Teaching Guide 6

MATHS WISE

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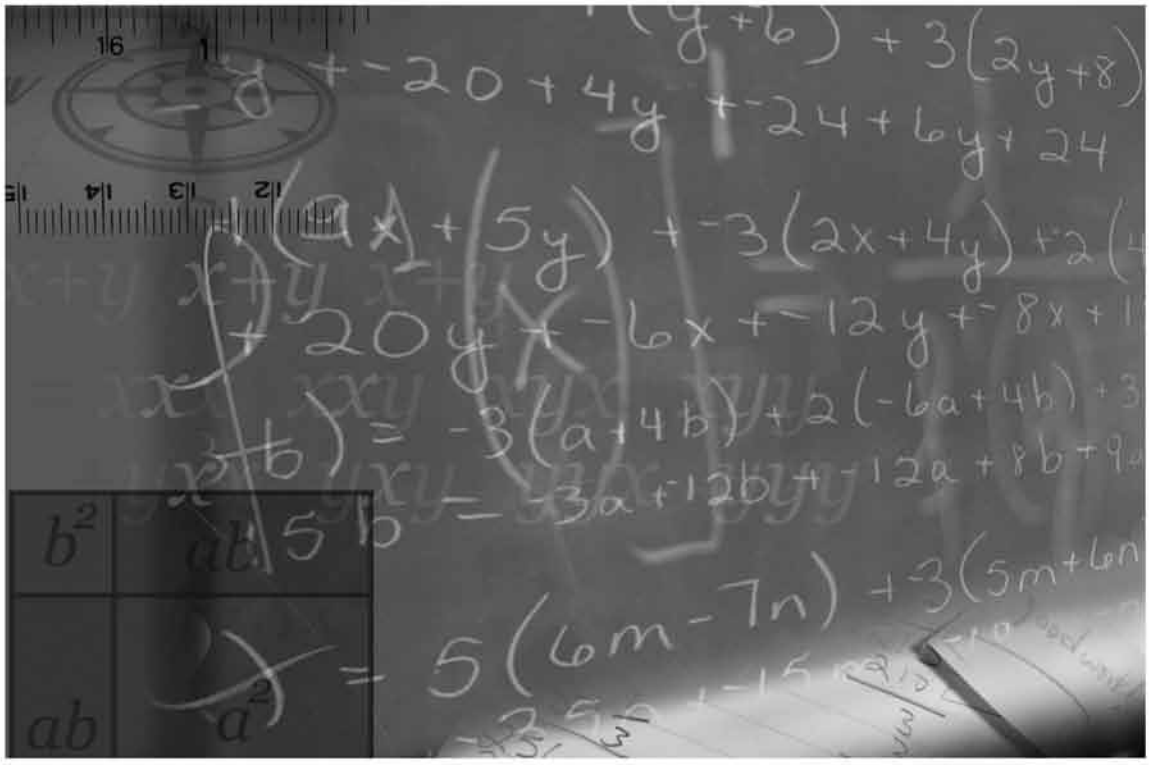

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CONTENTS

USING THIS TEACHING GUIDE

This teaching guide provides lesson plans for each unit. Each lesson starts with activities that can be completed within a specified time before the main lesson is taught. Working on starter activities help prepare the students for the more formal lessons and is an informal introduction to the topic at hand without straight away barraging them with new concepts.

While devising these activities, make sure that they can be done within a reasonable time span and that the recourses that are to be used are easily available.

Time required for completing each lesson is also given but can change depending upon the students' learning capabilities.

The guide refers to the textbook pages where necessary and exercise numbers when referring to individual work or practice session or homework.

This is not a very difficult guide to follow. Simple lesson plans have been devised with ideas for additional exercises and worksheets. Make sure that lessons from the textbook are taught well. Planning how to teach just makes it easier for the teacher to divide the course over the entire year.

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SETS

Topic: Sets
Time: 3 periods

Objectives

To enable students to:

- define a set,
- identify the elements of a set,
- represent sets in different ways,
- recognize and define different types of sets.

Starter activities

Students should be given activity sheets with drawings of objects, for example pictures of fruits, flowers, insects, playing cards, etc. and should be asked to separate the objects and divide them into groups, for example. A, B, C, etc. The students may be asked questions like the ones given below.

1. Give a reason for the grouping.
2. Are the groups of objects or sets well-defined?
3. What is common among the members of each group?

Discuss the answers the students give.

Main lesson

Refer to pages 9 to14 of the textbook.

- Define a set, explain the terms well-defined and distinct objects
- Notation of a set. Name the set with a capital letter and enclose the elements in curly brackets
  Example A = {a, b, c, d} etc.
- Elements of a set; symbols $\in$ and $\notin$

- Cardinal number of a set (number of elements) e.g. in the set, A = {a, b, c, d}, the cardinal number is 4 as there are four elements.
- Methods of representing a set:
  Descriptive form, Tabular form, and Set builder notation. Give at least two examples of each form.

Practice session

As oral practice, give examples of sets of numbers. The teacher writes a few sets on the board and students are asked to name the elements. Alternatively give the number of elements, and ask the students to write sets on the board in three different ways.

Individual work

Exercises 1a, 1b, and 1c on pages 11, 13, and 14 of the textbook should be given as class work.

Homework

1. Write the following sets in a tabular form:
   a. names of all the students in the class
   b. names of week days
2. Write any two sets in a descriptive form.
3. Write the sets of natural numbers from 1 to10 in set builder form.
4. Find the number of elements of a given set.
5. List the elements of a given set.

Recapitulation

Worksheets will be given to assess the students learning and understanding of the topic. Difficult topics should be discussed.

Topic: Types of sets
Time: 2 periods

Objectives

To enable students to: identify different types of sets

Starter activities

The teacher writes a few examples of finite, infinite, and null sets on the board to help introduce the tropic.

Examples

- set of days in a week
- set of whole numbers
- set of men who are 12 ft tall etc.

The students should be asked the following questions:

1. Which of the sets have a fixed number of elements?
2. Which set contains an unlimited number of elements?
3. Which set does not have any element?

Discuss the answers the students give.

Main lesson

Refer to pages 14 to17 of the textbook.

The teacher should explain and define the following with examples:

- finite and infinite sets and how to write them
- null set or empty set and the symbol ϕ
- the super and sub set and their symbols $\supset$, $\subset$, $\subseteq$
- difference between proper and improper sub set
- equal sets
- the universal set and its notation

Practice session

Students should be asked to give examples of finite, infinite and null sets, sub sets, super sets etc. on the board.

Individual work

Exercises 1d and 1e on pages 15 and 17 of the textbook should be given.

Homework

Worksheets should be given for assessment. These can include the following:

- writing sets in table form
- writing sets in set-builder form
- naming the types of sets
- giving the number of elements of each of the following sets

Recapitulation

Worksheets will be given to assess the students learning and understanding of the topic. Difficult topics should be discussed.

WHOLE NUMBERS

Topic: Whole numbers
Time: 4 periods

Objectives

To enable students to:

- differentiate between natural numbers and whole numbers
- represent whole numbers on a number line
- add, subtract, multiply, and divide whole numbers
- verify the commutative and distributive laws in addition and multiplication of whole numbers
- verify the distributive law of multiplication over addition and subtraction.

Starter activity

- Students will be asked write the number for the number of fingers or count the number of books in their bags and write the numeral to represent it.

The teacher will then ask:

- What is this way of counting objects called?
- What is the name given to this number system?
- How many people have three hands, two faces etc.
- How do you represent this in numerals?

Discuss the answers students give.

A few numerals in Roman script will be written on the board and the students will be asked to read them, e.g. I, II, IV, VI, X, IX, XI etc.

- What is this way of writing numerals called?
- Why did the Romans write this way?

Main lesson

Refer to the pages 21 to 30 of the textbook.

- Revision of the natural way of counting numbers, N, the set of natural numbers
- Develop the concept of zero
- Introduce the set of whole numbers W = {0, 1, 2...}
- Importance of the digit zero, place value
- Represent whole numbers on the number line
- Addition and subtraction of whole numbers on the number line
- Why zero is called the additive identity?
- Commutative and Associative properties of addition of whole numbers
- Multiplication and division of whole numbers
- '1' as the multiplicative identity
- Multiplication of a whole number by zero
- Commutative and Associative laws of multiplication
- Distributive law of multiplication over addition and subtraction
- Introducing simple number patterns.

Practice session

Activity sheets will be given to:

- draw number lines
- mark the numbers more than or less than a given number
- name the properties
- practise addition, subtraction, multiplication, and division sums
- challenges like the one on page 29 can be used as a practise activity

Individual work

Exercises 2a and 2b on pages 24 and 29 of the textbook should be given.

Homework

Ask the students to find the population of five big cities of Pakistan. They can then answer these questions using the information gathered:

- Which city has the largest population?
- Which city has the smallest population?
- What is the difference in the population of any two cities?

Assignments on the following topics could also be given,

- Multiplication and division with large numbers
- Form number patterns

Recapitulation

- Whole number system
- Natural numbers as a subset of whole numbers
- 0 as the additive identity
- 1 as the multiplicative identity
- Multiplication of numbers by 0

FACTORS AND MULTIPLES

Topic: Factors and multiples
Time: 6 periods

Objectives

To enable students to:

- identify the factors of a number
- identify the multiples of a number
- identify a square number
- recognize prime and composite numbers
- test for divisibility

Starter activity

Ask the following questions to begin the lesson:

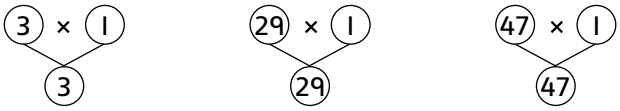
- What are prime numbers?
- What are composite numbers?
- Are all composite numbers even numbers?
- Which is the only even prime number?
- What are factors?
- What are the factors of 12?
- What are the common factors of 12 and 18?
- What are multiples?
- What are the common multiples of 4 and 6?
- Which are less than 60?
- How you will find out that a number is divisible by 2?

Main lesson

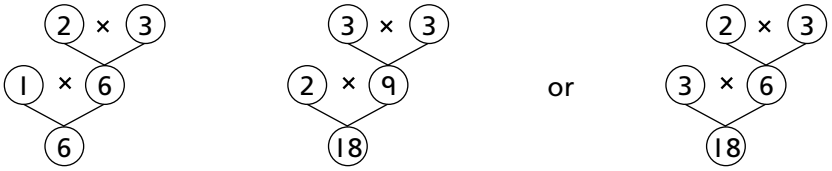
The difference between the prime and composite numbers will be explained to the students by giving examples.

Examples

2, 3, 5, 7, 11, 13, ... 97 are called prime numbers as they have only two factors, the number itself and 1.



Composite numbers have more than 2 factors.



- Square numbers will be explained to the students, with the help of examples.

  1^2, 2^2, 3^2, 4^2, 5^2, 6^2, 7^2, 8^2, 9^2, 10^2

  $1^2 = 1 \times 1 = 1$, $2^2 = 2 \times 2 = 4$, $3^2 = 3 \times 3 = 9$, $4^2 = 4 \times 4 = 16$, $5^2 = 5 \times 5 = 25$

It will be explained to the students that when a number is multiplied by itself, the result is a square number.

Test of divisibility will be explained by giving the following examples:

- All even numbers are divisible by 2.
- Divisibility by 3: The sum of all the digits in a number is divisible by 3. For example, 1362

  1 + 3 + 6 + 2 = 12. The sum is 12 which is a multiple of 3 hence it is divisible by 3.
- Divisibility by 4: The last two digits of a number are divisible by 4. For example, 3052

  52 ÷ 4 = 13, hence the number is divisible by 4.
- Divisibility by 5: If the last digit of a number is 5 or 0, for example, 260, 325, it is divisible by 5.
- Divisibility by 9: The sum of the digits of a number is divisible by 9.

  For example, 1524 = 1 + 5 + 2 + 4 = 12, it is not divisible by 9 because 12 is not a multiple of 9.

  Let's look at this example, 1692 = 1 + 6 + 9 + 2 = 18. 18 is a multiple of 9, hence it is divisible by 9.
- Divisibility by 10: If the number has 0 zero in its unit place. For example, 500, 250, 110 etc.
- Divisibility by 11: A number is divisible by 11 if the difference between the two sets of alternate digits is either 0 or a multiple of 11.

Example 1

1463
1 + 6 = 7, 4 + 3 = 7
Difference: 7 − 7 = 0

Example 2

90827
9 + 8 + 7 = 24, 0 + 2 = 2
Difference: 24 − 2 = 22
22 ÷ 11 = 2

Practice session

1. Which of the following numbers are the factors of 72?
   12, 5, 7, 3, 2, 10, 9, 11, 8
2. What are the square numbers between 1 and 40?
3. Which of the following numbers are divisible by 9?
   1791, 354, 801, 90 081, 3456, 1009
4. Write down the common multiples of 6 and 9 that are less than 100.

Individual work

Exercise 3a on page 37 will be done.

Homework

1. Write down all the square numbers between 1 and 100.
2. Write down the factors of the following numbers:
   37, 108, 221, 241, 101, 160

Topic: Factorization, Prime factors, Index notation
Time: 1 period

Objectives

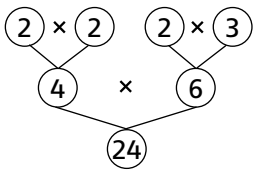
To enable students to:

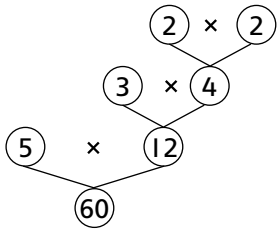
- break up a number into prime factors
- express a number in the index notation form.

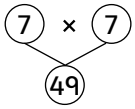
Starter activities

1. The students will be asked to find the missing factors in the following expressions:
   12 = 2 × 2 × _____.
   24 = 2 × 3 × 2 × _____.
   56 = 2 × 2 × 2 × _____.

2. They will make a factor tree with the following numbers 24, 60, 49.







$24 = 2 \times 2 \times 2 \times 3$ $60 = 5 \times 3 \times 2 \times 2$ $49 = 7 \times 7$ or 7^2

Main lesson

Prime factorization and Index notation will be explained to the students using the following examples:

Example 1

Find the prime factors of 72 and then write the answer in index notation.

2	72
2	36
2	18
3	9
3	3
	1

$72 = \underbrace{2 \times 2 \times 2}_{2^3} \times \underbrace{3 \times 3}_{3^2}$

$2^3 \times 3^2$

$2^2 = 2 \times 2$ This is read as 2 raised to the power of 2
$2^3 = 2 \times 2 \times 2$ This is read as 2 cubed (power of 3)
$3^2 = 3 \times 3$

The power is called 'index'. (plural, indices).

Example 2

Express 125 as prime factors in index notation.

5	125
5	25
5	5
	1

$125 = 5 \times 5 \times 5$
$125 = 5^3$

Practice session

Express the following numbers as a product of their prime factors in index notation:

48, 124, 30, 63, 96

Individual work

Exercise 3b on page 38 of the textbook will be done in class.

Homework

Express the following as prime factors in index notation:

625, 320, 400, 165, 90

Topic: HCF and LCM
Time: 3 periods

Objectives

To enable students to:

- calculate the HCF and LCM and write the answer in index notation
- solve the word problems.

Starter activity

1. What are the factors of 12 and 18?
2. What are the common factors of 12 and 18?
3. Which is the lowest common factor of 12 and 18?
4. Which is the highest common factor of 12 and 18?
5. What are the multiples of 6 and 8?
6. What are the common multiples of 6 and 8?
7. Which is the least common multiple of 6 and 8?

Main lesson

HCF and LCM will be explained to the students with the help of the following examples.

Example 1

Find the HCF of 25, 60, and 84, using index notation.

$24 = 2 \times 2 \times 2 \times 3 = 2^3 \times 3^1$

$60 = 5 \times 2 \times 2 \times 3 = 2^2 \times 5^1 \times 3^1$

$84 = 7 \times 2 \times 2 \times 3 = 2^2 \times 7^1 \times 3^1$

Product of the common factors with lowest index = 2^2

HCF = $2^2 \times 3^1$

$4 \times 3 = 12$

LCM = product of all the factors with their highest index.

$2^2 \times 2 \times 3 \times 5 \times 7$

$4 \times 2 \times 3 \times 5 \times 7 = 840$

The LCM of 24, 60, and 84 is 840 because 840 is divisible by all these 3 numbers.

