ii. Identify the pattern rule of a given increasing and decreasing pattern and extend the pattern for the next three terms.
iii. Describe the pattern found in a given table or chart.

Plan Ahead:

1.1 Numbers up to One Million
1.2 Addition and Subtraction
1.3 Multiplication and Division
1.4 Number Patterns
Allocate realistic time frame/ number of periods to each topic as per requirement.

Before You Start:

Pupils have already worked with numbers up to 6-digits. Here they will deal with up to 7-digit numbers. This lesson will lead them to add and subtract numbers of greater complexity. Pupils have already learnt about multiplication and division, now they will apply this knowledge to solve daily life problems involving mixed operations.

Watch Out For:

Students generally make mistakes when they add bigger numbers in expanded form, that is most times, they start the addition from the left side when it should be start from the right side (ones column). Students also struggle with placing the numbers under the correct place value column. This lead to mistakes when carrying out addition and subtraction. In case of subtraction given in words, the word 'from' causes confusion, and students generally write the subtrahend from the minuend first.

This Pairs with:

Math Lab 5, pages 2, 3, 4, 5, 7, 11, 13, 15, 17, 19, 20, 21

Make Sure You Have:

Bowl

Chits

If They're Struggling:

When you see the confusion bar, take note of how many pupils fall under each level. If pupils are at level 3 or below, have them solve the equivalent Math Lab pages in pairs, having weaker students work with more confident students. First do allow the class to collectively ask questions. If all pupils are at level 4 or above, move on to the next activity.

Let's Begin

Ask pupils if working with bigger numbers is more challenging than working with small numbers. If they say yes, ask them why that is, since they know how to work with numbers digit by digit. Prompt them to discuss what they find difficult and what is simple, so that you can use this information to inform your approach to the unit. Ask the class if anyone has ever had to use very large numbers for number operations in real-life. If anyone has, allow them to share with the class, but if not, ask if they think that being comfortable with could be helpful in real-life. How do they think it could potentially help them in their lives?

SLOs

1.1
i
ii

Activity 1
15 min

This pairs with Math Lab page 2

Hold a spelling test with random numbers, not going higher than one million. Ask pupils to write the numbers in words, as well as numerals, and ask them to peer review after.

Activity 2
10 min

Prepare two sets of number cards. Write 6 or 7-digit numbers in figures on one set and the same number in words on the other set. Distribute number cards among the pupils. Ask one pupil to show his/her card to the class. If the card has a number written in figures tell other pupils to quickly check who has a matching card of the same number written in words and read it loud and clear. Similarly, if the number is written in words, pupils will find a matching card of the same number written in figures. Stick the pair of cards on the board. Repeat the activity till all cards have been paired.

1.2
i
ii

Activity 3
15 min

Create groups of up to 3 pupils each. Ask each group to come to the front of the class and pick out two chits from a bowl. These chits should have numbers up to 6-digits. A coin should be flipped, and heads will be addition, and tails will be subtraction. If it is addition, the group will have to do the addition of the two numbers on the board, and if it is subtraction, they will subtract the smaller number from the larger. Each group should get one turn, unless they come to the wrong answer, in which case they should be allowed to try again, after they understand where they went wrong.

1.2
i
ii
1.3
i
iii

Activity 4
10 min

Provide each pupil with an activity card with questions on any of the four operations. This activity can be used for addition or subtraction of complex numbers and multiplication/ division of numbers up to 6-digits by 10, 100, and 1000. Time the activity and get the activity cards peer checked.

Sample Activity Cards:

Add the rows and columns to find the total of addition square		
198462	201546	
340786		
	137419	

Find the difference between these two of numbers:

149695 205343

Write the missing numbers:

a) 486238 × _____ = 48623800 b) 0.07 × _____ = 7

c) _____ ÷ 1000 = 0.0069432 d) 387200 ÷ 10 = _____

e) _____ × 100 = 9413

1.3 i ii	**Activity 5** 10 min	Write a 5-digit number on the board. For example, 29261. Ask pupils what will happen when you multiply this number by 10. Ask a volunteer to come to the board and solve this using long multiplication. When they have the answer, 292610, ask them if they notice how a number is affected when multiplied by 10. Then ask another volunteer to come to the board and multiply the original number by 100. When they come up with 2926100, the example should be clearer. Ask them to make note of the fact that when a number is multiplied by 10, one simply needs to write a zero to the right of the number to get to the correct answer, and when a number is multiplied by 100, then 2 zeros must be written on the right of the number. Ask the class if they can guess what the answer to 29261 multiplied by 1000 is. Ask a volunteer to come to the board and write down their guess without doing any working. To test this theory, ask each pupil, individually to choose any 5-digit number and multiply it by 10/100/1000 using long multiplication, and checking if it holds true. Explain that this can be seen in single digit numbers as well.

Let's try it

Ask pupils to individually attempt some multiplication. Here are examples of some questions they should be able to solve:

1) 2614×252
2) 25132×911
3) 8292×261
4) 72528×10
5) 70067×100
6) 25276×1000

1.3 iii	**Activity 6** 20 min	Write a 5-digit number on the board. For example, 90000. Ask pupils what will happen when you divide this number by 10. Ask a volunteer to come to the board and solve this using long division. When they have the answer, which should be 9000, ask them if they notice how a number is affected when divided by ten. Now ask another volunteer to come to the board and divide the original number by 100. When they come up with 900, the example should be clearer. Ask them to make note of the fact that when a number with 0 at its ones place is divided by 10, we simply need to remove a zero to get to the right answer, and when a number with 00 at its tens and ones place is divided by 100, then two zeros must be removed. Ask the class if they can guess what the answer to 29000 divided by 1000 is. Ask a volunteer to come to the board and write down their guess without doing any working with zeros at tens, hundreds, and thousands places. To test this theory, ask each pupil, individually to choose any 5-digit number and divide it by 10/100/1000 using long division, and checking if it holds true.

Let's try it

Ask pupils to individually attempt some division. Here are examples of some questions they should be able to solve:

1) $2614 \div 22$
2) $25132 \div 11$
3) $98292 \div 21$
4) $2575 \div 25$
5) $70067 \div 30$
6) $25276 \div 19$

Assign classwork from the textbook.

1.3
v

Activity 7
20 min

Ask pupils, to come up with a number story for any of the four number operations, in pairs, based on their daily lives to make it realistic. Give the class five minutes, and then have each pair come to the front of the class to read out their number story. The rest of the class will have to work out how to use number operations to solve and convert it to a number sentence. These can either be solved on the board, or pupils can make note of them to solve individually.

1.4
i
ii

Activity 8
10 min

Prepare work sheets as shown in sample. Write different rules (using any of the four operations) for finding the number pattern in ascending or descending order. Give random numbers in rows which satisfy these rules. Give one sheet to each pupil. Tell them to find number patterns as instructed.

Look at the number patterns and encircle them as shown.							
Count by 1s from 32 to 37				Count by 2s from 100 to 88			
Count by 2s from 2 to 12				Count by 3s from 41 to 53			
Count by 10s from 10 to 50				Count by 5s from 15 to 45			
32	33	34	35	36	37	44	67
100	98	96	94	92	90	88	86
23	14	95	90	85	80	75	70
39	41	44	47	50	53	56	59
25	57	58	59	60	61	62	80
30	10	20	30	40	50	43	85
15	20	25	30	35	40	45	67
15	20	25	30	35	40	45	67

Let's talk Math

It would be useful to discuss some interesting situations where we may have to deal with big numbers in real-life. For example, finding the number of words in a 200 page book with 37 lines per page and 8 words per line. With multiplication, we find that there would be $200 \times 37 \times 8 = 59200$ words in the book. Finding the number of minutes a 97 year old man has lived. On multiplication, we find the number of minutes to be $97 \times 365 \times 24 \times 60 = 50983200$. Along with that, discussing large scale things in general, like the height of a certain mountain in inches would certainly require one to be comfortable with large numbers. At the end of the discussion, give pupils 5 minutes to write a reflective paragraph.

Let's get practical

Ask pupils to fill in the blanks of a receipt. Connect it to real-life by asking the pupils to develop a story around the receipt and who would need all these items. Below is a template you could use, after removing some of the numbers for the pupils to calculate and fill in. Explain to pupils that when dealing with large sums of money, it is always important to keep track, especially when doing business. The given receipt could be one of a party planning service, so engage pupils by asking them why it would be so important for them to keep track of their expenses.

Item	Cost (Rs)	Quantity	Total
Transport rental/ hour	999	6	5994
Space rental/ hour	4500	5	22500
Paper Plates	45	20	900
Fizzy Drink	120	40	4800
Plastic cups	65	50	3250
Pack of Balloons	315	15	4725
Pizza sauce	345	50	17250
Mushrooms	455	20	9100
Chicken	1500	15	22500
Pizza Crusts	670	50	33500
Block of cheese	800	14	11200
Fresh Herbs	400	20	8000
		Total	**143719**

Self Assessment

1.1 Numbers up to one million
1.2 Addition and subtraction
1.3 Multiplication and division
1.4 Number Patterns

Refer to If they are struggling	Confusion level	1 – Does not understand any concept	2 – Does not understand most of the concepts	3 – Understands some concepts but has questions	4 – Understands all the concepts, just needs more practice	5 – Feels confident solving questions	If pupil is below 3 use Math Lab
	Number of Pupils						

Multiple Choice Questions

Read out the questions or write them on the board. You may ask pupils to either write the correct answer on a white board and hold it up or call out the options one by one, asking them to raise their hands to show which one they have chosen.

1. If we take around 1000 breaths an hour, how many breaths do we take in a year?
   a) 8760000
   b) 2264000
   c) 8670000
   d) 2642000
2. What is the place value of 9 in the number 2492585?
   a) thousandth
   b) hundred thousandth
   c) ten thousandth
   d) million
3. What is 2000 less than 840328?
   a) 839218
   b) 838328
   c) 838330
   d) 837328

Unit 2

Highest Common Factor (HCF) and Least Common Multiple (LCM)

2.1 Highest Common Factor

i. Find HCF of
- two numbers up to 2-digit numbers
- three numbers up to 2-digit numbers using
- prime factorization method
- division method.

2.2 Least Common Multiple

i. Find LCM of
- two numbers up to 2-digit numbers
- three numbers up to 2-digit numbers using
- prime factorization method
- division method.

ii. Solve real-life situations involving HCF and LCM.

Plan Ahead:

2.1 Highest Common Factor

2.2 Least Common Multiple

Allocate realistic time frame/ number of periods to each topic as per requirement.

Before You Start:

Students already know how to find common multiples of numbers. Thereafter, they will now find the LCM by the division method. Students have already learned how to find common factors of a number by prime factorisation. They will now learn to find the HCF by the long division method and prime factorisation. Students will further apply the knowledge of LCM and HCF to solve real-life problems.

Watch Out For:

Students often get confused in recognising events which are related to HCF and LCM in real-life story sums.

This Pairs With:

Math Lab 5, pages 22, 23, 24

Make Sure You Have:

Dice	A4 paper
Two coloured counters	Quiz cards

If They're Struggling:

Have as much class discussion as possible relating to why using HCF and LCM is the right way to answer certain questions. When you see the confusion bar, take note of how many pupils fall under each level. If pupils are at a level 3 or below, have them solve the equivalent Math Lab pages in pairs, having weaker students work with more confident students. First do allow the class to collectively ask questions. If all pupils are at level 4 or above, move on to the next activity.

Let's Begin

Students already know how to find factors and multiples of a number. They are aware of factorising a number by using prime factors. They can determine common factors and common multiples of two or more numbers. Now they will learn to find highest common factor and least common multiple using prime factorisation and long division method.

SLOs

2.1
i

Activity 1
10 min

Provide each pupil or each pair with a quiz card. Time the pupils and then swap the cards with other pupil or pair for peer checking. This activity saves time and is helpful for quick revision of prior concepts.

Quiz Card Sample:

1. The prime factors of 24 are _____
2. 5^3 = _____
3. Circle the number which is not a factor of 40.
   2 4 5 6 8 10
4. List all the prime numbers between 20 and 40.
5. Which number can evenly divide 81?

Assign classwork form the textbook.

2.1
i

Activity 2

20 min

Use two sets of counters, each of a different colour, for the two given numbers. Arrange the two sets of counters on either side of a demarcation line: for convenience, we may take the smaller number of counters on the left and the larger on the right. Arrange the counters on the left in a vertical line. Ask the children to justify this arrangement. The reason, as we know, is that HCF is always lesser than or equal to the greatest factor of the smaller number. Now arrange the ones on the right in as many rows as there are on the left. If you can arrange these in a rectangle, then the number of rows in the arrangement is the required HCF. If such an arrangement is not possible, change the arrangement on the left to the next possible rectangular arrangement, and then accordingly change the arrangement on the right as well. When both the sides are in a rectangular arrangement with the same number of rows, the number of rows is the HCF. For example, let us try to find the HCF of two numbers, 6 and 20.

In the first step, we arrange 6 counters in a vertical line to the left of the demarcation line (Line of Control!).

We now arrange the 20 other counters on the right. We find that we cannot arrange these in a rectangle (Fig. 1). So 6 is not the HCF of 6 and 20.

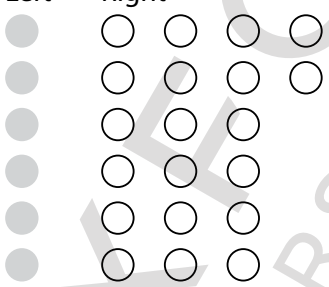


Fig. 1

We now change the arrangement on the left to three rows of two counters each.

Then we change the arrangement of the 20 counters.

Again we find that these do not form a rectangle (Fig. 2).

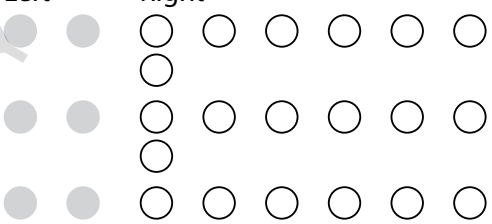


Fig. 2

The next step is to change the arrangement on the left yet again into two rows of three counters each.
Now we find that we can arrange the 20 counters in two rows.

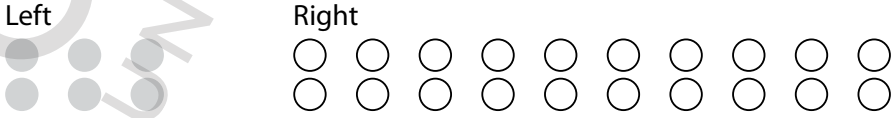


Fig. 3

Assign classwork form the textbook.

2.1
i

Activity 3

10 min

Collect and bring lots of bottle tops to the class. Give each pupil a specific number of bottle tops.

Ask pupils to arrange them in all possible rectangular arrays. The bottle tops should be arranged in rows. Single straight lines, both horizontal and vertical, are also acceptable. Each time a rectangle is formed, the number of rows is a factor of the given number. When it is not possible to arrange the given bottle tops in a rectangular form, shift bottle tops one by one from the end to form a new row.

