NEW CONCEPT

MATHEMATICS

for Junior Secondary Schools

Teacher's Guide

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Contents

Chapter 1 Standard form and indices

Objectives

By the end of this chapter, the student will be able to:

1 express any whole number in standard form;

2 express any decimal number in standard form;

3 perform basic arithmetic operations on any number expressed in standard form;

4 express any number in index form; and

5 state and apply the basic laws of indices in solving problems.

Powers of ten (Page 10)

Revise how to express numbers as products of prime factors in index form with the students, e.g. $200 = 2 \times 2 \times 2 \times 5 \times 5 = 2^3 \times 5^2$.

This will help them to express numbers in terms of powers of 10.

E.g. $100 = 10 \times 10 = 10^2$

$1\,000 = 10 \times 10 \times 10 = 10^3$

$10\,000 = 10 \times 10 \times 10 \times 10 = 10^4$

$100\,000 = 10 \times 10 \times 10 \times 10 \times 10 = 10^5$

$1\,000\,000 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^6$

Guide the students to follow the trend of the number of zeros and the power of 10s in each of the numbers.

Give them the difference between whole numbers and decimal numbers with examples.

Guide them on how to express decimal numbers as powers of 10.

E.g. $0.1 = \frac{1}{10} = \frac{1}{10^1} = 10^{-1}$

$0.01 = \frac{1}{100} = \frac{1}{10^2} = 10^{-2}$

$0.001 = \frac{1}{1\ 000} = \frac{1}{10^3} = 10^{-3}$

$0.0001 = \frac{1}{10\ 000} = \frac{1}{10^4} = 10^{-4}$

Guide the students to solve some of the questions in Exercise 1.1 of page 11 in the classroom. Give them simple and more challenging ones.

Numbers in standard form (Page 12)

Explain what is meant by the standard form of a number with examples 2.5×10^5, 9×10^0, and 7.2×10^{-3}. State the importance of standard form:

a) Its widespread use in science where it is known as scientific notation.

b) It also provides a concise way of presenting numbers so as to reduce the chance of making a slip over place values by putting in too few or too many zeros.

Guide the students to realise that there must be a power of 10 and that a decimal fraction will have a negative power of 10.

Further examples are:

$380 = 3.8 \times 10^2$

$2\ 521.3 = 2.5213 \times 10^3$

$99\ 300 = 9.03 \times 10^4$

$0.0015 = 1.5 \times 10^{-3}$

$0.0000205 = 2.05 \times 10^{-5}$

Guide the students to answer some selected questions in Exercise 1.2 (Pages 12 and 13) in the classroom and give them questions from Exercise 1.3 (Page 13 and 14) as an assignment to be done at home.

Basic operations on numbers in standard form (Page 14)

Explain the steps to follow in order to evaluate expressions involving the basic arithmetic operations on numbers involving standard form, i.e. addition, subtraction, multiplication and division, e.g.

$(5 \times 10^5) \times (4.2 \times 10^6)$, $6.5 \times 10^8) \div (2.5 \times 10^4)$, $(8.65 \times 10^5) - (5.3 \times 10^4)$, $(4.19 \times 10^{-5}) + (7.54 \times 10^4)$, etc.

Guide the students to apply the knowledge of standard form in solving practical problems. Lead them to solve any of the Questions 5–10 in Exercise 1.4 (Page 15) as classwork and Question 11-25 as an assignment.

Mixed calculation involving standard form (Page 15)

Guide the students through Examples 7 and 8, showing them the steps to solve mixed calculations in standard form.

Give Question 1-5 of Exercise 1.5 (Page 16) as classwork and give the rest as an assignment.

Indices

Explain indices as related to expressing numbers as the product of prime factors.

E.g. $24 = 2 \times 2 \times 2 \times 3 = 2^3 \times 3$

In 2^3, 3 is the index of 2, while 2 is the base. Index, which is the singular of indices, is the number of times the base is multiplied by itself,

e.g. $3 \times 3 \times 3 \times 3 \times 3 = 3^5$

Guide the students to express whole numbers in index form and vice versa using Examples 9, 10 and 11. See page 17. Guide students on how to use expansion of terms in solving problems involving indices.

E.g. $a^3 \times a^3 = (a \times a \times a) \times (a \times a) = a \times a \times a \times a \times a = a^5$

Guide students to answer some selected questions in Exercise 1.6 (Page 17), especially Questions 26 to 34. If possible explain Questions 21, 26 and 29.

Laws of indices (Page 18)

Apply the expansion of terms in deriving the various laws of indices using Examples 12 and 13

e.g. $y^2 \times y^4 = (y \times y) \times (y \times y \times y \times y)$

$= y \times y \times y \times y \times y \times y$

$= y^6$

$\therefore \quad y^2 \times y^4 = y^{2+4} = y^6$

Generally, $y^a \times y^b = y^{a+b} = y^6$

Guide the students to derive the other laws of indices and apply them in solving problems.

Solve Question 1-4 of Exercise 1.7 (Page 18) on the board with the students. Give Questions 5 - 10 as classwork and the rest as an assignment.

Solve series of questions as examples, using each of the laws of indices and explaining the steps in each of them.

Give Questions 1-10 of Exercise 1.8 (Page 19) as classwork and Question 11-25 as an assignment.

Lead them to understand specials of indices, such as the zero index law,

e.g. $a^0 = 1$ [$a^x \div a^x = \frac{a^x}{a^x} = a^{x-x} = a^0 = 1$]

Guide the students to realise the difference between expressions, such as

$7x^0$, $(7x)^0$ and $70^0 \times x$.

Give Questions 1-10 of Exercise 1.9 (Page 20) as classwork and Questions 1-15 of Exercise 1.10 (Page 21) as an assignment.

Use the Quantitative reasoning 1 (Pages 21 and 22) to explain the topic and give the students some of the questions there to solve at home. Revision exercise 1 can be given as class test.

Chapter 2 Whole numbers I

Objectives

By the end of this chapter, the student will be able to:

1 explain the meaning of a prime factor;

2 find the prime factors of numbers not greater than 200, using decomposition method;

3 find the highest common factor (HCF) of numbers;

4 find the lowest common multiple (LCM) of numbers;

5 identify some number patterns, such as rectangular, triangular, square; and

6 represent number patterns graphically.

Factors and prime factors (Page 24)

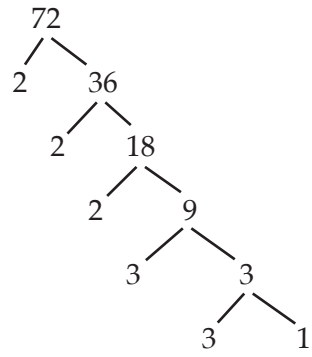
Guide the students on how to prepare the sieve of Eratosthenes to find prime numbers from 1 to 100.

Explain how to find the prime factors of given numbers using Examples 1 and 2.

Guide the students on how to use both the division table and the factor tree methods in expressing a given number as a product of prime factors in index form.

E.g. 72

2	72
2	23
2	18
3	9
3	3
	1



$72 = 2 \times 2 \times 2 \times 3 \times 3$

$= 2^3 \times 3^2$

$72 = 2 \times 2 \times 2 \times 3 \times 3 = 2^3 \times 3^2$

Guide and explain the steps to apply in carrying out the processes by two methods.

Give Questions 1-5 and 13-18 of Exercise 2.1 (Page 26) as classwork while Questions 6-12 and 19-26 are given as an assignment.

Highest common factor (HCF)

Guide the students on how to find the HCF of given sets of numbers, using the prime factorisation method (Example 3, Page 27), to find the factors of the numbers and to circle the common ones. The highest factor is then picked.

E.g. *Factor method*

The factors of 16 are (1), (2), (4), (8), 16.

The factors of 24 are (1), (2), 3, (4), 6, (8), 12, 24.

Common factors are 1, 2, 4 and 8.

The highest factor is 8.

Prime factorisation method

$16 = 2 \times 2 \times 2 \times 2$

$24 = 2 \times 2 \times 2 \times 3$

$HCF = 2 \times 2 \times 2 = 8$

Guide the students on the steps to follow in finding the HCF of numbers as in examples above.

Give them Question 1-12 of Exercise 2.2 (Page 28) to solve in the classroom and the rest as assignment to solve at home.

Lowest common multiple (LCM) (Page 28)

Guide the students on how to find the LCM of given sets of numbers, using prime factorisation method. Use Examples 4 (Page 28) to explain further.

E.g.

18 and 24

$18 = 2 \times 3 \times 3 =$

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

$LCM = 2^3 \times 3^2 = 2^3 \times 3^2 = 8 \times 9 = 72$

Give the students Questions 1-8 from Exercise 2.3 (Page 29) to solve in the classroom, so as to evaluate their understanding of the topic, and give them Question 9-18 as assignment to solve at home.

Divisibilty rule (Page 29)

Guide the students through all the tests for the various divisibility rules of different numbers, giving examples of each rule.

Give them Questions 1-5 of Exercise 2.4 (Page 31 and 32) as Classwork. Give Revision exercise 2 (Page 33) as assignment to solve at home.

Chapter 3 Whole numbers II (Squares and square roots)

Objectives

By the end of this chapter, the student will be able to:

1 find the squares of whole numbers;

2 find the square roots of perfect squares ;

3 compute squares of numbers using

a) tables **b)** simple calculator; and

4 compute square roots of numbers using

a) tables **b)** simple calculator.

Squares of whole numbers (Page 35)

When a number is multiplied by itself to gives another number, such other number is called a **perfect square** or a **square number**.

E.g. $3 \times 3 = 3^2 = 9$

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

$5 \times 5 = 5^2 = 25$

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

$1 \times 1 = 1^2 = 1$ etc.

Hence, numbers 1, 4, 9, 16, 25, 36, … are called square numbers or perfect squares.

Guide the students on how to apply the table of squares in solving problems. See Examples 1 and 2 (Pages 35 and 36).

Give them Questions A and B from Exercise 3.1 (pages 6 to 7) to solve in the classroom and Questions C and D to solve at home.

E.g. $4^2 = 4 \times 4 = 16$ as stated above.

A non-perfect square can be made a perfect square by multiplying it with a constant number.

Guide students on how to do this using Examples 3 and 4 (Page 37).

E.g. 135

3	135
3	45
3	15
5	5
	1

$135 = 3 \times 3 \times 3 \times 5$

In a perfect square the factors must have even indices.

$135 = 3 \times 3 \times 3 \times 5$ (note that 3 and 5 have no even indices)

$\therefore \quad 135 = 3 \times 3 \times 3 \times 5$

$135 \times 3 \times 5 = 3 \times 3 \times 3 \times 5 \times 3 \times 5$

$135 \times 15 = 3 \times 3 \times 3 \times 5 \times 1\,5$

$\therefore$ the required number $= 3 \times 5 = 1\,5$

Square roots of perfect squares (Page 37)

A number that multiplies itself will give a squared number or perfect square. The squared number is called the **square root** of the corresponding perfect square.

E.g. $64 = 8 \times 8$

or $64 = \sqrt{8^2} = 8$

Guide the students to realise that a number can have both a positive and negative number as its square root.

E.g. $\sqrt{64} = \pm 8$

$\sqrt{49} = \pm 7$ etc.

Since $-8 \times -8 = +64$ and $+8 \times +8 = +64$

The symbol of square root is $\sqrt{\ }$.

Guide the students on how to find the square roots of numbers by factorisation (see Examples 3, 4 and 5 page 37).

E.g. 36

$36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$

$\sqrt{36} = 2 \times 3 = 6$

Give the students Questions A and B from Exercise 3.2 (Page 38) as classwork and the rest to solve at home as assignment.

Squares of numbers using tables (Page 38)

Guide the students on how to find the squares of numbers which are not whole numbers using Examples 6, 7 and 8 (Page 39).

E.g. 4.6

$4.6^2 = 21.16$ from tables

Guide and explain to students how to find the squares of numbers to 2 or more decimal

places by estimation making reference to Table 3.1 (Page 38).

Give the students Questions 1 and 2 from Exercise 3.3 (Page 39) as classwork and Questions 3, 4, 5, and 6 as homework to be done at home.

Square roots of numbers using tables (Page 40)

Guide and explain to students how to find the square roots of numbers which are not perfect numbers, or numbers with decimals using Example 8.

Guide the students to learn how to use the lower bound and upper bound using Table 3.2

e.g. 59

$\Rightarrow \quad \sqrt{49} < \sqrt{59} < \sqrt{64}$

$\Rightarrow \quad 7 < \sqrt{59} < 8$

Checking tables, the desired result will be 7.62 under column 8.