$\frac{\overset{35}{\overset{\cancel{105}}{\cancel{840}}}}{\underset{\cancel{3}}{\cancel{24}}} = 35$ $\quad \frac{\overset{14}{\cancel{840}}}{\cancel{60}} = 14$ $\quad \frac{\overset{10}{\cancel{840}}}{\cancel{84}} = 10$

Example 2

16, 24, 32, 40

$16 = 2 \times 2 \times 2 \times 2 = 2^4$

$24 = 2 \times 2 \times 2 \times 3 = 2^3 \times 3^1$

$32 = 2 \times 2 \times 2 \times 2 \times 2 = 2^5$

$40 = 2 \times 2 \times 2 \times 5 = 2^3 \times 5$

$2^3 \times 2^2 \times 3 \times 5$

$8 \times 4 \times 3 \times 5 = 480$

Practice session

Find the HCF and LCM using both the methods for the following:

a) 10, 20, 30
b) 42, 56, 70
c) 36, 48, 72, 96

Individual work (1st period)

Questions 1a to1c of Exercise 3c on page 39 of the textbook will be done.

Homework

Questions 1f to1g of Exercise 3c on page 39 of the textbook will be done.

Individual work (2nd period)

Question 1 of Exercise 3d on page 40 of the textbook will be done.

Homework

Question 2 of Exercise 3d on page 40 of the textbook will be done.

Word problems based on HCF and LCM (3rd period)

Individual work

Questions 1 to 5 of Exercise 3e on pages 41 and 42 of the textbook will be done.

Homework

Questions 6–10 of Exercise 3e on page 42 of the textbook will be done.

INTEGERS

Topic: Integers
Time: 2 periods

Objectives

To enable students to:

- recognize the importance of negative numbers
- recognize + and − integers on a number line
- define the absolute or numerical value of an integer
- order integers.

Starter activity

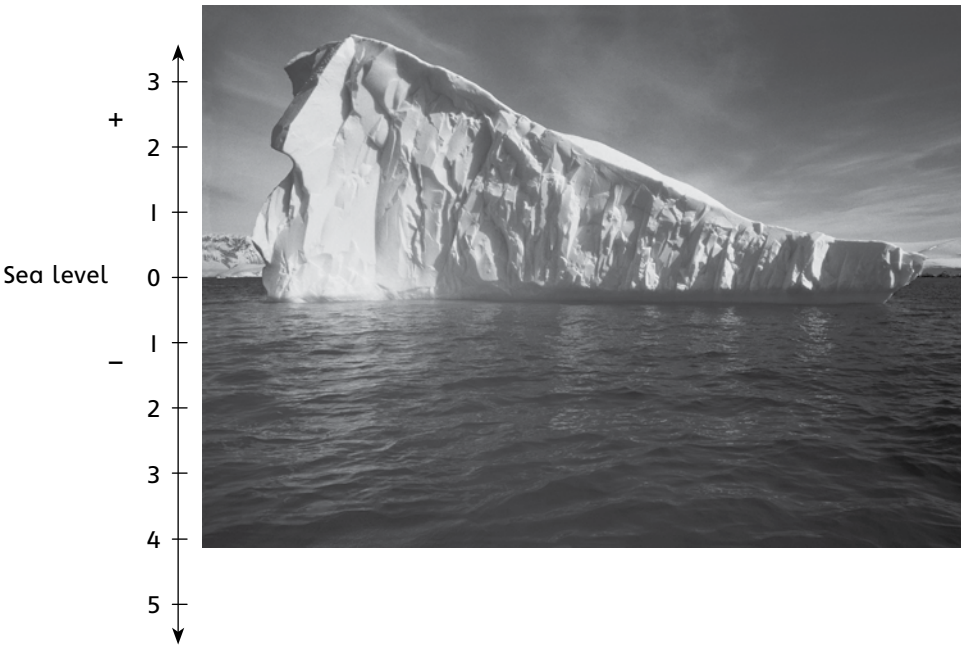
The students will be asked to answer the following questions:

- What are whole numbers?
- Which is the smallest whole number?
- Which is the largest whole number?
- What are natural numbers?
- Name the prime numbers that lie between 20 and 30.
- Rehan got a −5 marks in Science as he forgot to do his homework. How will you represent this number on a number line?
- Asim loses Rs 10. How would it be represented in mathematical terms?

Main lesson

Example 1

A picture of an iceberg will be drawn on the board showing only $\frac{3}{8}$ of the floating ice mass above the sea level. What fraction is hidden from view?



Sea level represented by zero.

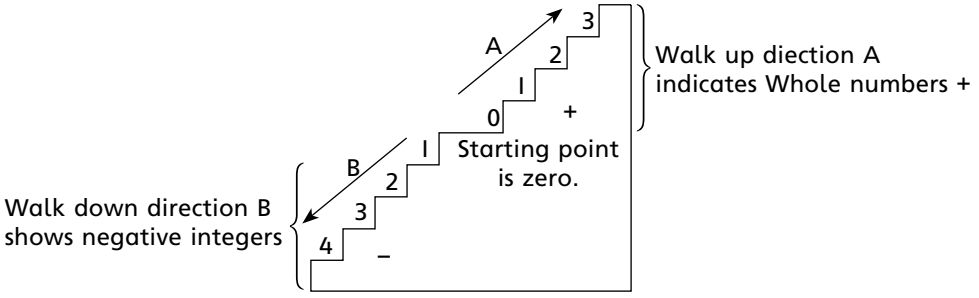
The part of the iceberg above sea level is represented by positive numbers.

The part of the iceberg below sea level (hidden) is represented by negative number.

Above sea level	+3
Below sea level	–5

Example 2

A staircase will be drawn on the board to give a clear concept of integers i.e. + and – numbers



From the given examples, the students will be able to understand that the set of whole numbers {0, 1, 2, 3, ...} cannot be used to indicate numbers in the opposite direction. We need a new set of numbers which corresponds to this. The minus sign is used for these new numbers which are written as:

−1, −2, −3, −4, ...

Explain to the students that: the set of positive integers, the set of negative integers, and zero form the set of integers.

Zero is neither positive nor negative.

Since all the negative integers lie to the left of the positive integers, every positive integer is greater than every negative integer.

Individual work

Questions 1 and 2 of Exercise 4a on page 45 of the textbook will be given.

Recapitulation

Any problems faced by the students will be discussed.

Topic: Ordering of integers
Time: 1 period

Ordering of integers will be explained to the students that integers increase to the right of zero and decrease to the left of it.

Practice session

Fill in the blanks by using the symbol > or <.

a) 15 _____ 13
b) 1 _____ 0
c) −1 _____ 1
d) −11 _____ −9
e) −5 _____ 2
f) 0 _____ −50

Individual work

Questions 1–4 of Exercise 4b on page 47 of the textbook will be done.

Recapitulation

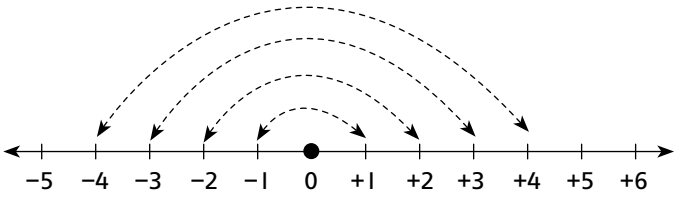
Any problems faced by the students will be discussed.

Homework

Questions 5, 6, 7 of Exercise 4b on page 47 of the textbook will be given as homework.

Absolute or numerical value of an integer

A number line will be drawn on the board to explain the absolute value of an integer corresponding to each positive integer with the help of the arrows.



A negative integer is equidistance from zero i.e. a positive integer will match with one negative integer, equidistant from zero.

The absolute value of -6 is 6 as it is 6 places away from zero. Two vertical bars on either side of the integer are drawn to show its absolute value.

Example 1

$|-6| = 6$

The absolute value of 6 is always 6 as it is 6 places away from zero.

Example 2

$|-8| + |-4| = 8 + 4 = 12$
$|3| + |-3| = 3 + 3 = 6$
$|3| - |-3| = 3 + 3 = 0$

Individual work

Question 1–4 of Exercise 4c on page 49 of the textbook will be done.

Recapitulation

Any problems faced by the students will be discussed.

Topic: Addition and subtraction of integers
Time: 2 periods

Objectives

To enable students to:

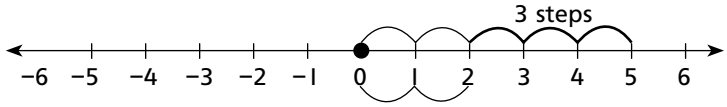
- add and subtract integers using a number line
- solve every day life problems.

Main lesson

Example 1

Add 5 + (−3)

A number line will be drawn on the board to show



Step 1

Start from 5 on the number line (5 steps) to the right of zero.

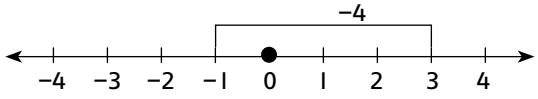
Step 2

Move 3 steps to the left, the arrow lands on 2.

5 + (−3) = 5 − 3 = 2

Example 2

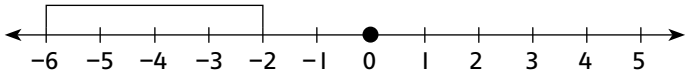
Add 3 + (−4)



3 + (−4) = − (4 − 3) = −1

Example 3

Add (−4) + (−2)



(−4) + (−2) = − (4 + 2) = −6

Practice session

On a number line, show the following.

a) (−5) + (2)
b) (−3) + (−4)
c) + 7 + (−2)

Rules for addition and subtraction will be explained with the help of the examples.

Rules for addition

1. For any two negative integers
   Add −3 and −7 (−3) + (−7)
   = − (3 + 7) = −10
2. For a positive integer and a negative integer
   Add −3 and +7 = (−3) + (7)
   7 is greater than 3 + (7 − 3) = +4
   Add −7 and 3, (−7) + (3)
   7 is greater − (7 − 3) = −4

Rules for subtraction

Example 1

6 − (−4) (change the sign of the integer to be subtracted)
6 + 4 = 10 (or add the additive inverse of −4)
Additive inverse of −4 is + 4.

Example 2

−5 − (−3)
−5 + 3 = − (5 − 3) = −2

Example 3

Subtract −15 from 9
9 − (−15) = 9 + 15
9 + 15 = 24

Practice session

Write the following on the board and call students one by one to solve them:

a) 4 − 5 b) −3 − 8 c) 6 − 4
d) −6 + 2 e) −8 + 9

Individual work

Questions 1-5 of Exercise 4d on page 53 of the textbook will be given.

Recapitulation

Any problems faced by the students will be discussed.

Homework

A worksheet based on addition and subtraction, and simple word problems will be given.

Topic: Multiplication and division of integers
Time: 1 period

Objectives

To enable students to:

- multiply and divide integers.

Starter activity

1. If the cost of one book is Rs 5, what will the cost of 15 such books be?
2. If the cost of 5 books is Rs 25, what will the cost of one such book, 8 books, and 20 books be?
3. 3 dozen articles cost Rs 180. Find the cost of 9 such articles.
4. There are 4 sets of books with 7 books in each set. Find the total number of books.

Main lesson

Multiplication and division of integers with positive and negative signs will be explained to the students with the help of the examples.

Example 1

(+3) × (+2)

++ ++ ++ = + + + + + +
Put in 3 sets of +2 +6

Example 2

(+3) × (−2)

− − − − − − = − − − − − −
Put in 3 sets of −2

Example 3

(−3) × (−2)

Take away 3 sets of −2 (dish is empty now) → We first put in 6 neutral pairs → Now remove 3 sets of −2 → +6

More examples

$3 \times 4 = 12$
$-3 \times -4 = 12$

For division it is the same.

$12 \div 4 = 3$ i.e. $+12 \div +4 = +\left(\frac{12}{4}\right)$

$-12 \div -4 = 3$ i.e. $+12 \div +4 = +\left(\frac{12}{4}\right)$

For two integers with one positive and one negative sign:

$+3 \times (-4) = -(3 \times 4)$ i.e. -12
$+12 \div (-3) = -\left(\frac{12}{3}\right) = -4$
$0 \times -3 = 0$
$0 \div -3$ or $+3 = 0$

Explain to the students that when more than two negative integers are multiplied, if the number of integers is even then the product will be positive, and if the number of integers is odd then the product will be negative.

Example1

$-3 \times -4 \times -2 \times -5$ (number of integers 4 i.e. even)
$+ (3 \times 4) \times + (2 \times 5)$
$+ (12 \times 10) = 120$

Example 2

$-3 \times -4 \times -5$ (number of integers 3 i.e. odd)
$+ (3 \times 4) \times (-5)$
$+ 12 \times -5 = -(12 \times 5)$
$= -60$

The properties of multiplication will be explained with the help of the following examples:

- $3 \times -6 = -18$
  $-6 \times 3 = -18$
  $-3 \times (5 \times 4) = (-3 \times 5)\ 4 = -60$
  } Order does not matter, the product will be the same.

- $-8 \times 0 = 0$
  $8 \times 0 = 0$
  $3 \times 8 \times 0$
  } Any integer multiplied by zero gives zero.

- $-8 \times 1 = -8$
  $8 \times 1 = 8$
  } Any integer multiplied by 1 is the integer itself.

Distributive property will be explained by giving the following example:

- $3 \times (4 + 5) = (3 \times 4) + (3 \times 5)$
  $3 \times (9) = 12 + 5$
  $27 = 27$
- $3 \times (7 - 5) = (3 \times 7) - (3 \times 5)$
  $3 \times (2) = 21 - 15$
  $6 = 6$

Practice session

A few questions to be written on the board and solved by the students in turns:

a) -8×3
b) $8 \div (-4)$
c) $-9 \div (-3)$
d) 12×-3
e) $-3 \times -2 \times 0$
f) $21 \div (-7)$
g) $-20 \div (-2) \div (-5)$
h) $-75 \div (-5) \times (-6)$

Individual work

Questions 1–4 of Exercise 4e on page 56 of the textbook will be done in the class.

Homework

Activity given on page 56 of the textbook will be given.

Recapitulation

Any problems faced by the students will be discussed.

SIMPLIFICATIONS

Topic: Simplifications
Time: 2 periods

Objectives

To enable students to:

- simplify mathematical expressions using BODMAS rule and recognize the order of operations in simplifying combined operations
- solve word problems applying the BODMAS rule.

Starter activity

Write a few sums on the board and ask the students to solve them.

$13 + 8$, $\frac{4}{7} + \frac{2}{7}$, $\frac{5}{8} - \frac{3}{4}$, etc.

$7 - 14 + 11$, $\frac{6}{11} \times \frac{2}{3}$ etc.

Write another sum with mixed operations and ask the students how it should be solved.

$\left(\frac{5}{6} - \frac{1}{2}\right) + \frac{4}{5} \div \frac{4}{5}$ of $1\frac{17}{25}$

Main lesson

To simplify sums involving combined operations, we apply the BODMAS rule.

Explain the BODMAS terms:

B→ stands for Brackets.
Introduce and explain types of brackets. (refer to textbook pg 57)
O→ stands for 'of' (of signifies multiplication)
D→ stands for division
M→ stands for multiplication
A→ stands for addition
S→ stands for subtraction

Solve the example on the board

$\left(\frac{5}{6} - \frac{1}{2}\right) + \frac{4}{5} \div \frac{5}{7}$ of $1\frac{17}{25}$

Step 1 (Open brackets)

Simplify within the bracket to remove it.

$\left(\frac{5-3}{6}\right) + \frac{4}{5} \div \frac{5}{7}$ of $\frac{42}{25}$

$\frac{2}{6} + \frac{4}{5} \div \frac{5}{7}$ of $\frac{42}{25}$

Step 2

Simplify 'of' by multiplying $\left(\frac{5}{7} \text{ of } \frac{42}{25}\right)$

$\frac{1}{3} + \frac{4}{5} \div \frac{\cancel{5}^{1}}{\cancel{7}_{1}} \times \frac{\cancel{42}^{6}}{\cancel{25}_{5}} = \frac{1}{3} + \frac{4}{5} \div \frac{6}{5}$

Step 3

Divide $\left(\frac{4}{5} \div \frac{6}{5}\right)$

$\frac{1}{3} + \frac{\cancel{4}^{2}}{\cancel{5}} \times \frac{\cancel{5}^{1}}{\cancel{6}_{3}}$ (Division is changed to multiplication and the fraction after the division sign is inverted)

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

Practice session

Solve a few more sums on the board with the help of students.