For example, to find all possible factors of six, we arrange the bottle tops as shown in the following figures.

Fig. 1 shows six bottle tops in a single row. Therefore, 1 is a factor of 6.

Fig. 2 shows two rows with 3 tops in each row. A rectangle is formed therefore, 2 is a factor of 6.

Fig. 3 shows 3 rows with 2 tops in each row. Since a rectangle is formed with three rows, 3 is a factor of 6.

Fig. 4 shows no rectangle is formed with 4 tops in a column and 2 tops in a row, therefore, 4 is not a factor of 6.

Fig. 5 shows 2 bottle tops in the first row and 1 in each of the remaining rows. No rectangle is formed, therefore, 5 is not a factor of 6.

Fig. 6 The next possible rectangular arrangement is a vertical line with six rows. Therefore, 6 is a factor of 6.

Extended Work: We can also ask the pupils to check whether a given number is prime or not using this method. The reason is that no rectangular form other than a single horizontal or vertical line is possible for a prime number.

2.2
i

Activity 4
10 min

Divide the pupils into pairs. Give each pair two dice. Instruct each pupil to roll the pair of dice and form a 2-digit number. Ask the pupils to find all the factors for their numbers and write them down on a sheet of paper.

Next ask them to compare their factors and calculate the HCF of the two numbers. Let the pupils follow the same steps for more numbers.

The same activity can be used for LCM as well. In this case pupil will roll only on dice and first find 10 multiples of the number and then the common multiple and LCM of two or more numbers.

Activity 5
10 min

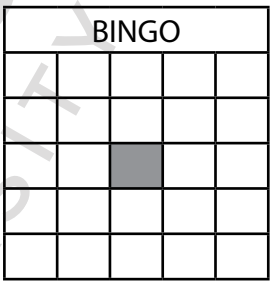
Give one blank bingo card to each pupil. Ask them to fill in their card with numbers from 1 to 25. Ensure they use a pen or marker so that numbers cannot be changed during the game. Make sure each child has filled in his/her card before you start the game.

Play the game by calling out pairs of numbers and instructing pupils to cross out the HCF of this pair. Make sure that the HCF of numbers you call out does not exceed 25. You might want to prepare the list of numbers beforehand so that you do not end up with the same HCF for multiple pairs.

Make sure that pupils note down the numbers and their HCF as you call them out so you can use it to cross-check the pupils' bingo cards when they are done.

Give the pupils time to calculate the HCF for each pair as you play the game.

The first pupil to cross out all four numbers in a row or column wins the game.



Activity 6
10 min

Write 3, 4, and 6 on board and ask the pupils to find the numbers which are divisible by all these numbers. (Hints: When we find the product of all three numbers i.e. $3 \times 4 \times 6 = 72$, it is clear that 72 is divisible by 3, 4, and 6 since 72 is the product of these numbers.) Ask the pupils, "Is 72 the smallest number that is divisible by 3, 4, and 6?" After collecting response from pupils, explain how 12 is the smallest number that is divisible by 3, 4, and 6 simultaneously. Hence, conclude that the smallest number that is divisible by all given numbers is called LCM or least common multiple. Introduce the two ways by which we can find the LCM of the given numbers i.e. prime factorisation method and division method by solving examples on the board. Later on, give them practice questions to solve and assess their understanding.

2.1
i
2.2
i

Activity 7
10 min

Provide a dice to every pupil in the class. You may also ask them to bring one from home. Instruct each pupil to roll the dice and to pair up and the first ten multiples for their numbers. Ask them to write the multiples down on a sheet of paper. Repeat the activity three times. Ask the pupil to compare and find the lowest common multiple of the three numbers. Let the pupils follow the same steps for more numbers.

Let's try it

Present pupils with questions to be solved individually. These questions should be based on real-life situations that require them to find the LCM and/or the HCF. Try to keep numbers 2-digit or less.

Assign classwork form the textbook.

Let's talk Math

Invite pupils to discuss the practical uses to these methods. HCF is used to find whether an event will repeat again and again. HCF is also used to divide two or more objects into equal points or split things into smaller equal sections. LCM is used to find whether two or more events will happen repeatedly at the same time. LCM is important to solve problems related to racetracks, traffic lights and load shedding etc. For example, if there is a race among three students on a circular track, and student A covers the track in 4 minutes, student B covers the track in 5 minutes and student C covers the track in 10 minutes, all starting from the same point, after what time will all three of them be at the starting point again? At the end of this discussion allow 5 minutes so that pupils may write a reflective paragraph about the unit.

Let's get practical

Ask pupils to use HCF or LCM to figure out how many times in 20 years their birthday will fall on a Saturday. They should assume the number of days between their birthdays are 365 days, unless they are born on a leap year, and days between Saturdays are 7.

Self Assessment

2.1 Highest Common Factor

2.2 Least Common Multiple

Refer to If they are struggling	Confusion level	1 – Does not understand any concept	2 – Does not understand most of the concepts	3 – Understands some concepts but has questions	4 – Understands all the concepts, just needs more practice	5 – Feels confident solving questions	If pupil is below 3 use Math Lab
	Number of Pupils						

Multiple Choice Questions

Read out the questions or write them on the board. You may ask pupils to either write the correct answer on a white board and hold it up or call out the options one by one, asking them to raise their hands to show which one they have chosen.

1. The prime factors of 195 are?
   a) 3 and 5
   b) 6 and 13
   c) 3, 5, and 13
   d) 15 and 13
2. If a number is even and divisible by 3, it is also a divisible of ____.
   a) 2
   b) 5
   c) 4
   d) 6
3. LCM of two prime numbers is _____.
   a) product of the numbers
   b) one of the two numbers
   c) sum of the numbers
   d) equal to the HCF of the numbers.

Unit 3

Fractions

3.1 Addition and Subtraction of Fractions

i. Add and subtract two or three fractions with different denominators.

3.2 Multiplication of Fractions

i. Multiply a fraction by a 1-digit numbers and demonstrate with the help of diagram.

ii. Multiply two or three fractions involving proper, improper fractions, and mixed numbers.

iii. Solve real-life situations involving multiplication of fractions.

3.3 Division of Fractions

i. Divide a fraction by another fraction involving proper, improper fraction, and mixed numbers.

ii. Solve real-life situations involving division of fractions.

Plan Ahead:

3.1 Addition and Subtraction of Fractions

3.2 Multiplication of Fractions

3.3 Division of Fractions

Allocate realistic time frame/ number of periods to each topic as per requirement.

Before You Start:

Pupils are familiar with fractions but will need revision. If they start with simpler questions they should be able to solve them with little guidance.

Watch Out For:

While simplifying fractions students sometimes use two different factors of the same number for cancellation. When multiplying two fractions they cancel both numerators or both denominators by the same factor, instead of cancelling the numerator with the denominator. When dividing fractions, they find the reciprocal of the first fraction instead of the second fraction.

This Pairs with:

Math Lab 5, pages 25-28

Make Sure You Have:

Bowls Chits

A4 sheets

If They're Struggling:

Based on how much support your pupils need, use real-life examples and diagrams, like fraction discs or bars. Try to keep the class from seeing fractions as solely numerical and get them to visualise the quantity that each fraction represents. When your students begin to multiply with common fractions, it is essential that they understand exactly what is happening. Language, therefore, should be kept simple, and there should be no rush to impose 'rules' which may make little sense to students. When you see the confusion bar, take note of how many pupils fall under each level. If pupils are at a level 3 or below, have them solve the equivalent Math Lab pages in pairs, having weaker students work with more confident students. First do allow the class to collectively ask questions. If all pupils are at level 4 or above, move on to the next activity.

Let's Begin

Pupils are aware of fractions according to their own understanding. They are aware of applying four operations on fractional numbers, ask them how they use fractions in their daily life.

SLO

3.1
i

Activity 1
10 min

Ask the class to pair up and pass around a bowl filled with chits. Each chit should have a fraction on it, using numbers with not more than 2-digits. Try to keep all the denominators of the fractions as different as possible to minimise overlap. Ask each pair to pick out three chits. After they all have their fractions, pick out three fractions for yourself. Write these fractions on the board and show the process of adding them together step by step making the denominator common. Once this is done, show them how to simplify the answer. After this is explained, return to the original three fractions. Ask pupils to help you so that they can be arranged biggest to smallest. Once they are arranged, subtract the in this order, and show pupils the process here as well. Now, ask each pair to do the exact same with their three fractions. Emphasise the importance of always making sure a fraction is simplified.

Assign 15 minutes of classwork from the textbook.

Activity 2
10 min

Before starting addition and subtraction of fractions, revise like and unlike fraction/ through this 5 minutes activity. Give each pupil an activity card to gauge their prior knowledge about fractions.

Sample activity card			
Draw a line to join the matching pairs of fractions.			
$1\frac{1}{3}$	$\frac{8}{5}$	$2\frac{2}{3}$	$\frac{6}{5}$
$2\frac{1}{3}$	$\frac{11}{5}$	$2\frac{1}{5}$	$\frac{8}{3}$
$1\frac{3}{5}$	$\frac{7}{3}$	$1\frac{1}{5}$	$\frac{4}{3}$

Once the pupils are confident in converting improper fractions into mix numbers and vice versa, next step is to find the lowest common denominator. For this 10 minutes, prepare index cards for each pupil. Write 20 different fractions on as many index cards, but most of these numbers should NOT be prime numbers. Mix up smaller numbers (within 1 and 20) with a few larger ones with a lot of factors. Divide the cards into 2 piles of 10 and give them to each pair. Tell the pupil to be alert and at the word "Go!" each player turns up one card in their pile and places it in the centre of the table.

The goal of the game is to calculate the lowest common denominator of both cards and say it aloud. The first player to call out the correct numbers wins the round. Repeat the above steps for subsequent rounds.

To add and subtract fractions with different denominators first recall how to add and subtract fractions with same denominators by writing questions on the board as shown in the given examples. Remind pupils to reduce their answers to the lowest terms. Examples:

Addition:

1. $\frac{2}{5} + \frac{1}{5} = \frac{3}{5}$

2. $\frac{1}{3} + \frac{1}{6} = \frac{2}{6} + \frac{1}{6} = \frac{3}{6}$ or $\frac{1}{2}$

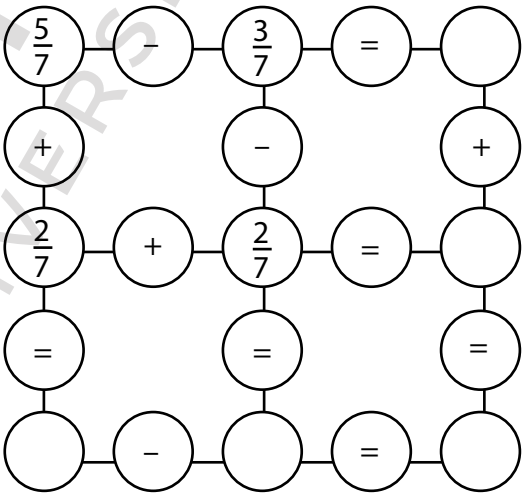
Subtraction:

1. $\frac{5}{6} - \frac{1}{6} = \frac{4}{6}$ or $\frac{2}{3}$

2. $\frac{7}{4} - \frac{1}{4} = \frac{7}{8} - \frac{2}{8} = \frac{5}{8}$

Prepare a puzzle activity sheet and distribute to each pupil. Explain that they should solve the puzzle by adding or subtracting fractions across and down. When everyone is done with their work, discuss the answers as pupils check their work.

Fraction Puzzle



Same type of puzzle can be made for fractions with different denominators.

3.2
i

Activity 3
10 min

On the board, work through the following questions with pupils.
$\frac{2}{5} \times 10$ $\frac{6}{15} \times 50$ $\frac{4}{7} \times 77$

Instead of focusing on the math, draw fraction discs to show the fractions. The way to work out the answer is to multiply 10 by 2, the numerator, and then divide the answer by 5, the denominator. Your answer will be 4. You will notice now, that if you were to draw $\frac{4}{10}$ as a fraction disc, it would look identical to the fraction disc for $\frac{2}{5}$. This is how you can tell that this is the right answer. Go through the other two questions in this way, making use of diagrams like fraction discs and fraction bars to help pupils grasp the concept.

Assign 25 minutes of classwork from the textbook.

Let's Pause

Language is important at every stage of your discussion; when looking at the example: $\frac{3}{4} \times \frac{3}{5}$, emphasise that this multiplication asks us to find 'three-quarters of three-fifths', and draw a diagram on the board to illustrate the point. Multiplication with mixed numbers is the ideal moment for you to bring in the idea of cancelling, since numerators become large and unwieldy at this stage, and the purpose of cancelling—making multiplication simpler and quicker—is easily demonstrated.

3.2
ii

Activity 4
10 min

Make three bowls of chits. One of proper fractions, one of improper fractions, and one of mixed numbers. Place these in the front of the class and pick one chit out of each bowl. Write them on the board like so
$\frac{12}{7} \times 8$ $10 \times \frac{16}{3}$
Ask pupils if they have any idea how to carry out this multiplication. They are familiar with the idea of changing unlike fractions to like fractions and adding and subtracting them, but may not be sure about approaching the mixed number. Explain that a mixed number is simply another form of a fraction. An improper fraction has a bigger numerator than denominator, so it can be converted into a mixed number, and similarly, a mixed number can be converted into an improper fraction.
Show this with the fractions you are using. Write out your improper fraction, in this case, $\frac{16}{3}$ and explain that the closest multiple of three to sixteen is fifteen. Since 5 threes are 15, we can look at 15 in the case of this fraction as five wholes. Therefore $\frac{16}{3}$ can also be written as $5\frac{1}{3}$. We get the $\frac{1}{3}$ because 1 is what is remaining after we remove 15 from the numerator, and 3 because the denominator stays the same. Ask pupils now if they have any idea how to convert the mixed number into an improper fraction. Allow them to attempt it, but if they can not figure it out, explain, using $1\frac{5}{7}$ as an example, that we have to see this fraction as one whole, and five parts of seven. Draw two circles and divide them each into seven segments, colouring one completely, and only five segments in the other to create a diagram for this mixed number. Using the diagrams, one could simply count the total number of coloured segments, and knowing the denominator would remain the same, deduce that the answer is $\frac{12}{7}$. The mathematical way to do this is to multiply the denominator 7 by the whole number 1, and add the numerator 5 to the answer 7. This gives us the numerator, which is 12. Go over this a few times and allow pupils to ask questions. Once the concept is clear to them, come back to the original question that is.

$\frac{12}{7} \times 8 \quad 10 \times \frac{16}{3}$

Ask pupils to help you multiply this on the board. Then, ask them each to pick a chit out of each bowl and solve them as homework to work out the answer to the multiplication question they get. Tell them they must draw fraction discs for all three fractions, and the answer they get. Remind them to make sure the answer is simplified.