$\therefore \quad \sqrt{59} \simeq 7.62$

Explain the above example and give more examples.

Guide the students to learn how to use the table frequently so that they will be used to it.

Given them Questions 5 and 6 from Revision exercise 3 (Pages 41 and 42) as classwork and Questions 1-4 as homework to be done at home.

Explain the quantitative reasoning (Page 39) after giving them as exercise.

Chapter 4 Fractions (Percentages, ratio, proportion and rate)

Objectives

By the end of this chapter, the student will be able to:

1 explain the term percentage and solve problems involving percentages;

2 express quantities in percentages;

3 solve problems on percentage increase and decrease;

4 solve problems on ratio;

5 solve problems on proportion; and

6 solve problems on rate.

Percentages (Page 43)

A percentage is a number expressed as a fraction of 100. The symbol for percentage is %. This can be explained using Fig. 4.1 (Page 43).

E.g. $60\% = \frac{60}{100}$

Give and explain the steps to follow to convert numbers between fractions and percentages.

E.g.

1 $\frac{3}{5} = \frac{3}{5} \times 100\% = 60\%$

2 $105\% = \frac{105}{100} = \frac{21}{20} = 1\frac{1}{20}$

Guide the students to realise that a decimal number can as well be expressed as a percentage.

E.g.

$$0.75 = \frac{75}{100} = \frac{3}{4} \times 100\% = 75\%$$

Guide the students on how to convert fractions and decimals to percentages and how to convert percentages to fractions and decimals.

Guide the students through the solutions of Examples 1 to 2 (Pages 43 and 44).

Exercise 4.1 (Page 44)

Give the students Questions 1–6 as a classwork and the rest as an assignment so as to evaluate their understanding of the topic.

Guide the students on how to solve practical problems involving percentages.

Percentage of quantities (Page 45)

A percentage of given quantities can as well be determined. Lead the students on how to solve problems on this. See Example 4 (Page 45).

E.g. what is the product of 30% of 60 and 20% of 40?

$$= \left(\frac{30}{100} \times 60\right) \times \left(\frac{20}{100} \times 40\right)$$

$$= 18 \times 8$$

$$= 144$$

Exercise 4.2 (Page 45)

Give the students questions from this exercise to solve so as to evaluate their understanding of the topic. It is suggested to give the students Questions 1, 2, 3, 4 and 7 as classwork and the rest as an assignment.

Expressing one quantity as a percentage of another (Page 45)

To express a quantity as a percentage of another, first express the quantity as a fraction of the second, and then multiply the resulting fraction by 100%.

E.g. express 54 as a percentage of 72.

$$= \frac{54}{72} \times 100$$

$$= \frac{3}{4} \times 100$$

$$= 3 \times 25\%$$

$$= 75\%$$

Guide the students to realise the importance of following the steps given above. See Examples 5 and 6 (Page 45).

Explain that the quantities must be in the same unit (smaller unit) before they can be expressed as fractions and subsequently as percentages.

E.g. express 500 g as percentage of 8 kg.

First, change 8 kg to g (1 000 g = 1 kg)

8 kg = 8 × 1 000 g = 8 000 g

$\therefore$ 500 g as a percentage of 8 kg $= \frac{500 \text{ g}}{8\ 000 \text{ g}} \times 100$

$$= 6\frac{1}{4}\%$$

$$= 6.25\%$$

Give and explain the steps to follow when solving word problems involving percentage by solving some of the questions in Exercise 4.3 (Page 46) as examples. Allow the students to participate fully in the interpretation and in solving the problems.

Give the students Questions 10–15 of Exercise 4.3 (Page 46) to solve as homework so as to evaluate their understanding of the topic.

Percentage increase or decrease (Pages 46-49)

Percentage increase represents the rise or appreciation of a given number, amount or quantity.

Guide the students on how to increase a given quantity by a specified percentage.

e.g. increase 210 by 30%

increase = 30% of 210

$= \frac{30}{100} \times 210 = 63$

$\therefore$ new quantity = 210 + 63 = 273

Give and explain the alternative method, in which percentage increase could be found by adding the given percentage to 100%, expressing the sum over 100, and multiplying by the given quantity or amount.

E.g. % increase = 30%

Total percentage = (30 + 100) % = 130%

$\therefore$ new quantity = $\frac{130}{100} \times 210 = 273$

See Example 7 (Pages 46 and 47) for details.

Give the students Questions 1-6 in Exercise 4.4 (Pages 47 and 48) to solve in the classroom under your supervision.

Percentage decrease represents a reduction or depreciation in the value of quantities. It is the opposite of percentage increase.

Guide the students to realise that percentage decrease is the reverse process of percentage increase.

E.g. reduce 64 g by 8%

$\Rightarrow$ percentage decrease = 8%

$\Rightarrow$ total percentage decrease = (100–8) = 92%

$\Rightarrow$ the number to be decreased = 64

$\therefore$ new quantity = 92% of 64

$$= \frac{92}{100} \times 64$$

$$= 58.88 \text{ g}$$

Guide the students to learn the two methods in solving problems involving percentage increase and percentage decrease. See Example 8 (Pages 48–49) and Example 9 (page 49) for detailed explanation.

Exercise 4.5 (Pages 49 and 50)

Give the students the odd-numbered questions to solve in the classroom under your supervision. Mark and give the necessary corrections. Give the even-numbered questions in the same Exercise 4.5 to the students to solve as an assignment.

Ratio (Page 50)

A ratio compares two or more quantities or amounts of the same kind. A given ratio can be expressed as a fraction in its lowest term.

E.g. $8 : 12 = \frac{8}{12} = \frac{2}{3}$

$\therefore$ $8 : 12 = 2 : 3$

Guide the students to learn that to get the lowest terms, they have to change the given ratios into fractions, and then simplify completely.

See Examples 10 and 11 (Pages 50 and 51) for details.

It is important to point out that quantities in the ratio form must be in the same unit (the smaller).

E.g. 4 m : 80 cm

1 m = 100 cm

4 m = 400 cm $\Rightarrow$ 100 cm $\times$ 4 = 400 cm

$\therefore$ 4 cm : 80 cm = 400 cm : 80 cm

$= 5:1$

Exercise 4.6 (Pages 51 and 52)

Give the students Questions 7–10 (Page 51) to solve in the classroom under your supervision. Mark and give them the necessary corrections.

Give the students Questions 12–16 as an assignment, so as to evaluate their understanding of the topic.

Sharing of quantities in a given ratio (Page 52)

Lead the students to realise that apart from using ratio to compare quantities, it can also be used in sharing or dividing amounts, quantities and numbers.

For example three children are to share 936 biscuits in the ratio 2:3:4. How many will each receive?

Let $A:B:C = 2:3:4$

No. of shares $= 2 + 3 + 4 = 9$

Total biscuits $= 936$

A's share $= \frac{2}{9} \times 936 = 208$ biscuits

B's share $= \frac{3}{9} \times 936 = 312$ biscuits

C's share $= \frac{4}{9} \times 936 = 416$ biscuits

Adequate time and care should be taken to explain the steps involved in the solution.

Guide them through Examples 12 and 13 (Pages 52 and 53) for more understanding.

Exercise 4.7 (Page 53)

Guide the students to solve Questions 1–5 (Page 53) in the classroom under your supervision. Mark and give the necessary corrections. Give the students Questions 6–10 to solve as an

assignment.

Increasing or decreasing quantities, using ratio (Page 54)

Lead the students to realise that ratio can also be used to increase and decrease certain quantities, amounts or numbers. See Examples 14 and 15 (Page 54) for details.

Give the students the questions in Exercise 4.8 (Page 54) to solve as an assignment so as to evaluate their level of understanding of the topic.

Converting ratios to percentages (Page 55)

A given ratio can be converted to a percentage. See Example 16 (Page 55) for details.

Converting percentage to ratios (Page 55)

A given percentage can be converted to ratio. See Example 17 (Page 55) for details.

Percentages of quantities involving ratios. See Example 18 (Page 56) for details.

Lead the students to the examples of the above topics (Examples 16, 17 and 18). Explain so that they can differentiate the questions from one another.

Guide the students using the examples and pick some of the questions in Exercise 4.9 as examples.

Exercise 4.9 (Pages 56 and 57)

Give the students Questions 1, 2 and 6 (Page 56) as a classwork under your supervision. Mark and give the necessary corrections.

Give Questions 4, 5, 7, 8, 10, 14 and 12 of Exercise 4.9 as an assignment.

Give revision Exercise 4 (Pages 58 and 59) as an assignment because the questions are revision for ratio and percentage.

Chapter 5 Household arithmetic

Objectives

By the end of this chapter, the student will be able to:

1 solve problems involving household budgeting; and

2 solve problems involving rents, bills and taxes.

Household budgeting (Page 60)

Household budgeting is the process of planning how to spend an amount of money on family needs.

Give practical explanations, allowing the students to participate fully. Guide them to realise the need for household budgeting and how to solve problems involving household budgeting.

Explain the solution to Examples 1 and 2 (Pages 60 and 61) fully, giving the explanation of each step.

Exercise 5.1 (Pages 61 and 62)

Give the students Questions 1–6 (Pages 61 and 62) as classwork under your supervision. Mark and give the necessary corrections.

Give Questions 7–10 (Page 62) as an assignment so as to evaluate their understanding of the topic.

Savings (Page 62)

Savings refers to part of a family income that is kept aside for future use, such as during the time of sickness or retirement when money may not be readily available.

Savings can be a fixed amount or a certain percentage of the family income or earnings in a month or in a given period of time, but the value can change depending on the budget of the family.

Guide the students on how to learn the solutions to problems involving household savings.

Examples 3 and 4 (Pages 62 and 63)

Give the students the odd-numbered questions in Exercise 5.2 (Pages 63 and 64) to solve in the classroom under your supervision. Mark the solution and give the necessary corrections.

Give the even numbered questions in Exercise 5.2 (Pages 63 and 64) as an assignment.

Remember to give the step-by-step solutions to each of the questions.

Rent (Page 64)

Rent is the amount of money that is paid by a person for occupying a place like a house, a shop or a park that does not belong to that person, for a period of time.

Rent can be a fixed amount or it can be reduced or increased from time to time, depending on the agreement made between the owner and the person occupying the place.

Take time to revise percentages of given quantities done earlier as this may greatly help the students in solving problems involving increase or decrease in rent.

Example: A rent of ₦150 000 per annum is increased by 10%. Find the new rent.

Original rent $= ₦150\,000$

Increase $= 10\%$ of ₦150 000

$= \frac{10}{100} \times ₦150\,000 = ₦15\,000$

$\therefore$ new rent $=$ Original rent + increase

$= ₦150\,000 + ₦15\,000$

$= ₦165\,000$

Guide the students to learn the solutions to Examples 5 and 6 (Page 64) so as to realise the application of percentages in problems involving rent.

Exercise 5.3 (Page 65)

Give the students the odd-numbered questions to solve in the classroom under your supervision. Mark and give the necessary corrections so as to evaluate their level of understanding of the topic.

Give the students the even-numbered questions to solve as homework. Ask verbal questions to remind them what they have learnt concerning percentages of given quantities.

Bills (Page 65)

The amount of money that is paid when service is rendered is called a bill. There are many types of bills, e.g. electricity bills, telephone bills and water rate bills.

Collect and show the students these bills (electricity, telephone, water rate) to enable the students understand better, rather than discussing them in the abstract.

Electricity bills (Page 65)

Electricity bills are paid for the use of electricity in places like homes, companies, hotels and business centres. The payment is based on the number of units consumed within a period of time (mostly for a month). The number of units consumed is determined by the reading on a meter.

To get the electricity bill for a particular month, the following are considered: demand charge, high charge, etc. which will be explained below.

Guide the students to learn how to calculate the electricity bills, taking the following into consideration:

i) the demand charge

ii) high charge rate

iii) low charge rate

iv) value added tax (VAT)

Lead the students to learn how to find the quantity of energy (electricity) consumed.

For example, if the previous reading on an electricity meter is 16 055 units and the present reading is 17 102 units of electricity, calculate the quantity of electricity consumed for the month.

Previous reading = 16 055

Present reading = 17 102

Quantity of electricity consumed = Present reading – Previous reading

= (17 102 – 16 055) units

= 1 047 units

Explain the meaning of VAT, giving several examples and the rate of VAT (5%) in any transaction.