$\frac{5}{8} \times \frac{2}{3} + \frac{7}{12} \div \left(\frac{7}{8} + \frac{1}{6}\right)$ of $\frac{3}{5}$

$\frac{5}{8} \times \frac{2}{3} + \frac{7}{12} \div \left(\frac{21 + 4}{24}\right)$ of $\frac{3}{5}$ open brackets

$\frac{5}{8} \times \frac{2}{3} + \frac{7}{12} \div \frac{25}{24}$ of $\frac{3}{5}$ simplify of

$\frac{5}{8} \times \frac{2}{3} + \frac{7}{12} \div \frac{5}{8}$

$= \frac{5}{8} \times \frac{3}{3} + \frac{7}{12} \times \frac{8}{5}$ (divide + multiply)

$= \frac{5}{12} + \frac{14}{15}$ (add)

$= \frac{25 + 56}{60}$

$= \frac{81}{60} = 1\frac{21}{60}$

$= 1\frac{7}{20}$ Answer

Explain the rules for brackets (refer to page 58 of the textbook) with the help of examples on the board. Solve the examples with student participation.

Individual work

Select a few sums from exercise 5a, question 1. The students will solve word problems 2 and 3

Homework

Complete exercise 5a. More word problems may be given.

Recapitulation

Revise the BODMAS rule and the rule for opening brackets.

UNIT 6 RATIO AND PROPORTION

Topic: Ratio and Proportion
Time: 1 period

Objectives

To enable students to:

- understand and calculate ratio
- describe the relationship between ratio and fractions
- solve real-life problems involving ratios

Starter activities

Activity 1 (10 mins)

Two pencils measuring 15 cm and 5 cm, will be drawn on the board. The students will be asked the following questions.

red pencil
15 cm

green pencil
5 cm

- How much longer is the red pencil than the green pencil?
- How much shorter is the green pencil than the red pencil?

The red pencil is 10 cm longer than the green pencil.
The green pencil is 10 cm shorter than the red pencil.

15 : 5 or $\frac{15}{5} = \frac{3}{1}$

or we can say that the red pencil is 3 times longer than the green pencil.

We can also say that the ratio of the length of the red pencil to that of the green pencil is 15 : 5 = 3 : 1

Explain that ratio can be written in the form of the fraction e.g. $\frac{15}{5}$ also.

When a ratio is written as a fraction, we can write the fraction in its lowest term as:

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

It will be explained to the students that 15 and 5 are called the terms of the ratio. The first term that is 15 is called the **antecedent** and 5 is the **consequent**. Order matters in writing a ratio, 15 : 5 is not the same as 5 :15.

From the above example children will be able to understand that 'a ratio expresses a relationship between two quantities of the same kind.' It does not have a unit.

Activity 2 (Time: 10 mins)

Give the following worksheet to be solved in class.

Worksheet

Books in the school library

Type	History	English Fiction	Science	Biography	Sports	Hobbies
Number	460	800	380	340	593	160

Write a ratio as a fraction in its lowest term to compare the number in the table.

a) ratio of History books to Biography
b) ratio of Sports books to Hobbies
c) ratio of Science books to History
d) ratio of Fiction books to Science

Activity 3

Example 1 (10 mins)

Express the following ratios in their simplest form.

$5\frac{2}{3} : 2\frac{1}{6}$

$= \frac{17}{3} : \frac{13}{6}$

If the denominators of the given ratios are different, the LCM is calculated to make the denominators equal.

- LCM of 3 and 6 is 6.
- Multiply both the fractions by 6.

$\frac{17}{3} \times 6^{2} : \frac{13}{6} \times 6^{1}$

34 : 13

Example 2 (10 mins)

Sarah scores $\frac{15}{25}$ in English and $\frac{40}{50}$ in Maths. In which subject did she score better marks? Find the ratio between the two subjects.

English : Maths

$\frac{15}{20} : \frac{40}{50}$

The denominators are different.

LCM of 20 and 50 is 100

$\frac{15}{20} \times 100^{5} : \frac{40}{50} \times 100^{2}$

75 : 80

Sarah's marks in Maths are better than her marks in English

Example 3 (10 mins)

Ali walks 2 km a day while his sister walks 800 m a day. Find the ratio of their walks.

2 km = 2000 m (first convert km into m)

Ali : Sister

2000 : 800 or $\frac{2000^{5}}{800_{2}}$

5 : 2

Practise Session

Questions will be given for the students to solve.

1. There are 40 eggs out of which 6 are broken. Find the ratio of the unbroken eggs to the broken ones.
2. Express the following ratios in their simplest form:

   a) 24 : 42 b) 0.84 : 1.12 c) 144 : 128

   d) 35 mints : 1 hr e) 25 cm : 1.25 m f) $8\frac{3}{4} : 3\frac{1}{8}$

Individual work

The students will solve questions 1 to 5 of Exercise 6a from the textbook.

Homework

Questions 6 and 7 of Exercise 6a will be given as homework.

Topic: Dividing amount according to the given ratios
Time: 40 periods

Objective

To enable students to:

- divide the amount in a given ratio

Main Lesson

Example 1

Wajid has Rs 3000. He wants to divide it among his two brothers Shahid and Sajid in the ratio of 3:5. How much did each get?

Step 1: Sum of the Share = 3 + 5 = 8
(divide Rs 3000 into 8 shares)

Step 2: Shahid's share $\frac{3}{\cancel{8}}$ of $\overset{375}{\cancel{3000}}$ = 1125

Step 3: Sajid's share $\frac{5}{\cancel{8}}$ of $\overset{375}{\cancel{3000}}$ = 1875

Example 2

Divide 1 km in the ratio of 4 : 6

Step 1: Change 1 km to metre.
1 km = 1000 m

Step 2: Sum of the ratio = 4 + 6 = 10

Step 3: $\frac{4}{\cancel{10}}$ of $\cancel{1000}$ = 400 m

$\frac{6}{\cancel{10}}$ of $\cancel{1000}$ = 600 m

Practise Session

1. Divide each of the following quantities according to the given ratios:
   a) 900 in the ratio of 7 : 8
   b) 5 hrs in the ratio of 7 : 5
   c) 2 km in the ratio of 12 : 8

2. Divide Rs 3360 in the following ratios:
   a) 5 : 9 b) 3 : 13 c) 7 : 17

Individual work

The students will be asked to solve questions 1 to 4 from Exercise 6b.

Homework

1. Express the following ratios in their simplest form:
   a) 8 : 12 : 24 b) 56 : 70 : 112
   c) $4\frac{1}{3} : 5\frac{2}{5}$ d) $\frac{9}{20} : \frac{3}{5}$
2. Questions 5 and 6 of Exercise 6b as homework.

Topic: Ratio & Proportion
Time: 40 mins

Objective

To enable students to:

- understand proportion and its application in everyday life

Starter activity

Example 1

Sarah bought 3 books for Rs 36 and Amina bought one of the same book for Rs 12. Who paid more?

ratio of the prices for Sarah 36 : 3 = 12 : 1
ratio of the prices for Amina 12 : 1 = 12 : 1

As both the ratios are equal, the price per book is the same.

$\therefore$ ratio of the prices = ratio of the number of books

It will be explained to the students that when two ratios are equal they are said to be in proportion.

Use the symbol ': :' for proportion to show the two ratios are equal.

36 : 3 : : 12 : 1

36 × 1 = 3 × 12

36 and 1 (first and last terms) in a proportion are called Extremes.

3 and 12 (the 2nd and 3rd terms) are called Means.

It will be explained that product of extremes = product of means.

$36 \times 1 = 3 \times 12$ or $36 = 36$

Example 2

Are the ratios, 5 m to 80 cm and 40 seconds to 3 minutes in proportion?

1st ratio 5 m : 80 cm = 500 : 80 = 25 : 4
2nd ratio 40 seconds : 3 minutes = 40 : 180 = 2:9

$\frac{\cancel{500}^{25}}{\cancel{80}_{4}} = \frac{25}{4}$ (reduced to the lowest term)

$\frac{\cancel{40}^{2}}{\cancel{180}_{9}} = \frac{2}{9}$

25 : 4 : : 2 : 9

$25 \times 9 = 225$ (extremes)
$4 \times 2 = 8$ (means)

The products of extremes and means is not equal, therefore they are not in proportion.

We can write the proportion like this:

$\frac{25}{4} \times \frac{2}{9} = 225 \neq 8$ (not proportional)

This is also known as cross product rule. If the cross products are equal, the ratios are proportional.

Example 3

Are the ratios 15 : 24 = 5 : 8 in proportion?

Using the cross product rule:

15 : 24 = 5 : 8

$\frac{15}{24} \times \frac{5}{8}$ $\quad 15 \times 8 = 24 \times 5$

$120 = 120$

The products are equal. Hence the ratios are in proportion.

Example 4

At a parking lot, the ratio of the number of cars to that of motor cycles is 9:4.

Calculate the number of cars given when the number of motor cycles is 16.

Solution

Number of cars : Number of motor cycles = 9 : 4

This means that there are 9 cars and 4 motor cycles.

$\frac{9}{4} = \frac{\text{Cars}}{16}$

Suppose the number of cars to be x.

$\frac{9}{4} \times \frac{x}{16} = 4x = 16 \times 9$

$x = \frac{16}{4} \times 9 = 36$

Therefore the number of cars = 36

Practise session

Find the value in each of the following:

1. a) $3 : 9 = 4 : x$ b) $4 : x = x : 6$ c) $14 : 9 = 7 : x$
2. A sum of money is divided in the ratio 3 : 7. Calculate the smaller share if the larger share is: (a) Rs 108 and (b) Rs 369.

Individual work

From Exercise 6c, give questions 1 to 4 to the students to solve, and check their work individually.

Homework

Exercise 6c, questions 5 to 9 to be done as homework.

Topic: Direct Proportion
Time: 1 period

Objective

To enable students to:

- recognize direct proportion
- understand the difference between direct and inverse variation

Starter activity

In our day to day lives we hear people using phrases such as:

↑ more jobs	↑ more workers
↓ no pain	↓ no gain
↑ more strike	↓ less production
↑ more talk	↓ less action

If we analyze these phrases or statements we realize how one thing depends on the other. A change in one brings a change in the other.

Main Lesson

There are two types of variations: Direct and Inverse

Direct proportion

The teacher will explain with the help of examples that the more we buy the more we pay, or the more the apples, the more the weight.

If two quantities change, but keep the same ratio they are said to be directly proportional.

Example 1

If the cost of 8 pens is Rs 120, find the cost of 3 such pens.

	No. of pens	Cost in (Rs)	
start	8	120	start
	3	x	

The lesser the no. of pens — The lesser the amount or cost

$8 : 3 :: 120 : x$ (both the arrows showing the same direction)

or

$\frac{8}{3} \times \frac{120}{x}$ (cross product)

$8x = 3 \times 120$

$x = \frac{3 \times \overset{15}{\cancel{120}}}{\cancel{8}} = 45$

Rs 45 will be the cost of 3 pens.

Example 2

A cyclist takes 44 minutes to cycle a distance of 11 km. How long will it take him to cycle a distance of (a) 45 km (b) 36 km?

Solution

	Distance (km)	Time (minutes)	
start	11	44	start
	45	x	
	the more the distance	the more the time	

So according to direct proportion, increasing distance corresponds to increase in time.

Extremes

$45 : 11 :: x : 44$

means

$45 \times 44 = 11 \times x$

$$x = \frac{45 \times \cancel{44}^{4}}{\cancel{11}_{1}} = 180$$

or $\frac{45}{11} \times \frac{x}{44}$ $= 11x = 45 \times 44$

$$x = \frac{45 \times \cancel{44}^{4}}{\cancel{11}} = 180$$

It requires 180 minutes or 3 hrs to cover the distance of 45 km.

Practice session

1. Write the type of variation against the following statements:
   a) The number of pencils bought and their cost
   b) The distance covered and the time taken by a car moving with a constant speed
   c) The number of men at a task and the days required to complete it
   d) The speed of a car and the time taken to cover a distance
2. The cost of 5 m of cloth is Rs 800. How many metres of the same cloth can be purchased for Rs 2000?
3. An agent gets a commission of Rs 100 for selling goods worth Rs 1000. How much commission will he get by selling goods worth Rs 15000?

Individual work

From Exercise 6d, give questions 1 to 4 for the students to solve and help them. Find the solution.

Homework

From Exercise 6d, give questions 5 to 10 as homework.

Topic: Inverse Proportion
Time: 1 period

Objectives

To enable students to:

- identify inverse proportion and to enable students to apply it in everyday life

Starter activities (10 min)

Ask a few questions in the class to clarify the concept of inverse proportion.

- If the speed of a car is slow, does it take more or less time?
  The slower the speed the more time will be taken.
- If the speed of a car is fast, will it take more or less time?
  The faster the speed the lesser will be the time taken.
- If one man can complete a task in 3 hours, will five men take more or less time to complete the same task?
  A lesser number of men need more time. The more the men, the lesser will be the time taken.
- An increase in car pooling will decrease air pollution.

Main lesson (20 min)

Use the following examples to explain inverse proportion.

Example 1

If 8 men can complete a task in 20 days, how many men are required to do the same work in 10 days.

Method 1

product of extremes = product of means
$20 \times 8 = 10 \times x$

$$x = \frac{\overset{2}{\cancel{20}} \times 8}{\underset{1}{\cancel{10}}} = 16$$

$x = 16$ men
16 men are required.

Method 2

Cross product rule

$$\frac{20}{10} \times \frac{x}{8}$$

$10x = 20 \times 8$

$$x = \frac{\overset{2}{\cancel{20}} \times 8}{\cancel{10}} = 16$$

$x = 16$ men

Example 2

15 taps fill a water tank in half an hour. How much time will 18 taps take to fill the same tank?

Solution

No. of taps	Time taken (minutes)
↑ 15	30 ↓
↑ 18	x ↓
more taps	less time

The direction of arrows shows an increase in one quantity with a corresponding decrease in the other.

$$\frac{18}{15} \times \frac{30}{x}$$ (cross product rule)

$18x = 15 \times 30$

$$x = \frac{\overset{5}{\cancel{15}} \times \overset{5}{\cancel{30}}}{\underset{1}{\cancel{18}}} = 25$$

$x = 25$
$= 25$ minutes

Example 3

Speed and time

A man traveling by a car at an average speed of 70 km / h completes a journey in 54 minutes. On his return journey, he travels at an average speed of 45 km / h. How long does the return journey take?

Speed (km)	Time (minutes)
70 ↓	54 ↑
45	x
speed decreases	time increases

$$\frac{70}{45} \times \frac{x}{54}$$

$45x = 70 \times 54$

$$x = \frac{{}^{14}\cancel{70} \times {}^{6}\cancel{54}}{{}_{9}\cancel{45}} = 84$$

$x = 84$
= 84 minutes or 1 hour and 24 minutes

Practice session (10 min)

Some simple questions will be given in pairs to solve.

Individual work (20 min)

Questions 1 to 4 from Exercise 6e should be given as class work.

Homework

Questions 5 to 10 from Exercise 6e should be given as homework.

Recapitulation

Discuss the problems faced by the students.

UNIT 7 FINANCIAL ARITHMETIC

Topic: Financial Arithmetic
Time: 3 periods

Objectives

To enable students to:

- identify and define percentage
- express one quantity as a percentage of another quantity
- convert common decimal fractions into percentage
- convert a percentage into a fraction
- increase or decrease percentage of a quantity
- manipulate percentages and solve real-life problems involving percentages

Starter activities

A chart will be displayed with a square divided into a hundred equal parts, 25 shaded blue and 17 shaded red. The teacher can then ask the students questions like:

1. How many blocks out of a hundred are shaded blue?
2. How many of the blocks are shaded red?
3. How do we write these shaded parts as fractions?

   $\frac{25}{100}, \frac{17}{100}$ etc.

The students must have seen while shopping with their parents at malls or shopping centres, banners or announcements like the ones given below.

Sale upto 50% off, 40% discount on all items, Buy a pack of 3 and save 10% etc. Ask them what they understand by 50%, 40%, 10% etc.