Let's Pause

Your success in teaching 'division by fraction' depends largely on the extent to which your students understand the concept and language of division. Return briefly to the beginner's language of division and put students through some very simple exercises just to remind them of exactly what they do when they divide. This division language is then applied to a simple problem involving a common fraction divisor: $1 \div \frac{1}{4}$. If you ask, 'how many quarters make a whole?', the answer will come back loud and clear!

3.3
i

Activity 5

10 min

After reminding pupils about the concept of reciprocating when dividing fractions, ask them to write out the fractions used for the previous activity. On the board, write down the fractions that you used as below:

$\frac{12}{7} \div \frac{8}{10} \div \frac{16}{3}$

Ask the class to follow along in their notebooks but using their own fractions. The division should go as follows:

$\frac{12}{7} \div \frac{16}{3}$

$\frac{12}{7} \times \frac{3}{16}$

$\frac{36}{112} = \frac{18}{56} = \frac{9}{28}$

Once every pupil has individually reached an answer, ask them to draw fraction discs for their answer. Ask them how dividing a fraction affects that coloured portion. Does the fraction get bigger or smaller? And is that the same as when you multiply it?

Assign 25 minutes of classwork from the textbook.

3.2
iii
3.3
ii

Activity 6

10 min

Ask pupils if they have ever used or seen anyone use fractions in their lives. If most of them answer no, it is probably because they do not realise. Point out that every time they are given a slice of cake, or pizza, that is a real-life application of fractions. Even deciding how much time they want to spend on a certain activity involves planning a fraction of a day. Go around the class and ask pupils to each discuss a part of their lives where they think fractions are or could be used. Once they have presented a real-life situation, ask what number operation they think they would need when handling this situation, and why. Ask them to help you form a statement that you can write out on the board. Once it is written down, the other pupils will have to help solve it.

Let's talk Math

In the last activity, each pupil found fractions in their own lives, so now ask them to discuss why it might be easier to navigate these things with a more comprehensive idea of what fractions are, as opposed to thinking of things as a quarter, or a half, which are concepts that everyone is familiar with. Lead them to the conclusion that fractions are ideal for situations that call for precision. Perhaps when planning your day, it is not necessary to use fractions (although you could) because most days don't need to be planned in that way, and people find it easier to say a number of minutes than to create a fraction for everything, but in situations where specification is key, proper use of fractions is helpful. Fractions are used in baking to tell what quantity of an ingredient to use, in telling time; each minute is a fraction of the hour., and on a doctor's prescription to tell how much of a medicine should be taken. Give pupils 5 minutes to write a reflective essay about what they learnt and understood while studying this unit.

Let's get practical

Present pupils with this ingredient list for a 2 pounds vanilla cake which can serve 12 people.

Recipe:

All purpose flour	$\frac{3}{4}$ cups
Baking soda	2 teaspoons
Salt	$\frac{1}{4}$ teaspoons
Softened butter	$\frac{3}{4}$ cup
Regular sugar	$\frac{3}{4}$ cup
Milk	$\frac{2}{3}$ cup
Eggs	2
Vanilla essence	$\frac{1}{2}$ teaspoon

Rewrite the list of ingredient which will be needed to make one pound cake?

How many people will it serve? work out which number operation will be necessary?

Self Assessment

3.1 Addition and Subtraction of Fractions

3.2 Multiplication of Fractions

3.3 Division of Fractions

Refer to If they are struggling	Confusion level	1 – Does not understand any concept	2 – Does not understand most of the concepts	3 – Understands some concepts but has questions	4 – Understands all the concepts, just needs more practice	5 – Feels confident solving questions	If pupil is below 3 use Math Lab
	Number of Pupils						

Multiple Choice Questions

Read out the questions or write them on the board. You may ask pupils to either write the correct answer on a white board and hold it up or call out the options one by one, asking them to raise their hands to show which one they have chosen.

1. Change into mixed fraction.

   Write $\frac{51}{16}$ on the board)

   a) $3\frac{3}{16}$

   b) $4\frac{3}{16}$

   c) $3\frac{4}{16}$

   d) $4\frac{4}{16}$

2. Add the fractions: $\frac{4}{11} + \frac{3}{22}$.

   a) $\frac{7}{11}$

   b) $\frac{7}{22}$

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

   d) $\frac{22}{11}$

3. To get the product 1, what will be multiplied by $\frac{4}{5}$?

   a) $\frac{4}{5}$

   b) $\frac{5}{4}$

   c) $\frac{1}{1}$

   d) 0

Unit 4

Decimal Numbers and Percentages

4.1 Decimal Numbers

i. Compare numbers up to 3-digits with 2 decimal places using signs <, >, or =.

ii. Arrange numbers up to 3-digit numbers with 2 decimal places in ascending and descending order.

iii. Add and subtract 4-digit numbers up to 3-decimal places.

iv. Multiply a 3-digit number up to 2 decimal places by 10, 100, and 1000.

v. Multiply a 3-digit number up to 2 decimal places by a whole number up to 2-digit.

vi. Multiply a 3-digit number up to 2 decimal places by a 3-digit number up to 2 decimal places.

vii. Divide a 3-digit number up to 2 decimal places by 10, 100, and 1000

ix. Divide a 3-digit number up to 2 decimal places by a 2-digit number up to 1 decimal place.

x. Convert fractions to decimals using division.

xi. Solve real life situations involving division of 3-digit numbers up to 2 decimal places.

4.2 Estimation

i. Round off a 4-digit number up to 3-decimal places to the nearest tenth or hundredth.

ii. Estimate sum or difference of the numbers (up to 4 digits).

4.3 Percentages

i. Recognise percentage as a special kind of fraction.

iii. Solve real life situations involving percentages.

Plan Ahead:

4.1 Decimal Numbers

4.2 Estimation

4.3 Percentages

Allocate realistic time frame/ number of periods to each topic as per requirement.

Before You Start:

Pupils have already learnt about decimals in previous year. They learnt to express decimal numbers to fractions and fractions to decimal numbers and applied basic operations on decimal numbers. They also learnt to estimate decimal numbers to whole numbers. Now, they will perform four operations on decimals with greater number of decimal places. They will learn to convert fractions into decimals using division. They know how to round off the decimal numbers to the nearest whole numbers, now they will round off numbers with 3 decimal places to the nearest tenth or hundredth.

Percentages will be a new topic for them. Tell them the importance and uses of this topic in real-life.

Watch Out For:

Students tend to make errors in placing decimal points on its exact place. often carry out addition and subtraction of percentages, without finding its actual value. They can not recall percentage formula exactly.

This Pairs with:

Math Lab 5, pages 29-33, 36

Make Sure You Have:

100 square grid sheet

Colour pencils

Paper chits with addition and subtraction sums

A basket

If They're Struggling:

Conversion of fractions may be harder for the pupils. They might get confused when percentages are in fractions or decimals. When you see the confusion bar, take note of how many pupils fall under each level. If the pupils are at level 3 or below, have them solve the equivalent Math Lab pages in pairs, having weaker students work with more confident students First do allow the class to collectively ask questions. If all pupils are at level 4 or above, move to the next activity.

Let's Begin

Recall the concept of addition and subtraction of decimal numbers as they have done in previous class.

Introduce the symbol of %. Tell them that percentage is a part out of 100, so 40% means $\frac{40}{100} = 0.4$ percentages can be converted to fractions or decimals and vice versa.

Also, have a detailed discussion about estimation and rounding off decimal numbers. Tell them that we follow the same rule for rounding off decimal numbers as we do for whole numbers.

SLO

4.1

iii

Activity 1

5 min

Provide each pupil with a magic number puzzle as shown in the given sample. Let them figure out on their own how to solve the puzzle.

Ask them to solve the magic number puzzle below, in which each row, column, and diagonal line must add up to 5.5.

2.4		
1.2	2.7	

Activity 2

10 min

Make decimal activity sheets as shown in sample. Write as many sums as you want.

Distribute one sheet to each pair. Tell them that one child will round off the given decimal numbers and give an estimated answer. The second one will calculate the exact answer and check whether the estimate is correct or not. Then they switch the task.

#	Questions	Estimation	Original Answer
1	0.75 + 1.23	1 + 1.23 = 2.23	1.98
2	99.8 – 65.7	100 – 68 = 32	34.1
3	43.89 + 0. 66	44 + 1 = 45	44.55
4	21. 03 – 15.44	21 – 15 = 6	5.56

Let's try it

Ask pupil to solve the given word problem. I had Rs 54.93. I earned Rs 340.25. Then I spent Rs 246.79. How much is left with me now?

4.3

ii

Activity 3

10 min

Provide the following activity sheet to each pupil to solve individually first and then get it peer checked.

Percentage	Fraction	Decimal
50%		
	$\frac{3}{4}$	
		8.5
20%		

Activity 4

15 min

Ask pupils to work in pairs. Prepare and distribute Number cards (1 to 9) to each pair. Calculate percentage of the given number Ask them to Shuffle the card and place then face down in the centre of the table. Then one player must turn over a card. Explain that the players must add zero to the digit to calculate the percentage. For example, if they draw a 9, they need to calculate 90%. Now, invite the second player to roll the dice.

Next, the players must quickly add up the total of the 2 dice and calculate the appropriate percentage. For instance, if the total of the dice is 8, they must calculate 80% of 8.

The player who arrives at the correct answer first wins the round.

4.3
iii

Activity 5
10 min

Prepare worksheets with questions involving percentages in real-life. Ask the pupils to research about their favourite cricketer and bring information related to his number of matches played, runs scored, wickets taken in different test and one day matches. Then ask them to express their findings in terms of percentages. For example:

Samiullah took 364 wickets in test matches and 182 wickets in other matches, overall in his career. The percentage of his wickets taken in the test matches is:

364/544 = × 100 = 66.91% or 67%

And that of his wickets taken in others is:

= 100 – 67 = 33%

Example: Sara gets a monthly pocket money of Rs 2000. She keeps half of it for her daily expenses and decides to go shopping with the rest. She liked a dress on a 35% sale, originally worth Rs 1500. Can Sara afford the dress on sale?

Let's try it

Ask pupils to solve some realistic questions that involve percentages.

Here are some examples of questions given below.

- In a class of 30 students, 70% are present on a particular day. Find the number of students absent in the class that day?
- Ashir covered 35% of his journey in the morning. If he had to travel 1500 km, which percentage of the journey is left?

Assign 25 minutes of classwork from the textbook.

Let's talk Math

Decimal are a way of representing numbers. Every fraction can be represented as a decimal, but not always every decimal is a fraction. Decimals are used in a variety of range in daily life or real world situations to express money, mass, height, and capacity of object. Decimals are used in measuring different physical and chemical quantities. They can also be represented on number line. The decimal value for $\frac{1}{2}$ is 0.5, for quarter is 0.25 and for three quarters is 0.75. Ask the students where they have observed the usage of decimals as well as percentages and how it helps them conduct their daily life affairs. Allow the student 5 minutes to write a reflective paragraph.

Let's get practical

Provide a digital mass balance to the class. Allow each student to weigh three small objects they bring from home. Ask them to write the mass of each object to two decimal places. Once all students are done weighing their objects, ask them to estimate the sum of their weighed objects and then find the actual sum.

Self Assessment

4.1 Decimal Numbers
4.2 Estimation
4.3 Percentages

Refer to If they are struggling	Confusion level	1 – Does not understand any concept	2 – Does not understand most of the concepts	3 – Understands some concepts but has questions	4 – Understands all the concepts, just needs more practice	5 – Feels confident solving questions	If pupil is below 3 use Math Lab
	Number of Pupils						

Multiple Choice Questions

Read out the questions or write them on the board. You may ask pupils to either write the correct answer on a white board and hold it up or call out the options one by one, asking them to raise their hands to show which one they have chosen.

1. 0.06×1000 is?
   a) 6.00
   b) 60.00
   c) 600.00
   d) 6000.00
2. Estimate the sum of 3689 and 2508.
   a) 6197
   b) 6180
   c) 6200
   d) 5000
3. Percentage means:
   a) per thousand
   b) per hundred
   c) per ten
   d) per hundredth

Unit 5

Distance and Time

5.1 Distance

i. Convert measures given in
   - kilometers to meters and vice versa
   - meters to centimeters and vice versa
   - Centimeters to millimeters and vice versa.

ii. Solve real-life situations involving conversion, addition and subtraction of measures of distance.

5.2 Time

i. Convert
   - hours to minutes and vice versa
   - minutes to seconds and vice versa.

ii. Convert years to months and vice versa, months to days and vice versa, weeks to days and vice versa.

iii. Add and subtract intervals of time in hours and minutes with carrying and borrowing.

iv. Solve real-life situations involving conversion, addition and subtraction of intervals of time.

Plan Ahead:

5.1 Distance

5.2 Time

Allocate realistic time frame/ number of periods to each topic as per requirement.

Before You Start:

Students have already worked with units of length and time in their previous class. They are well aware of addition, subtraction and conversion of units of length and this will lead them to add and subtract measure of distance. Furthermore, the knowledge about conversion of units of time will help them to add, subtract, and convert years to months, months to weeks, weeks to days, and vice versa.

Watch Out For:

A common mistake while converting one unit to the other, students use the wrong conversion unit and the wrong operation. Students forget that we 'multiply' when converting a bigger unit to a smaller unit (e.g. 5 m = 5 x 100 = 500 cm). On the other hand we 'divide' when converting a smaller unit to a bigger units (e.g. 200 cm = 200 ÷ 100 = 2 m)

This Pairs with:

Math Lab 5, pages 39, 40

Make Sure You Have:

Chart paper Scissors Colour pencils

If They're Struggling:

The students when converting might struggle a bit. Therefore, keep revising the conversion tables and find ways for the students to remember it easily. When you see the confusion bar, take note of how many pupils fall under each level. If pupils are at a level 3 or below, have them solve the equivalent Math Lab pages in pairs, having weaker students work with more confident students. First do allow the class to collectively ask questions. If all pupils are at level 4 or above, move on to the next activity.

Let's Begin

Kilo means 1000, centi means 100, and milli means 1/1000. When a bigger unit is converted to a smaller unit: we multiply with the conversion factor. When a smaller unit is to be converted to a bigger unit; we divide with the conversion factor. 1 km = 1000 m 1 m = 100 cm, and 1 cm = 10 mm.

When hours are converted to minutes multiply by 60. When minutes are converted to hours divide by 60. When minutes are converted to seconds multiply by 60. When seconds are converted to minutes divide by 60. One hour = 60 minutes, half an hour = 30 minutes, quarter of an hour = 15 minutes and three quarters of an hour = 45 minutes. Midnight to noon makes 12 hours. There are 24 hours in a day, 7 days in a week, 52 weeks in a year and 12 months in a year. Two common calendars are solar and lunar calendars. April, June, September and November have 30 days, the rest of the months have 31 days except February which has 28 days, and 29 in each leap year.

SLO

5.1

i

ii

Activity 1

10 min

Having given pupils a breakdown of all the conversions, give them some real-life examples of distance and ask them to help you do some conversion on the board. Here are some examples of questions you can use.

Jawad is going to distribute Eid sweets in his neighborhood. He walks 20 metres to the first house. How many centimetres did he walk?