Guide the students to learn the solutions to Examples 7 and 8 (Page 66).

Exercise 5.4 (Page 67)

Give the students the even-numbered questions to solve as classwork. Mark and give the necessary corrections so as to evaluate their level of the understanding of the topic.

Give the students the odd-numbered questions as an assignment.

Telephone bill (Page 67)

The amount of money that is charged for phone calls is called **telephone bill**. The amount charged depends on the time spent in calling, time of the day, the distance covered by the call, local or international calls, etc.

Guide the students to learn how to prepare telephone bills, taking the following into consideration:

i) rentage or fixed charge

ii) charge rate

iii) VAT (5% of the total charge)

Explain the above to the students and see Examples 9 and 10 (Page 68) for easy understanding and explanation.

Exercise 5.5 (Pages 68 and 69)

Give the students Questions 1–6 (Page 69) to solve in the classroom under your supervision. Mark and give the corrections.

Give the students Questions 7–10 (Page 69) to solve as homework. Mark and give the necessary corrections.

Water rate (Page 69)

A **water rate** is the amount of money that is paid for the quantity of water consumed for a period of time. A water meter is used to determine the quantity of water consumed.

The use of the student's knowledge of percentages should be emphasised as well.

The bill for water rate includes the following:

i) fixed charge

ii) charge on the number of units consumed at a given rate.

iii) VAT (5%)

Guide the students to learn the solutions to Examples 11 and 12 (Pages 69 n and 70). Explain the steps taken in solving the problems so that the students can quickly understand them.

Exercise 5.6 (Pages 70 and 71)

Solve Questions 1–4 (Pages 70 and 71) as examples for the students, allowing them to participate fully in the process.

Give the students Questions 7–10 (Page 71) to solve as an assignment. Mark and give the necessary corrections so as to evaluate their level of understanding of the topic.

Taxes (Page 71)

Taxes refer to monies raised by the government to generate revenue for the purpose of providing services like education, road maintenance, water and security for the public.

Explain the different types of taxes and how to calculate them.

Income tax (Page 71)

Income tax refers to the levy that citizens pay to the government on their earnings, such as salaries and rents.

Income tax (pay as you earn i.e. PAYE)

Give practical examples in the classroom so as to enhance learning.

Explain those that are eligible to pay tax and those that are not, giving examples from their immediate environment.

Explain taxable income and tax-free income.

Guide the students to learn the solutions to Examples 13 and 14 (Pages 71 and 72), giving the step-by-step explanation.

Exercise 5.7 (Page 73)

Give the students Questions 2–5 (Page 73) to solve in the classroom under your supervision.

Mark and give the necessary corrections so as to evaluate their level of understanding of the

topic.

Give Questions 8–10 (Page 73) as an assignment.

Property tax (Page 73)

Property tax is the revenue that the government generates from assessing properties like land, companies, shops and so on. The assessment is called **rateable value**, while the levy that the owner pays to the government in a year is called **property tax**.

See Examples 15 and 16 (Page 74) for better explanation and learning.

Exercise 5.8 (Page 74)

Give the students the odd-numbered questions to solve in the classroom under your supervision. Mark and give the necessary corrections. Give the students the even-numbered questions as an assignment.

Mark the assignment and give the corrections so as to evaluate their level of understanding of the topic.

Revision exercise 5 (Pages 75 and 76)

Solve some of the questions and give some others as an assignment or a classwork. Mark and give the necessary corrections.

Chapter 6 Commercial arithmetic

Objectives

By the end of this chapter, the student will be able to:

1 solve problems involving profit and loss;

2 calculate simple interest on savings and find the principal, amount, rate and time related to simple interest; and

3 solve problems involving discount, instalmental buying and commission.

Profit and loss (Page 77)

In any transaction (buying and selling) when the cost price of an item is lower or less than the selling price, it will result in gain or profit.

E.g. If the cost price of a bag of rice is ₦7 500, and the selling price is ₦12 000 then the gain or profit is ₦4 500.

On the other hand, when the cost price of an item is higher or greater than the selling price, it results in a loss.

E.g. If the cost price of a gallon of oil is ₦2 300 and the selling price is ₦1 800, then there is a loss of ₦500.

The following should be explained to the students so as to help them in solving problems involving profit and loss.

1 Cost price = Selling price – Profit

2 Selling price = Cost + Profit

3 Profit = Selling price – Cost price

4 Loss = Cost price – Selling price

Apply these formulae to explain the solutions to Examples 1 and 2 (Pages 77 and 78).

Guide the students to learn how to solve problems involving profit and loss, giving all necessary steps and not forgetting the correct units.

Exercise 6.1 (Page 78)

Give the students Questions 1–6 (Page 78) to solve in the classroom under your supervision. Mark and give the necessary corrections.

Give the students Questions 7–10 (Page 78) to solve as homework. Mark and give the necessary corrections so as to evaluate their levels of understanding of the topic.

Profit and loss percent (Page 78)

Profit and loss are always a percentage of the cost price of the item. Remind the students of the following:

1 Profit = Selling price – Cost price

2 Loss = Cost price – Selling price

Hence,

$$\text{percentage profit} = \frac{\text{profit}}{\text{cost price}} \times \frac{100}{1}\%$$

$$\text{percentage loss} = \frac{\text{loss}}{\text{cost price}} \times \frac{100}{1}\%$$

In each case, the answer should be left in percentage .

Example: A chicken which costs ₦1 200 was sold for ₦1 500. Find the percentage profit.

Cost price = ₦1 200

Selling price = ₦1 500

Profit = Selling price – Cost price = ₦1 500 – ₦1 200 = ₦300

$$\% \text{ profit} = \frac{\text{profit}}{\text{cost price}} \times \frac{100}{1}\%$$

$$= \frac{₦300}{₦1\,200} \times \frac{100}{1}\% = 25\%$$

Lead the students to learn the solution to Examples 3–5 (Page 79)

Exercise 6.2 (Pages 79 and 80)

Guide the students to solve Questions 1–7 (Page 79) as classwork. Give the necessary assistance and corrections.

Give the students Questions 8–12 (Page 80) as homework. Mark and give the necessary corrections so as to evaluate their understanding of the topic.

Interest (Page 80)

The additional money that a depositor gets from savings or that a borrower pays to a bank or the lender is called **interest**.

Give practical examples to explain the meaning of interest.

The interest paid for deposited money is called **interest on savings** while the interest paid for borrowing money is called **interest on loan**.

If the interest is paid on loan or savings at a fixed interval of time, e.g. quarterly, half yearly or yearly, it is called **simple interest i**.

$$\text{Simple interest} = \frac{\text{Principal } (P) \times \text{Time } (T) \times \text{Rate } (R)}{100}$$

$$= I = \frac{PRT}{100}$$

P = The money deposited or borrowed

R = Rate of interest, usually in percentages.

T = The period of payment, always in a years

Lead the students to learn how to apply this formula in solving problems.

Example: Find the simple interest on ₦40 000 for 4 years at the rate of 5%

$I = ?$

$P =$ ₦40 000

$R = 5\%$

$T = 3$ years

$$I = \frac{PRT}{100} = \frac{₦40\,000 \times 5 \times 3}{100} =$$

$$I = ₦400 \times 15$$

$I =$ ₦6 000

Give and explain the following relationship by using them to solve problems as examples.

$$P = \frac{100I}{RT},\ R = \frac{100I}{PT} \text{ and } T = \frac{100I}{PR}$$

See Examples 6 and 7 (Pages 80 and 81) for easy explanation and learning.

Exercise 6.3 (Page 81)

Give Questions 6–10 (Page 81) as homework. Mark and give the necessary corrections so as to evaluate their level of understanding of the topic.

Remember to guide the students to learn that amount, in a transaction of this nature is the sum of the interest and the principal,

i.e. Amount = Principal + Interest

$$A = P + I$$

Discount (Page 81)

Discount is the amount of money reduced from the original or marked price of a given item.

It can be calculated as a percentage of a marked price or the original price.

The knowledge of percentage of quantities is highly needed here as well.

See Examples 8 and 9 (Page 82) for easy explanation.

Exercise 6.4 (Page 81)

Solve Questions 1–4 (Page 82) as examples for the students. Give the students Questions 5–7 (Page 82) as classwork. Mark and give the necessary corrections.

Give the students Questions 8–10 (Page 82) to solve as an assignment. Mark and give corrections so as to evaluate their understanding of the topic.

Instalmental buying (Page 83)

An **instalment** is one payment out of a number of payments into which an amount of money is divided. When a buyer does not have enough money to pay fully at once for an item, he or she can request for payment by instalment.

Give examples of items that are mostly bought on instalment, e.g. cars, motorcycles, tricycles, land and electronic gadgets.

See Examples 10 and 11 (Page 83) for easy explanation to the students.

Exercise 6.5 (Pages 84 and 85)

Give the students Questions 5–10 (Pages 84 and 85) as classwork. Supervise how they solve them. Mark and give corrections.

Commission (Page 85)

A **commission** *is* an amount of money that is paid to someone according to the value of goods sold. It can be in terms of a specific amount charged or calculated as a percentage of the amount generated from sale.

The knowledge of how to calculate the given percentages of a quantity is also required here. See Examples 12 and 13 (Page 85) for easy explanations.

Exercise 6.6 (Pages 85 and 86))

Solve Questions 3 and 4 (Page 85) as examples for the students. Encourage their participation in solving the problems.

Give Questions 1,2,5,6,7,8 and 9 (Pages 85 and 86) to the students to solve as homework. Mark and give the necessary corrections.

Revision exercise 6 (Page 86)

Give the exercise as class test.

Chapter 7 Approximation and estimation

Objectives

By the end of this chapter, the student will be able to:

1 round off numbers to any given degree of accuracy;

2 approximate numbers to any given:

- decimal places
- significant figures;

3 carry out calculations to any given decree of accuracy; and

4 solve quantitative reasoning problems involving approximation.

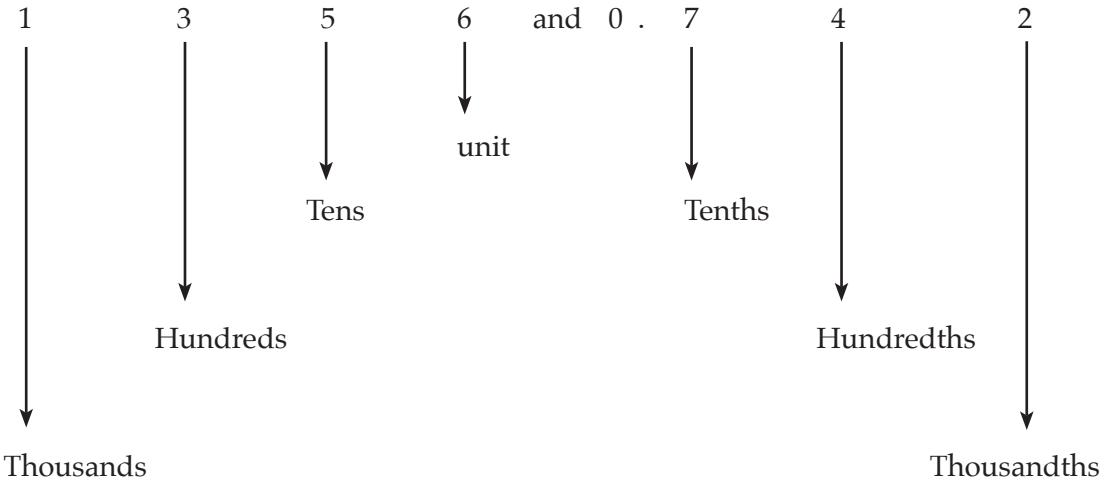
Approximation (Page 88)

This is a number, amount or cost that is not exact, but is almost exact. Approximation leads us to results very close to the exact answer.

Round off numbers (Page 88)

Rounding off is the process of approximating a number to a nearby one by eliminating the least significant digits. Whole numbers can be rounded to the tens place, hundreds place, thousands place, millions place and so on, while decimal numbers can be rounded to the tenths place, hundredths place, thousandths place and so on.

Revise the place-value of integers and decimal fractions with the students e.g. 1 356.742.



Guide the students to learn that when rounding off numbers, the digits 0, 1, 2, 3 and 4 are rounded down, while the digits 5, 6, 7, 8, 9 are rounded up.