Display some flash cards showing discount announcement and ask questions to the students regarding these discount offers.

Main Lesson

Refer to the textbook pages 74 to78 and explain the following:

- The meaning of percentage
- The symbol used to represent percentage %
- Percentage as a part of a whole
- Converting percentage into common and decimal fractions
- Converting common fractions and decimal fractions into percentage emphasis on the symbol % to represent percent
- Increase or decrease of a quantity by a given percent
- Solving real-life problems involving percentage

Practice session

Write questions like the ones given below on the board and ask the students to come in turns and solve them.

- Write as a common fraction: 45%, 30%, 29%, 75% etc.
- Write as a decimal fraction: 45%, 30%, 29%, 75% etc.
- Write as a percentage: $\frac{14}{100}$, $\frac{16}{25}$, $\frac{18}{50}$, −27, −05 etc.

Individual work

Exercises 7a, 7b, and 7c from the textbook will be given.

Homework

Complete the table:

Fraction	$\frac{14}{28}$			$\frac{40}{50}$	
Decimal		15			
Percentage			85%		36%

Topic: Profit and loss
Time: 3 periods

Objectives

To enable students to:

- define cost price, selling price, profit, loss and discount
- solve real-life problems involving profit, loss and discount
- calculate cost price and selling price when profit or loss percentage is given.

Starter activity (10 min)

Fun fare activity may be conducted in the class. A group of 5 students could be asked to buy a few articles from the market (pencils, erasers, story books etc.) and set up a shop in the classroom.

Other students could be asked to buy them.

Ali sold a book to Anis.

Teacher: Ali for how much did you buy this book?
Ali: Rs 25

Teacher: For How much did you sell this book to Anis.
Ali: Rs 30

Teacher: Tariq, what is the cost of your pen?
Tariq: 50 rupees

Teacher: Whom did you sell the pen to and for how much?
Tariq: I sold it to Suman for Rs 45.

What is this transaction called?

What do shopkeepers or businessman do?

- They buy things and sell them.
- Do they sell the things for the same amount for which they buy it at?
- Why do they do this?
- Do the shopkeepers always make a profit in sales?

Students' answers to these questions will be noted and discussed.

Main lesson (20 min)

Explain the term transaction.

Explain the terms, cost price and selling price by giving examples and write the abbreviated form for cost price (C.P), and for selling price (S.P). The cost price is the price which a person pays to buy an article.

The selling price is the price or amount that a person gets by selling an article to another person. Explain the terms profit or gain and loss. When the S.P is more than the C.P. we get a profit.

i.e. S.P − C.P. = profit

When the S.P is less than the C.P., we suffer a loss.

C.P − S.P = loss

Explain the percentage gain or loss. Gain or loss is always calculated as a percentage of the C.P

Give examples by referring to page 82 of the textbook.

Explain the term, overhead costs, discount, marked price, sale price (refer to textbook page 85).

Practice session

Exercise 7d question 1: complete the table

Individual work (30 min)

Exercises 7d and 7e. Give selected questions to be done in class.

Homework

Complete exercises 7d and 7e.

Recapitulation (10 min)

Revise the terms.

C.P., S.P., profit, loss, overhead costs, sale, discount, marked price etc., percentage profit and loss.

UNIT 8

INTRODUCTION TO ALGEBRA

Topic: Algebra
Time: 6 periods

Objectives

To enable students to:

- understand the language of algebra (use of letters of the alphabets to represent numbers)
- perform the four basic operations i.e. addition, subtraction, multiplication and division of algebraic expressions.
- substitute numbers for letters of the alphabet in expressions and formula and evaluate
- manipulate simple algebraic expressions

Starter activities

Some numerical expressions will be written on the board and students will be asked to solve them.

3 + 4, 7 + 1, 9 + 5, etc.

The teacher will then write some algebraic expression and the answers of the students will be checked.

x + 4, 7 − x, 2x + 5 etc.

Main Lesson

Using the textbook pages 88–98, the teacher will explain:

- Difference between numerical and algebraic expressions
- Mathematical and open sentences
- Variables and constants
- Coefficients, variables, and exponents (numerical and literal coefficients)

- Algebraic expressions (like and unlike terms)
- Addition & subtractions of like terms (rules of signs), horizontal and vertical method will be explained
- Evaluation of algebraic expression by substitution

Practice session

Worksheets will be given and students will solve them with the help of the teacher as well as other class fellows.

Worksheet

Write as algebraic sentences:

i) the integer one more than x
ii) the integer one less than x
iii) a plus 25 equals 12 times b
iv) one half of a number is equal to 17
v) the sum of $3x$ and $2y$ divided by z

Activity

Think of a number

Add three to it.

Double the result.

Take away four

Halve the result.

Take away the number you first thought of. What is the answer?

Individual work

Exercises 8a, 8b, 8c, 8d & 8e will be done.

Homework

Some sums other than the textbook will be given as homework.

Simplify:

i) $a + 17a + 5a$
ii) $31p - 14p + 7p$
iii) $9x - 4y + 3x + 7y$
iv) $4a + 5b + 2c - 3a - 2b - 2c$
v) $a \times 3a$
vi) $2ab \times ab \times -3ab$
vii) $2a^2b \div ab$

If $a = 5$ find the value of

i) $a^2 - a$

ii) if $x = -3$, $y = 4$ find the value of $-xy$

Recapitulation

Rules of addition and subtraction.

Rules of multiplication and division will be reviewed.

A short test will be conducted to check the understanding and application of the students.

UNIT 9

LINEAR EQUATIONS

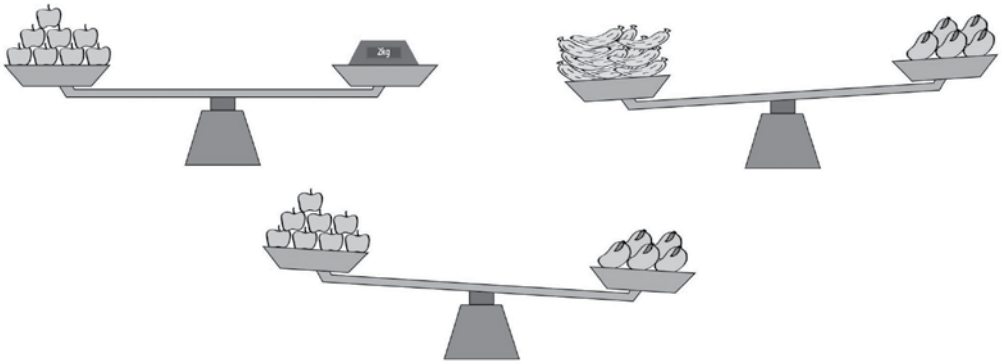
Topic: Linear Equations
Time: 4 periods

Objectives

To enable students to:

- define an algebraic equation
- differentiate between an expression and an equation
- solve simple linear equations
- form equations from real-life situations and solve

Starter activities (15 min)



Look at the figures and then answer these questions.

1. What is the weight of 8 apples?
2. Is the weight of 12 bananas equal to the weight of 5 mangoes?
3. Is the weight of 5 mangoes more than 8 apples?
4. Is the weight of 5 mangoes less than the weight of 12 bananas?
5. How do we write the same statements in an algebraic form using the symbols =, ≠, < or >.

Main lesson (60 min)

The answers to the preceding questions:

1. The weight of 8 apples is 2 kg.
2. The weight of 12 bananas is not equal to the weight of 5 mangoes etc. are grammatical statements but we can write these statements using the symbols as shown below.

   = to mean equal
   ≠ not equal to
   < less than (read left to right)
   > greater than (read left to right)

If we use the variables a, b & m for apples bananas and mangoes respectively we can write the above sentences as:

a) $8a = 2$ b) $12b \neq 5m$
c) $5m > 8a$ d) $5m < 12b$

The above four examples are called statements or sentences but only the first one uses the equal sign. This algebraic statement is called an equation.

The statement b, c, and d do not use the equal sign and are therefore called inequalities.

Using the textbook (pages 99 to108), define 'equation' and 'linear equation'.

An equation is an algebraic statement consisting of two expressions connected by an equal sign. Give more examples of equations.

Variables are called unknowns in an equation.

Difference between an expression and an equation

Solve simple linear equations

Give rules for solving equations adding, subtracting, multiplying and dividing both sides, with examples

Transform real-life problems into an equation form and solve

Practice session (20 min)

Solve examples with student participation.

Individual work (20 mins)

Exercise 9a, 9b, 9c, 9d and 9e from the textbook.

Homework

Give word problems based on real-life situations.

Recapitulation (15 min)

Revise the rules for solving equations. Supervise the students who have grasped the concept, help the slower students.

UNIT 10

GEOMETRY

Topic: Line segment, Bisection of a line segment, Construction of a perpendicular
Time: 2 periods

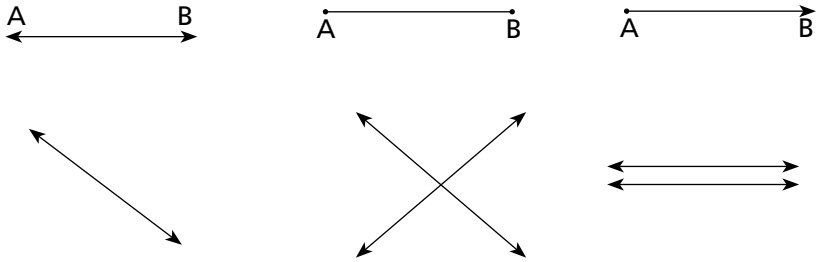
Objectives

To enable students to:

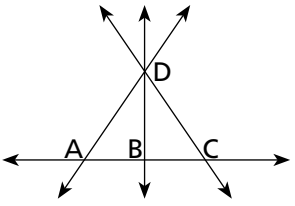
- add and subtract measures of two or more line segments.
- bisect a given line segment
- draw a perpendicular to a line segment

Starter activity: (18 min)

A few lines will be drawn on the board and the students will be asked to name them.



Use this figure and name 4 lines, 6 segments, 5 rays and 5 angles.



Main Lesson (10 min)

Explain to the students how to draw a line segment when a measurement is given.

Method 1

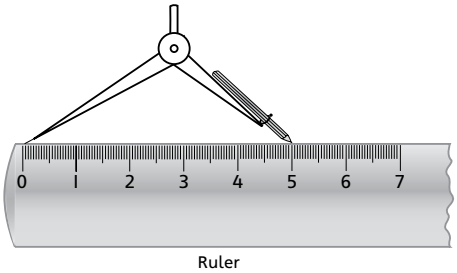
Draw a line segment AB of 5 cm with a ruler.

The teacher will mark a point A on the board. Place the ruler such that the zero mark coincides with A. Next, mark another point B coinciding with 5 cm on the ruler. Join the two points A and B by moving the pencil along with the straight edge of the ruler so that AB = 5 cm.

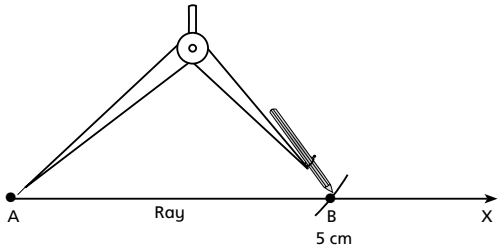
Method 2

Draw a line segment with the help of a ruler and a compass.

- A ray AX will be drawn on the board.
- Place the needle of the compass at the zero mark of the ruler and open the compass wide enough so that the tip of the pencil falls on 5 cm.
- Place the needle tip on A and draw an arc to cut AX at B, so that AB = 5 cm.



Ruler



Adding measures of two line segments

Given PQ = 4 cm and RS = 3 cm, draw XY such that XY = PQ + RS

Solution

PQ + RS = XY
4 + 3 = 7 cm
XY = 7 cm

After finding the length of XY the students will be asked to follow method 2 to draw XY.

Practice session

The students will be asked to solve the examples given on pages 110 and 111 of the textbook.

Individual work

Exercise 10a, questions 1 to 5 will be done.

Homework

A worksheet will be given to measure the given line segments.

Topic: Bisecting a line segment: drawing a perpendicular to a given line from a point on it.

Objectives

To enable students to:

- bisect a line segment
- draw a perpendicular

Starter activities (10 min)

The following questions will be asked to make the concept of bisection and perpendicular clearer.

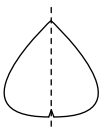
- What does mono mean?
- What is the meaning of bi, tri, tetra… etc?
- What do you understand by perpendicular?
- Name the objects in your classroom that are perpendicular to the (a) floor, (b) roof of your class.

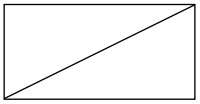
Time: 10 min

Main lesson

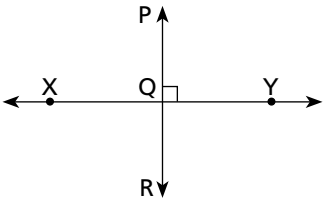
A few pictures will be drawn on the board to clarify the concept of bisection and perpendicular.

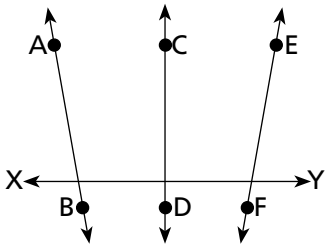
Bisection means dividing into two equal parts.



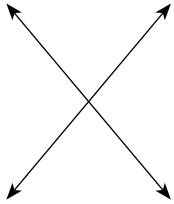


Line PR and XY intersect to form a right angle (90°)
Lines PR and XY are perpendicular.
The sign ⊥ denotes a perpendicular.





Which of the above lines are perpendicular?



Are these lines perpendicular to each other?

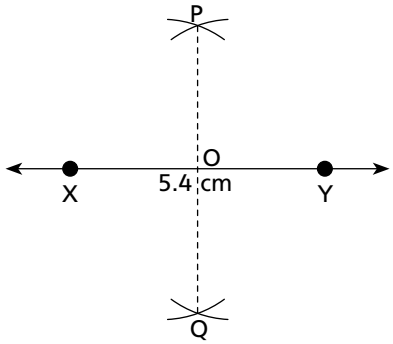
Bisecting a line segment

Construction: (10 min)

Draw a line segment XY of 5.4 cm and bisect.

Method

- A line segment $\overline{XY}$ of 5.4 cm will be drawn on the board
- Taking a radius of more than half of $\overline{XY}$, two arcs will be drawn from point X, one above $\overline{XY}$ and the other below $\overline{XY}$.
- With the same radius from point Y, two more arcs will be drawn cutting the previous arcs at P and Q respectively.
- Join P and Q with a dotted line cutting $\overline{XY}$ at O.
- $\overline{XY}$ is bisected at O
  $\overline{XO} = \overline{OY} = 2.7$ cm



The students will be asked to do the same in their exercise books.

Drawing a perpendicular to a given line from a point on it

Time: (10 min)

Construct a perpendicular on $\overleftrightarrow{XY}$ from the point Q.

Method I

Construction will be explained on the board.

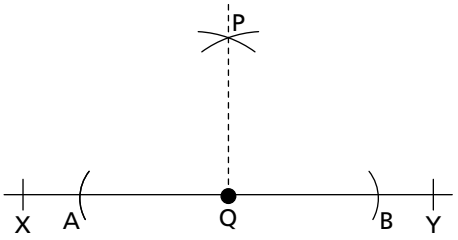
Step I: A line $\overleftrightarrow{XY}$ will be drawn on the board.

Step 2: A point Q will be marked on $\overleftrightarrow{XY}$.

Step 3: Taking Q as centre or placing the needle of the compass on Q, draw two arcs on either side of Q to cut XY at A and B.

Step 4: Place the needle of the compass first on A then on B, and draw two more arcs cutting each other at P.

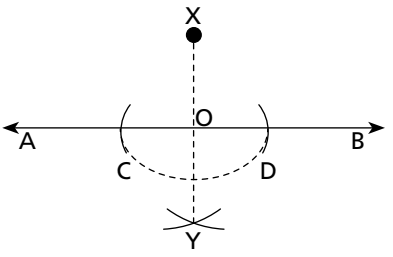
Step 5: Join Q and P with a dotted line PQ is perpendicular to $\overleftrightarrow{XY}$.