He walks 100 metres to the next house. How many centimetres did he walk? How many millimetres did he walk?

He walks 4500 centimetres to the next house. How many metres did he walk?

He can't make it to the next house because it is 2000 metres away. How many kilometres is it?

Assign classwork from the textbook to allow pupils to practice these skills.

SLO		
	Activity 2 15 min	Take the pupils to the play area. Divide them in groups. At random distance, mark 4 to 5 points A, B, C, and D on the ground. Provide measuring tape to each group and ask them to measure and note the distance between the marked points. Bring the pupils back to class, provide them with A4 sheets and give them two tasks. One to convert each length into centimetres and millimetres, and second to write real-life sum involving the measurements they already have. Make sure that each pupil makes an addition and subtraction sum.
	Activity 3 10 min	Similarly, ask pupil to research at home and find distance between the city they are residing and any three cities of their choice, or the distance of their native country and any three countries of their choice. Once they have the information, let them work in pairs. Pupils must share their findings with their peer. Then prepare sums involving conversion, addition, and subtraction of units of distance, swap their sheets with their partner who will solve these questions. Example: Javeria lives in Dubai. In July, she flew to Karachi to spend vacations with her family. Her cousin, Tina, lives in Lahore. They both decided to visit their grand parents who live in Islamabad. Calculate the total distance they both travelled for this trip.
		Assign classwork from the textbook to allow pupils to practice these skills.
5.2 i	**Activity 4** 15 min	Make groups of 4 to 6 pupils. Give each group chart paper and child-friendly scissors. Ask them to cut their chart paper in a circle or any shape that they choose (or they can leave it in it is original shape). Now ask them to draw lines on the shape dividing it into ten equal parts. Tell pupils that they will have to do this before they cut out their shape so that they do not choose a complicated shape. Once the paper is divided into ten parts, ask them to divide each of the ten parts into six, and colour the paper in. Before they colour, ask them to make sure the dividing lines stay visible. When they are done, explain that each one-sixtieth of the chart paper is as a minute of an hour and also as a second of a minute. Link this to fraction discs or bars. Ask pupils to put their chart papers up around the class, and use them as a visual aid when doing classwork.

5.2
iii
iv

Activity 5
10 min

Draw this activity sheet on the board to be copied out, or make a worksheet of it. Ask pupils to fill them out in groups of three.

1. Yousuf decides to start practising for his Maths exam on Friday at 3:15 p.m. which is due after the weekend. Day: Friday Time: 3:15 p.m.	2. 5 hours later he gets bored and decides to take a break for dinner. Day: Time:	3. 15 hours later he picks up his science book and starts reading the new topic his teacher gave him for homework. Day: Time:
After 2 hours he decides to take a break for lunch. Day: Time:	Half an hour later he takes a nap for 45 minutes. Day: Time:	Then he goes for a bicycle ride with his friends for an hour. What time is it now? Day: Time:

Ask them to peer review at the end.

Let's try it

Ask pupils to solve some realistic questions that involve distance. Here are some examples of questions below:

- Javeria and Tina drove to their aunt's house. Javeria drove 9 ¾ kilometres. Tina drove 3500 meters before they arrived. How many kilometres had they driven in all?
- Mira flew 1234 kilometres to Lahore to visit her uncle. After picking up Mira, her uncle drove 20 kilometres to his house from the airport. How many kilometres had Mira travelled in all?
- Nobody wanted to ride the 22 kilometres back to town after the family reunion. So relatives rode 10 kilometres to the nearest hotel. How many kilometres did the family ride in all?

Assign classwork from the textbook to allow pupils to practice these skills.

Let's talk Math

Distance is a numeral measurement which can be used to tell how far one object is from other. It is used for jogging on a path, travelling, races, bicycle riding, distance between the earth and planets etc. We need time to calculate the duration of any work done. It is also needed to find the rate of speed of vehicles. Time is used everywhere while travelling, working and cooking. Ask the pupil what if there no no multiple units for measurement, but only one unit. For example, only km for length, kg for mass, l for capacity, and hours for time. How would our lives be different then? Will we have difficult measuring the distance, mass, capacity or time? Allow the students 5 minutes to write a reflective essay.

Let's get Practical

While travelling by road, pupils must have seen the sign boards telling the distance from one city to other city. Let's consider the following problem. A train travels 120 km/hr, How far will it travel in 30 minutes. Ask the pupils to find the answer without calculating on papers. Guide them that 30 minutes is half of an hour, so the train will travel half of the distance.

Self Assessment

5.1 Distance

5.2 Time

Refer to If they are struggling	Confusion level	1 – Does not understand any concept	2 – Does not understand most of the concepts	3 – Understands some concepts but has questions	4 – Understands all the concepts, just needs more practice	5 – Feels confident solving questions	If pupil is below 3 use Math Lab
	Number of Pupils						

Multiple Choice Questions

Read out the questions or write them on the board. You may ask pupils to either write the correct answer on a white board and hold it up or call out the options one by one, asking them to raise their hands to show which one they have chosen.

1. Convert 893.2 m into km.
   a) 0.8932 km
   b) 8932 km
   c) 8.932 km
   d) 89.32 km
2. Convert 4 hours and 10 minutes into minutes.
   a) 50 minutes
   b) 500 minutes
   c) 250 minutes
   d) 410 minutes
3. Convert 200 minutes into hours.
   a) 2 hours 60 minutes
   b) 3 hours 20 minutes
   c) 4 hours
   d) 2 hours 20 minutes

Unit 6

Unitary Method

6.1 Unitary Method

i. Calculate the value of many objects of the same kind when the value of one of these objects is given.

ii. Calculate the value of one object of the same kind when value of many of these objects are given.

iii. Calculate the value of many objects of the same kind when the value of some of these is given.

Plan Ahead:

6.1 Unitary Method

Allocate realistic time frame/ number of periods to each topic as per requirement.

Before You Start:

Students are familiar with the four operations. Here, they will learn to use appropriate operations to find the value of one or more than one object. They will deal with larger amounts using measurements of mass and capacity together in a bill. They will be able to solve real-life problems involving unitary methods.

Watch Out For:

Students only tend to make mistakes when they are unable to understand the language of the word problems, leading them to performing incorrect operations.

This Pairs with:

Math Lab 5, pages 41, 42

Make Sure You Have:

Books Recipe Cards

If They're Struggling:

When you see the confusion bar, take note of how many pupils fall under each level. If pupils are at a level 3 or below, have them solve the equivalent Math Lab pages in pairs, having weaker students work with more confident students. First do allow the class to collectively ask questions. If all pupils are at level 4 or above, move on to the next activity.

Let's Begin

Explain that unitary method is a process by which we find the value of a single unit using the values of multiple units and the value of multiple units using the value of single unit. Unitary method is used in solving variation problem in our daily life. For example to find the number of people required to completes a given task.

SLO

6.1 i

Activity 1

15 min

Collect at least ten copies of the same book. This can be one of the class textbooks, but it is not necessary. Place one book in front of the class and ask pupils to find out how many pages there are. Once they have checked, write the number on the board, and then place four books on top of the first one. Suppose the book has 100 pages. Ask pupils how many pages there are now in the pile. Since there are five books, the class should be able to deduce that there are 500 pages. Explain that this calculation that they have just made involved, or at least should have involved, the unitary method. Write number of pages : number of books on the board. So when you multiply the number of books by 5, you also multiply the number of pages. Now add three more books to the pile. And write 8 under number of books. Ask a pupil to come to the board to explain to their peers how to calculate how many pages 8 books would have.

6.1 ii

Activity 2

10 min

Prepare an activity sheet as shown. Distribute the activity sheet to each pupil to work individually.

Activity Sheet
Task 1: 1. 40 copies in 8 minutes = 40 ÷ 8 = 5 copies per minute 2. 30 pints of juice in 5 containers = _____÷ _____ = _____.pints per container 3. 5 tanks with 265 fish = _____ ÷ _____ = _____ fish per tank 4. 4 trays with 48 ice cubes = _____÷ _____ = _____ ice cubes per tray 5. 4 boxes can hold 40 books = _____÷ _____ = _____ books per box 6. 5 game controllers had 25 buttons = _____÷_____ = _____ buttons per
Task 2: Next ask pupils to make their own list of items of their choice along with their price. Swap the sheet with their peer, who will solve it. Peer check answers.

Let's try it

Provide a list of 5 grocery items to each group of students. State the unit price of each item and ask the students to calculate the amount needed to buy these grocery items. Ask each student of the group to calculate the price of each item, if pupils were to buy one for each person in their household. Here is an example below:

Price List	Grocery List
cost of 1 egg Rs 8	1 dozen eggs
cost of 1 banana Rs 10	2 dozen bananas
cost of 1 kg sugar Rs 80	2 kg sugar
cost of 1 litre of milk Rs 90	5 liters of milk
cost of 1 kg of flour Rs 45	3 kgs of flour

Ask them to use unitary method to find the price of unit item.

6.1
iii

Activity 3
10 min

Divide the class into pairs. Explain how to calculate and find of different quantities, using unitary method. Each pair should be given a recipe card and a worksheet related to the recipe card. Responses are to be shared with the rest of the class.

RECIPE CARD

TOMATO SOUP

To make tomato soup for 4 people, I need:	To make tomato soup for 8 people, I need:
6 tomatoes	_____ tomatoes
1 potato	_____ potato
1 onion	_____ onion
1 carrot	_____ carrot
2 table spoon of olive oil	_____ table spoon of olive oil
2 cups of vegetable stock	_____ cups of vegetable stock
4 pieces of bread	_____ pieces of bread

Assign classwork from the textbook to allow pupils to practice these skills.

Let's talk Math

The unitary method is important when it comes to cooking and baking as recipes require specific ratios of different ingredients. When we go shopping we buy things in bulk. Using the unitary method unable us to find the price of one unit or any quantity we require. Ask pupils why the unitary method might be the best for calculating instead of just using fractions or simply numbers. Lead them to the conclusion that unitary method is one that makes calculations easier when working with several number of items, and also lets us work with two numbers at a time. At the end of this discussion give them 5 minutes to write a reflective paragraph.

Let's get Practical

Set up a small market in the classroom and assign students different roles, such as shopkeeper and customer (tell students before conducting the lesson to bring empty boxes of the below mentioned items or any other, so that they can easily set up the market).

The class will be divided into groups. One group will be playing the role of the shopkeepers, others will be buyers. Students prepare the bill based on the shopping lists for a number of problems given to them. Give them the following important hints;

- The value of many quantities is calculated by multiplying the value of one quantity by the number of quantities.
- The value of one quantities calculated by dividing the value of many quantities by the number quantities.

Self Assessment

6.1 Unitary Method

Refer to If they are struggling	Confusion level	1 – Does not understand any concept	2 – Does not understand most of the concepts	3 – Understands some concepts but has questions	4 – Understands all the concepts, just needs more practice	5 – Feels confident solving questions	If pupil is below 3 use Math Lab
	Number of Pupils						

Multiple Choice Questions

Read out the questions or write them on the board. You may ask pupils to either write the correct answer on a white board and hold it up or call out the options one by one, asking them to raise their hands to show which one they have chosen.

1. In unitary method, we need to find the cost of _____ item first.
   a) few
   b) many
   c) two
   d) one
2. If 5 pairs of shoes cost Rs 3000, find the price of 12 pair of shoes.
   a) Rs 6000
   b) Rs 5000
   c) Rs 7200
   d) Rs 6500
3. If 36 men complete a job in 25 days, how many days will it take for 15 men to complete the job?
   a) 7 days
   b) 22 days
   c) 50 days
   d) 60 days

Unit 7

Geometry

7.1 Angles

i. Recognise straight and reflex angle.
ii. Recognise the standard units for measuring angles is 1˚, which is defined as 1/360 of a complete revolution.
iii. Identify, describe and estimate the size of angles
iv Classify them as acute, right or obtuse.
v. Compare angles with right angles and recognize that a straight line is equivalent to two right angles.
vi. Use protractor and ruler to construct:
- a right angle
- a straight angle
- reflex angles of different measures.

vii. Describe adjacent, complementary, and supplementary angles.

7.2 Triangles

i. Identify and describe triangles with respect to their angles. (Acute angled triangle, Obtuse angled triangle and right-angled triangles).
ii. Use protractor and ruler to construct a triangle when
- two angles and their included side is given.
- two sides and included angle is given.

ii. Measure the lengths of the remaining two sides and one angle of the triangle.

7.3 Quadrilaterals

i. Recognise the kinds of quadrilateral (square, rectangle, parallelogram, rhombus, trapezium, and kite).
ii. Identify and describe properties of quadrilaterals including square, rectangle, parallelogram, rhombus, trapezium, and kite, and classify those using parallel sides, equal sides and equal angles.
iii. Use protractor and ruler to construct square and rectangle when lengths of sides are given.

7.4 Symmetry

i. Recognise different types of symmetry (reflective and Rotational) in 2-D figures.
ii. Identify lines of symmetry for given 2-D figures.
iii. Find point of rotation and order of rotational symmetry of given 2-D figures.

7.5 Three Dimensional (3-D) Objects

i. Identify cubes, cuboids and pyramids from their nets.
ii. Describe and make 3- D objects (cubes, cuboids, cylinder, cone, sphere, pyramids).

Plan Ahead:

7.1 Angles
7.2 Triangles
7.3 Quadrilaterals
7.4 Symmetry
7.5 Three Dimensional Objects

Allocate realistic time frame/ number of periods to each topic as per requirement.

Before You Start:

Students have learnt to draw vertical and horizontal lines, they also know that angles are measured and named according to their sizes (acute, right, obtuse, straight, and reflex angles) with a protractor and according to their positions (adjacent, complementary, and supplementary). In this unit, students will identify different triangles according to their sides and angles, and the hypotenuse of a right-angled triangle. Students will also identify and name different types of quadrilaterals. They will now use compasses and rulers to construct triangles.

Students are familiar with 3D and 2D shapes from their daily life. They have seen and held objects, such as a ball (a sphere), a dice (a cube), a toothpaste box or a lunch box (a cuboid), an ice cream cone (a cone), etc. They have also felt the flatness of shapes, such as a floor tile (a square) or a windowpane (a rectangular), a round plate (a circle). They have a visual idea of what each looks like, but often get a confused with names. At this level their knowledge of shapes takes a slightly more formal shape.

Watch Out For:

Students enjoy the topic of geometry at this level and make very few mistakes. They only sometimes are unable to identify or name angles and triangles according to their sides or angles.
Make sure to give plenty of time for pupils to get used to names, especially when introducing the 3D shapes at the end of the unit.

This Pairs with:

Math Lab 5, pages 43-50, 52-61.

Make Sure You Have:

Foam sheets	Rulers	Scissor
A4 Sheets	Markers	Playdough

If They're Struggling:

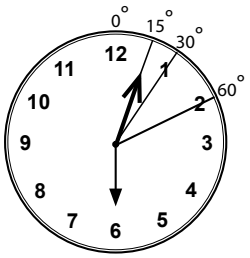
When you see the confusion bar, take note of how many pupils fall under each level. If pupils are at a level 3 or below, have them solve the equivalent Math Lab pages in pairs, having weaker students work with more confident students. First do allow the class to collectively ask questions. If all pupils are at level 4 or above, move on to the next activity.