Examples

1 Round off 2 549 to the nearest:

a) ten

b) hundred

c) thousand

a) 2 549 = 2 550 to the nearest ten

b) 2 549 = 2 500 to the nearest hundred

c) 2 549 = 3 000 to the nearest thousand

2 Round off 0.4854 to the nearest:

a) tenth

b) hundredth

c) thousandth

a) 0.4854 = 0.5 to the nearest tenth

b) 0.4854 = 0.49 to the nearest hundredth

c) 0.4854 = 0.485 to the nearest thousandth

See Examples 1–4 (Pages 89 and 90) for easy explanation and learning.

Give the students some of the questions in Exercise 7.1 (Page 90) to solve in the classroom under your supervision. Mark and give the necessary corrections.

Decimal places (Page 90)

The number of digit(s) after the decimal point in any given number is called its decimal places,

e.g. 0.2 is in 1 decimal place or nearest tenth

2.65 is in 2 decimal places or nearest hundredth

Guide the students to use the techniques of round up and rounding down as explained previously in Examples on pages 89 and 90.

See Examples 5–7 (Pages 91 and 92) for more explanations.

Give the students some of the questions in Exercise 7.2 (Page 92) to solve in the classroom and some others as an assignment.

Significant figures (Page 92)

Guide the students on how to follow the rules for finding significant figures. See page 93 for the rules.

Guide the students to use the techniques of rounding up and rounding down given numbers as explained previously.

See Example 8 (Page 93) for detailed explanations.

Give the students Questions 1-5 in Exercise 7.3 (Page 93). You can make it oral questions in the classroom.

Give the students Questions 6-25 in Exercise 7.4 (Page 93) to solve in the classroom under your supervision. Mark and give necessary corrections.

Using estimation and approximation in calculations (Page 94)

Approximation is a number, amount or cost that is not exact, but almost exact.

Estimation is when rounded values are used to calculate a rough answer to an arithmetic problem or to give a rough size in a measurement situation.

Guide the students to understand how to use both in calculations,

e.g. estimate the following:

1 $38 \div 5.3 = 40 \div 5 = 8$

2 $29.43 \div 5.6 = 30 \div 6 = 5$

See details in Examples 9, 10 and 11 (Pages 94 and 95).

In most cases, estimate, should be done with numbers rounded to 1 significant figure.

Guide the students to do more of practical work under this topic, especially measuring the lengths of tables, board, dimensions of the class or some distances.

Give the students Questions 1-10 in Exercise 7.5 (Page 95) to solve in the classroom and Question 11-15 as an assignment to be done at home.

Quantitative reasoning 7 (Page 96)

Give the students some time to go through the sample first, then allow them to attempt on their own questions on Quantitative reasoning page 96 in the classroom. Mark and give the necessary explanation by means of detailed corrections.

Guide the students to understand that the questions are what they have treated so far.

Chapter 8 Directed numbers

Objectives

By the end of this chapter, the student will be able to:

1 add and subtract directed numbers;

2 multiply and divide directed numbers;

3 find the additive inverse of a number;

4 find the multiplicative inverse of a number; and

5 solve word problems involving the use of inverse operations.

Directed numbers (Page 98)

Directed numbers are whole numbers e.g., –3, –2, –1, 0, 1, 2, 3,… Positive and negative whole numbers, including zero are called **directed numbers**.

The basic arithmetic operations (addition, subtraction, multiplication and division) on directed numbers can be done on the number line.

Addition and subtraction of directed numbers (Page 98)

Lead the students to realise the following for using the number line for addition and subtraction of directed numbers.

1 To add a positive number, move to the right.

2 To add a negative number, move to the left.

3 To subtract a positive number, move to the left.

4 To subtract a negative number, move to the right.

See Example 1 (Page 98) for easy explanations. However expressions involving addition and subtraction of directed numbers can be done without using the number line.

Give and explain the following so as to help them.

−	×	−	=	+
+	×	+	=	+
−	×	+	=	−
+	×	−	=	−

See Example 2 (Page 99) for easy explanation.

Exercise 8.1 (Page 101)

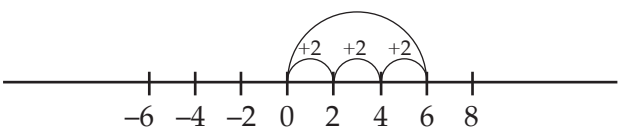
This exercise tests the students ability to simplify expressions involving addition and subtraction of directed numbers with the number line and without the number line.

Students can be engaged in the classroom with Questions 1–15 of Exercise 8.1 (Page 99), since they learn easily with diagrams. Questions 24–30 are suggested as homework for the students. Mark and give the necessary corrections so as to evaluate their understanding of the topic.

Multiplication of directed numbers (Pages 99 and 100)

Multiplication of directed numbers can also be done on the number line,

e.g. $3 \times 2 = 3 \times (+2)$.



See Examples 3, 4 and 5 (Pages 100 and 101) for easy explanation.

As earlier explained, multiplication of directed numbers can as well be done without the number line,

e.g. **1** $(+3) \times (-5) = -(3 \times 5) = -15$

2 $(-4) \times (-2) = + (4 \times 2) = +8$

3 $\left(-1\frac{1}{2}\right) \times (-6) = +\left(1\frac{1}{2} \times 6\right) = +\left(\frac{3}{2} \times \frac{6}{1}\right) = +9$

Exercise 8.2 (Page 101)

This exercise centres on the simplification of expressions involving multiplication of directed numbers with the number line and without the number line.

Students will be more interested in Questions 16 and 17 because of the tables and the quantitative diagrams. Much attention should be given to the outcome of multiplying the signs.

Division of directed numbers (Page 101)

When dividing directed numbers the following rules will be helpful.

1 When two directed numbers with the same sign are divided, the answer is positive,

e.g. $(-36) \div (-9) = +4$

$(+36) \div (+9) = +4$

2 When two directed numbers with different signs are divided the answer is negative,

e.g. $(+48) \div (-6) = -8$

$(-45) \div (+9) = -5$

Guide the students to learn the solution to Examples 6 and 7 (Page 102)

Exercise 8.3 (Page 102)

This exercise will assess the student's understanding of division of a directed number by another, learnt earlier. It is suggested that the students are given Questions 11–18 (page 102) as classwork under your supervision, while Questions 19 to 24 (Page 102) are given as an assignment.

Inverse and identity (Page 103)

When two numbers are added to give zero (0), then each number is the **additive inverse** of the other,

e.g. $(-4) + (+4) = -4 + 4 = 0$

$\therefore$ –4 is the additive inverse of +4 and +4 is the additive inverse of –4.

Lead the students to solve the problems in Activities 8.1 and 8.2 (Page 102) orally.

Guide the students to realise that the identity for addition is zero (0).

Exercise 8.4 (Page 103)

The questions in this exercise can be answered by the students orally under your supervision in the classroom.

Guide the students to learn how to apply the knowledge of additive inverse in solving simple equations (balance method).

See Examples 8 to 10 (Pages 103 and 104) for easy explanation and learning.

Exercise 8.5 (Page 104)

This exercise evaluates the students' ability to apply additive inverse in solving simple equations.

Encourage them to apply the method and not otherwise. On the other hand, when the product (outcome of multiplication) of two numbers is 1, each number is the **multiplicative inverse** of the other,

e.g. **1** $\frac{2}{3} \times \frac{3}{2} = 1$

Then, $\frac{2}{3}$ is the multiplicative inverse of $\frac{3}{2}$ and $\frac{3}{2}$ is the multiplicative inverse of $\frac{2}{3}$.

2 $-\frac{8}{7} \times -\frac{7}{8} = 1$

Hence $-\frac{8}{7}$ is the multiplicative inverse of $-\frac{7}{8}$ and vice versa.

See Activities 8.3 and 8.4 (Page 104)

Lead the students to realise that identity for multiplication is 1.

Exercise 8.6 (Page 105)

This exercise evaluates the students ability to state the multiplicative inverse of given numbers.

Remember to let the students know that the multiplicative inverse of a number is simply its reciprocal.

This exercise can be given to the students to answer orally under your supervision.

The knowledge of multiplicative inverse can also be used to solve simple linear equations,

e.g. Solve $\frac{3x}{2} = 9$

Multiply both sides by the multiplicative inverse of $\frac{3}{2}$.

$\frac{3x}{2} \times \frac{2}{3} = 9 \times \frac{2}{3}$

$x = 3 \times 2$

$\therefore \quad x = 6$

See Examples 11 and 12 (Page 105).

Exercise 8.7 (Page 105)

Give the students Questions 1 to 18 to solve in the classroom and Questions 21–30 to solve as homework. Mark and give the necessary corrections so as to evaluate their understanding of the topic.

Word problems involving inverse operations (Page 106)

Guide the students to understand that this topic is the application of how to apply the inverse of numbers in simple equations,

e.g. When I think of a number and subtract 6 from it and the result is 12, the number is:

$x - 6 = 12$

$x - 6 + 6 = 12 + 6$

$x = 18$

See Examples 13 and 14 (Page 106) for easy explanation and learning.

Exercise 8.8 (Pages 106 and 107)

This exercise will lead students to know how to apply the inverse operation when solving word problems.

Give the students Question 1 (Page 106) orally in the classroom and Questions 2–12 as homework. Mark and give the necessary corrections so as to evaluate their understanding of the topic.

Revision exercise 8 (Page 107)

Give students some of these questions as class test to evaluate their understanding of the topic.

Quantitative reasoning (Page 108)

Give Quantitative reasoning to students as classwork.

Chapter 9 Tables and charts

Objectives

By the end of this chapter, the student will be able to:

1 read and interpret data in charts, timetables and schedules; and

2 use conversion tables and graphs to convert given quantities from one measure to another.

Timetables and schedules (Page 110)

Timetables and schedules show planned events at a glance. Such timetables give the time of commencement and end of the event in question, e.g. the school timetable.

See Table 9.1 (Page 109) for explanation.

Guide the students to solve the questions in Exercise 9.1 (Page 110) orally in the classroom.

Give the students homework on how to prepare their daily timetable allocation activities with time:

Flight schedules (Page 110)

Guide the students to learn the details of Table 9.2 (Page 110) and apply it in solving problems.

Explain the 24-hour clock times to the students, so that they can easily apply it when solving other related problems.

Guide the students to learn how to convert times between 24-hour clock and the 12 hour clock,

e.g. **1** 11.45 a.m = 1 145 hours

2 4.20 p.m = 420 + 1 200 = 1 620 hours

3 05 40 hours = 5.40 a.m.

4 2310 hours = 23.10 – 12.00 = 11.10 pm.

Exercise 9.2 (Page 111)

Give Questions 1(a–g) on page 111 as a classwork and Questions 2(a–f) on page 111 to be done as an assignment.

Distance by road between state capitals in Nigeria (Page 111)

Explain Table 9.3 (Page 113) in finding the distances between two or more state capitals in Nigeria.

Exercise 9.3 (Page 111)

Guide the students to answer Questions 1(a–h) on page 111 in the classroom orally using Table 9.3 on page 113.

Give the students Questions 2–5 (Page 111) as an assignment.

Conversion graphs (Page 111)

Conversion graphs can be used to obtain information concerning relationships between two quantities,

e.g. converting money from one unit to another (Naira to Dollars, Cedis, Euro, etc.).

See Examples 3 and 4 (Page 112) for more explanation.

Guide the students to learn how to use the graph to convert units and to understand the scale of the graph as well, so they can read off small units easily.

Exercise 9.4 (Pages 114–116)

Guide the students to answer Questions 1 to 3 (Page 114) in the classroom.

Give the students Questions 4–6 (Pages 115–116) as an assignment.

Chapter 10 Expansion and factorisation of algebraic expressions

Objectives

By the end of this chapter, the student will be able to:

1 identify algebraic terms and perform basic operations involving directed algebraic terms;

2 evaluate algebraic expressions by substitution;

3 expand algebraic expressions;

4 factorise simple algebraic expressions; and

5 simplify algebraic expressions involving fractions.

Algebraic terms (Page 119)

Though the concept of algebraic terms, expressions and co-efficient have been introduced to students in JSS 1. Care should be taken to differentiate between algebraic terms and expressions, e.g. $3x$ is an algebraic term, while $(3x + 2y)$ is an algebraic expression.

The students should be reminded that when two or more algebraic terms are joined together by any, or combination of, addition, subtraction, multiplication and division, the result is called an **algebraic expression.**

Exercise 10.1 (Page 119)

Although this exercise can easily be done orally, it is preferable that the results are written down in order to give the students the opportunity of writing algebraic terms and expressions.