Method 2: (Time 10 min)

Drawing a perpendicular to a given line from a point outside it

Step 1: Draw a line $\overleftrightarrow{AB}$ of any length.
Step 2: Mark a point X outside $\overleftrightarrow{AB}$.
Step 3: Place the needle of the compass at X and draw two arcs cutting AB at C and D.
Step 4: With C as centre and the radius equal to CD, draw an arc above or below AB.
Step 5: With D as centre and the radius equal to CD, draw another arc cutting the previous arc at Y.
Step 6: Join XY with a dotted line cutting AB at O. XO is perpendicular to AB.



Individual Work

Exercise 10b will be given as class work.

Recapitulation

Any problems faced by the students will be discussed.

Homework

A few questions will be given for practice.

Topic: Construction of Angles
Time: 2 periods

Objectives

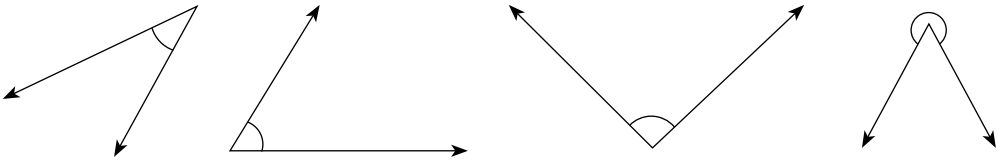
To enable students to:

- draw an angle with the help of a protractor

- to construct an angle with help of a compass and a ruler
- to distinguish between acute, obtuse, straight and reflex angles
- to divide an angle into two equal angles and into 4 equal angles.

Starter activities

1. Some angles will be drawn on the board and students will be asked to name them.



2. Draw the following angles with the help of a ruler and protractor:
   60°, 75°, 130°, 220°

Main Lesson

Construction of angles without using a protractor

- The students will be shown how to construct angles of 70°, 140°, 60°, 120° and 90° with a compass and ruler.
- Bisection of angles using a compass and ruler will also be explained to the students on the board.

Practice session

Construct the following angles without using a protractor and the bisect them.
70°, 90°, 128°

Individual work

Exercise 10c, questions 1 and 2 will be done in the class.

Homework

Exercise 10c, questions 3 and 4 will be given as homework.

Recapitulation

Any problems faced by the students will be discussed. They could be asked to make up questions for their partners.

Topic: Construction of Triangles
Time: 2 periods

Objectives

To enable students to construct triangles when:

- three sides are given (SSS)
- two sides and the included angles are given (SAS)
- two angles and side are given (ASA)
- the hypotenuse and one side is given of a right triangle.

Starter activities

A triangle will be drawn on the board and the students will be asked to answer the questions.

- How many sides does a triangle have?
- How many angles does a triangle have?
- What is the sum of all the angles of a triangle?
- What are the elements of a triangle?
- What is the hypotenuse?

Main lesson

Construction of a triangle, when sides, side angle side (SAS), and two angles and a side (ASA) are given, will be explained on the board.

They will be shown how to draw a plan or rough diagram before constructing a triangle.

Practice session

The students will be asked to construct an equilateral triangle and an isosceles triangle using their own measurements.

Individual work

Exercise 10d will be given to solve in class.

Recapitulation

Any problems faced by the students will be discussed.

UNIT 11 AREA AND PERIMETER

Topic: Area and Perimeter
Time: 2 periods

Objectives

To enable students to: calculate or determine the area and perimeter of various shapes

Starter activities

1. What is perimeter?
2. What is the perimeter of your maths book? Measure the sides and calculate it.
3. What is the approximate length of your classroom?
4. What is the perimeter of the mango leaf given to you?

Main lesson

The perimeter of a shape or figure is the distance around the figure.

For a rectangular shape or figure, we can use the formula, 2(l + b), where 'l' stands for length and 'b' stands for breadth because opposite sides are equal and congruent.

A square has all four sides equal, therefore the formula, side × 4 is used.

Distances and lengths are measured in mm, cm, m, and km.

Example 1

Find the perimeter of a room which is 6 m long and 4.8 m wide.

length = 6 m, breadth = 4.8 m
P = 2(l + b)
= 2(6 + 4.8)
= 2(10.8)
P = 21.6 m

Example 2

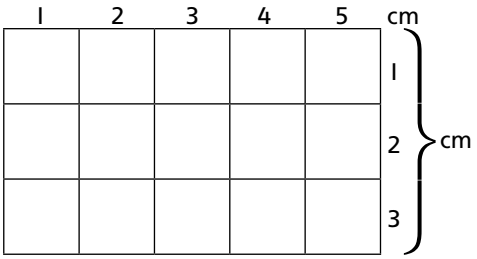
Find the pe°rimeter of a square boundary with each side = 6.5 m.

P = 4 × length
4 × 6.5 = 26.0
P = 26 m

Example 3

Find the area of a rectangle whose length is 5 cm and breadth is 3 cm.

Area will be explained to the students by drawing a rectangle on the board.



Area = l × b
5 cm × 3 cm = 5 × 3 × cm × cm
Area = 15 cm

Example 4

Find the area of a square board with each side measuring 15.4 cm.

Length = 15.4 cm
$A = l \times l = l^2$
$A = 15.4 \times 15.4 = 237.16 \text{ cm}^2$

Example 5

Square tiles with sides of 25 cm are used to tile a kitchen that measures 15 m by 10 m. How many such tiles are needed?

Area of the kitchen = 15 m × 10 m = 150 m
Since the length of the tile is in cm, we will convert 150 m^2 into cm.

100 cm = 1 m
$1 \text{ m}^2 = 100 \times 100 = 10000 \text{ cm}$

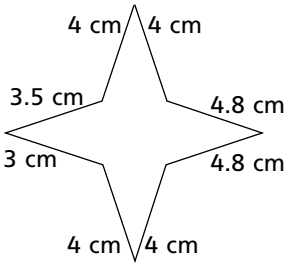
or

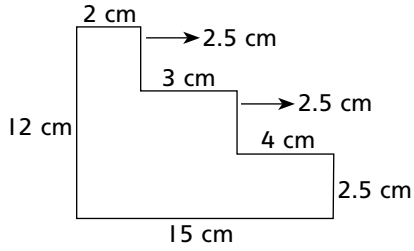
15 m = 15 × 100 = 1500 cm
10 m = 10 × 100 = 1000 cm
Area in cm = 1 500 000 cm^2

Length of the tile 25 cm
Area of tile = 25 × 25 = 625 cm
Tiles required = $\frac{1\ 500\ 000}{625}$ = 2400
Number of tiles required = 2400

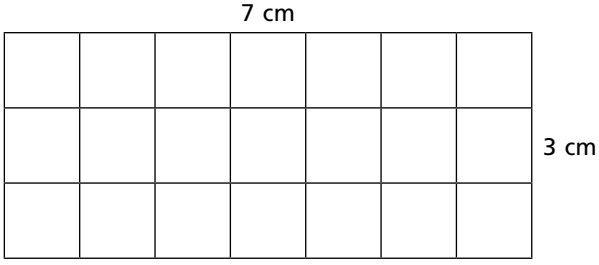
Practice session

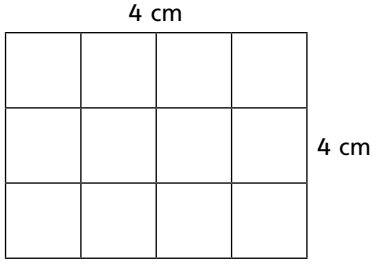
Find the perimeter of these shapes:





Find the area of these shapes:





Individual work

Exercise 11a, questions 1–5 will be done in the class.

Homework

Exercise 11a, questions 6 and 7 will be given as homework.

Topic: Area of composite shapes
Time: 1 period

Objectives

To enable students: to determine the area of a composite shape

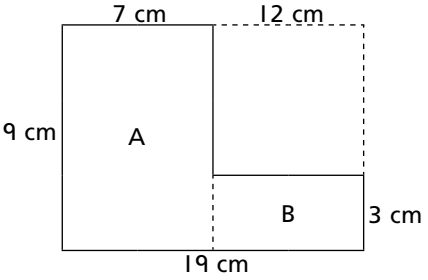
Starter activities

Find the area of the following shape:

Example 1

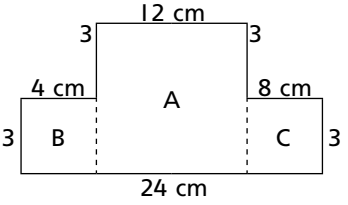
Divide this shape into two rectangles as shown using dotted lines.

Area of shape 'A' 9 cm × 7 cm = 63 cm²
Area of shape 'B' 12 cm × 3 cm = 36 cm²
Total area: 63 cm² × 36 cm = 99 cm²



Example 2

Find the area and perimeter of the given figure.



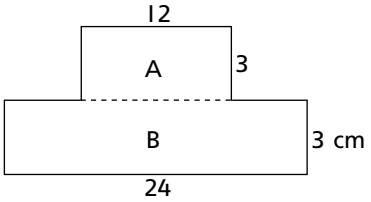
Step 1

Divide this figure into 3 rectangles.

Area = l × b
Area of 'A' = 12 cm × 6 cm = 72 cm²
Area of 'B' = 4 cm × 3 cm = 12 cm²
Area of 'C' = 8 cm × 3 cm = 24 cm²
Total area = 72 cm² + 12 cm² + 24 cm = 108 cm²

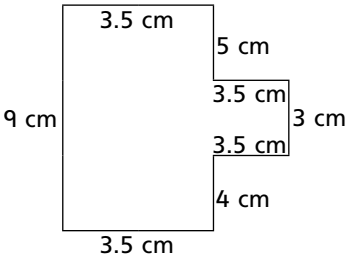
The same figure divided into 2 rectangles.

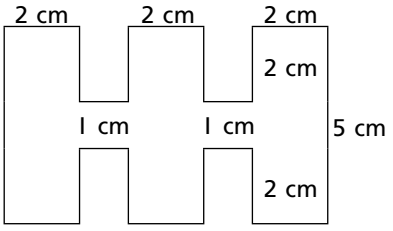
Area of 'A' = 12 × 3 = 36 cm²
Area of 'B' = 24 × 3 = 72 cm²
Total area = 36 + 72 = 108 cm²



Practice session

Find the area of these figures.





Individual work

Exercise 11b, questions 1, 2 and 3 will be done in class.

Homework

Exercise 11b, questions 4 and 5 will be done as homework.

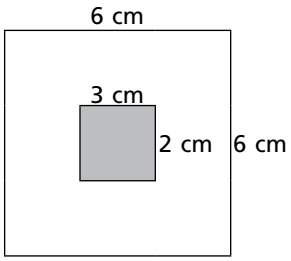
Topic: Area of a path of a rectangle or square
Time: 1 period

Objectives

To enable students to: determine the area of shaded and un-shaded parts

Starter activities

Draw a 6 × 6 cm square. In the centre of this square draw a rectangle 3 cm by 2 cm and colour it. Find the area of the part not coloured.



Area of the square l × l
A = 6 × 6 = 36 cm^2
Area of the coloured rectangle: 3 cm × 2 cm = 6 cm^2
Area of un-coloured part: 36 cm^2 − 6 cm^2 = 30 cm^2

Main lesson

Calculating the area of a path inside the rectangle

PQRS is a rectangle where PQ = 75 m and PS = 48 m

A path is constructed inside the rectangle. The width of the part is 3 m wide all round. Find the area of the path.

Solution

- When the path is inside, subtract twice the width of the path.
- If the path is outside the rectangle or square, add twice the width of the path.

Width of the path 3 m
Twice 3 m = 6 m
Length of PQ = 75 m
= 75 − 6 = 69 m
Breadth 48 m
= 48 − 6 = 42 m
Area of the path: 75 × 48 − (69 × 42) m^2
= 3600 − 2898 = 702 m^2
Area of the path is therefore, 702 m^2

Practice session

Figures will be drawn on the board to calculate the areas of shaded and unshaded regions.

Individual work

Exercise 11c, questions 1 to 4 will be done in class.

Homework

Exercise 11c, questions 5 and 6 will be given as homework.

Topic: Area of polygons (triangle, trapezium, and parallelogram)
Time: 2 periods

Objectives

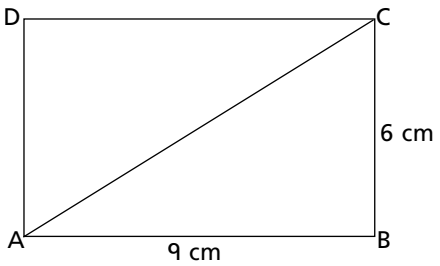
To enable students to:

- determine the area of different types of polygons
- deduce formulae

Starter activities

Example 1

To find the area of a triangle, draw a rectangle on the board and explain how the formula for the area of the triangle has been deduced.



The diagonal AC divides the rectangle into two equal triangles.

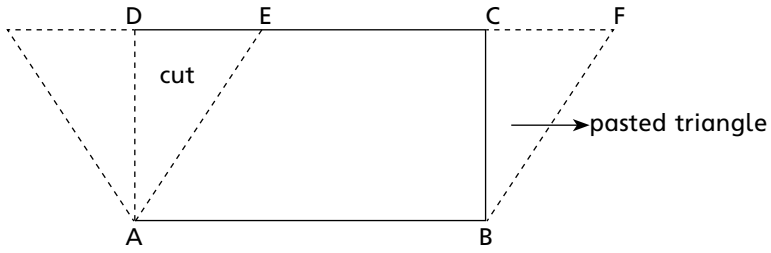
Area of the rectangle ABCD = $l \times b$
A single triangle is half of the rectangle
$l \times \frac{b}{2}$ or l = base of triangle
Width is the height of the triangle
$\frac{l}{2} \times b \times h$

Area of triangle ABC = ADC = $\frac{l}{2} \times 9 \times 6 = 27$ cm^2
Area of rectangle = $l \times b = 9 \times 6 = 54$ cm^2
27 cm is half of 54 cm^2

Example 2

Area of parallelograms

A rectangle will be drawn on the board.

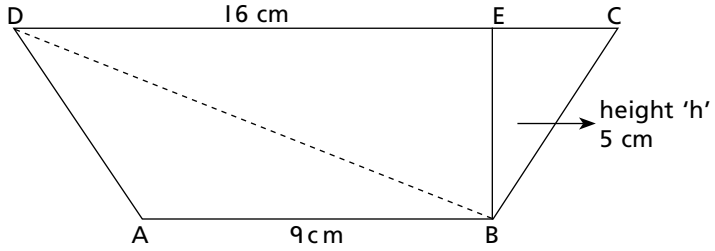


Cut the triangle ADE and paste it on the other side with BC to form triangle BCF. ABFE is a new quadrilateral called parallelogram.
Area of parallelogram = Area of rectangle = l × b

Area of parallelogram = sum of the area of two triangles
Area of parallelogram = base × height = b × h (cm^2)

Example 3

Area of a trapezium will be explained in the same way by drawing the figure on the board.



DBA and DBC are two triangles
BE = height

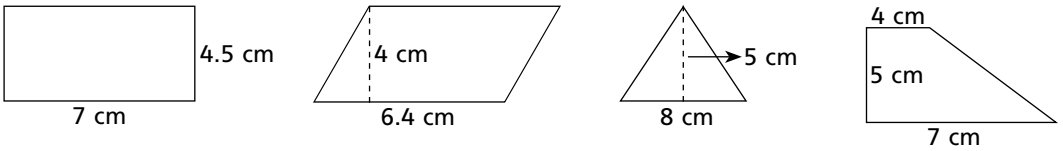
Area of trapezium = (sum of the parallel sides) × $\frac{h}{2}$

$\frac{(16 + 9)}{2 \times 6}$

$\frac{25}{2} \times 6 = 75\ cm^2$

Practice session (Day–1)

Calculate the area of these quadrilaterals.



Individual work

Exercise 11d, questions 1 to 5 will be done in class.

Homework

A few questions will be given to be done as homework.

Individual work (Day–2)

Exercise 11e, questions 1 to 3 will be done in class.

Homework

Exercise 11e, questions 4 and 5 will be given as homework.

