NEW GENERAL MATHEMATICS

for Junior Secondary Schools

JSS Teacher's Guide 3

2013 NERDC Curriculum

ZI Chima, GU Garba, AO Kalejaiye, MF Macrae

PEARSON

Pearson Education Limited
Edinburgh Gate
Harlow
Essex CM20 2JE
England
and Associated Companies throughout the world

First published in 2014

ISBN 9781447978343

Cover design by Dion Rushovich
Typesetting by Martingraphix

Acknowledgements:
The Publishers would like to thank the following for the use of copyrighted images in this publication:
Cover photo/artwork from Carol and Mike Werner/ Alamy / Afripics A09T98

Introduction

This is the first time in two decades that a teacher's component has been prepared for the *New General Mathematics* series, which previously consisted of the Student's Book and the Student's Practice Book. In this revision, the Student's Practice Book has been called the Workbook. This Teacher's Guide supports the *New General Mathematics* for Junior Secondary Schools 1–3 series as revised to align to the 2013 NERDC curriculum.

The Teacher's Guide contains:

- information on how to use the course as a whole
- a suggested scheme of work for the year and a curriculum matching chart
- additional chapters that were not included in the Student's Book. You can use these with your class, as time permits
- suggested lesson plans of how to break each chapter down into teachable portions, as well as notes on foundation knowledge required and assessment milestones
- printable test papers for the chapter revision and term revision tests
- answers for the puzzle corners, Chapter revision tests, and term revision tests, which were deliberately excluded from the Student's Book
- workbook marking sheets.

We hope that you will find this guide a useful resource for you as a teacher. We welcome any comments or suggestions you may have, and ask you to direct your comments through the publisher, using our website address *www.pearsonnigeria.com.*

Contents

Introduction . . . iii

JSS3 Scheme of Work and Curriculum Matching Chart . . . v

Methodology and Features of the Student Book, Teacher's Guide and Workbook . . . ix

Section 1: Additional material . . . 1

Preliminary chapter: Review of previous coursework . . . 2

Enrichment chapter: ICT and computers . . . 14

Section 2: Lesson plans . . . 20

Chapter 1 Binary system: Operations and applications . . . 21

Chapter 2 Word problems . . . 23

Chapter 3 Factorisation 1: Common factors . . . 25

Chapter 4 Geometrical constructions . . . 27

Chapter 5 Area of plane shapes . . . 29

Chapter 6 Formulae: Substitution; change of subject . . . 31

Chapter 7 Similarity 1: Similar shapes and scale factors . . . 33

Chapter 8 Trigonometry 1: Tangent of an angle . . . 35

Chapter 9 Factorisation 2: Quadratic expressions . . . 37

Chapter 10 Equations 1: Equations with fractions . . . 40

Chapter 11 Compound interest . . . 42

Chapter 12 Similarity 2: Area and volume of similar shapes . . . 44

Chapter 13 Proportion: Direct; inverse; reciprocal . . . 46

Chapter 14 Equations 2: Simultaneous linear equations . . . 48

Chapter 15 Trigonometry 2: Sine and cosine of angles . . . 50

Chapter 16 Everyday statistics . . . 52

Chapter 17 Rational and non-rational numbers . . . 54

Section 3: Revision tests . . . 56

Chapter revision test sheets . . . 57

Chapter revision test answers . . . 87

Term revision test sheets . . . 90

Term revision test answers . . . 116

Section 4: Workbook answer sheets . . . 118

Index . . . 179

JSS3 Scheme of Work and Curriculum matching chart

The chart on the following pages also appears in the Students' Book. It combines a Scheme of Work for JSS3 with corresponding themes and objectives that appear in the current NERDC basic mathematics curriculum for Junior Secondary schools.

Scheme of Work

The Scheme of Work appears in the three left-hand columns of the chart. The scheme follows the chapter order of *New General Mathematics* JSS Student's Book 3 and is based on an average school term of ten effective teaching weeks. For Terms 1 and 2, the chapters in the book have been carefully arranged in a sequence that combines a logical coverage of the curriculum topics with a spiral approach to learning. By spiral approach, we mean that instead of treating a curriculum theme (such as algebra) all at once, the chapters return to a theme during Terms 1 and 2, enabling step-by-step learning so as to develop competence and capacity over time. Term 3 is devoted to whole–course revision. In this case it is more appropriate to revise the course theme by theme.

Note that the Scheme of Work makes allowance for end-of-term revision and testing, an important component of the school year.

The chapter order provides a sound and carefully thought-out Scheme of Work. However, other schemes are perfectly possible. Your school, district or State may have a preferred approach. We advise that you follow the official scheme where it exists. Otherwise, simply follow the chapter order of *New General Mathematics* JSS Student's Book 3.

In Section 1 of this Teacher's Guide there is an enrichment chapter: ICT and computers. This chapter is only appropriate if students have access to computers and a relevant spreadsheet program. Refer to this chapter if possible, bearing in mind that it is not examinable at JSCE level.