Directed algebraic terms (Pages 119 and 120)

Like directed numbers, directed algebraic terms have positive and negative signs associated with each term. See page 119 for the multiplication and division rule and Example 1, page 120 shows the operation of directed algebraic terms.

Exercise 10.2 (Page 120)

Lead the students to solve Questions 5–12 (Page 120) in the classroom while Questions 20–24 (Page 120) should be given as an assignment.

Substitution (Page 120)

In the substitution of numerical values for variables, care should be taken to consider the signs of the numerical values as well.

E.g. If $x = 3$, $y = -2$ and $z = 5$, find $x^2 + xy + z^2$.

$$x^2 + xy + z^2 = (3)^2 + (3)(-2) + (5)^2$$

$$= 9 - 6 + 25$$

$$= 3 + 25$$

$$= 28$$

The solution is to be followed step-by-step so as not to lose focus. See Examples 2 and 3 for more explanations.

Exercise 10.3 (Page 121)

Such Questions as, 18, 24 and 25 need to be given attention because of the multiple operations involved. Students should be advised to simplify the numerator and the denominator separately to avoid any mix-up.

Expansion of algebraic expressions (Page 121)

When algebraic expressions need to be simplified, the brackets will have to be removed or opened by a process called **expansion**,

e.g. **1** $3(5x - 2y) = 3(5x) - 3(2y) = 15x - 6y$

2 $(4a - b)(-2) = 4a \times (-2) - b \times (-2)$

$= -8a + 2b$

The multiplier with which to remove the bracket can be before the bracket or after the bracket.

Note the sign combinations in expansion of algebraic expressions,

e.g. **+ × + = +, – × – = +, – × + = – and + × – = –**

Remind the students by asking them questions orally.

Exercise 10.4 (Page 122)

Give Questions 1–10 (Page 122) to the students to solve in the classroom. Mark and give corrections, carrying all the students along.

It is suggested that Questions 15–20 (Page 122) be given as an assignment.

Expansion of algebraic expressions of the form $a(b + c)$, $a(b–c)$ (Page 122)

Guide the students to this type of problem by leading them to some examples:

1 $3x(4y + z) = 3x \times 4y + 3x \times z = 12xy + 3xz$

2 $2(3a - b) - 3(a - 4b) = 2 \times 3a - 2 \times b - 3 \times a + 3 \times 4b$

$= 6a - 2b - 3a + 12b$

$= 6a - 3a + 12b - 2b$

$= 3a + 10b$

Expansion of algebraic expressions of the form $(a + b)(c + d)$ and $(a - b)(c - d)$

$(a + b)(c + d) = a(c + d) + b(c + d)$

$$= ac + ad + bc + bd$$

$$(a - b)(c - d) = a(c - d) - b(c - d)$$

$$= ac - ad - bc + bd$$

See Example 6 (Page 124) for easy explanation and learning.

Exercise 10.5 (Page 124)

Give the students Questions 18–25 (Page 124) to solve as an assignment.

Factors and multiples of algebraic terms (Page 124)

Factors of a number divide the number without a remainder, e.g. 1, 2, 3, 4, 6 and 12 are factors of 12

Factors of 12*ab* are:

1, 2, 3, 4, 6, 12, *a*, 2*a*, 3*a*, 4*a*, 6*a*, 12*a*, *b*, 2*b*, 3*b*, 4*b*, 6*b*, 12*b*, *ab*, 2*ab*, 3*ab*, 4*ab*, 6*ab*, and 12*ab*.

Guide the students to learn how to find the factors and highest common factor as explained in Example 7 (Page 124).

Exercise 10.6 (Page 125)

Give the students the questions in Exercise 10.6 (Page 125) as an assignment. Mark and give the necessary corrections.

Exercise 10.7 (Page 125)

The solutions to the questions in this exercise can be discussed orally with the students.

Binomial factorisation (Page 125)

Guide the students to learn that binomial means containing two terms only,

e.g. $8x^2 + 12xy$, $abc - b^2c$, etc.

Challenge the students to give their own examples. If possible, all the students should give examples of binomial expression.

Lead the students to learn the solutions to Examples 8(a–e), page 125.

Exercise 10.8 (Page 126)

Lead the students to solve the questions in the classroom with a few ones given as homework. Students are now familiar with algebraic expressions and fraction skills.

Simplifying algebraic expressions involving fractions (Page 126)

Expressions like $\frac{x}{4}, \frac{3x}{7}, \frac{2}{x}$ etc .are algebraic fractions containing numerators and denominators. These can also be expressed as equivalent fractions.

Guide the students to understand that algebraic fractions are similar to ordinary fractions.

See Example 9 (Page 126) for easy explanation and learning of equivalent fractions.

Exercise 10.9 (Page 127)

Give Questions 1–5 to the students to solve (or you can discuss it orally with the students). Then Questions B (1–4) and C (1–4) (Page 127) can be given as an assignment.

Basic operations involving algebraic fractions (Page 127)

Guide the students through the solution to Example 10 (Page 127)

Exercise 10.10 (Page 128)

Solve Questions 1–4 (Page 128) as examples in the classroom with students participating actively.

Give the students Questions 11–19 (Page 128) to solve as homework. Mark and give the necessary corrections so as to evaluate their understanding of the topic.

Give the questions in Quantitative reasoning 10 (Page 128) as an assignment and Revision exercise 10 (Pages 129 and 130) as class test.

Chapter 11 Simple equations

Objectives

By the end of this chapter, the student will be able to:

1 solve problems on simple equations using the balance method;

2 solve simple equations by collecting like terms;

3 solve simple equations involving brackets; and

4 interpret and solve word problems involving simple equations.

Solving equations by the balance method (Page 131)

Solving an equation means to find the value of the unknown variable that will make the left hand side equal to the right hand side,

e.g. $x - 3 = 2$

$x - 3 + 3 = 2 + 3$

$x = 5$

Guide the students to realise that the balance method involves performing the same operations on both sides of the equation.

See Example 1 (Pages 131 and 132) for easy explanation and learning.

Let the students realise the importance of drawing the scale and its application.

Exercise 11.1 (Pages 132 and 133)

This exercise can be done in the workbook, as the scales are already drawn there. This will take care of the stress of drawing the scale.

Solving equations by collecting terms (Page 133)

Ask the students relevant questions to remind them of like and unlike terms,

e.g. $2x$ and $-3x$ are like while $3x$ and $3y$ are unlike terms.

This concept is about grouping all like terms, especially the unknown terms on one side, and unlike terms, the numbers, on the other side,

e.g. $8x - 6 = 3x + 9$

$8x - 3x = 9 + 6$

$5x = 15$

Divide both sides by 5

$$\frac{5x}{5} = \frac{15}{5}$$

$\therefore \quad x = 3$

See Examples 2(a) and (b) (Page 133) for easy explanation and learning.

Exercise 11.2 (Page 134)

Solve Questions 16–20 (Page 134) as examples in the classroom, allowing the students to fully participate in the solution.

Give the students Questions 9–15 (Page 134) as an assignment. Mark and give the necessary corrections.

Equations involving brackets (Page 134)

Ask the students question on how to remove brackets in an algebraic expression, e.g. $2(3x + 4y) = 6x + 8y$.

When given an equation involving brackets, first remove the brackets and collect like terms for the solution,

e.g. $5(5x - 2) - 9(3x - 2) = 2$

$25x - 10 - 27x + 18 = 2$

$25x - 27x + 18 - 10 = 2$

$-2x = 2 + 10 - 18$ (Divide both sides by –2)

$$\frac{-2x}{-2} = \frac{-6}{-2}$$

$$x = 3$$

See Examples 3(a and b) (Page 134) for easy explanation and learning.

Exercise 11.3 (Page 134)

Give the students Questions 1–5 (Page 134) to solve as an assignment. Mark and give the necessary corrections.

Equations involving fractions (Page 135)

Give and explain the following steps to be followed in solving equations involving fractions:

i) Clear the fractions by multiplying each term in the equation by the LCM of the denominators.

ii) Clear brackets if available.

iii) Collect like terms and solve completely.

See Examples 4(a) and 4(b) (Page 135) for easy explanation and learning.

Exercise 11.4 (Page 135)

Solve some of the equations in the exercise as examples for the students, e.g. solve the equation.

$$\frac{x+2}{2} - \frac{x-1}{3} = \frac{x}{4} \quad \text{(LCM = 12)}$$

Multiply each term by 12, the LCM of the denominators.

$$\frac{x+2}{2} \times 12 - \frac{x-1}{3} \times 12 = \frac{x}{4} \times 12$$

$$6(x + 2) - 4(x - 1) = 3x$$

$$6x + 12 - 4x + 4 = 3x$$

$$6x - 4x - 3x + 12 + 4 = 0$$

$$-x = -12 - 4$$

$$-x = -16 \quad \text{(Divide both sides by } -1\text{)}$$

$$\therefore \quad x = 16$$

Give the students Questions 5–10 (Page 135) to solve as an assignment. Mark and give the necessary corrections.

Word problems involving equations (Page 136)

Give attention to the interpretation of word problems into mathematical equations.

Explain the meaning and interpretation of words, such as:

i) sum

ii) difference

iii) product

iv) quotient

Guide the students to realise that only correctly interpreted word problems will give the correct answers.

See Examples 5–7 (Page 136) for easy explanation.

Exercise 11.5 (Page 137)

Give the students Questions 5–10 (Page 137) to solve in the classroom under your supervision.

Mark and give the necessary corrections so as to evaluate their understanding of the topic.

Chapter 12 Linear inequalities in one variable

Objectives

By the end of this chapter, the student will be able to:

1 identify and solve linear inequalities in one variable;

2 represent solutions of linear inequalities in one variable on the number line; and

3 solve word problems involving linear inequalities.

Inequality symbols (Page 139)

$>$	=	greater than
$<$	=	less than
$\geq$	=	greater than or equal to
$\leq$	=	less than or equal to

See Examples 1(a)–(e) (Page 140)

Exercise 12.1 (Page 140)

The questions here can be given to the students as classwork under your supervision.

Exercise 12.2 (Page 140)

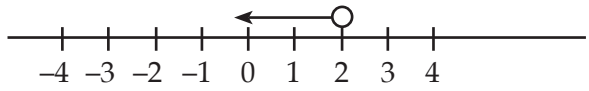
The questions here can be given to the students as an assignment.

The graphs of linear inequalities in one variable is the number line. (Page 141)

Guide the students to learn how to represent the solution of linear inequalities in one variable graphically, stressing the starting point and the direction of movement.

See the illustrations on page 141.

E.g. $x < 2$



Exercise 12.3 (Page 141)

Give the students Questions 5–10 (Page 141) as classwork under your supervision. Mark and give the necessary corrections so as to evaluate their understanding of the topic. You can pick some questions from the same exercise, e.g. Questions 11, 13, 14 and 19 as examples and guide the students on how to solve the inequalities before representing on a number line,

e.g. **1** $\frac{x}{3} > 5 \Rightarrow x > 15$

2 $2(x - 1) < 3x$

$2x - 2 < 3x$

$-2 < 3x - 2x$

$-2 < x$

or $x > -2$

Give the remaining questions to students to solve as homework.

Guide the students to learn how to interpret number lines into inequality.

Exercise 12.4 (Pages 141 and 142)

Solve some as examples and give the students Questions 5–10 to solve as an assignment.

Multiplication and division of negative numbers (Page 142)

Under this topic, you apply the operations of signs similar to directed numbers.

Solution of linear inequalities in one variable (Page 142)

It should be noted that when both sides of an inequality is multiplied or divided by a negative number, the inequality is reversed,

e.g. $-3x > 6$

$\Rightarrow \quad x < -2$

See Examples 2(a–e) (Page 143) for easy explanation and learning.

Exercise 12.5 (Page 144)

Give the students Questions 9–15 (Page 144) to solve in the classroom under your supervision and give Questions 16–20 (Page 144) as an assignment.

Guide the students to learn the solution to Examples 3(a) and (b) (Page 144).

Exercise 12.6 (Page 144)

Give the students Questions 5–10 (Page 144) to solve as an assignment.

Word problems involving linear inequalities (Page 145)

Remind the students of the steps to take to interpret word problems into numerical expressions.

See Example 4 (Page 145) for easy explanation and learning.

Exercise 12.7 (Pages 145 and 146)

Give the students Questions 5–10 (Pages 145 and 146) to solve as an assignment.