Let's Begin

Ask students to bring pictures of different items or objects (easily available at home), on which they can identify and make angles. For example, a fork in a glass or a table and chair, clock, flag, or any geometrical shape. Ask them to identify the type of angle. (This task can be given to students as homework also). They may bring a picture of a clock with angles marked as shown. Ask the students to share their findings with the rest of the class and display their work in the class.

Ask the class to volunteer any information they remember about shapes, and which shapes they can name. As they name them, ask them to come up to the board and draw them. Write the name of each shape down next to them. When they are done, if there is a circle, a square, a rectangle, and a triangle on the board, group them together, and tell the class that these are the shapes they should focus on. If one of them is missing, add it, and explain to the class what it is called. For the purpose of this activity, include all the shapes on the board. Ask pupils if they see any similarities, or differences. Try to prompt them to be aware of the lines. Which ones are curved, and which ones are straight, even if the circle is the only shape on the board that does have a curved line.

SLOs		
7.1 iv	**Activity 1** 10 min	Ask pupils to bring pictures of different items or objects (easily available at home), on which they can identify and make angles. For example, a fork in a glass or a table and chain, clock, flag, or any geometrical shape. Ask them to identify the type of angle. (This task can be given to pupils as homework also). They may bring a picture of a clock with angles marked as shown. Ask the pupils to share their findings with the rest of the class and display their work in the class.



Let's try it

Distribute half sheet of A4 paper to each pupil. Ask them to write their name in capital letters using straight lines. Ask them to mark angles (as many as possible) on each alphabet of their name. Then name each angle according to its size.

7.2 i ii	**Activity 2** 10 min	Assign 15 minutes of classwork from the textbook so that pupils can revise these concepts Assign 15 minutes of homework from your textbook Explain the properties of different triangles before starting this activity. Let pupils work in pairs. Provide each pupil with an A4 sheet. Ask them to draw triangles of different sizes and different angles. Once they have drawn their triangles, tell them to swap their sheet with their partner, who will identify and classify triangles according to sides and angles. Ask pupils to name each one of them and give a reason for it.

Let's try it

Classify the given triangles according to their angles:

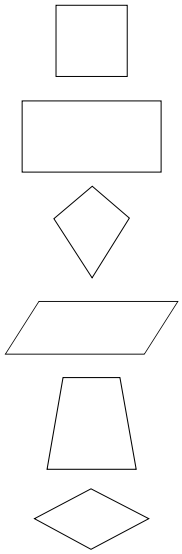
Acute-angled triangle, Obtuse-angled triangle, Right-angled triangle

a) 40°, 50°, 90°

b) 25°, 48°, 107°

c) 60°, 50°, 70°

7.3 i ii	**Activity 3** 10 min	Assign 15 minutes of classwork from the textbook so that pupils can revise these concepts Assign 15 minutes of homework from your textbook Explain the properties of different quadrilaterals before starting this activity. Let pupils work in pairs. Provide each pupil with an A4 sheet. Ask them to draw different quadrilaterals. Once they have drawn their quadrilaterals, tell them to swap their sheet with their partner, who will identify and classify quadrilaterals according to their properties. Ask pupils to name each one of them and give a reason for it. Sample worksheet is shown below.



_____ Reason: _____

_____ Reason: _____

_____ Reason: _____

_____ Reason: _____

_____ Reason: _____

_____ Reason: _____

Let's try it

Distribute two cut-outs of different quadrilaterals to each pupil. Ask them to write the properties of the shapes on the cut-outs with respect to the sides and angles and hand it over to the teacher.

Assign 15 minutes of classwork from the textbook so that pupils can revise these concepts

Assign 15 minutes of homework from your textbook

7.4
i
iii

Activity 4
15 min

This activity needs pre-planning. Make cut-outs of simple geometrical shapes from chart paper, and activity sheets (as shown in sample) with as many shapes as you want.

Name of the shape	Has reflective symmetry? Write YES or NO	Has rotational symmetry? Write YES or NO	Order of rotational symmetry

Bring these cut-outs, tracing paper sheet, and paper plates in the class for the activity. Let pupil's work in pairs. Distribute three or four cut-outs, tracing paper, paper plates and one activity sheet to each child. Tell them to trace the shape using the tracing paper, place it on the shape and then rotate it to find the order of the rotational symmetry.

Assign 15 minutes of classwork from the textbook so that pupils can revise these concepts

Assign 15 minutes of homework from your textbook

Let's talk Math

Discuss how every aspect of our lives has geometry or a part of geometry in it. Talk about how we are surrounded by different lines, angles, and shapes. Ask the students to point our places where different 3-D shapes, lines, and angles commonly found. Allow the students 5 minutes to write a reflective essay about how their understanding of geometry changed this year as compared to previous years.

Moving further, ask the students to observe symmetrical objects. On an A4 sheet, ask the students to draw the symmetrical object and find the total lines of symmetry. Also conclude if the object has reflective symmetry or rotational symmetry.

Let's get Practical

Take the students out in the playground and allow them to observe geometry in the environment. Ask them to point out the use of angles and once they do, ask them which kind of angle it is. They may also observe curved and straight lines all around them.

Self Assessment

7.1 Angles

7.2 Triangles

7.3 Quadrilaterals

7.4 Symmetry

7.5 Three Dimensional Objects

Refer to If they are struggling	Confusion level	1 – Does not understand any concept	2 – Does not understand most of the concepts	3 – Understands some concepts but has questions	4 – Understands all the concepts, just needs more practice	5 – Feels confident solving questions	If pupil is below 3 use Math Lab
	Number of Pupils						

Multiple Choice Questions

Read out the questions or write them on the board. You may ask pupils to either write the correct answer on a white board and hold it up or call out the options one by one, asking them to raise their hands to show which one they have chosen.

1. An angle less than 90° is called?
   a) Acute angle
   b) Obtuse angle
   c) Right angle
   d) Reflex angle
2. Two angles that give a sum of 180° are called?
   a) Adjacent angles
   b) Complementary angles
   c) Supplementary angles
   d) Right angles
3. Triangles that have all three equal sides are called?
   a) Right angled triangle
   b) Equilateral triangle
   c) Isosceles triangle
   d) Scalene triangle

Unit 8

Perimeter and Area

8.1. Perimeter and Area

i. Differentiate between perimeter and area of a square and rectangular region.
ii. Identify the units for measurement of perimeter and area.
iii. Find and apply formulas to find perimeter and area of a square and rectangular region.
iv. Solve real-life situations involving perimeter and area of square and rectangular regions.

Plan Ahead:

8.1 Area and Perimeter

Allocate realistic time frame/ number of periods to each topic as per requirement.

Before You Start:

Student have learnt to find perimeter and area of 2-D shapes on a square grid. They also know the units used for area and perimeter. Now they with learn to find area and perimeter of a square and rectangular to real-life situation.

Watch Out For:

Children make mistakes in choosing correct formula for area and perimeter. They need to understand why and when a particular formula has to be applied.

This Pairs with:

Math Lab 5, pages 62, 63

Make Sure You Have:

Bowl	Chits
Grid paper	Chart paper

If They're Struggling:

When you see the confusion bar, take note of how many pupils fall under each level. If pupils are at a level 3 or below, have them solve the equivalent Math Lab pages in pairs, having weaker students work with more confident students. First do allow the class to collectively ask questions. If all pupils are at level 4 or above, move on to the next activity.

Let's Begin

Provide each student with cut-outs of square and rectangular shapes. Ask them to write the name of the shape on each cut-out. Paste cut-outs of rectangle and square on the board. Make them understand the difference between length and breadth. Measure the length and breadth using a ruler introduce the formula and find the area and perimeter of the two shapes in front of them. Ask random questions to identify the sides of the shapes.s

SLO

8.1

iii

Activity 1

20 min

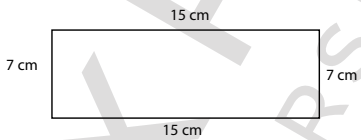
Take the pupils in the play area. Tell them to work in pairs and assign an alphabet for example, A, B, C, ... to each pair. Provide chalk, measuring tape or metre ruler to them. Ask each pair to draw a square and a rectangle of any measurement (preferably in whole numbers) on the ground using the resources provided and write the assigned alphabet in the centre of the figure drawn. Once all pupils have drawn the figures, then ask them to move around and start finding the perimeters and areas of the squares and rectangles drawn by their peers. Remind them to write the correct alphabet of the figure whose perimeter and area they have found. Bring the pupils back to class. Now ask them to swap their answer sheets with their peers. Let one pupil call out the answer of perimeter and area of figure A and ask the others to check whether their answer is correct or not. Repeat the process till answers of all figures are checked.

Activity 2

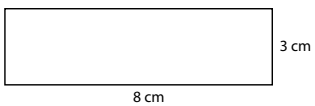
20 min

Draw the following figures on the board, one by one, and ask pupils to come to the front of the class to help you find the area or perimeter. Try not to use the same pupils for both so that more children can have a turn. Explain that area is finding how much space a shape has internally, and perimeter is more about the borders.

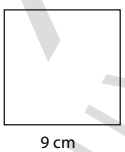
1. What is the length and breadth of each side?



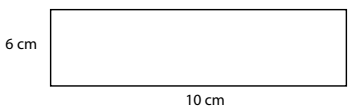
2. What is the perimeter?



3. What is the area?



4. What is the area?



At the end of this activity, Ask them all to draw their own square in their notebooks, and assign measurements. Then swap work with a partner and proceed to find the dimensions of each other's squares. End this activity with a class discussion. Ask pupils to put the difference in between area and perimeter into their own words.

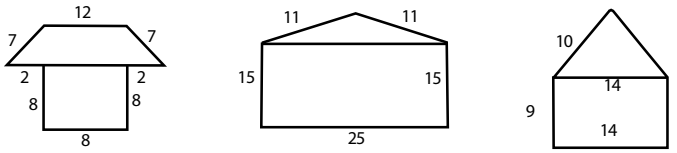
8.1
iii

Activity 3

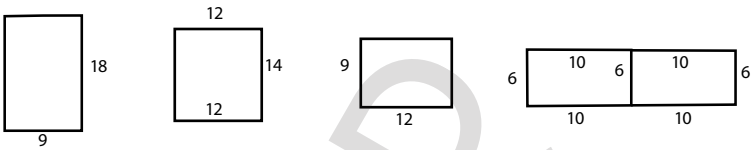
20 min

Having explained area and perimeter to the class, as well as the methods for finding them, draw the following figures on the board. Divide the class into groups of five, and ask them to see which group can find the area and perimeter of the following.

Find the perimeter.



Find the area.



Point out how the measurements of the shapes have no units. Remind pupils that if there was a unit, they would have to mention it in their answers as well.

8.1
iv

Activity 4

20 min

Hand out chart paper and ask pupils to design their dream house. Remind them to make a rough sketch in their notebooks before using the chart paper. Tell them that there must only be straight lines, and they must only make shapes that are square or rectangular. They may assign their own measurements but will have to think realistically about what units to use. Once they are done, put the chart papers up around the class. Using these as an example, start a class discussion about how, even if it seems a shape is not taking up so much space, it can take up a large area. At random, choose chart papers and start to solve them on the board. Ask pupils to think about the formulas that are used to find area and perimeter. Ask them what rules they have noticed when working with area and perimeter. Spend about fifteen minutes using the chart papers to set an example, but as you do so, collect rules and ideas about the unit from the pupils and write them on the board. Make sure that they copy it down before the activity ends.

Let's try it

Write the following questions on the board.

Find the perimeter and area of the following shapes using the formula.

1) A square with each side 15 cm
2) A rectangular lawn with length of 85 m and breadth of 10 m

Let's talk Math	Let's get practical
Geometry helps in the field of medicine e.g. X-ray and ultrasound, in the accurate calculation of physical distances. In the field of astronomy to map the distance between planets and stars, with in computer aided designs, it entails lines, curves, and angles, and in designing buildings, bridges, and furniture, patterns, and geometrical designs.	Ask pupils to make groups of up to 5. Each group may choose a room in the school, and using what they have learnt in this unit, they must collect data, like the dimensions of the room, and use it to calculate the area and perimeter.

Self Assessment

8.1 Perimeter and Area

Refer to If they are struggling	Confusion level	1 – Does not understand any concept	2 – Does not understand most of the concepts	3 – Understands some concepts but has questions	4 – Understands all the concepts, just needs more practice	5 – Feels confident solving questions	If pupil is below 3 use Math Lab
	Number of Pupils						

Multiple Choice Questions

Read out the questions or write them on the board. You may ask pupils to either write the correct answer on a white board and hold it up or call out the options one by one, asking them to raise their hands to show which one they have chosen.

1. The perimeter of a square of side 'l' is measured by?
   a) $l + l$
   b) $4l$
   c) l^2
   d) $4l^2$
2. The enclosed space within the shape of an object is it _____?
   a) area
   b) perimeter
   c) mass
   d) volume
3. If the perimeter of a square s 16cm. its area is?
   a) 8 cm^2
   b) 12 cm^2
   c) 16 cm^2
   d) 32 cm^2

Unit 9

Data Handling

9.1 Average

i. Find and describe average of given quantities in the data.
ii. Solve real-life situations involving average.

9.2 Bar Graphs

i. Organise the given data using bar graph.
ii. Read and interpret a bar graph given in horizontal and vertical form.
iii. Draw horizontal and vertical bar graphs for given data.
iv. Solve real-life situations using data presented in bar graphs.

Plan Ahead:

9.1 Average
9.2 Bar Graphs

Allocate realistic time frame/ number of periods to each topic as per requirement.

Before You Start:

Students will work on their previous knowledge of how to read and interpret block graphs and line graphs. They will draw block graphs and column graphs in horizontal and vertical form. Furthermore, they will also learn to calculate the average of given data.

Watch Out For:

Students often make mistakes when drawing bar graphs, where they don't leave a gap between the two bars (there should be a gap between the two bars).

This Pairs with:

Math Lab 5, pages 64, 65

Make Sure You Have:

Number cards

If They're Struggling:

When you see the confusion bar, take note of how many pupils fall under each level. If pupils are at a level 3 or below, have them solve the equivalent Math Lab pages in pairs, having weaker students work with more confident students. First do allow the class to collectively ask questions. If all pupils are at a 4 or above, move on to the next activity.

Let's Begin

To find the average of a set of quantities, add them together, then divide the total by the number of quantities. Block graphs are used to represent data. Types of items are indicated on the horizontal axis and the number of items is presented on the vertical axis. A bar graph is a representation of data which helps us compare information. A collection of facts and statistics gathered or available for analysis and calculation about a specific topic is called data. Show pupils examples of bar graphs on the board, and ask them for examples of the kind of data one could show in a bar graph.