UNIT 12

THREE-DIMENSIONAL SOLIDS

Time: I period

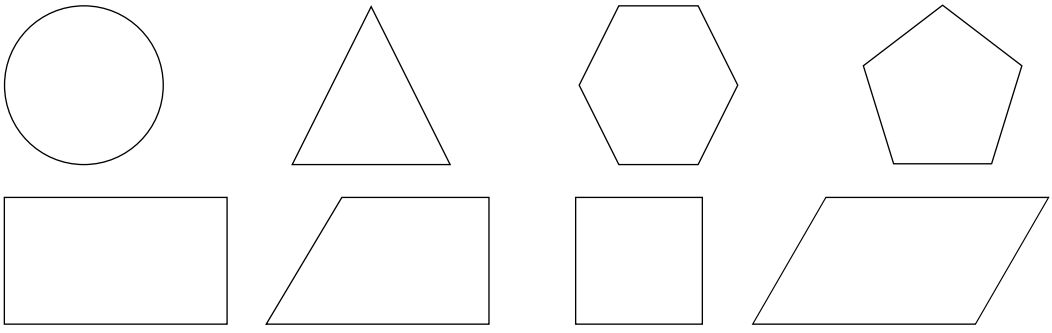
Objectives

To enable students to:

- recognize three dimensional objects
- determine the volume of a solid cube and cuboid

Starter activities

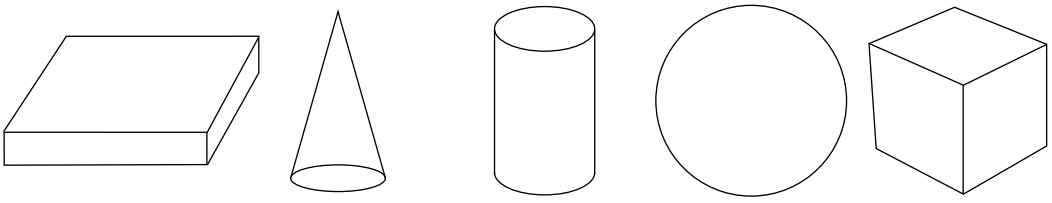
Some 2D shape figures will be drawn on the board and students will be asked to write the names of each figure.



Next, explain to the students that these figure have a length and breadth. They can be drawn on a paper or the board. They have no thickness and are called 2D (two dimensional) figures.

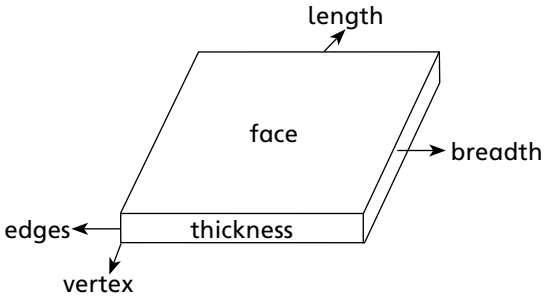
Main lesson

The objects shown on the next page will be placed on the table and the students will be asked to name the objects.



A cuboid will be drawn on the board to show its length, breadth and thickness.

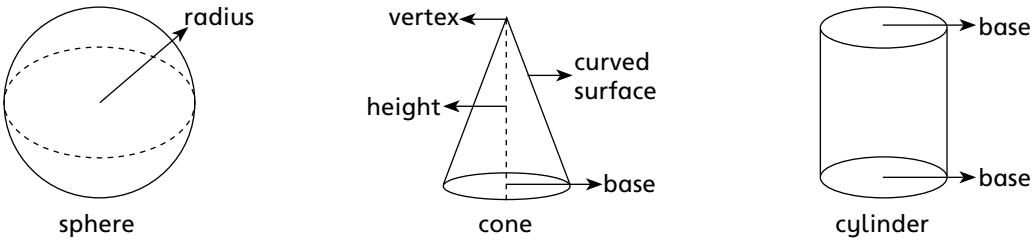
Objects with length, breadth and a thickness are called 3D (three dimensional) objects.



Edge, vertex, height (thickness), face, length and breadth will be shown with the help of real objects. The students will be asked to count the number of edges, vertices and faces. In the cuboid shown, there are:

12 edges, 8 vertices and 6 faces.

Shapes of a cone, a cylinder and a sphere will be drawn on the board and their parts will be discussed.



Practice session

The students will be asked to draw a few three dimensional figures that they come across in real-life.

Individual work

The students will be asked to bring these things and fill in the given table.

Objects	Edges	Vertices	Faces	Shape of faces	Name of shape
a shoebox					
a tea box					
a football					
an ice cream cone					
a juice can					
a dice					

Recapitulation

Any problems faced by the students will be discussed.

Homework (Project)

The students will be asked to make 3D objects with the help of 2D paper shapes.

Topic: Volume and surface area of 3D shape
Time: I period

Objectives

To enable students to: determine the volume and surface area of cube and cuboid

Starter activities

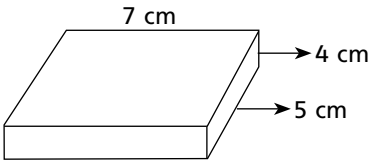
Volume will be defined to the students by filling some shapes like a juice can (a cylinder) or a lunch box (a cuboid) with water. The amount of water which either shape will hold can be poured into a measuring cylinder to find the volume.

The formula for calculating the volume will be explained.

- Volume (V) = length × breadth × height
- Volume of cube is (l = b = h) cm^3

Main lesson

Find the volume of the following shapes using the formulae.



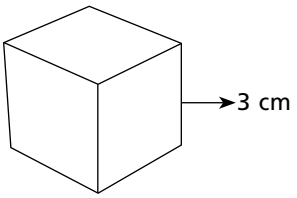


Figure 1 is a cuboid.

$V = l \times b \times h$

$V = 7 \text{ cm} \times 5 \text{ cm} \times 4 \text{ cm} = 140 \text{ cm}^3$

Figure 2 is a cube.

(three edges) $= 3 \times 3 \times 3 = 27 \text{ cm}^3$

Practice session

Find the volume of a cubical box whose side or edge is 4.5 cm.

V of cube $= (\text{edge})^3$

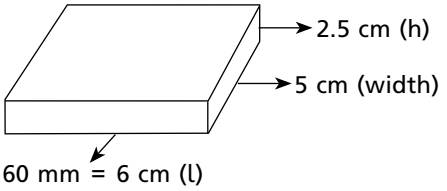
$= (4.5)^3$

Find the volume of a box whose dimensions are 60 mm, 5 cm and 2.5 cm.

Draw the box to show its dimensions.

Convert 60 mm to cm

$\frac{60}{10} = 6$ cm



$V = l \times b \times h$

$(6 \times 5 \times 2.5) \text{ cm}^3$

75.0 cm^3

Individual work

Exercise 12a, questions 1 and 2 and Exercise 12b, questions 12 and 13 will be done in class.

Homework

Students will be asked to calculate the volume of their pencil box and a match box.

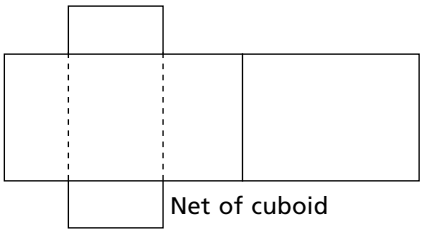
Recapitulation

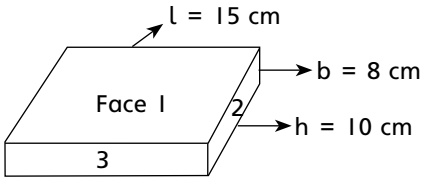
Any problems faced by the students will be discussed to clarify the concepts taught.

Topic: Total surface area of cubes and cuboids
Time: 1 period

Objectives
To enable students to: determine the total surface area of cubes and cuboids

Starter activities
A cardboard cuboid and cube will be made and cut along the edges as drawn below.





A cuboid has 6 faces. Opposite faces are equal and congruent.

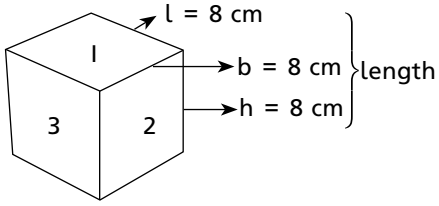
Face-1: A = l × b = 15 cm × 8 cm = 120 cm^2
Face-2: A = b × h = 8 cm × 10 cm = 80 cm^2
Face-3: A = l × h = 15 cm ÷ 10 cm = 150 cm^2
Total surface area = 2(120 + 80 + 150) cm = 2(350) cm^2
Total surface area = 700 cm^2

The formula for total surface area of a cuboid is 2 (l × b + b × h + l × h)

A cube will be drawn on the board so that it indicates that all the faces of a cube are equal and congruent.

For a cube: length = breadth = height

Total surface area = 2(3 × length × length)
$6(length)^2 = 6(8)^2$
$= 6(64) = 384\ cm^2$



Practice session
1. Find the area of a box 8 cm long, 3.5 cm wide and height 6 cm.
2. Find the area of a cube with a length of 12 cm.
3. The length, breadth and height of a cupboard is 6 m, 4.5 m and 3.8 m respectively.
   a) Find its surface area.
   b) Find the cost of painting it at the rate of 15 m^2.

Surface area = 2 (6 × 4.5 + 4.5 × 3.8 + 6 × 3.8)
= (27.0 + 17.10 + 16.8)
= 60.90 m^2
Cost of painting l m^2 is Rs 15
Cost of painting 60.90 m^2:
60.90 × 15 = Rs 913.50

Individual work

Students will be asked to do exercise 12b, questions 1 to 5.

Recapitulation

Any problems faced by the students will be discussed.

Homework

Questions 6 and 7 of Exercise 12b, and a worksheet based on surface area of cubes and cuboids will be given.

Note: As the exercise is lengthy one more period will be required to complete it.

UNIT 13

INFORMATION HANDLING

Topic: Information handling
Time: 3–4 periods

Objectives

to enable students to:
- collect data
- classify and tabulate data
- read and interpret tables and graphs
- construct bar graphs, and pie charts

Starter activities

Students will be divided into 4 to 5 groups with 6 to 8 students in each group and will be given the task of collecting information on the following. (Let the group leader record the information in a tabular form).

i) Means of transport used for school, a) school van b) public transport c) private car or

ii) Favourite sport: cricket, football, hockey etc.

The information collected will be written on the board by the teacher and questions like the ones given below will be asked.

1. Which is the most common means of transport?
2. Which is the most popular sport?

Main Lesson

Refer to pages 151 to 160 of the textbook.

- Define data and ways of collecting data
- Importance of grouping the data
- Formation of frequency distribution table

- Construction of simple bar graph, multiple bar graphs, pie charts
- How to interpret the data and draw conclusions

Practice Session

A frequency table will be drawn on the board and the students will be asked a few questions:

- What is the class interval?
- How many classes is the data divided into?
- What is the upper limit of the 4th group?
- What is the lower limit of the 2nd group?
- What is the frequency of the 3rd group?
- What is the total frequncey?

Group work: given a set of data, make a frequency distribution table with 5 as the size of class interval.

Individual work

Exercises 13a and13b will be given from the textbook.

Homework

The students will be asked to collect information from friends, and neighbours on various topics like: the best TV channel, the most popular newspaper etc., and will draw a bar chart.

Get information on rainfall during a year, in a city or a country and draw a pie chart.

Recapitulation

Definitions of terms used in information handling will be revised.

Problems faced during the formation and collection of data will be discussed.

ANSWERS

Getting Ready for Class 6...

1. a) 10 040 603 b) 671 093 075
2. In alphabetical order: Bangladesh, Brazil, China, Indonesia, Japan, Nigeria, Pakistan, Russia, USA
3. 5
4. 1 : 15
5. 100 soldiers
6. 199 111 102
7. 1 hour 45 minutes
8. 500 seconds which is around 8 minutes
9. 960 cards
10. 33 614
12. a) Rs 51.07 b) Rs 143.58 c) Re 1.05
    d) Rs 40.01 e) 0.56 m f) 1.45 km
    g) 5.656 kg h) 0.25 l i) 1.5 g
13. 17.7 kg
14. a) 18 emails b) 4 levels
15. 8 squares
16. 7350 m
17. a) 8 slices b) 3 eggs
18. No, 6000 cm
19. a) 49.5 feet b) $148\frac{5}{8}$ feet^2
20. 25 pins
21. 950 ml
22. a) 26 days b) 230 days
23. a) 168 hours b) 145 hours
24. Duluth, Minnesota
25. 37 times
26. a) 31 min 5 sec b) 74 min 30 sec c) 4 min 13 sec
27. a) 2 hr 49 min b) 8 min 28 sec c) 1 hr 59 min 23 sec
28. $\frac{2}{5}$

29. a) 49° b) 300° c) 215° d) 135°

30. a) 1 hr 53 min 6 sec b) 1 hr 58 min 51 sec

31. Packs of ten for Rs 110

32. a) 70% b) 9 flies

33. 678, 402

34. 25%

35. a) 7 b) 9 c) 13

36. a) 96 b) 3420 c) 390 d) 360

37. Rs 2000

38. 15

39. 160 cm

40. a) 0 b) 11.556 c) 0.5 d) 1.11
e) 0 f) $\frac{2}{5}$

41. a) 36% b) 108% c) 50%

42. a) $\frac{33}{50}$ b) $\frac{2}{3}$

44. a) C b) S c) C d) C
e) N f) N g) C h) S
i) N j) N

48. Bilal: 1400, Kashif: 0, Shad: 300, Owais: 420

49. 60%

50. No, because all the four angles of a quadrilateral should add up to 360°.

51. 70°

52. a) 79.4 b) 12.5 c) 209.1 d) 7.2
e) 989.9

53. a) 15.007 b) 6.145 c) 40 d) 48
e) 316 500

54. a) acute b) obtuse c) right d) reflex

55. a) 60° b) 144° c) 180° d) reflex

56. a)

		185	
	85		100
57		28	72

b)

		115	
	65		50
50		15	35

57. a) 295, 278 b) 186, 176 c) 103, 121, 176 d) 295, 278

58. a) 7, 8 b) 24, 25

59. 1.42 m

Unit 1: Sets

Exercise 1a

1. a) No
   b) W = {Monday, Tuesday, Wednesday, Thursday}
   c) A = {J, K, L, Y}
   d) S = {C, O, M, I, T, E}
   e) N = {I}
   f) C = {Pakistan, India, Sri Lanka, Bangladesh}

Exercise 1b

1. a) R = {snake, lizard, alligator, crocodile}
   b) N = {1, 2, 3, 4}
   c) W = {4, 8, 12}
   d) X = {H, I, P, O, T, A, M, U, S}
2. a) P = {deforestation, air pollution, dumping chemical wastes}
      P= {three reasons for global warming}
      P = {x: x is a cause of global warming; x = 3}
   b) D = {Mickey Mouse, Pluto, Donald Duck}
      D = {three Walt Disney cartoon characters}
      D = {y: y is a Disney cartoon character; y = 3}

Exercise 1c

1. a) $\in$ b) $\notin$ c) $\notin$ d) $\in$
2. a) T b) T c) T d) F

Exercise 1d

1. a) T b) T c) F d) T

Exercise 1e

1. a) No b) No c) Yes d) Yes
   e) No
2. a) M = {February}
   b) C = {Karachi, Lahore, Faisalabad}
   c) P = {red, blue, yellow}
   d) W = {M, O, N, S}
3. a) N = {16, 17, 18, 19, 20}
   b) V = {e, i, a}
   c) P = {Mercury, Mars}
   d) M = {February, April, June, September, November}

4. a) B = {number that is neither prime nor composite}
   B = {smallest natural number}
   B = {number that is a factor of every number}

   b) C = {first four prime numbers}
   C = {prime factors of 6 and 35}
   C = {prime factors of 14 and 15}

   c) D = {women Prime Ministers of India and Pakistan}
   D = {2 women Prime Ministers of SAARC countries}
   D = {2 Asian women Prime Ministers whose parent were also Prime Ministers}

   d. E = {Cricket World Cup winning captains of Pakistan}
   E = {former Pakistani cricketer who has built a cancer hospital}
   E = {founder member of the Tehreek-e-Insaaf political party in Pakistan}

5. a) T b) T c) T d) T
   e) F, $4 \in B$

6. a) $\notin$ b) $\in$ c) $\in$

7. a) C is infinite; D is finite b) E is finite; F is infinite
   c) G is infinite; H is finite d) J is finite; K is infinite

8. sets C and E are null sets

9. a) equal and equivalent b) equivalent c) equivalent

10. a) $\notin$ b) $\subseteq$ c) $\in$ d) $\supset$

11. a) 5 b) 3 c) 1 d) 2
    e) 4

12. A = {2}; B = {2}; therefore A = B as they have identical elements.

13. a) 0 b) 3 c) 2 d) 4

14. a) 6 b) X = Y c) $A \leftrightarrow B$ d) $\subset$

15. a) singleton b) equivalent c) superset

Unit 2: Whole Numbers

Exercise 2a

1. 1, 2, 3, 4, 5, 6, 7, 8, 9
2. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
3. a) 1 b) 0
4. JI: please mark the numbers on the number line and place here. Shakeel to do.
5. a) A = 3, B = 7 b) C = 22, D = 26, E = 29

Exercise 2b

1. a) 7 b) 34 c) 8 d) 0
   e) 1 f) 10, 45 g) 9 h) 46
   i) 10
2. a) F b) F c) T d. T
3. 82 years
4.