Chapter 13 Graphs

Objectives

By the end of this chapter, the students will be able to:

1 identify the x-axis and y-axis;

2 plot points on the Cartesian plane;

3 plot graphs of linear equations in two variables;

4 plot linear graphs involving real-life situations; and

5 interpret given information from real-life graphs.

Coordinates (Page 149)

Coordinates of a point are usually ordered pairs comprising the x coordinate which comes first, and then the y coordinate which comes second,

e.g. (x, y) e.g. $A(3, 5)$

See Fig. 13.1 (Page 149) and Fig. 13.2 (Page 150). Guide the students to learn how to locate a point on the Cartesian plane through the coordinates and how to plot a point on a plane.

Exercise 13.1 (Page 150)

This exercise evaluates the students' understanding of the coordinates of points on a Cartesian plane.

Guide the students to answer the questions in the classroom.

Lead the students on how to solve and understand Examples 1 and 2 (Pages 150 and 151).

Exercise 13.2 (Page 152)

Give the students the questions to solve in the classroom under your supervision.

Take adequate care in explaining how to choose scales when plotting graphs. Choosing a correct scale is an important part of plotting good graphs. Figs 13.5, 13.6 and 13.7 (Pages 152 and 153) are ready-made grid and Cartesian planes to explain the concept of choosing correct scales for plotting graphs.

Exercise 13.3 (Page 153)

This exercise evaluates the students' ability to choose correct scales and read graphs.

Guide the students to solve the questions in this exercise. Make the necessary corrections.

Linear graphs (Page 153)

Linear graphs can be continuous or discontinuous. See Figs 13.9, 13.10 and 13.15 (Pages 155–161). Guide the students to learn the solutions as explained in Examples 3 and 4 (Pages 154 –155).

Take adequate time and care to explain how to read graphs as most students find this aspect difficult.

Exercise 13.4 (Pages 156 and 157)

Guide the students to learn how to solve Questions 1–3 (Page 156) in the classroom. Allow the students to perform the major tasks with only little guidance.

Give the students Questions 5–7 (Page 157) as an assignment.

When a straight line is plotted, such that other relative information cannot be obtained from the graph, it is called a **discontinuous graph**.

Guide the students to learn Example 5 (Pages 157 and 158) in the classroom under your supervision.

Distance-time graphs (Page 160)

Distance-time graphs are useful in many areas of real-life activities, e.g. service scheduling and internal planning.

Allow the students to participate by giving other applications of distance-time graphs. See Fig. 13.14 on page 160.

Guide the students through Example 6 (Pages 160–162) so as to understand the application of distance-time graphs.

Allow the students to perform the major tasks with your guidance.

Conversion graphs (Page 162)

Conversion graphs are practically applied in real-life activities, such as the conversion of currencies, investments, interest rates and units of measurement.

Guide the students through Example 7 (Page 163) to apply in explaining the usefulness of conversion graphs.

Exercise 13.6 (Pages 163)

Guide the students to solve Questions 1–5 (Page 163) in the classroom, under your supervision.

Exercise 13.7 (Page 163–165)

This exercise will evaluate the students' understanding of the topic so far. Give the students Questions 1–5 (Pages 163–165) as an assignment.

However, you should endeavour to solve the problems as corrections even if they all attempted the questions.

Tables of values for linear equations (Page 165)

A table of values for any linear equation is obtained by mere substitution of the given range of values into the functions. See Example 8 (Page 165) for easy explanation and learning. When a graph of y against x is plotted for linear function, we get a straight line.

Lead the students to learn and apply the steps given on page 166.

Guide the students through Examples 9–16 (Pages 166–170)

Exercise 13.9 (Page 170)

Guide the students to learn the solution to Questions 2 and 3 (Page 170) as classwork. Mark and give the necessary corrections so as to evaluate their understanding of the topic.

Questions 5 and 6 (Page 170) are suggested as homework for the students.

Give the questions in Revision exercise 13 (Page 171) as a class test and the questions in Quantitative reasoning 13 (Page 172) as home work to solve at home.

Chapter 14 Plane shapes

Objectives

By the end of this chapter, the students will be able to:

1 state the properties of plane shapes such as triangles, trapezium, rectangles and squares;

2 identify and define quadrilaterals;

3 identify the properties of parallelograms, rhombuses and kites;

4 identify similarities and differences between quadrilaterals and discover connections between them; and

5 form patterns from plane shapes.

Plane shapes (Page 173)

This chapter adopts the activity approach whereby the students discover the properties of plane shapes by cutting, folding, observing and measuring. Students will need their mathematical instruments while you should supply cardboard paper, solid shapes and scissors. It is advisable and more appropriate for you and the class to work together.

Triangles (Page 173)

Point out the different types of triangles as shown in Figs 14.1, 14.2, 14.3 and 14.4 (Pages 173 and 174) and allow the students to discover their properties, similarities and differences.

Guide the students to discover the lines of symmetry through folding only.

Exercise 14.1 (Page 175)

This exercise tests the students' ability to find the similarities and differences between the

various types of triangles, and other plane shapes.

Quadrilaterals (Page 175)

Guide the students to remember and answer questions relating to the general properties of all quadrilaterals.

Lead them through Activities 14.1–14.4 (Pages 175–178) to discover the properties of the parallelogram, rhombus, kite and isosceles trapezium.

It has been discovered that students learn faster through activities when they are fully involved. All the students should actively participate in the activities.

Ask questions based on the following:

a) the number of lines of symmetry of each of the quadrilaterals as a basis for their similarities and differences.

b) the relationship between the diagonal lines, as regards the length, the angle formed at the centre and the angle made with the sides.

Exercise 14.2 (Pages 178 and 179)

The exercise evaluates the students understanding of the activities earlier carried out.

Questions 1–4 can be discussed together with the class. All the students must participate.

The last sets of questions in the exercise are nice for homework for the students. However, the corrections are to be given in the classroom.

Similarities and differences between quadrilaterals (Page 180)

Cut pieces in the shape of the quadrilaterals from cardboard paper and actively involve the students in stating the similarities and the differences, e.g. both a square and a rectangle have diagonals that bisect each other, but a square has four lines of symmetry while a rectangle has only two.

Guide the students through the similarities and differences as itemised on page 180.

Connections between quadrilaterals (Page 181)

This gives the summary of the definitions of the quadrilaterals. From the definitions, it can

be seen that squares are special quadrilaterals because they have properties of rectangles, rhombuses and parallelograms.

See Fig. 14.18 (Page 181) for easy explanation and learning. Using the arrows in the figure, the following conclusions can be arrived at:

1 a square is both a rectangle and a rhombus.

2 a rhombus is both a parallelogram and a kite.

3 also, squares, rhombuses and rectangles are special parallelograms.

– Note that not all parallelograms can be squares, rectangles or rhombuses.

Exercise 14.3 (Page 181)

These questions can be given to the students as both classwork and homework. Adequate care should be given to grade answers and give corrections where necessary.

Patterns (Page 182)

Plane shapes can be filled together to make interesting designs. Common plane shapes, when arranged by repeating, build up into a pattern.

Engage the students to make different patterns, using plane shapes.

Exercise 14.4 (Page 182)

Give the students the questions in this exercise as classwork.

Revision exercise 14 (Page 183)

Give the students this exercise as an assignment.

Chapter 15 Scale drawing

Objectives

By the end of this chapter, the students will be able to:

1 discover the meaning of scale, and convert actual measurement to a scale and vice versa;

2 apply scale to drawing lengths and calculating distances in real-life; and

3 interpret maps and drawings accurately, using scale drawing.

Scale (Page 185)

A **scale** is the relationship between the actual size of an object and the size that represents it, e.g. 1 cm: 3 cm means that the length of 1 cm represents 3 cm in actual size.

See Activity 15.1 (Page 185)

Guide the students to study and understand the activity while performing it in the classroom. This will enable them to understand the topic better.

$$\text{Scale} = \frac{\text{Actual size of the object}}{\text{Corresponding length on a drawing}}$$

Scale drawing (Page 186)

Professionals, such as architects and engineers draw the plans of houses and roads for construction.

Scale drawing is also useful when making technical drawings. In addition, maps are useful for geographers, sailors and so on.

The maps here are drawn and reduced to a reasonable size. The students are to make meaningful contributions to the discussion so as to carry them along.

Guide the students to learn the solution to the questions given in Examples 1, 2 and 3 (Pages 186 and 187).

Exercise 15.1 (Pages 187 and 188)

The first sets of questions can be discussed together with the students in the classroom. These centre on finding the scale in given diagrams and the application of scale in solving problems.

Questions 25–27 (Page 188) are suggested as an assignment for the students. The homework should be marked and the necessary corrections given so as to evaluate their understanding of the topic.

Application of scale drawing (Page 188)

This requires active participation of the students as the drawing needs attention to carry out. See Examples 4 and 5 (Pages 188 and 189).

Guide the students to study the application of scale drawing in solving practical problems.

Exercise 15.2 (Pages 189–190)

The questions in this exercise (Especially Questions 1 and 2) can be given as a project work to the students.

Questions 1 and 2 are more practical on the field and in the classroom. It is advisable to group the students into four or five groups, depending on the size of the class. Supervise the project work.

Maps and drawings (Page 191)

A map is a drawing of an area of land showing rivers, roads, mountains and cities. A map can also be a drawing of a whole country or several countries, e.g. the map of Nigeria or of the world. See Fig. 15.12 (Page 192).

To find the distance between two places on a map, it is advisable to use thread and later get the length on a scale rule. The actual length of the distance can be determined, using a scale.

Exercises 15.3, 15.4 and 15.5 (Pages 191–193)

These exercises evaluate the knowledge of finding the distances between two places on a map and how to locate the position of a place or a point on a map. Most of the questions here are to be discussed with the students in the classroom.

Revision exercise 15 (Page 195 and 196) can be given to the students as class test while Quantitative reasoning 15 should be given as homework.

Chapter 12 Angles in a polygon

Objectives

By the end of this chapter, the students will be able to:

1 solve problems involving angles between lines and angles at a point.

2 calculate angles in triangles;

3 calculate angles in quadrilaterals;

4 define and name types of polygons;

5 derive the formula for the sum of angles in a polygon; and

6 calculate angles in a convex polygon, using formula.

Properties of angles (Page 197)

Revise the following properties of an angle taught the students in JSS 1.

a) Angles on a straight line sum up to 180° (supplementary).

b) Angles at a point sum up 360°.

c) Vertically opposite angles are equal.

d) When a transversal cuts across a pair of parallel lines:

i) corresponding angles are equal.

ii) alternate angles are equal.

iii) the sum of two interior angles is 180°.

iv) vertically opposite angles are equal.

It is very important that diagrams are drawn to revise and explain the angle properties given above. See Figs 16.1, 16.2, 16.3 and 16.4 (pages 197–198). Examples 1 and 2 (page 198) can as well be used for this purpose.

Exercise 16.1 (Page 199)

This exercise evaluates the angle properties given above. Questions 1, 2 and 7 evaluate angles on a straight line, Questions 3, 4, 8, 9 and 10 evaluate vertically opposite angles and angles at a point and Questions 5, 6, 11 and 12 deal with angles between parallel lines (corresponding, alternate and co-interior angles).

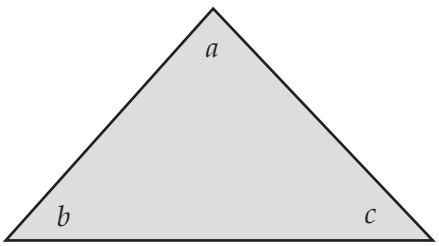
Some of these questions can be given to the students to solve so as to evaluate their understanding of the topic.

Angles in a triangle (Page 200)

Revise the following general properties of triangles with the students.

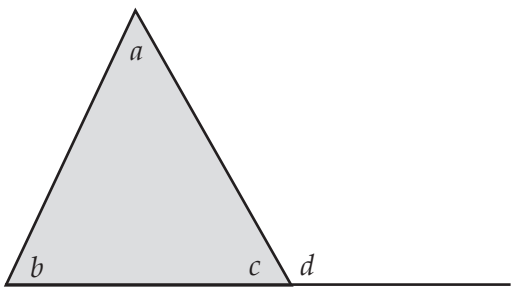
1 The sum of angles in a triangle is 180°, e.g.

$a + b + c = 180°$



2 The exterior angle of a triangle is equal to the sum of the two opposite interior angles, e.g.

$a + b = d$



It is highly recommended that the diagrams are given to make explanation better.