Curriculum matching chart

The two right-hand columns of the chart show how, in Terms 1 and 2, the chapters of *New General Mathematics* JSS Student's Book 3 match with the National Curriculum as published by NERDC in 2013. The first column shows the five curriculum themes and related topics and the page number in the NERDC curriculum where they may be found. The curriculum themes are:

- Number and numeration
- Basic operations
- Algebraic processes
- Mensuration and geometry
- Everyday statistics

The final column contains related curriculum performance objectives.

Together, these columns show that *New General Mathematics* JSS Student's Book 3 fully covers the NERDC curriculum. However, due to space restrictions, NERDC references have been abbreviated. We advise that you refer to the full 36-page Mathematics Curriculum document (NERDC, 2013).

We wish to draw your attention to the performance objectives. The objectives state what students should be able to do after they have been taught a topic. Objectives are spelled out in full at the beginning of each chapter of New General Mathematics and are reflected in the Chapter Summary that appears at the end of the chapter. Each chapter contains an end–of–chapter test to help you to measure student attainment of the objectives.

Scheme of Work: JSS3, Term 1				Curriculum matching	
TERM 1	**NGM Ch no**	**Chapter title**	**Worksheet no**	**NERDC JSS3 Themes and Topics**	**NERDC JSS3 Performance Objectives**
Week 1	Pre 1	Review of previous coursework		Number and numeration Basic operations Algebraic processes Mensuration and geometry Everyday statistics	Content summary relating to NERDC performance objectives for JSS1 and JSS2
Week 2	Ch 1	Binary system: Operations and applications	1	Number & Numeration, p. 28 Sub-theme: Whole numbers Topic 1: Whole numbers Basic Operations, p. 30 Topics 1 – 4 Operations with base two numerals	Recall and use binary number operations Convert binary numbers to other bases and vice versa Solve QR problems on binary systems Add, subtract, multiply numbers in base two
Week 3	Ch 2	Word problems	2	Number & Numeration, p. 28 Sub-theme: Whole numbers Topic 1: Whole numbers	Translate word problems into numerical expressions
Week 4	Ch 3	Factorisation 1: Common factors	3	Algebraic Processes, p. 31 Sub-theme: Algebraic operations Topic 1: Factorisation	Factorise simple algebraic expressions Solve word problems involving factorisation
Week 5	Ch 4	Construction	4	Mensuration & Geometry, p. 35 Sub-theme: Shapes Topic 5: Construction	Revise line and angle bisection Construct angles of 90°, 45°, 60°, 30° Copy a given angle Construct simple shapes
Week 6	Ch 5	Area of plane shapes	5	Mensuration & Geometry, p. 34 Sub-theme: Shapes Topic 5: Area of plane figures	Find the area of triangles, parallelograms, trapeziums, circles, sectors Solve word and QR problems on area (in the home, the environment and in relation to land measure)
Week 7	Ch 6	Formulae: Substitution, change of subject	6	Algebraic Processes	Substitute values in a formula Change the subject of a formula
Week 8	Ch 7	Similarity 1: Place shapes, scale factor	7	Mensuration & Geometry, p. 33 Sub-theme: Shapes Topic 1: Similar shapes	Identify similar plane figures (triangles, rectangles, squares) in the environment Enlarge a shape by a given scale factor
Week 9	Ch 8	Trigonometry 1: Tangent of an angle	8	Mensuration & Geometry, p. 33 Sub-theme: Shapes Topic 2: Trigonometry	Determine the tangent of an acute angle Apply the tangent ratio to finding distances, lengths and angles
Week 10	Revision Exercises and Tests, Ch 1 - 8			Use revision exercises and tests to consolidate Term 1 content	
End of Term 1					

Scheme of Work: JSS3, Term 2				Curriculum matching	
TERM 2	**NGM Ch no**	**Chapter title**	**Worksheet no**	**NERDC JSS3 Themes and Topics**	**NERDC JSS3 Performance Objectives**
Week 1	Ch 9	Factorisation 2: Quadratic expressions	9	Algebraic Processes, p. 31 Sub-theme: Algebraic operations Topic 1: Factorisation	Factorise quadratic expressions Solve word problems involving factorisation
Week 2	Ch 10	Equations 1: Equations with fractions	10	Algebraic Processes, p. 31 Sub-theme: Algebraic operations Topic 2: Simple equations involving fractions	Solve simple equations involving fractions Solve word problems leading to equations involving fractions
Week 3	Ch 11	Compound interest	11	Number & Numeration, p. 29 Sub-theme: Whole numbers Topic 1: Whole numbers	Solve compound interest problems Apply the use of compound interest in daily life activities
Week 4	Ch 12	Similarity 2: Area and volume of similar shapes	12	Mensuration & Geometry, p. 33 Sub-theme: Shapes Topic 1: Similar shapes	Calculate lengths, areas and volumes of similar shapes Use scale factor (k, k2, k3) in relation to areas and volumes of similar shapes
Week 5	Ch 13	Proportion: Direct, inverse, reciprocal	13	Number & Numeration, p. 29 Sub-theme: Whole numbers Topic 1: Whole numbers	Solve problems involving direct and inverse proportion Apply direct and inverse proportions to practical problems
Week 6	Ch 14	Equations 2: Simultaneous linear equations	14	Algebraic Processes, p. 32 Sub-theme: Algebraic operations Topic 3: Simultaneous linear equations	Compile tables of values Solve simultaneous linear equations graphically Solve simultaneous equations using elimination and substitution methods Apply methods of solving simultaneous equations to real life activities
Week 7	Ch 15	Trigonometry 2: Sine and cosine of angles	15	Mensuration & Geometry, p. 33 Sub-theme: Shapes Topic 2: Trigonometry	Identify and determine the sine and cosine of acute angles Apply the sine, cosine and tangent ratios to finding distances, lengths and angles, and solving word problems
Week 8	Ch 16	Everyday statistics	16	Everyday Statistics, p. 36 Topic 1: Measures of central tendency Topic 2: Data presentation	Find mean, median, mode and range of given data Represent and interpret information in tables and on pie charts, bar charts and pictograms Apply everyday statistics to analysis of information/data and environmental issues