SLOs

Activity 1

10 min

9.1

i

ii

Let the pupils work in pairs. Various resources, for example number cards, newspaper, books, etc. can be used for this activity.

If they chose number cards, provide each pair with the cards. Ask them to pick any number of cards randomly out of the pile. One pupil will arrange the cards and the other will add all the numbers to find the total value of the numbers written on these cards. Another peer will check the total and then both will find the average of these numbers.

If they chose a book, then one pupil will open the book randomly and the other will write the page numbers. They must choose at least 10 to 15 terms. Then both will find the total value of the numbers written on these pages and average of these numbers.

Take feedback from each pair, ask them how they calculated the average.

Some pupils may not have gotten to the right answer, so using the cards from one of the pairs, do it on the board. Some pupils may have gotten to the right answer without the right method. Ask them to discuss how they came up with the right answer.

Activity 2

10 min

9.1

ii

Ask ten pupils how old they are and ask a volunteer to collect the answers on the board. Discuss the concept of averages and ask pupils to try to estimate what the average might be.

After they have explored their ideas, explain that to find the average of a set of quantities, add them and then divide the total by the number of quantities. You have taken the data of 10 students, now find the sum of their ages and divide by the number of students (10).

$$\frac{10 + 8 + 9 + 9 + 8 + 10 + 9 + 10 + 8 + 9}{10} = \frac{90}{10} = 9 \text{ years}$$

This means that there may be some students around 10 years of age and some may be of 8 years of age, but the average tells us that the maximum number of students are 9 years old.

9.2
i
ii
iii
iv

Activity 3
20 min

Talk to pupils about the importance of having breakfast in the morning. Discuss healthy options for breakfast. Give one paper plate to each pupil. Ask pupils to write down what they had for breakfast that morning. Tell them pupils who did not have breakfast should just write 'nothing'. Group the breakfast items into categories such as 'milk and cereal', 'fruits', 'toast', 'eggs', etc.

Divide the pupils into groups. Each group will sort out and organise the data by gathering all plates which represents the same category of breakfast, for example, milk and cereals at one table.

Explain that a bar graph will make it easy to organise the pupils' responses, therefore, each group will draw a bar graph on a chart paper of the data that they have collected of the breakfast category assigned to them.

Once the pupils have completed the task, call each group one by one in front of the class to explain their findings. Repeat the same steps for each of the remaining categories. Analyse the bar graph and discuss the data.

Let's try it

Ask each pupil to draw bar graphs to show how many people like something. Ask them to make a list of anything they choose, perhaps colours, or movie titles, and then go around the class asking their classmates to each choose one. They should then construct a bar graph to show how many pupils chose each object. Remind them that they can make this bar graph vertically or horizontally but do remind them of the importance of labelling both axes.

Let's talk Math

Ask pupils how can the information provided in this unit can be helpful to people. Data is useful for a census which gives the government the facts and figures about the population. Bar graphs tells you about the preferences of different groups of people. Averages can be used to calculate the average rainfall in a region or the rate of a batsman in a cricket match (which tells us about his performance) Averages help people predict the annual, semi or quarterly performance of a company. Are they also useful in any way that the pupils could use, maybe if not now, in their adult lives? At the end of this discussion, allow 5 minutes for the class to write a reflective paragraph.

Let's get practical

Ask each student to develop their own survey. They should come up with a question to ask two large quantity of people for example, which subject do you think is the hardest. Once they have collected the data, they should construct a bar chart to represent their findings. Each student should then be able to present his or her findings to the class.

Self Assessment

9.1 Average

9.2 Bar Graphs

Refer to If they are struggling	Confusion level	1 – Does not understand any concept	2 – Does not understand most of the concepts	3 – Understands some concepts but has questions	4 – Understands all the concepts, just needs more practice	5 – Feels confident solving questions	If pupil is below 3 use Math Lab
	Number of Pupils						

Multiple Choice Questions

Read out the questions or write them on the board. You may ask pupils to either write the correct answer on a white board and hold it up or call out the options one by one, asking them to raise their hands to show which one they have chosen.

1. To find the average of 2.5, 3.5, 4.5, 5.5, and 6.5, we divide the sum by?
   a) 2
   b) 4
   c) 5.5
   d) 6.5
2. The collection of information, facts, and statistics gathered for analysis and calculation is called?
   a) Data
   b) Probability
   c) Bar graphs
3. What is the average of the first five numbers?
   a) 3
   b) 4
   c) 5
   d) 6

NEW

COUNTDOWN

BOOK 5

Lesson plans to be used in conjunction with the New Countdown book series.

Features of the Lesson Plan

The lesson plan contains the following features. The headings through which the teachers will be led are explained as follows:

Suggested Time Frame

Timing is important in each of the lesson plans. The guide will provide a suggested time frame. However, every lesson is important in shaping the behavioural and learning patterns of the students. The teacher has the discretion to either extend or shorten the time frame as required.

Learning Curve

It is important to highlight any background knowledge of the topic in question. The guide will identify concepts taught earlier or, in effect, revise the prior knowledge. Revision is essential, otherwise the students may not understand the topic fully. The initial question when planning for a topic should be how much do the students already know about the topic? If it is an introductory lesson, then a preceding topic could be touched upon, which could lead on to the new topic. In the lesson plan, the teacher can note what prior knowledge the students have of the current topic.

Each topic is explained in detail by the author in the textbook supported by worked examples. The guide will define and highlight the specific learning objectives of the topic. It will also outline the learning outcomes and objectives.

Real-life Application

Today's students are very proactive. The study of any topic, if not related to practical real-life, will not excite them. Their interest can easily be stimulated if we relate the topic at hand to real-life experiences.

Frequently Made Mistakes

It is important to be aware of students' common misunderstandings of certain concepts. If the teacher is aware of these they can be easily rectified during the lessons. Such topical misconceptions are mentioned to support teachers.

Summary of Key Facts

Facts and rules mentioned in the text are listed for quick reference.

Suggested Activities

This teaching guide provides you enough hands on activities for making your lesson plan more interesting and engaging. These activities will have more impact on students' learning.

Model Lesson Plan

Planning your work and then implementing your plan are the building blocks of teaching. Teachers adopt different teaching methods/ approaches to a topic.

A model lesson plan is provided in every unit as a preliminary structure that can be followed. A topic is selected and a lesson plan is written under the following headings:

Topic

This is the main topic/sub-topic.

Duration

The suggested time duration is the number of periods required to cover the topic. Generally, class dynamics vary from year to year, so flexibility is important.

The teacher should draw his/her own parameters, but can adjust the teaching time depending on the receptivity of the class to that topic. Note that introduction to a new topic takes longer, but familiar topics tend to take less time.

Specific Learning Objectives

This identifies the specific learning objective/s of the sub-topic being taught in that particular lesson.

Key Vocabulary

List of mathematical words and terms related to the topic that may need to be pre-taught.

Resources: Teaching and Learning Aids (Optional)

This section includes everyday objects and models, exercises given in the chapter, worksheets, assignments, and projects.

Strategy

Starter: Engagement Activity

The lesson can begin with something interesting, such as telling a story, relating a real-life experience or an everyday event which may or may not lead to the topic; but is interesting enough to capture the attention of the students. Involving students in a discussion to find out how much knowledge they have of the topic being taught is also a good strategy. Teachers can use their own creativity to come up with ideas to create a sense of fun.

Main Developmental Activity

Learning needs to start with practical activities, therefore the main developmental activity is the first step that leads to actual learning, which in turn leads to the required outcome of the lesson. This activity can be planned as individual work, pair or group work as per requirement. Working individually creates self-confidence where the child enjoys a sense of self-achievement, whereas pair and group activities create a sense of discovering and learning together.

These activities enhance concentration and improve retention of memory. Through these activities the teacher can build understanding of concepts in a fun-filled way. It is easier for students to grasp the concepts and then move from abstract to concrete.

Written Assignments

Finally, written assignments can be given for practice. It should be noted that classwork should comprise sums of all levels of difficulty, and once the teacher is sure that students are capable of independent work, homework should be handed out. For continuity, alternate sums from the exercises may be done as classwork and homework.

Supplementary Work (Optional): An activity or assignment could be given. It could involve group work or individual research to complement and build on what students have already learnt in class.

The students will do the work at home and may present their findings in class.

Wrap up

At the end of each sub-topic, a wrap up should be done using various strategies. For example, a quick question and answer session involving the whole class, challenging students with a question to check their understanding of the concept taught.

1 Whole Numbers and Operations

Suggested Time Frame

10-12 periods

Learning Curve

Students will deal with up

to 10 digit numbers. Previously they have added and subtracted numbers up to 6-digit numbers. This lesson will lead them to add and subtract numbers of greater complexity. Students have already learnt about multiplication and division, now they will apply this knowledge to solve daily life problems involving mixed operations. They will also apply BODMAS rule to carry out combined operations.

Real-life Application

It would be useful to discuss some interesting situations where we may have to deal with big numbers in real-life. For example,

- Finding the number of words in a 200 page book with 37 lines per page and 8 words per line. On multiplication, we find that there would be $200 \times 37 \times 8 = 59\,200$ words in the book.
- Finding the number of minutes a 97 year old man has lived. On multiplication, we find the number of minutes to be $97 \times 365 \times 24 \times 60 = 5\,09\,83\,200$
- Finding the height of a certain mountain in inches! etc.

Frequently Made Mistakes

- Students add bigger numbers in expanded form, as they start the addition from the left side despite the fact addition should start from the right side i.e. from the ones column.
- Get confused by the BODMAS rule and its application with the arithmetic operation rule.
- Mix up the order of operations when using BODMAS to solve problems.

Summary of Key Facts

- According to International Place Value Chart, commas are replaced by spaces.

- Zeros should be placed on the right and move the number towards the left, while multiplying a number with powers of 10.
- When a number is multiplied by 0, the result is 0, and when a number is multiplied by 1, it remains the same.
- When we have problems with two or more of the four operations without
- brackets, the rule of DMAS should be used for simplification.
- Brackets are also called grouping symbols, brackets help us to solve problems involving two or more operations by telling which part to simplify first.

Model Lesson Plan

Topic
Place value

Duration
2 periods

Specific Learning Objectives
By the end of the lesson, students will be able to add and subtract numbers of complexity.

Key Vocabulary
addition, subtraction

Resources
Whiteboard, marker

Strategy
Engagement Activity (5 mins)

Math Game Double Trouble

Tell students to use their whiteboards for this activity. Call out a 4-digit number and ask them to double it. Once they have, tell them to double the answer. Repeat doubling of numbers till they a reach a 7 or 8 digit number.

Main Developmental Activity
Teacher's Exposition (20 mins)

Explain that when we buy or sell expensive things, such as property or prepare a budget for government projects, we deal in bigger numbers.

Example:

Sana bought property worth Rs 315360 and her brother, Ali, bought property worth Rs 313412. Who has spent more money and how much more?

Rs 315360
– Rs 313412
Rs 1948

Sana spent Rs 1948 more than her brother.

Activity (10 mins)

Tell students to work in pairs.

Give newspaper cutting to them which have bigger number used in daily life situation.

Ask them to choose any to 5 or 6-digit numbers and add and subtract them.

Written Assignments (40 mins)

Ex 1b Q4 (a, b, c), Q7 (a, b, c), Q11

Wrap up (5 mins)

End the lesson by asking students**,** where do they see addition and subtraction of complex numbers in real-life? Give any two examples.

2 HCF and LCM

Suggested Time Frame

10-12 periods

Learning Curve

Students already know how to find common multiples of numbers and least common multiple by prime factorisation. Thereafter, they will now find the LCM by the division method. Students have already learned how to find common factors of a number and the highest common factor by prime factorisation. They will now learn to find the HCF by the long division method. Students will further apply the knowledge of LCM and HCF to solve real-life problems.

Real-life Application

- HCF is used to find whether an event will repeat again and again. HCF is also used to divide two or more objects into equal points or split things into smaller equal sections. For example, if there are 21 students from Grade 4 and 28 students in Grade 5 and the teacher wants to arrange students in minimum rows, she/he will calculate the HCF of 21 and 28. Since the HCF is 7, Grade 4 students will be arranged in 3 rows and Grade 5 in 4 rows.
- LCM is used to find whether an event will happen repeatedly at the same time.
- LCM is important to solve problems related to racetracks, traffic lights, and load shedding etc. For example, if there is a race among three students on a circular track, and student A covers the track in 4 minutes, student B covers the track in 5 minutes and student C covers the track in 10 minutes, all starting from the same point, after what time will all three of them be at the starting point again?

Frequently Made Mistakes

Students often get confused in recognising events which are related to HCF and LCM in word problems.

Summary of Key Facts

- A number is divisible by 4 if the number formed by the last two digits of the number is divisible by 4.
- A number is divisible by 6, if it is an even number and the sum of its digits is divisible by 3.
- A number is divisible by 8, if the number formed by the last three digits is a multiple of 8 or there are zeros at its hundreds, tens and ones places.
- If the digits of any number add up to a number which is exactly divisible by 9, then the original number is also divisible by 9.
- HCF and LCM can be found by prime factorisation and division methods.
- The LCM of the given numbers is the product of all the prime factors including the common factors used only once.
- The product of two numbers is equal to the product of their HCF and LCM.

Model Lesson Plan

Topic

Highest Common Factor (HCF)

Duration

2 periods

Specific Learning Objectives

By the end of the lesson, students will be able to find the HCF of three sets of 2-digit numbers using the long division method.

Key Vocabulary

factors, common factors, highest common factors (HCF)

Resources

Chart papers, markers

Strategy

Engagement Activity

Mental maths (5 mins)

A quick recall of dodging times-tables up to 12, orally.

Begin the lesson with small numbers and counters. Tell the students that any number of counters that can be grouped in smaller sets (without leaving a remainder) is a factor of the larger number.

For example, 15 counters can be arranged in either of the following ways:

1	○○○ ○○○ ○○○ ○○○ ○○○	$5 \times 3 = 15$
2	○○○○○ ○○○○○ ○○○○○	$3 \times 5 = 15$
3	○○○○○○○○○○○○○○○	$1 \times 15 = 15$
4	○○○○○○○○○○○○○○○	$15 \times 1 = 15$

Children 'see' how the numbers 3 and 5, 1 and 15, are factors of 15. Several similar examples will serve to make the concept clearer.

Main Developmental Activity

Group Work (20 mins)

Divide the class into groups and provide each group with three sets of 2-digit numbers and the following rules or steps to find out the HCF. For example:

Group 1: Find the HCF of 18, 27, and 45.

Instructions:

Step 1: Taking the bigger number 27 as the dividend and the smaller number 18 as the divisor, division is carried out**:**

```
    1
18 ) 27
   −18
     9 remainder
```

Step 2: The remainder 9 obtained in the previous step becomes the new divisor and the old divisor 18 becomes the new dividend and division is carried out again. There is no remainder here.

```
    2
9 ) 18
   −18
     0 remainder
```

Step 3: Step 2 is repeated. Since there is no remainder of division is carried out with the biggest number 45 as a dividend and 9 as a divisor.