13	**6**	11
8	10	12
9	**14**	**7**

5. a) 368 b) 975 c) 1776 d) 6732
   e) 5016 f) 10 638
6. a) 23 500 b) 34 700 c) 96 800 d) 105 600
   e) 567 000 f) 109 800

Unit 3: Factors and Multiples

Exercise 3a

1. a) i) 1 ii) 10 iii) 2 iv) 8
   b) i) 3 ii) 5 iii) 10 iv) 2
   c) i) 3 ii) 1 iii) 2 iv) 8
   d) i) 5 ii) 0 iii) 5 iv) 0
2. a) 2 + 13 b) 11 + 13 c) 13 + 23 d) 17 + 23
   e) 19 + 37

Exercise 3b

1. a) 22×32 b) 26 c) 34 d) $2^2 \times 5^2$
   e) $2^6 \times 3^2$ f) $2^3 \times 3 \times 5^2$ g) $2^2 \times 3^4$ h) $3^2 \times 5^2$
   i) $3^2 \times 7^2$ j) $2^3 \times 5^3$

Exercise 3c

1. a) $2 \times 3 = 6$ b) $2 \times 3 \times 5 = 30$ c) $3^2 = 9$ d) $5 \times 7 = 35$
   e) $2 \times 5^2 = 50$ f) 3 g) $3 \times 5^2 = 75$ h) 11

Exercise 3d

1. a) 450 b) 420 c) 90 d) 154
   e) 1260
2. a) $2^2 \times 3^2 \times 5^2 = 900$ b) $2^2 \times 3^2 \times 5 = 180$ c) $2^3 \times 3 = 96$
   d) $2 \times 3 \times 4 \times 11 = 264$ e) $2^2 \times 3 \times 7 = 84$

Exercise 3e

1. a) HCF = 3, LCM = 60 b) HCF = 15, LCM = 150
   c) HCF = 7, LCM = 280 d) HCF = 13, LCM = 195
2. a) 4 b) 72 c) 45

Exercise 3f

1. 3600 cm
2. 6 packs of sausages, 5 packs of bread
3. 60 books
4. a) 50 litres b) 36 times
5. after 12 days
6. 10:03:20 p.m.
7. 8
8. 5 : 01 : 30 p.m.
9. a) 45 cm b) 10 strips
10. a) 1 b) 1 c) product d) b e) d
    f) 0 g) 216 h) 2 i) odd numbers
    j) composite

Unit 4: Integers

Exercise 4a

1. −2°C
2. Islamabad; Skardu, 8°C; Islamabad, 17°C; Skardu, 11°C; 5°C, −2°C, 1°C, 3°C

Exercise 4b

1. a) 8 b) −2 c) −10 d) −6
   e) −6
2. a) < b) < c) < d) >
3. a) T b) F c) T d) F
   e) T
4. −6, −7, −8, −9, −10
5. a) −0.5, −0, 0.5, 1 b) $-\frac{1}{4}$, 0, $\frac{1}{4}$, $\frac{1}{2}$
6. −2.5, −1, −0.5, 0, 1
7. 1, $\frac{1}{4}$, 0, $-\frac{1}{2}$, $-\frac{3}{4}$, −1

Exercise 4c

1. a) 16 b) 91 c) 86 d) 73
2. a) 20 b) 16 c) 4 d) 113
3. a) F b) T c) T d) F
   e) T
4. |3|, −5, |7|, 8, |−10|, |−12|

Exercise 4d

1. a) −2 b) −3 c) −1 d) 3
   e) −5 f) −5 g) 2 h) −5
   i) 12 j) −101 k) 6 l) 8
   m) −8 n) −9 o) −8 p−10
   q) −5 r) −11 s) 0 t) 8
2. a) 3°C b) −3°C c) −11°C
3. a) 10°C b) 7°C c) 9°C
4. 35
5. −11

Exercise 4e

1. a) 50 b) 42 c) 0 d) 0
   e) 30 f) 0
2. a) − b) + c) − d) +
3. a) −6 b) 4 c) 155 d 1
   e) 0
4. a) −6 b) −8 c) −42 d) 79
   e) 0

Unit 5: Simplifications

Exercise 5a

1. a) 1 b) 3 c) $-\frac{1}{4}$ d) 1 whole $\frac{1}{6}$
   e) 1 whole $\frac{1}{8}$ f) $\frac{1}{9}$ g) 0 h) 2
   i) 2
2. 33
3. a) 2296 b) 287
4. 7
5. 1239

Unit 6: Ratio and Proportion

Exercise 6a

1. 2 : 3
2. 3 : 5
3. a) 45 g b) 3 : 2
4. a) Rs 4500 b) 8 : 5
5. a) 5 : 6 b) 1 : 6
6. a) 2 : 5 b) 8 : 3 c) 2 : 3 d) 1 : 3
   e) 1 : 5
7. a) 1 : 16 b) 10 : 1 c) 1 : 12 d) 2 : 3
   e) 3 : 1 f) 13 : 2 g) 1 : 20 h) 51 : 100
   i) 5 : 1 j) 27 : 7

Exercise 6b

1. a) $\frac{7}{11}$ b) $\frac{4}{11}$
2. a) $\frac{5}{9}$ b) $\frac{4}{9}$
3. a) $\frac{2}{5}$ b) $\frac{3}{5}$
4. a) 300 g : 200 g b) 300 : 400 c) 300 m : 700 m
   d) 140 min : 100 min e) Rs 30 : Rs 50
5. 250 kg
6. a) Mrs Moin and Miss Shabbir

Exercise 6c

1. 4500 litres
2. Rs 30 000
3. 75 pages
4. 9
5. Rs 30 000 and Rs 20 000
6. 2 : 6 : 7 = 4 cm : 12 cm : 14 cm
7. 2 : 3 : 4 = 40° : 60° : 80°
8. 0.6 cm
9. Creek view High School

Exercise 6d

1. Rs 5400
2. Rs 500
3. 714 ml
4. a) 7 hours and 30 min b) 72 km
5. 166 runs
6. 58 min 48 sec
7. 30°
8. 4000
9. 13.5 litres
10. 60 m

Exercise 6e

1. 77 days
2. 65 men
3. 6 hours
4. 16 days
5. 6 days, 4 days
6. 6 oranges
7. 160 revolutions
8. 14 days
9. 10 men
10. 7 and $\frac{1}{2}$ months

Unit 7: Financial Arithmetic

Exercise 7a

1. a) 28% b) 82% c) 55% d) 60%
   e) 60.5% f) 170%
2. a) $\frac{3}{4}$ b) $\frac{1}{2}$ c) $\frac{2}{25}$ d) $\frac{9}{10}$
   e) 2 f) $\frac{3}{20}$
3. a) 0.35 b) 0.07 c) 0.18 d) 0.153
   e) 1.3 f) 0.0125
4. 0

Exercise 7b

1. a) 6% b) 100% c) 36% d) 62.5%
   e) 56% f) 106% g) 180% h) 412.5%
   i) 63.6% j) 57.1%
2. a) 60% b) 170% c) 50% d) $\frac{4}{25}$
   e) 40%
3. a) muscles = , fat = $\frac{1}{5}$, bones = $\frac{4}{5}$, others = $\frac{3}{25}$
   b) Rs 10 000
   c) i) 20% ii) 80%
   d) i) 60% ii) 208
   e) i) 53.33% ii) 46.67%
   f) i) From top to bottom: 64, 96, 112, 128 ii) 76 iii) 356
   g) Maths = 95%, English = 80%, Science = 75%, Urdu = 80%; Maths; Science
   h) 59.3%

Exercise 7c

1. a) Rs 224 b) 420 cm c) Rs 30.24 d) 82.29 litres
   e) 34.5 km
2. a) 25% b) 1.85% c) 9.09% d) 12.5%
   e) 8.33% f) 12% g) 0.07%
3. Rs 14 980
4. 37.5%
5. a) 37.5% b) 62.5%
6. 687 937
7. Principal: Rs 518 400, Teachers: Rs 388 800, Administrators: Rs 194 400; No
8. 313 students
9. CD player = Rs 4095, TV = Rs 11 934, Oven = Rs 11 524.50
10. Rs 297 500
11. 1015 workers
12. 20%
13. 88%
14. 88 g
15. Rs 7500

Exercise 7d

1. a) Profit: Rs 350
   b) Selling Price: Rs 2000
   c) Selling price: Rs 26 500
   d) Cost Price: Rs 67 700
   e) Rs 15 200
   f) Overheads: Rs 200
   g) Loss: Rs 5700
2. 31.25%
3. 6.67%
4. Profit% = 16.67%
5. Rs 783
6. Rs 40 859
7. Rs 2.67
8. Rs 24 265
9. Rs 1540
10. The shopkeeper suffered a loss.

Exercise 7e

1. 100 g
2. 25%
3. a)

Item	Price after discount
Socks	Rs 48
Ties	Rs 144
Shirts	Rs 400
Sweaters	Rs 1360
Trousers	Rs 2000

   b) Rs 440 c) Rs 1548
4. Rs 8550
5. From left to right: 20%, 30%, 25%, 50%
6. Rs 5420.10

Unit 8: Introduction to Algebra

Exercise 8a

1. a) 20 b) 10 c) 22 d) 5
   e) 100
2. a) C: 8; V: a b) C c) C: 6; V: xyz d) C: −6; V: c
   e) C: $\frac{1}{2}$; V: y^2
3. Statement: a, d Open sentence: b, c

Exercise 8b

1. a) $4m$, $3n$ b) $3b$, $5c$ c) $12x^2y$, $9x^2y$, 8 d) $17abc$
2. a) 9 b) $\frac{1}{2}$ c) $45bx^2$ d) -1
3. a) 6 b) $17z$ c) $-4xb$ d) $\frac{3}{4}xz$
4. a) $30 \times x \times x \times y \times y \times z \times z$ b) $25 \times a \times a \times b \times b \times b \times b \times b$
   c) $-9 \times a \times a \times a \times a \times a \times a \times y \times z \times z \times z \times z$
   d) $9 \times a \times a \times a \times q \times q \times r \times r \times r \times r$
5. a) p^5 b) $3m^2n^4$ c) t^a d) $3s^4$
   e) $p^aq^br^c$

Exercise 8c

1. a) $30a$ b) $27xy$ c) $8abc$ d) $5y$
   e) $6bc$ f) $13abc$ g) $-55a^2$ h) $6x^2y$
   i) $-10xy$ j) not possible
2. a) $5ab + 8bc$ b) $7a - 18b + 20c$
   c. $2x^2y^2 - 5xy + 14$ d) 0
3. a) $8a + 3b + 4c$ b) $36x - 2y + 11z$
   c) $10p^2 + 7p$ d) $18x^2 - 5y^2 - 9xy$
4. a) $-10x + 4y$ b) $-2a - 13b - 4c$
   c) $-2p^2 - 2p + 14$ d) $-2a^2 - 39b^2 + 56$
   e) $9n^2 + 3mn - 8m^2$
5. a) -11 b) $-3x$ c) $10xy$ d) 0
   e) $-y$
6. $5p - 8q + 10$

Exercise 8d

1. a) 6 b) $10x$ c) $10a$ d) x
   e) $6a^2 - 3a + 4$ f) $2x - 3y$ g) a h) $y + z$
   i) $8a - 9b$ j) $3 - 1$ k) $b - c$ l) $b - c + d$
   m) $-x + y$ n) $-a^2 - b^2 + c^2$ o) $-2x - 3y - 2z$

Exercise 8e

1. a) i) 17 ii) -4
   b) i) 9 ii.) -1
   c) i) 6.5 ii) 12.5
   d) i) 2 ii) -10
   e) i) 3 ii) -2
   f) i) -6 ii) 48
2. a) 17 b) -3 c) -1.4
3. a) 7.5 ml b) 1.875 ml

Unit 9: Linear Equations

Exercise 9a

1. Expressions: a, b, e Equations: c, d, f
2. Linear equations: c, d, h, j

Exercise 9b

1. a) 12 b) 1 c) 9 d) −2
   e) 2 f) 20 g) −1 h) −8
   i) −8 j) −5

Exercise 9c

1. a) 15 b) 3 c) −8 d) $\frac{2}{3}$
   e) 0 f) −16.5 g) 147 h) −5
   i) −88 j) 4.5

Exercise 9d

1. a) 2 b) 14 c) 8 d) 18.6
   e) $\frac{1}{18}$ f) 4 g) 72 h) −14
   i) 43.4 j) −3

Exercise 9e

1. a) ii b) ii c) iii d) ii
2. b) b = z + 18 c) z = 2k + 3
   d) t = (m + b) − 5 e) y + z + b + m + s + k + t = 150
3. a) 3 b) 21
   c) i) 12 years ii) 35 years
   d) 16 e) 5 f) 24 g) 6 years
   h) 17 cm i) 12

Unit 11: Area and Perimeter

Exercise 11a

1. 18 m
2. 1200 m
3. 36 m^2
4. 64 cm
5. a) Area = 1250 cm^2; Perimeter = 150 cm b) Rs 6250 c) Rs 525

6. 3000 tiles
7. a) 8 cm b) 24 cm c) 12 cm

Exercise 11b

1. 40 cm^2
2. 16 cm^2
3. 51 cm^2
4. 56 cm^2
5. 33 cm^2

Exercise 11c

1. a) 12 000 000 m^2 b) 250 000 cm^2 c) 500 mm^2 d) 500 acres
2. 336 m^2
3. 304 m^2
4. Rs 95 200
5. a) 1084 m^2 b) Rs 164 160
6. a) 36 cm^2 b) 32 cm^2

Exercise 11d

1. a) 6 cm^2 b) 120 cm^2 c) 30 cm^2
2. c has the largest area: 14 cm^2
3. 40 cm^2
4. 17 cm^2
5. 84 m^2

Exercise 11e

1. a) 30 cm^2 b) 77 cm^2 c) 6 cm d) 10 cm
   e) 12 cm
2. a) 36.25 cm^2 b) 61.2 cm^2 c) 90 m^2
3. a) 47 m^2 b) 51 m^2
4. The trapezium has the largest area: 25.5
5. 19%

Unit 12: Three-dimensional Solids

Exercise 12a

1. a) 12 cubes b) 40 cubes c) 18 cubes d) 64 cubes
2. a) 198 cm^3 b) 90 cm^3 c) 105 cm^3 d) 791.2 cm^3
   e) 49 cm^3

Exercise 12b

1. From top to bottom: cube, cone cylinder, cuboid
2. From left to right: prism, cuboid, sphere, cuboid, circle
3. 75 people
4. 32 cm^3
5. a) 105 litres b) 26.25 cm
6. Volume = 400 cm^3 ; New volume = 840 cm^3
7. Box B
8. a. 32 cm^3 b) 2 cm c) 18 cubes
9. 7.5 m^3
10. 105 m^3
11. Rs 324
12. 32.4 cm^2
13. A cube of side 5 cm (150 cm^2)
14. 4150 cm^2
15. Rs 5600

Unit 13: Information Handling

Exercise 13a

1. a)

Number of sixes	Tally	Frequency
0	𝍸	5
1	IIII	4
2	II	2
3	III	3
4	I	1
5	II	2
6	II	2
7		0
8	I	1
Total		20

b) 0 c) 51

2. a)

Score	Tally	Frequency
1	𝍸	5
2	𝍸 I	6
3	𝍸 I	6
4	𝍸 I	6
5	III	3
6	IIII	4
Total		30

b) 30 c) Answer depends on students

3. a)

Temperature ° C	Tally	Frequency
14–16	𝍸	5
17–19	𝍸 III	8
20–21	𝍸 I	6
22–23	𝍸	5
Total		24

b) 17–19 c) warm

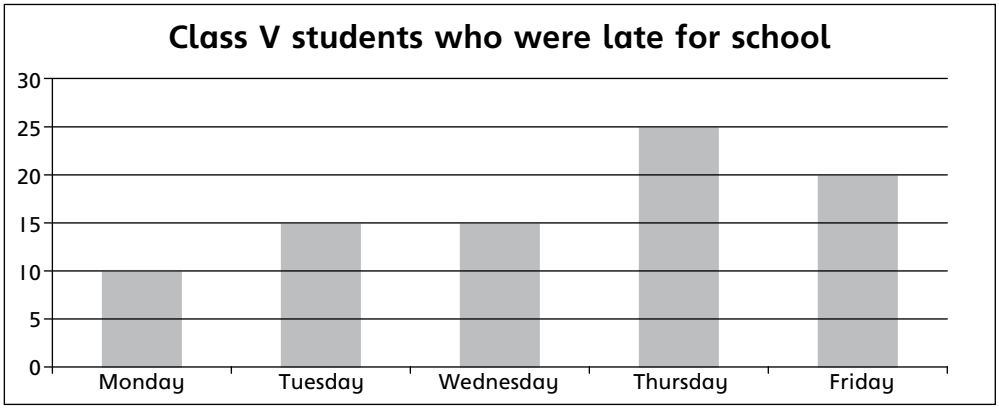
4. a)

Height in cm	Tally	Frequency
141–150	III	3
151–160	~~IIII~~ IIII	9
161–170	~~IIII~~ ~~IIII~~ II	12
171–180	~~IIII~~	5
181–190	I	1
Total		**30**

b) 30 c) 3 d) 18

Exercise 13b

1.