Study the solution to Examples 3(a–d) (Pages 200 and 201) with the students in the classroom. Challenge the students to answer most of the questions while you only guide them.

Exercise 16.2 (Pages 201 and 202)

This exercise tests the understanding of the students on the angle properties of triangles.

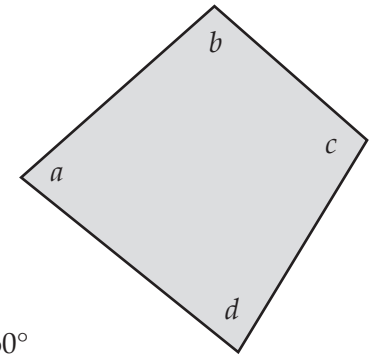
Some of the questions can be given to the students to solve as classwork under your supervision while some can be given as an assignment.

Angles in quadrilaterals (Page 202)

Revise the definition of quadrilaterals with the students while they give examples based on the definition, e.g. rectangle, square, kite, rhombus, parallelogram and trapezium.

Revise the angle properties of quadrilateral with the students.

E.g. sum of angles in a quadrilaterals is 360°, i.e.



$a + b + c + d = 360°$

Explain the solutions to Examples 4–6 (Pages 202 and 203) to the students as examples in the classroom, while allowing them to do the bulk of the work.

Exercise 16.3 (Pages 203 and 204)

Give the students some of the questions to solve as classwork while some can be given as an assignment.

Polygons (Page 204)

A closed plane figure bounded by straight lines (edges) is called a **polygon** e.g. triangle, quadrilateral, pentagon and hexagon.

Explain or revise when a polygon is said to be regular, convex and concave (re-entrant), giving examples and diagrams. Examples of regular polygons include equilateral triangle and square. See Figs 16.25(a) and (b) (Page 205).

Challenge the students to give the names of polygons according to the number of sides.

See Table 16.1 (Page 205).

Sum of interior angles in a polygon (Page 205)

Guide the students through the Activity 16.1 (Page 205) and Table 16.2 (Page 206) to determine the formula for finding the sum of interior angles in a polygon.

Lead them to derive the formula below.

Sum of interior angles in a polygon = $(n - 2) \times 2$ right angles

$= (2n - 4) \times$ right angles

$\therefore$ sum $= (n - 2) \times 180°$ or $(2n - 4) \times 90°$

Similarly, the sum of exterior angles of an n-sided polygon is 360°.

Remember to add the following for regular polygons.

Each interior angle = $\frac{(n-2)\times 180°}{n}$ and each exterior angle = $\frac{360°}{n}$,

where n = number of sides.

Lead the students through the solutions to Examples 7–10 (Pages 206 and 207).

Exercise 16.4 (Page 207)

Give the students some of the questions (especially in the modified JSCE) to solve under your supervision. Some of the questions can as well be given as an assignment.

Chapter 17 Angles of elevation and depression

Objectives

By the end of this chapter, the student will be able to:

1 distinguish between horizontal and vertical planes;

2 discover what angles of elevation and depression mean;

3 discover the relationship between angles of elevation and depression; and

4 calculate heights and distances, using scale drawing.

Horizontal and vertical planes (Page 210)

A **plane** is a flat surface that goes on forever in all directions.

Any plane surface that is parallel to the surface of the ground is called the **horizontal plane**, e.g. the top of a desk.

On the other hand, any plane surface that makes angle 90° (right angle) with the horizontal is referred to as the **vertical plane**, e.g. the wall of the classroom.

Endeavour to use examples in the students' immediate environment e.g. flag pole, electric pole and wall of a fence.

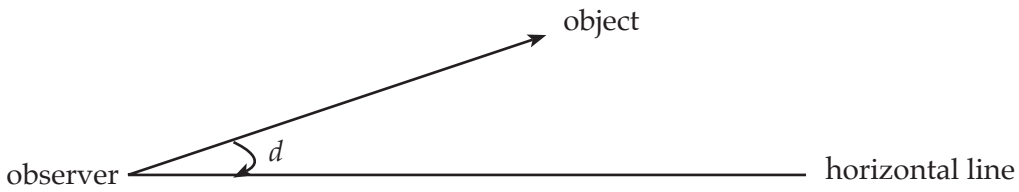
Ask the students to mention objects that are horizontal or vertical in the classroom or within the school compound. This will arouse their interest.

Angle of elevation (Page 210)

The angle between the horizontal and the line of sight of an object above the eye level is called the **angle of elevation**. See the illustrations in Figs. 17.1 and 17.2 (Pages 210 and 211).

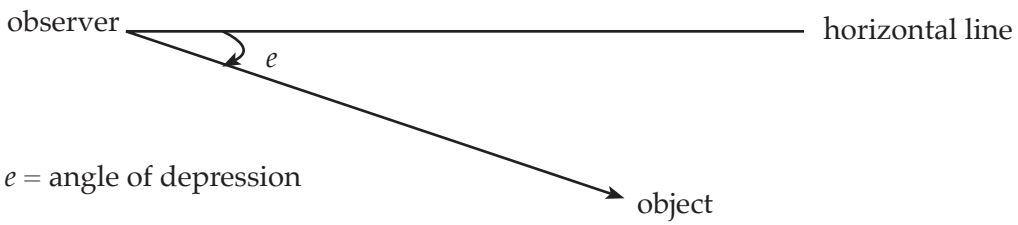
Guide the students to realise the importance of the horizontal line on the angle of elevation,

e.g. d = angle of elevation



Angle of depression (Page 211)

When the object is lower than the horizontal line, then the angle formed between the horizontal line and the object line is the **angle of depression**, e.g.



Hence the angle of depression is the angle between the horizontal and the line of sight of an object below the eye level.

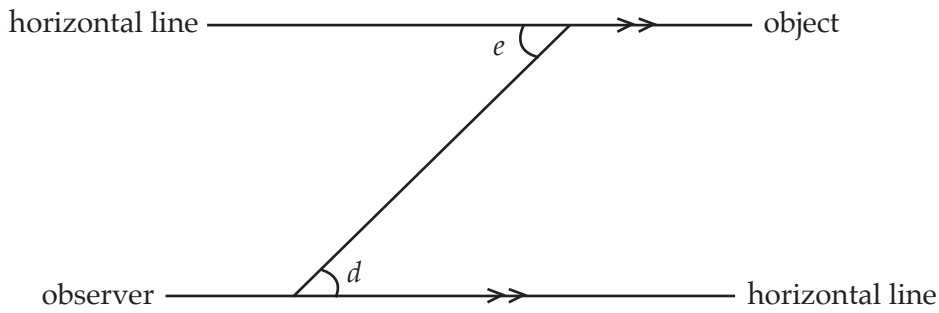
See Fig 17.3 (Page 211) for easy explanation and learning.

Guide the students through Activity 17.3 (Page 211). This will assist the students in understanding the difference between angle of elevation and angle of depression.

Relationship between angles of elevation and depression (Page 211)

Guide the students through Fig. 17.4 (Page 211). Diagram can be drawn on the board, using a number of students in class. This will bring familiarity into the teaching of the topic.

Remind the students of the condition under which two angles are alternate, as this is required in the relationship between angles of elevation and depression. The angle of elevation of an object from an observer is equal to the angle of depression of the object



The two horizontal lines are parallel hence, $e = d$ (alternate angles)

Exercise 17.1 (Page 212)

Discuss the questions given in this exercise in the classroom with the students participating fully.

Measuring angles of elevation and depression (Page 212)

A clinometer is used in measuring angles of elevation and depression. See Fig. 17.9 (Page 212).

Guide the students to design a clinometer as given on page 212 and carry out Activity 17.4 (class project) under your supervision. The class can be grouped into four or five students depending on the size of the class.

Calculating heights and distances, using scale drawing (Page 213)

Revise scale drawing with the students.

Guide the students through the solutions to Examples 1 and 2 (Pages 213 and 214) on the use of scale drawing in finding heights and distances.

Exercise 17.2 (Pages 214 and 215)

This exercise centres on the application of scale drawing in finding heights and distances

in practical or real-life situations. Some of the questions are suggested to be solved in the classroom, with the students expected to participate actively.

Revision exercise 17 (Page 215)

Some of the questions can be given to the students to solve as an assignment.

Chapter 18 Bearings and distances

Objectives

By the end of this chapter, the students will be able to:

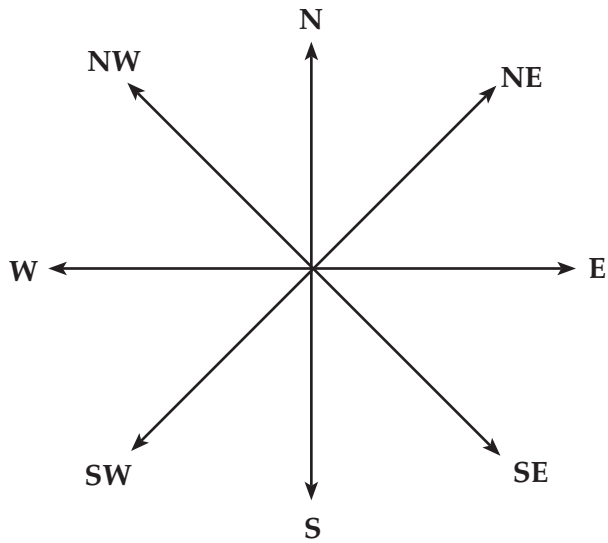
1 identify the cardinal points;

2 use bearings to locate the positions of objects; and

3 use bearings and scale drawing to calculate distances between objects.

The cardinal points (Page 217)

The cardinal points are made up of primary directions of North, East, South and West (N, E, S, W) and secondary directions of North-East (NE), South-East (SE), South-West (SW) and North-West (NW).



Guide the students to learn that the angles between two consecutive directions, e.g. between North and North-East is 45°.

Use Figs 18.2 (a) and (b) (page 217) to explain the concept of clockwise and anticlockwise movements as it affects bearing.

Exercise 18.1 (Pages 217 and 218)

The questions here can be discussed orally.

Bearings (Page 218)

A **bearing** is an angle measured in a clockwise direction from the north. It is measured with an instrument called the magnetic compass. See Fig. 18.3 (Page 218).

A bearing can be an acute-angle bearing or a three-figure bearing. See pages 219–220.

Guide the students through the solution to Examples 1 and 2 (Page 219) so as to understand how to state the acute-angle bearing of a point.

Exercise 18.2 (Page 220)

This exercise evaluates the students' ability to state the acute-angle bearing of points.

An acute-angle bearing can be changed to a three-figure bearing and vice versa. See page 220.

Exercise 18.3 (Page 221)

The exercise centres on the conversion between acute angle bearings and three-figure bearings.

The questions here can be given to the students as classwork under your supervision.

Exercise 18.4 (Pages 222 and 223)

This exercise basically evaluates the students' ability to solve problems on bearings, using the three-figure bearings.

Bearings and distances, using scale drawing (Page 223)

The application of scale drawing in solving problems is not new to the students, as they have already done this in angles of elevation and depression.

Guide the students through the solutions to Examples 4 and 5 (Pages 223 and 224).

It is advisable that the scale drawing of these questions be carried out in the classroom with full participation of the students; the scale should be followed strictly.

Exercise 18.5 (Pages 224–225)

Solve some of the problems in this exercise as examples to the students. The other ones can be given as project work while the students are grouped.

Surveying (Page 225)

Surveying is the science of finding out the exact details about the shape and size of any portion on the surface of the earth.

An examination of an area of land, city, state, country, etc. in order to make a map of it, is also known as survey.

See Figs 18.20 and 18.21 (Page 226)

When a survey is done, a scale drawing of the required portion can be made.

Explain the illustrations given by Figs 18.20 and 18.21 (Page 226) thoroughly.

Exercise 18.6 (Page 226)

These questions can be given as classwork since they are to be answered from the survey given in Figs 18.19 and 18.21.

Revision exercise 18 (Page 227)

This exercise centres on the evaluation of the students based on what was discussed in the chapter. Some of these questions can be given as an assignment or classwork.