Hence, the HCF of 18, 27, and 45 is 9.

```
    5
9 ) 45
   −45
    00 remainder
```

Feedback (10 mins)

Ask each group to share their solution and explain each step in detail. Discuss the practical application of HCF in daily life.

Written Assignments (40 mins)

Ex 2b Q6 (a to e)

Wrap up (5 mins)

1. Is there any other method to find the HCF?
2. Give one example of HCF from daily life.

3 Fractions

Suggested Time Frame

8-10 periods

Learning Curve

Students already know how to apply four operations on 'like fractions' and they have also verified the commutative and associative law of addition and multiplication. Here, they will apply the four operations on 'unlike fractions', which will lead them to solve real-life problems involving fractions. They will be also be able to apply the BODMAS rule while simplifying expressions involving fractions.

Real-life Application

Fractions are used:

- while cooking to understand and use particular amount of ingredients.
- to tell the time, as a second is a fraction of a minute and a minute is a fraction of an hour.
- during sales to determine the amount of discount that is to be given on a product.

Frequently Made Mistakes

- While simplifying fractions, students sometimes use two different factors of the same number for cancellation.
- When multiplying two fractions. they cancel both numerators or both denominators by the same factor, instead of can celling the numerator with the denominator.
- When dividing fractions, they find the reciprocal of the first fraction instead of the second fraction.

Summary of Key Facts

- A fraction can be reduced to the lowest term by dividing the numerator and denominator by the common factor.

- To add and subtract, make the denominators the same.
- To multiply fractions, reduce them to the lowest term, then multiply the numerator with the numerator and the denominator with the denominator.
- Commutative, associated, and distributive laws are true and can be verified for fractions.

Model Lesson Plan

Topic

Fractions

Duration

2 periods

Specific Learning Objectives

By the end of the lesson, students will be able to add and subtract fractions with different denominators.

Key Vocabulary

numerator, denominator, like fractions, unlike fraction

Resources

Worksheet

Strategy

Engagement Activity (5 mins)

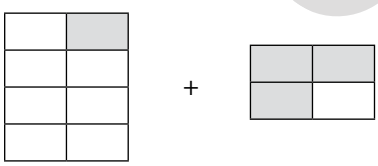
Recall

Write two fractions on the board $\frac{1}{8}, \frac{2}{4}$ and ask students which fraction is bigger and why?

Main Developmental Activity

Teacher's Exposition (15 mins)

Draw the following diagram on the board and explain to the students that they cannot add or subtract these fractions because they have different denominators. In order to add these fractions we need to make the denominators the same; we need to take out the LCM. Hence the LCM of 8 and 4 is 8.

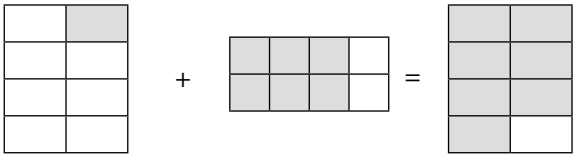


$\frac{1}{8}$ + $\frac{3}{4}$

$\frac{1 \times 1}{8 \times 1} + \frac{3 \times 2}{4 \times 2}$

$\frac{1}{8} + \frac{6}{8}$

Since, the two fractions now have the same denominator, they can easily be added together.



$\frac{1}{8} + \frac{6}{8} = \frac{7}{8}$

Individual Work (15 mins)

- Write down a few sets of fraction sums on the board.
- Let the student work in pairs. For example,

  $\frac{1}{3}+\frac{3}{4}+\frac{1}{6}$ $\frac{5}{8}+\frac{1}{4}+\frac{1}{2}$ $\frac{4}{6}+\frac{1}{2}+\frac{2}{3}$ $\frac{7}{8}+\frac{1}{2}+\frac{3}{4}$

- Tell each pair to choose two different sums and that both of them should solve one each on the worksheet.

Instructions	**Solution**
1. Write down the question. 2. Make the denominator the same. 3. Add the fractions 4. Simplify your final answer.	

Peer Checking

Worksheets will be checked by peers. While the students are peer checking, the teacher solves the sums on the board. Discuss possible errors and answer their queries. Students will do the correction on their own worksheet.

Written Assignments (40 mins)

Ex 3a Q4 (a, c, e) Q5 (a, c, e).

Wrap up (5 mins)

Ali and Sana bought two medium size pizzas. Ali cuts his pizza into 4 equal slices and Sana cuts the pizza into 3 equal slices. Ali ate two slices and Sana ate two slices, who is left with more pizza? Discuss the strategies to solve the problem.

4 Decimals and Percentages

Suggested Time Frame

8-10 periods

Learning Curve

In the previous grade, students have already used the decimal point when working with money. They have also learnt to apply four operations on decimal numbers and can convert them into fractions and vice versa. This knowledge will further lead them to add and subtract decimal numbers, and multiply and divide a decimal number by 10, 100, and 1000 and with a whole number. Furthermore, they will use division to change fractions into decimal numbers, simplify decimal expressions involving brackets, and round off decimals. They will be able to recognise percentage as a special kind of fraction and convert percentages to fractions and to decimals and vice versa. Students will be applying all the above mentioned knowledge when they solve real-life problems.

Real-life Application

- We use decimals in every day life while dealing with money, weight, length etc.
- Decimal numbers are used in situations where more precision is required than the whole numbers can provide. For example, when we calculate our weight and height.
- Rounding off and approximation is especially useful when adding, subtracting, multiplying, and dividing a group of numbers in order to get an idea of something.
- Shops advertise discounts on products. These discounts are in percentages.
- Banks quote interest charged to the clients on loans, or interest paid for money invested, as a percentage.
- Companies describe their success or failure as an increase or decrease in percentage of their profits.
- Marks sheets also represent students' marks in percentages.
- Antiques or jewellery may increase in value as time goes by; we usually express that increase as a percentage.
- Items, such as equipment and machinery, usually decrease in value. We express that decrease as a percentage.

Frequently Made Mistakes

- When applying operations of decimal numbers, students often do not align the the decimal point and the columns properly.
- When adding or subtracting decimal numbers, students forget to put the decimal point in the correct place.
- When multiplying or dividing fractions they do not remember whether the decimal appear to move towards the right or left (although the decimal point does not move).

Summary of Key Facts

- Numbers with the same number of decimal places can be easily added or subtracted by writing each digit under the other.
- Multiplication gives a bigger number as the answer while division gives a smaller number as the answer. So, decimal point is moved accordingly.
- In order to multiply two numbers with decimals, it is easy to change the numbers into common fractions and then multiply them.
- In order to divide two numbers with decimals, it is easy to first change the numbers into common fractions and continue dividing, as would be done in the case of fractions.
- The same number of decimal places in the numerator and denominator means that the 'decimal points' can be ignored. In other cases, we multiply the dividend and the divisor with 10s or 100s, as need be, to change them into whole numbers and then proceed to divide them as usual. But, we need to re-introduce the decimal and decimal place numbers after the calculations.
- When a decimal number is multiplied by 10, 100, and 1000, apply the same rule as for whole numbers; move one column to the left.
- When a decimal number is divided by 10, 100, and 1000, count the zeros in the divisor, then shift the dividend the same number of columns to the right.
- Rounding off means making an estimate but maintaining its value close to the original figure.
- Half-way numbers are always rounded off upwards.
- The word 'percentage' is based on the Latin word 'Centum'. A percentage is a special kind of a fraction with 100 as a denominator.
- The symbol used for percentage is %, which means 'per cent' or 'upon 100'.
- To change a percentage into a decimal, first convert it into a common fraction and then express it as a decimal.

Model Lesson Plan

Topic

Percentage

Duration

2 periods

Specific Learning Objectives

By the end of the lesson, students will be able to convert fractions into decimals and percentages.

Resources

Grids with 100 squares (10 × 10), coloured buttons

Key Vocabulary

percentage, fraction, decimal

Strategy

Engagement Activity (5 mins)

The teacher can start the lesson by distributing counters (equal amounts to each group) and 100-square grids among groups of students. The students in each group first segregate the counters according to their individual colour preference and then fill up each small square on the grid with a counter.

Main Developmental Activity

Teacher's Exposition (15 mins)

Once students are done with the engagement activity, ask each group to write down the number of squares occupied by each colour as a fraction by preparing a table in the format shown below. Since any fraction with a denominator of 100 can be expressed as a percentage, all these fractions can be easily expressed as a percentage.

Now explain that if we divide the numerator by the denominator we will get a decimal number and if we multiply the fraction by 100, we have expressed it as a percentage.

For example,

$\frac{15}{100} \times 100 = 15\ \%$

Group Work (10 mins)

	Fraction	Decimal Fraction	Percentage
Red: 15 out of 100	$\frac{15}{100}$	0.15	15%
Yellow: 20 out of 100	$\frac{20}{100}$	0.20	20%
Blue: 17 out of 100	$\frac{17}{100}$	0.17	18%
Pink: 35 out of 100	$\frac{35}{100}$	0.35	35%
White: 13 out of 100	$\frac{13}{100}$	0.13	13%

Percentages are useful while comparing unlike fractions. These fractions are converted into equivalent fractions having 100 as their denominator.

Written Assignments (40 mins)

Ex 4c Q6 (a to f), Q7 (a to f)

Wrap up (5 mins)

Discuss what steps are needed to calculate percentages from fractions. Ask if Ali scores 20 marks out of 25 in maths, what is his percentage in mathematics? Can we convert percentages into decimals? If yes, then how?

5 Distance and Time

Suggested Time Frame

8-10 periods

Learning Curve

Students have already worked with units of length in their previous class. They are well aware of addition, subtraction and conversion of units of length and this will lead them to add and subtract measure of distance. Furthermore, the knowledge about conversion of units of time will help them to add, subtract and convert years to months, months to weeks, weeks to days, and vice versa. Next, they will recognise units of temperature in Fahrenheit and Celsius. Students will be able to apply the knowledge of conversion, of units of distance, time and temperature, in real-life situation.

Real-life Application

- Distance is a numeral measurement which can be used to tell how far one object is from other. It is use for navigation. For example: a driver calculate the amount of distance he has to travel from one place to another. It is also used to determine how near or far something is from us.
- Time is used everywhere while travelling, working and cooking. We measure time to determine how long something would take.
- Time and distance are also used together, for example, we measure the amount f time it would require from us to cover certain distance.

Frequently Made Mistakes

- A common mistake while converting one unit to the other, students use the wrong conversion unit and the wrong operation.
- Students forget that we 'multiply' while converting a bigger unit to a smaller unit and we 'divide' when converting a smaller unit to a bigger units.

Summary of Key Facts

- Kilo means 1000, centi means 1/100, and milli means 1/1000.
- 1 km = 1000 m , 1 m = 100 cm and 1 cm = 10 mm.
- When hours are converted to minutes multiply by 60. When minutes are converted to hours divide by 60.

- When minutes are converted to seconds, we multiply by 60. When seconds are converted to minutes, we divide by 60.

Model Lesson Plan

Topic
Conversion of units of distance

Duration
2 periods

Specific Learning Objectives
By the end of the lesson, students will be able to convert units of measures of length/distance.

Key Vocabulary
millimetre, centimetre, kilometre, convert, conversion, conversion factor

Resources
Activity cards

Strategy
Engagement Activity

Whole class discussion (5 mins)

Start the lesson by asking questions related to units of measures of length/ distance. For example, which unit will be used to measure the length and breadth of a book or the height of a room or distance between two cities?

Main Developmental Activity
Demonstration (10 mins)

A conversation with the students is useful to gauge their knowledge about units of measurement.

This may be followed up with a little discussion on how to decide what unit will be used to measure different objects (long and short) and long distances. All units of measurement are useful in a real-life.

Explain how to convert the two units of measurement by using the following conversion factors:

To convert a bigger unit to a smaller unit To convert a smaller unit to a bigger unit

Kilometre × 1000 = Metre

Metre × 100 = Centimetre

Centimetre × 10 = Milimetre Milimetre ÷ 10 = Centimetre

Centimetre ÷ 100 = Metre

Metre ÷ 1000 = Kilometre

Instructions:
Provide the Activity Card to each student and write the conversion table on the board.

Conversion of measures of distance

Activity Card

Conversion of measures of distance

1. Jawad is going to distribute sweets in his neighbourhood on Eid. He walks 20 metres to the first house. How many centimetres did he walk?

Answer: _____

2. He walks 100 metres to the next house. How many centimetres did he walk? How many millimetres did he walk?

Answer: _____

3. He walks 4500 centimetres to the next house. How many metres did he walk?

Answer: _____

4. He can't make it to the next house because it is 2000 metres away. How many kilometres is it?

Answer: _____

5. Javeria and Tina drove to their aunt's house. Javeria drove 9 ¾ kilometres. Tina drove 3500 metres before they arrived. Convert kilometres to metres and metres to kilometres.

Answer: _____

6. Mira flew 1234 kilometres to Lahore to visit her uncle. After picking up Mira, her uncle drove 20 kilometres to his house from the airport. How many metres had Mira travelled in all?

Answer: _____

7. Nobody wanted to ride the 22 kilometers back to town after the family reunion. So, relatives rode 10 kilometres to the nearest hotel. How many kilometres did the family ride in all?

Answer: _____

Addition work (optional)

The students can carry out a fun activity where they find out distances between different cities of Pakistan from their own city. Keep a record and then discuss in class how they found the distance. Then compare results with their peers and find out:

- Which city is the closest to their city?
- Which city is the farthest from their city?
- Which two cities have the minimum or maximum distance between them?
- What is the different between the maximum and the minimum distances?
- Arrange these distances in ascending or descending order.

Written Assignment (30 min)

Ex 5a Q 1 to 6

Wrap up (5 min)

Can we calculate the distance between two planets? If yes, then how and what unit of measure will we use?

6 Unitary Method

Suggested Time Frame

8-10 periods

Learning Curve

Students will become familiar with the unitary method and know how to prepare bills. Here, they will learn to prepare bills of larger amounts using measurements of weight and capacity together in a bill.

Real-life Application

The unitary method is important when it comes to cooking and baking as recipes require specific ratios of different ingredients. When we go shopping we buy things in bulk. Using the unitary method unable us to find the price of one unit or any quantity we require.

Frequently Made Mistakes

Students only tend to make mistakes when they are unable to understand the language of the word problems, leading them to performing incorrect operations.

Summary of Key Facts

- The value of many objects of the same kind can be calculated when the value of one of the objects is given.
- The value of one object of the same kind can be calculated when the value of many of the objects is given.
- The value of many object of the same kind can be calculated when the value of some of the objects is given.

Model Lesson Plan

Topic

The Unitary Method

Duration

2 periods

Specific Learning Objectives

By the end of the lesson, students will be able to apply the unitary method involving real-life problems.

Key Vocabulary

unitary method, bills

Resources

Empty boxes, price lists

Worksheet

Classroom shop; shopping lists in the following format:

Popcorn: Rs 10 per pack

Flour: Rs 52 per kg

Butter: Rs 250 per kg

Orange juice: Rs 69 per bottle

Strategy

Engagement Activity

Role play (15 mins)

Set up a small market in the classroom and assign students different roles such as shopkeeper and customer. Tell students before conducting the lesson to bring empty boxes of the above mentioned items or any other, so that they can easily set up the market.