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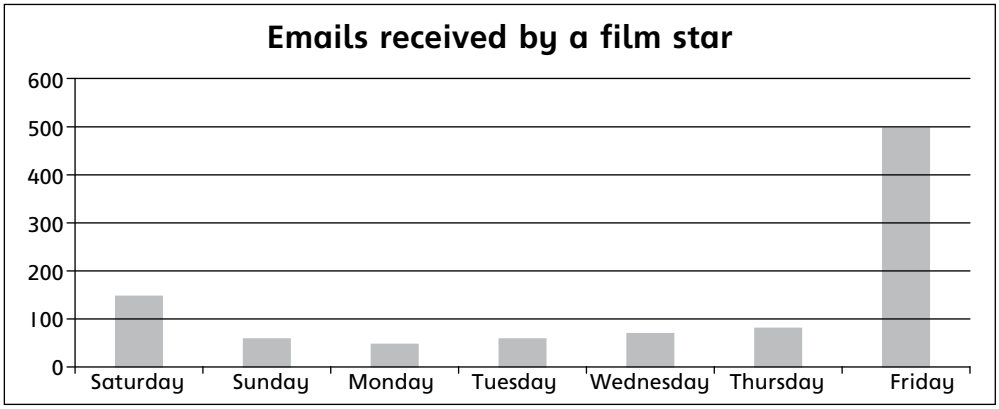

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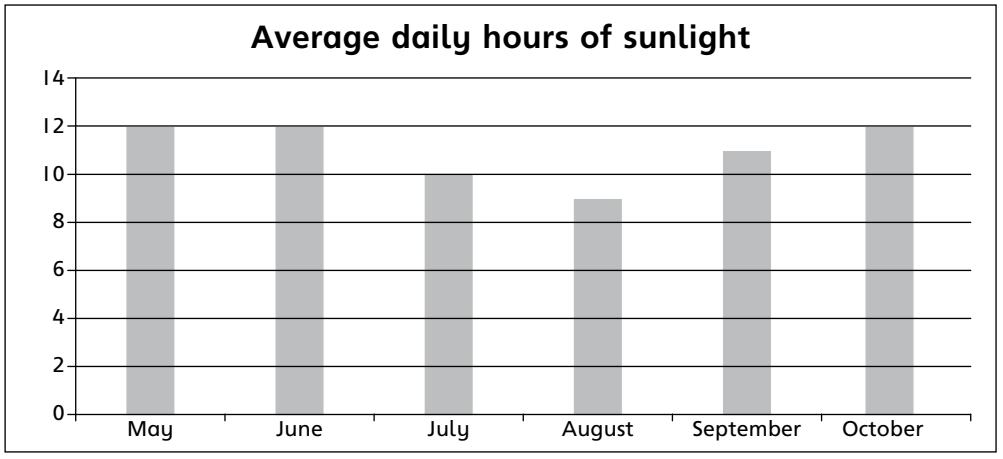
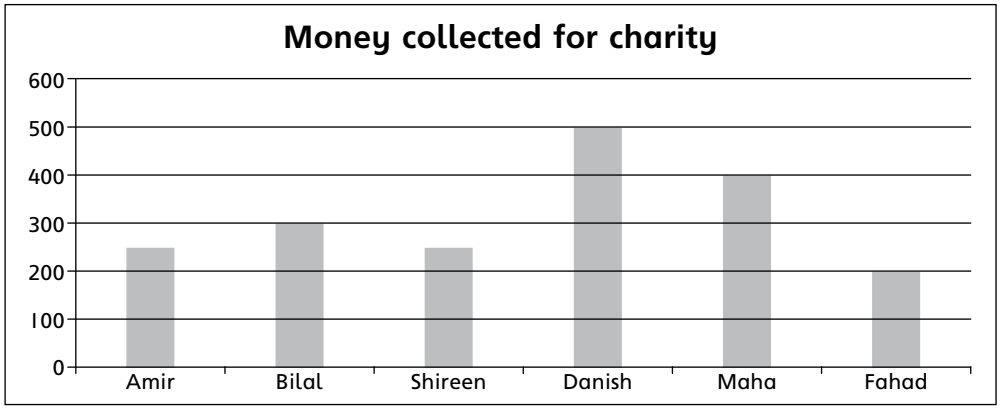
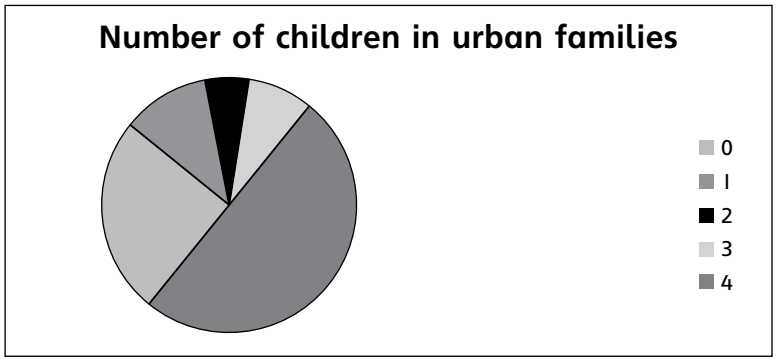


4.

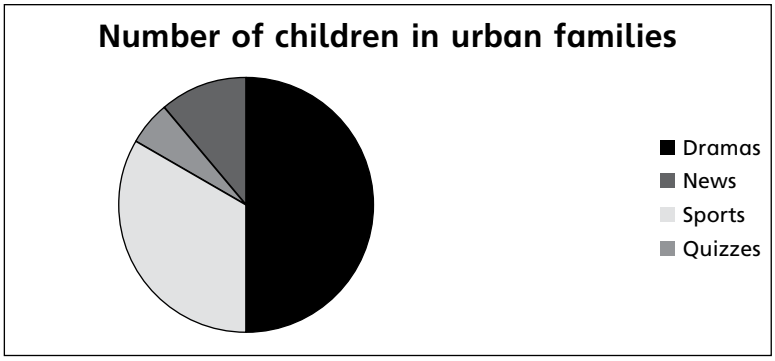


5. a) 74 b) 40 c) 12–13 d) 6 e) 47

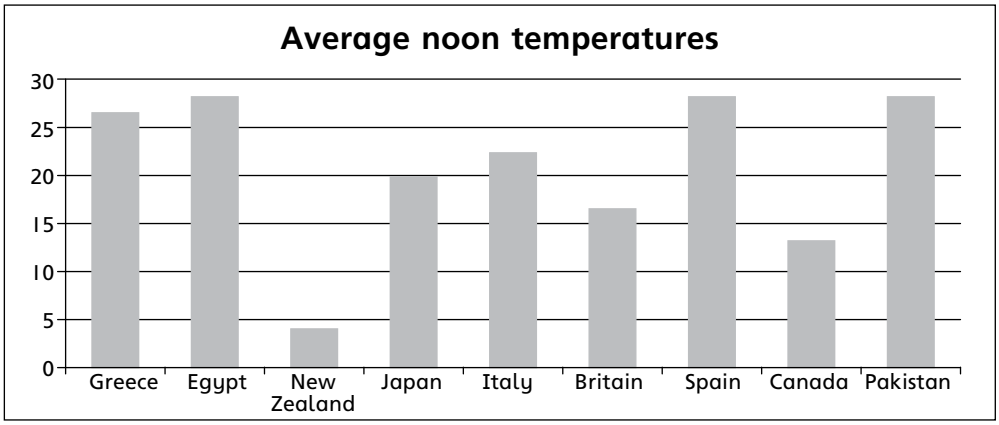
6.



7.



8.



9. The instructor should be happy because half the class is strong in swimming and a quarter have got average marks at the end of the term.

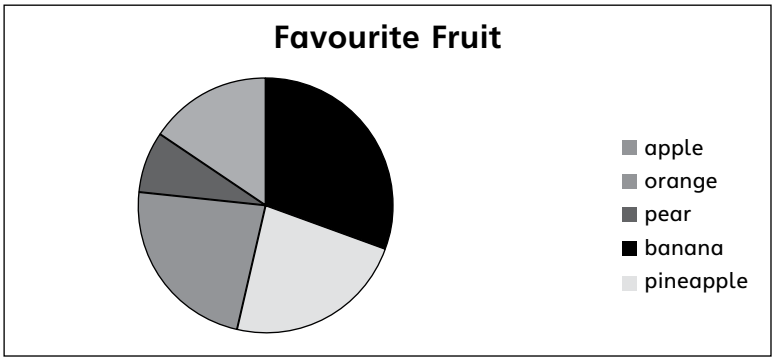
10. a) History b) All except Science
c) i) 15 ii) 25 iii) 13 iv) 40
d) 15 e) 33.3%

11. a) Velcro shoes b) $\frac{1}{10}$ c) $\frac{11}{20}$ d) 10 e) 60

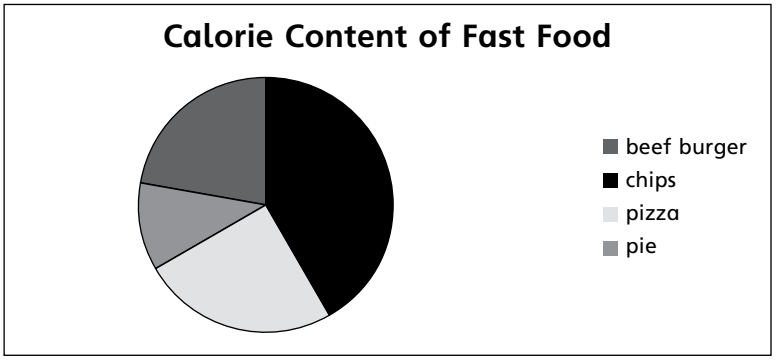
End-of-Year Review

1. a) −4 b) −10 c) −20 d) 4
2. a) 46.7 b) 9.93 c) 4560 d) 9900
3. 11 700 cells
4. Field A: 2950 m^2; Field B: 2000 m^2
5. 80°, 100°

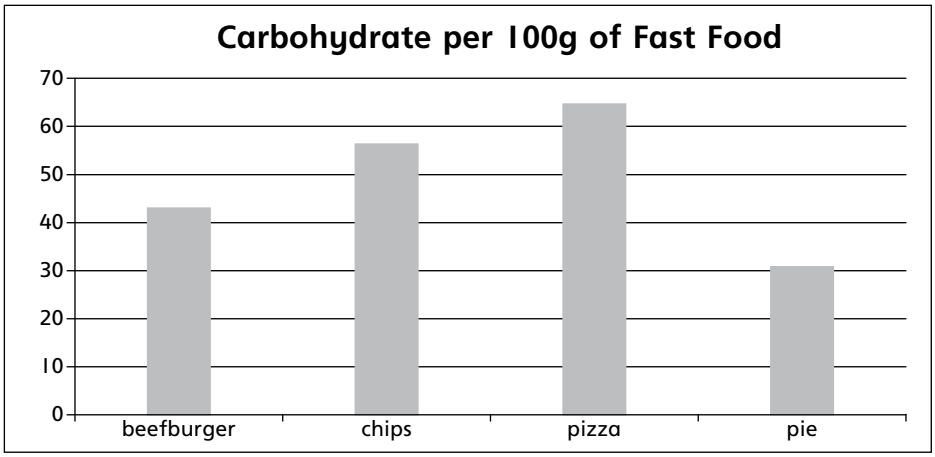
6. a) 200 ml
   b) orange juice: 1250 ml, ginger juice: 250 ml, lemonade: 3500 ml
7. a) 40% b) 40.625%
8. Volume = 2.744 cm^3; Surface area = 11.76 cm^2
9. 10 000 cm^2
10. 1 000 000 m^2
11. a) 160 cm^3 b) 480 cm
12. 22 500, 22 999
13. a) 6.67 m/sec b) 66 km c) 5 min d) 0.133 km
14.



15. a)



b)



c) pizza, beefburger

16. $16x$ – 4 units

17. Approximately 15 logs of wood

18. 60 g

19. a) 300 kg b) 9 weeks

20. a) 100 g margarine, 200 g sugar, 250 g flour, 150 g ground rice
    b) 250 g margarine, 500 g sugar, 625 g flour, 375 g ground rice
    c) 24 biscuits

21. 273 chairs, 252 people, little overestimated

22. a) 9 b) 41 c) 7 d) y e) n + 1

23.

0.9		0.8		1.4		0.5
	1.7		**2.2**		**1.9**	
		3.9		4.1		

24. a)

1.6		4		1.25
	6.4		**5**	
		32		

b)

3		**3**		**4**
	9		**12**	
		108		

25. 1798.294

26. 2187.5 ml

27. 200 stones

28. 800 cm

29. a) P = {Sindh, Punjab, Balochistan, Khyber Pakhtunkhwa}
    b) O = {Pacific, Atlantic, Artic, Indian, Antarctic}
    c) N = {52, 59, 61, 67, 71, 73, 79}
    d) W = {0}

30. a) infinite b) infinite c) empty
    d) empty and equal e) equivalent f) singleton

31. a) $36 = 2^2 \times 3^2$
    $60 = 2^2 \times 3 \times 5$
    $84 = 2^2 \times 3 \times 7$ HCF = 12; LCM = 1260
    b) $36 = 2^2 \times 3^2$
    $54 = 2 \times 3^3$
    108 = 22 33 HCF = 18; LCM = 108

32. 120 cm

33. 67

34. 2400 AD

35. 297

36. a) 28, 64, 96 b) 45, 96, 111, 150 c) 96
    d) 28, 45 e) 73, 101 f) 64
    g) 96 and 150—12 factors each

37. a) −2 b) −6, −7 c)`−7, 8 d) 8, −7
    e) −6, −7

38. a) 437°F b) −100°F

39. a) $\frac{3}{5}, \frac{1}{10}$ b) $\frac{19}{20}$ c) $\frac{7}{20}$ d) $\frac{1}{20}$
    e) 57% f) 2.8 kg g) 14.4 calories

40. 104, 105, 106

41. 17

42. a) 4 b) 10°, 10°, 160° c) isosceles

43. 25

44. 1008

45. 2.65 seconds

46. Approximately 13 seconds

47. Sample I, because it has retained more amount of water.

48. 6 honeybees
49. 300 m
50. 24 watts
51. 28 pianos
52. Rs 260 for 750 g
53. 30 hours
54. 5 days
55. 160 km
56. 1 cup
57. 27 boxes
58. a) 36 kg b) 16 kg c) 30.4 kg d) 8.33 kg
    e) 17.12 kg
59. a) 20.21 b) 0 c) 2 whole $\frac{1}{5}$ d) 23 whole 8/9
    e) $1\frac{1}{2}$ f) 25 g) 21 h) $-y$
    i) $7(2a - b)$ j) $11a - 10b + 4c$
60. length = 84 m; area = 882 m^2

NOTES