Chapter 19 The Pythagoras rule

Objectives

By the end of this chapter, the students will be able to:

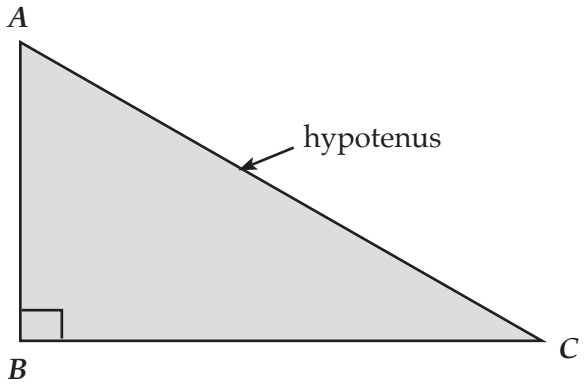
1 discover and state the Pythagoras' rule;

2 discover the Pythagorean triple; and

3 apply the Pythagoras' rule to solve problems involving triangles.

The right-angled triangle (Page 229)

The right-angled triangle is a triangle in which one of the angles is equal to 90°. Revise this definition with the students and challenge them to draw the right-angled triangle.



$\hat{B}$ =90° = a right-angle, hence $\triangle ABC$ is a right-angled triangle.

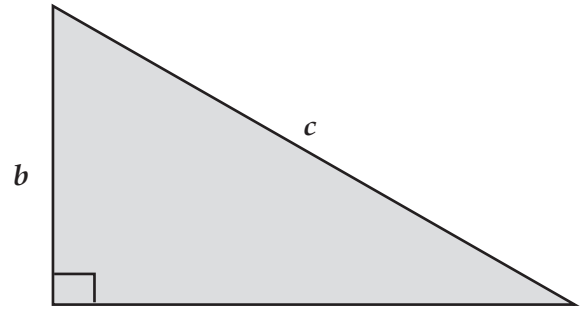
Take adequate care in explaining how to determine the hypotenuse in a right-angled triangle.

The hypotenuse is the side facing the right angle and/or the longest side of the triangle.

Pythagoras' rule (Page 229)

Guide the students through Activity 19.1 (Pages 229–231) to derive the Pythagoras' rule for solving right-angled triangles.

Generally, here is a right-angled triangle with sides a, b and c below.



$c^2 = a^2 + b^2$

The Pythagoras' rule states that, in a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

Note the following in the statement of the rule and explain to the students:

i) the rule is only applicable to a right-angled triangle;

ii) the ability to determine the hypotenuse is very important.

The hypotenuse is the longest side of the three sides.

Guide the students through the solutions to Examples 1–3 (Pages 231 and 232).

Exercise 19.1 (Pages 232 and 233)

This exercise centres on the application of Pythagoras' rule in solving right-angled triangles.

Some of the questions can be solved in the classroom as examples.

The students should be given some of the questions to solve either as classwork or homework so as to evaluate their understanding of the topic.

Pythagorean triple (Page 233)

This is a set of three whole numbers a, b and c that satisfies the Pythagoras's rule $c^2 = a^2 + b^2$.

Examples are (3, 4, 5), (5, 12, 23), (8, 15, 17) and their multiples.

Give the students the opportunity to state examples of Pythagorean triples while you guide them.

Guide the students through the solutions to Examples 4 and 5 (Page 234) for them to understand the topic better.

Exercise 19.2 (Pages 234 and 235)

This exercise deals with evaluating the students' ability to find Pythagorean triples, and tests if a set of three whole numbers is a Pythagorean triple. It also tests the students' quantitative reasoning with regards to Pythagorean triples.

Application of Pythagoras' rule to real-life problems (Page 235)

The Pythagoras' rule can be used to solve problems related to real-life situations. When such questions are given, it is advisable to sketch the information in a diagram before solving the problem.

Guide the students through the solutions to Examples 6 and 7 (Page 235).

Let the students participate fully in solving the problems.

Exercise 19.3 (Page 236)

This exercise evaluates the students' understanding of the application of Pythagoras' rule to real-life problems.

As earlier given, it is very important to sketch a diagram representing the information so as to make solving the questions simple.

Some of the questions can be given to the students to solve under your supervision.

Revision exercise 19 (Page 238)

The revision exercise picks questions from all the sub-topics taught under the topic. The students can seize this opportunity to revise what they were taught.

Chapter 20 Geometrical constructions

Objectives

By the end of this chapter, the students will be able to:

1 bisect any given angle;

2 copy any given angle;

3 construct triangles given all the necessary information; and

4 construct common triangles.

Bisecting any given angle (Page 239)

Guide the students to know that construction is a process of making accurate drawing. The following mathematical instruments are essential.

i) A pair of compasses (it must be tight for accurate drawing).

ii) Ruler (the edge of the ruler must not be blunt).

iii) Pencil (the pencil must be hard and sharp-pointed).

Guide the students by following the steps in bisecting any given angle on pages 239–240.

Exercise 20.1 (Pages 240 and 241)

Lead the students in solving Questions 5(a) and (b) (Page 241) as classwork. Make sure that you supervise how the students use the mathematical instruments.

Guide them on how to use the mathematical instruments correctly. Refer them to the workbook on this exercise (bisection of angles).

Copying any given angle (Page 241)

Lead the students to the steps to follow when copying any given angle.

See page 241 for the steps.

Explain the steps by demonstrating it on the board.

Construction of triangle (given 3 sides) (Page 242)

Guide the students by demonstrating how to construct triangles when three sides are given.

Lead them to Example 1 (Page 242) and how to follow the steps.

Guide them to always follow the steps.

Exercise 20.2 (Pages 242 and 243)

Give the students Questions 7, 8, 9 and 12 (page 243) to solve as a classwork under your supervision. Mark and give the necessary corrections. Questions 3, 5, 6, 7, 10 and 11 are suggested as homework for the students.

Refer students to the workbook for more exercises.

Construction of a triangle, given two angles and a side (Page 244)

Guide the students through Example 2 (Page 244) and explain how to follow the steps.

Exercise 20.3 (Page 245)

Give the students Questions 1–5 as a classwork and supervise them. Mark their work so as to evaluate their understanding. Give them Questions 8–12 as an assignment. Refer students to the workbook for more exercises.

Construction of a triangle, given two sides and the included angle (Page 245)

Lead the students through the solutions to Example 4 (Page 246). Explain the steps and let the students understand the importance of it.

Exercise 20.4 (Pages 246 and 247)

Guide the students to solve Questions 2, 4, 6 and 8 (Page 241) as a classwork under your supervision. Mark and give the necessary corrections. Remember that construction is more of practical work so you need to be very careful when explaining your examples and corrections.

Give the students Exercises 1, 3, 5, 7, 10 and 11 as an assignment.

Construction of common triangles (Page 247)

The common triangles are:

1 equilateral triangle (equal angles and equal sides)

2 isosceles triangle (equal base angles and two equal sides)

The construction of these triangles are similar to the previous methods treated so far, depending on the information given.

Exercise 20.5 (Page 247)

Guide the students to solve Exercise 20.5 (Page 247) Questions 3–5 and 6–8 in the classroom under your supervision. Mark and give the necessary corrections. Questions 1, 2, 9 and 10 could be given as an assignment.

Chapter 21 Data presentation

Objectives

By the end of this chapter, the student will be able to:

1 construct a frequency table from a given set of data;

2 present statistical data in graphical forms such as pictograms, bar charts and pie charts; and

3 read and interpret information presented in graphical form.

Introduction (Page 249)

The students were taught how to collect and present data in a certain order in their JSS 1. This chapter should, therefore, expose them to several other methods of presentation of data, such as frequency table, pictogram, bar chart and pie chart.

Frequency table (Page 249)

Guide the students to revise the meaning of frequency and how to present data collected in a frequency table.

Frequency refers to the number of times a particular number or score occurs in a given set of data with the corresponding frequency attached to each score or a group of scores.

See Table 21.1 (Page 249).

Revise the use of tally marks in the preparation of frequency table as this makes the task easier.

Lead the students through Figs 21.1 and 21.2 (Page 250). This will enable them to understand the concept of tally marks as it relates to the preparation of frequency table, e.g. 13 = 𝍸 𝍸 III.

Guide the students through the solutions to Examples 1 and 2 (Page 250). This will expose them more to the rudiments of the preparation of a frequency table and interpreting it to solve given problems.

Exercise 21.1 (Pages 251 and 252)

This exercise treats and evaluates the ability of the students in preparing a frequency table and applying it in solving problems.

Some of the questions in the exercise can be given to the students to solve either as classwork or homework. Adequate time and care should be given to check the work and give the necessary corrections so as to evaluate their understanding of the topic.

These are the diagrammatic or graphical forms of representing data, e.g. pictogram, bar chart and pie chart. Newspapers and journals can be used as instructional materials here. Show the students how these pictorial means are used even in real-life situation.

The pictogram (Page 253)

This involves the use of pictures, hence it is otherwise called a **picture graph** or **ideograph**.

Guide the students to learn that it is clearer, easier and faster to obtain information from a pictogram than from the given raw data.

Lead the students through the solutions to Examples 3 and 4 (Pages 253 and 254).

Bar chart (Page 254)

In a bar chart, we use rectangular bars, blocks or columns to represent the data.

The following points should be discussed with the students as regards the representation of data in a bar chart:

i) Same width and equal spaces between the bars.

ii) the height of each bar or column represents the frequency or the number of times that each event occurs.

iii) the bars can either be drawn vertically or horizontally.

Guide the students through the solution to Example 5 (Page 254).

Pie chart (Page 255)

A pie chart is a circular graph which is divided into sectors, such that the angle at the centre is proportional to the frequency represented by each of the different parts.

See Fig. 21.6 (Page 255).

Guide the students to learn how to find the angle of each sector of a pie chart. Give and explain the following formula for that purpose.

Sectorial angle $= \frac{f}{N} \times \frac{360°}{1}$, where f = frequency of the particular item and N = sum of all the frequencies.

Lead the students through the solution to Example 6 (Page 255).

Exercise 21.2 (Page 256)

This exercise evaluates the students' ability to represent data pictorially.

Some of the questions in the exercise can be given to the students either as classwork or an assignment.

Revision exercise 21 (Pages 257 and 258)

The questions in this revision exercise tests the students understanding of the topic generally. Some of the questions can as well be given either as classwork or an assignment. You need to supervise the work so as to give the necessary corrections.

Chapter 22

Probability

Objectives

By the end of this chapter, the students will be able to:

1 discuss the occurrence of chance events in everyday-life;

2 define and explain the probability of an event;

3 determine the probability of sure events; and

4 apply probability to chance events in everyday-life.

Introduction (Page 260)

Certain events in our everyday-life activities occur by chance, and a chance event is one in which every possible outcome depends entirely on chance, and is not in anyway influenced by the conductor of the event. The measure of the chance or likelihood of an event happening is called **probability**.

Chances in everyday life (Page 260)

In our everyday-life, chances exist for certain events to occur. Lead the students through the explanation given.

Exercise 22.1 (Page 261)

Discuss with the class the chance elements in each of the situations given in the exercise. Allow the students to participate in the discussion.

Basic probability concepts (Page 261)

Take adequate time and care to explain the basic concepts of probability to the students. Their contribution is also important in this regard.

Sample space (Page 262)

A **sample space** is a list of all possible outcomes of a given experiment.

E.g. in a single toss of a die, the sample space, S, is

$$S = \{1, 2, 3, 4, 5, 6\}$$

Also, in a toss of two fair coins, the sample space S, is

$$S = \{HH, HT, TH, TT\}$$

Guide the students through the illustration given in Table 22.1 and Fig. 22.1 (Page 262).

The tree diagram should be greatly explained, using other illustrations as well. The students can also be made to give examples of sample space in a given situation.

Event (Page 262)

An **event** is a subset (part) of the sample space(s) chosen by a given rule.

For example, in a toss of two fair coins, let E be an event that at least one head occurs.

Thus, an event, E, becomes

$$E = \{HT, TH, HH\}$$

The meaning of probability (Page 262)

Probability refers to the study of random experiment. It is given as a fraction. Hence, the probability of an event, E, written as $\Pr(E)$, is given as

$$\Pr(E) = \frac{\text{Number of required outcomes}}{\text{Number of possible outcomes}}$$

Guide the students through the solutions to Examples 1, 2 and 3 (pages 262–263). Give and explain the basic facts about probability, with the students participating fully.

Lead the students through Activities 22.1, 22.2, and 22.3 (Pages 264 and 265) so as to enable the students to understand better.

Exercise 22.2 (Pages 265 and 266)

This exercise evaluates the students' ability to solve problems on the application of probability to real-life situations.

Some of the questions can be given as classwork under your supervision, while others are given as an assignment.

Revision exercise 22 (Pages 266 and 267)

This revision exercise centres on the test of the ability of the students to solve problems involving chances.