Main Developmental Activity

Group Work (20 mins)

The class will be divided into groups. One group will be playing the role of the shop keepers, others will be buyers. Students prepare the bill based on the shopping lists for a number of problems given to them.

Example:

For a birthday party, Sana bought 20 packets of popcorn, 2.5 kg flour, 1.25 kg butter, and 5.25 litre of orange juice.

Prepare a bill for her using the cost of each item given on the worksheet.

Quantity	Description	Cost per unit	Total cost
20 packets	Popcorn	Rs 10	Rs 200
2.5 kg	Flour		
1.25 kg	Butter		
5.25 litre	Orange juice		

Feedback (10 mins)

Ask students about the total bill. How did they calculate it?

Written Assignments (30 mins)

Ex 6 Q4 (a, b, c) and word problems 1 to 4.

Wrap up (5 mins)

A short discussion should be held on the importance of the unitary method. Ask students where they use the unitary method in their daily life.

7 Geometry

Suggested Time Frame

8-10 periods

Learning Curve

Students have learnt to draw vertical and horizontal lines, they also know that angles are measured and named according to their sizes (acute, right, obtuse, straight, and reflex angles) with a protractor and according to their positions (adjacent, complementary, and supplementary). In this unit, students will identify different triangles according to their sides and angles, and the hypotenuse of a right-angled triangle. Students will also identify and name different types of quadrilaterals. They will now use compasses and rulers to construct triangles.

Real-life Application

Geometry helps:

- in the field of medicine e.g. X-ray and ultrasound.
- in the accurate calculation of physical distances.
- in the field of astronomy to map the distance between planets and stars.
- in computer aided designs, it entails lines, curves, and angles.
- in designing buildings, bridges, and furniture, patterns, and geometrical designs.

Frequently Made Mistakes

Students enjoy the topic of geometry at this level and make very few mistakes. They only sometimes are unable to identify or name angles and triangles according to their sides or angles.

Summary of Key Facts

- An acute angle is less than 90°, a right angle is equal to 90°, an obtuse angle is more than

90° but less than 180°, and a reflex angle is more than 180°.

- Adjacent angles have a common vertex.
- Two angles are complementary if their sum is 90°.
- Two angles are supplementary if their sum is 180°.
- The sides of an equilateral triangle are equal in length and each angle is of 60°.
- An isosceles triangle has two equal sides and two equal base angles.
- All three sides of a scalene triangle have different lengths, therefore, all three angles are different.
- The sum of all angles in a triangle is equal to 180°.
- In a right-angled triangle, one of the angles Is 90°.
- In an acute-angled triangle, all the angles are acute.
- In an obtuse-angled triangle, one angle is obtuse and the other two angles are acute.

Model Lesson Plan

Topic

Angles

Duration

2 periods

Specific Learning Objectives

By the end of the lesson, students will be able to define and measure reflex angles.

Key Vocabulary

acute angle, right angle, obtuse angle, reflex angle

Resources

A large size wooden geometry box

Strategy

Engagement Activity (5 mins)

Show the big wooden geometry box to the class and ask them to guess the topic. Once the students have guessed the topic then ask them to define an acute angle, right angle, and obtuse angle and side-by-side draw these angles on the board using the wooden protractor.

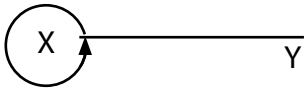
Main Developmental Activity

Demonstration (15 mins)

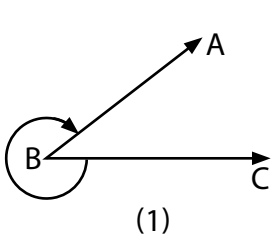
Start with a quick run through of the work done in the previous class, before moving on to measuring and constructing angles using a protractor. Working on the blackboard with a large wooden protractor is useful.

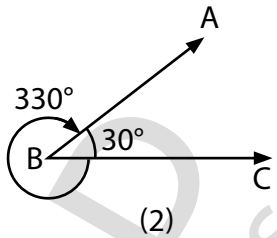
Students know that:

- when a line XY turns a full circle at point X (below) before returning to its original position, the measure of degrees at the point of turning is 360°.



- a reflex angle is greater than 180°. Reflex angles can be drawn in two ways.
  Look at the following figures:





Use a protractor to draw an acute angle. Let angle ABC = 30°

Subtract: 360° – 30° = 330°

The outer angle ABC = 330° which is the required reflex angle.

Group Work (15 mins)

Working in groups is fun. Divide the class into groups.

Instructions:

Ask group one to construct an acute angle on A4 size sheet (any size to be given) then calculate and measure its corresponding reflex angle. In the same manner, the rest of the groups will construct a right angle, obtuse angle and their corresponding reflex angles.

Ask each group which angle they have drawn and what is its corresponding reflex angle.

Written Assignment (40 mins)

Ex 7a Q7 (a, b, c, d), Q8 (a, b, c, d).

Wrap up (5 mins)

Hold a small discussion on the importance and application of different angles in our daily life.

8 Perimeter and Area

Suggested Time Frame

8-10 periods

Learning Curve

In the previous grades, student have calculated areas and perimeters of simple shapes. In this unit, students will move on to calculate areas of composite shapes using formulas.

Real-life Application

The calculation of area is beneficial when we want to find:

- how many tiles are needed to cover the floor, or the size of carpet required for a room.
- the covered area of a plot for construction of a building.

Frequently Made Mistakes

Students often get confused between area and perimeter, as they do not realise that area is the inside part and perimeter is the sum of the sides of the outer boundary. They also make mistakes in writing the correct units of area and perimeter.

Summary of Key Facts

- Perimeter is the sum of all the sides of the outer boundaries of a closed region.
- Area is a surface covered by a closed region.
- Composite shapes consist of two or more shapes.

Model Lesson Plan

Topic

Area and perimeter of composite shapes.

Duration

2 periods

Specific Learning Objectives

By the end of the lesson, students will be able to calculate area and perimeter of composite shapes.

Key Vocabulary

area, perimeter, simple shapes, composite shapes

Resources

Chart papers, markers, cut-outs of different composite shapes.

Strategy

Engagement Activity

Recall (5 mins)

Paste cut-outs of simple 2D shapes like square and rectangle on the board as shown in Fig. 1 ask the students if they can find the area and perimeter of these shapes. Once they say yes, join the shapes as shown Fig. 2 and ask how can the area and the perimeter of the new composite shape be found using the formula for the area and perimeter of a square and rectangle?

Square

Fig. 1

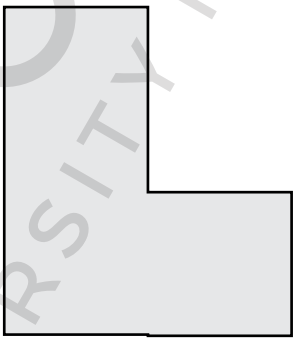


Fig. 2

Area of a square = length × length = $(\text{length})^2$

Perimeter = 4 (length)

Rectangle

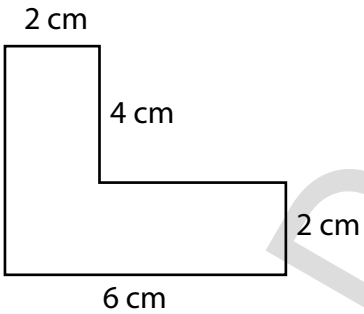
Area of a rectangle = length × breadth

Perimeter = 2 (length + breadth)

Main Developmental Activity

Group Work (20 mins)

- Divide the class into groups.
- Provide each group with the different composite shapes and ask them to calculate the area and perimeter of the given shape on a chart paper.



Feedback (15 mins)

Ask each group to represent their work and tell the other groups to give remarks on each other's work.

Written Assignments (30 mins)

Ex 8a Q 4, (a, b). Ex 8b Q5 (a to f), Q10 (a to d)

Wrap up (5 mins)

Ask students where they see composite shapes in their surroundings.

9 Data Handling

Suggested Time Frame

4-6 periods

Learning Curve

Students will work on their previous knowledge of how to read and interpret block graphs and line graphs. They will draw block graphs and column graphs in horizontal and vertical form. Furthermore, they will also learn to calculate the average of given data.

Real-life Application

- Data is useful for a census which gives the government facts and figures about the population.
- Bar graphs tells you about the preferences of different groups of people.
- Averages can be used to calculate the average rainfall in a particular region or the rate of a batsman in a cricket match (which tells us about his performance)
- Averages help people predict the annual, semi or quarterly performance of a company.

Frequently Made Mistakes

- Students often make mistakes when drawing bar graphs, where they do not leave a gap between the two bars (there should be a gap between the two bars).

Summary of Key Facts

- To find the average of a set of quantities, add them together, then divide the total by the number of quantities.
- Block graphs are used to represent data. Types of items are indicated on the horizontal axis and the number of items are presented on the vertical axis.
- A bar graph is a representation of data which helps us compare information.
- A collection of facts and statistics gathered or available for analysis and calculation about a specific topic is called data.

Model Lesson Plan

Topic

Averages

Duration

2 periods

Specific Learning Objectives

By the end of the lesson, students will be able to calculate the average of a set of quantities.

Key Vocabulary

averages, total, sum

Resources

White board, Markers

Strategy

Engagement Activity (5 mins)

Start your lesson by asking any ten students about their age and jot down on the board in the following manner.

10, 8, 9, 9, 8, 10, 9, 10, 8, 9

Just collect the data and move to the explanation.

Main Developmental Activity

Teacher's Exposition (10 mins)

To find the average of a set of quantities, add them and then divide the total by the number of quantities. You have taken the data of 10 students, now find the sum of their ages and divide by the number of students (10).

$$\frac{10 + 8 + 9 + 9 + 8 + 10 + 9 + 10 + 8 + 9}{10} = \frac{90}{10} = 9$$

This means that there may be some students around 10 years of age and some may be of 8 years of age, but the average tells us that the maximum number of students are 9 years old.

Group Work (20 mins)

Instructions:

- Divide the class into groups.
- Ask students to use white boards and markers.
- Give each group different data to calculate average.

For Example:

Group 1

If there are 20 students in the class, the number of students who the wore wrong uniform on each day of the week is as follows:

Monday 7 students, Tuesday 13 students, Wednesday, 14 students, Thursday 10 students, and Friday 6 students. Find the average number of students who wore the wrong uniform during the week.

Ask each group to share their work with the class, by showing their working on the white boards.

Written Assignments (40 mins)

Ex 9a Q1, 2, 3, 4

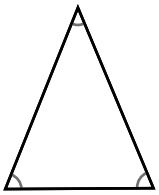
Wrap up (5 mins)

Discuss the importance of averages in daily life.

Glossary

A

acute-angled triangle

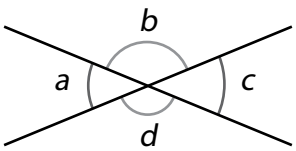


a triangle with three acute angles (angles that are less than 90°)

angles at a point

angles that converge at a point, where the sum of angles is equal to 360°

Example



$\angle a + \angle b + \angle c + \angle d = 360°$

area

the amount of surface taken up by a figure

Example

Area of triangle = $\frac{1}{2} \times \text{base} \times \text{height}$

C

cubic unit

Unit of measure of volume

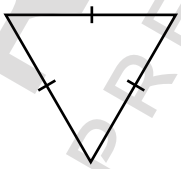
D

decimal

"Decimal number" is often used to mean a number that uses a decimal point followed by digits that show a value smaller than one.

E

equilateral triangle



a triangle with three sides of equal length and three equal angles, where each angle is 60°

estimation

estimation means having a rough calculation of the value, number, or quantity.

H

HCF

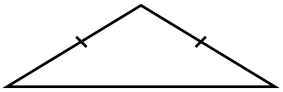
a common number that completely divides two or more numbers.

I

improper fraction

when the numerator of a fraction is larger than it denominator

isosceles triangle



a triangle with two sides of equal length and two equal angles

L

LCM

a number that is the first common multiple of two or more numbers

litre (ℓ)

a unit of measure of volume, where
1 ℓ = 1000 ml

M

million

7th place value from the left, where
1 million = 1 000 000

millilitre (mℓ)

a smaller unit of measure of volume (see litre)

mixed numbers

a fraction that consists of a whole number and a fraction

O

obtuse-angled triangle

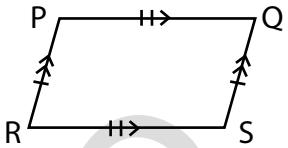
a triangle with one obtuse angle (an angle that is more than 90° and less than 180°)

order of symmetry

the number of times a shape fits into itself in one complete rotation is called the order of rotational symmetry

P

parallelogram



a quadrilateral with opposite sides that are parallel and equal in length and opposite angles that are equal.

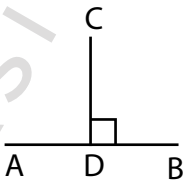
percentage

a number expressed as a fraction of 100

perpendicular lines

two straight lines that meet at a right angle (see right angle)

Example



We write CD ⊥ AB or AB ⊥ CD.

R

rate

the ratio between two related quantities

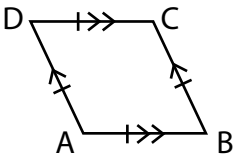
ratio

the relationship between similar quantities displaying the number of times is one of the other

reflective symmetry

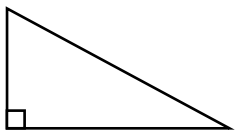
when a shape or pattern is reflected in a mirror line or a line of symmetry. The shape that is reflected will be the same as the original, will also be of the same size and it will be the same distance away from the mirror.

rhombus



a quadrilateral with opposite sides that are parallel, all sides equal in length and opposite angles that are equal.

right-angled triangle



a triangle with a right angle (a 90° angle)

rotational symmetry

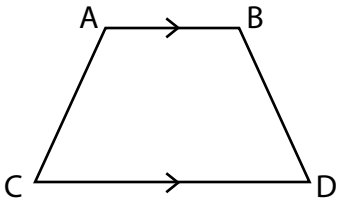
A shape has rotational symmetry when it looks the same after some rotation

rounding off

rounding off means the number is made simpler by keeping its value intact but closer to the next number. Rounding off is done for whole numbers, and for decimals at various places of hundreds, tens, tenths, etc.

T

trapezium



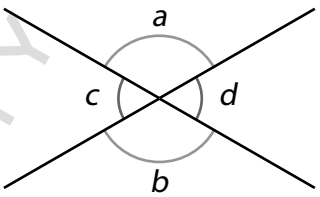
a quadrilateral with only one pair of parallel sides

V

vertically opposite angles

angles that are formed when two lines intersect, where the angles are equal to each other

Example



$\angle a$ and $\angle b$ are vertically opposite angles, where $\angle a = \angle b$.

$\angle c$ and $\angle d$ are vertically opposite angles, where $\angle c = \angle d$.