Week 9	Ch 17	Rational and non-rational numbers	17	Number & Numeration, p. 29 Topic 2: Rational and non-rational numbers	Identify and distinguish between rational and non-rational numbers Determine approximate values of pi (π) and square roots
Week 10	Revision Exercises and Tests, Ch 9 - 17			Use revision exercises and tests to consolidate Term 2 content	
End of Term 2					

Scheme of Work: JSS3, Term 3 Whole Course Revision			**Curriculum matching**	
TERM 3	**NGM Ch no**	**Chapter title**	**NERDC JSS3 Themes and Topics**	**NERDC JSS3 Performance Objectives**
Weeks 1 and 2	Ch R1	Number & numeration and Basic operations	Number & Numeration (all topics JS1 to JS3) Basic Operations (all topics JS1 to JS3)	NERDC Performance Objectives in number and numeration, and basic operations for JS1 to JS3
Weeks 3 and 4	Ch R2	Algebraic processes	Algebraic processes (all topics JS1 to JS3)	NERDC Performance Objectives in algebraic processes for JS1 to JS3
Weeks 5 and 6	Ch R3	Mensuration and geometry	Mensuration and Geometry (all topics JS1 to JS3)	NERDC Performance Objectives in mensuration and geometry for JS1 to JS3
Weeks 7 and 8	Ch R4	Everyday statistics	Everyday Statistics (all topics JS1 to JS3)	NERDC Performance Objectives in everyday statistics for JS1 to JS3
Weeks 9 and 10	JSCE Prep	JSCE Practice Examinations	Number and numeration Basic operations Algebraic processes Mensuration and geometry Everyday statistics	NERDC Performance Objectives for JS1, JS2 and JS3 + Practice in examinations techniques
As required	En	ICT and computers	Number & Numeration, p. 29 Sub Theme: Whole numbers Topic 1: Whole numbers	Use a computer to do simple mathematical calculations
End of Term 3				
JSCE Examination				

Note: QR means Quantitative Reasoning (ability to cope with numbers and calculation)

Methodology and features of the Student's Book, Teacher's Guide and Workbook

Features of the Student's Book

The *New General Mathematics* JSS Student's Book 3 consists of 17 chapters. Each chapter starts with a list of objectives, or commonly known as performance objectives (as listed in NERDC, 2013), that will be covered in each chapter.

In addition, the exercises in the Student's Book have been carefully developed to ensure integration of the performance objectives from the curriculum, and a steady progression of skills throughout the year. The Curriculum Matching Chart and Scheme of Work provides a suggested order for you to follow. The chapters follow a 'teach and practise' approach:

- Teaching and learning materials, including what students and teachers should bring to each lesson, are suggested. While it is not always possible to provide everything listed, it is essential that every student has at least an exercise book, a pen, a drawing set and, when appropriate, graph paper.
- New concepts are explained and given context in their meaning. A full glossary is included at the back of the Student's Book as well.
- Worked-through examples provide students with guidelines and models for setting out mathematical work. In some cases, we have added mark schemes to show students and teachers how marks are earned.

Exercises allow students to practise on their own. Exercises are graded by writing the question numbers in three different ways:

1. You must do all of these questions if you are to understand the topic.
2. You should do these questions if possible.
3. If you want a challenge, then you could do these questions.

At the end of each chapter is a chapter summary, which lists the main learning outcomes students need to achieve.

Revision exercises round off each chapter as a mixed exercise covering all the problems addressed in the chapter.

Summative assessment activities are provided at the end of every term in the three Revision chapters.

These assessments test students on all the knowledge and skills they have gained in each term. Additional features include:

- Key words: Key terminology, with definitions, is highlighted for the students.
- Puzzle corners: Additional problems, usually in a real-life context to help grow an appreciation of Mathematics in everyday life.

Quantitative reasoning [QR]

Where you see QR beside an exercise or a question, this stands for Quantitative reasoning. Students should do and discuss these questions with you and their classmates. They give special practice at improving the students' number work and their ability to calculate.

Features of the Teacher's Guide

This *New General Mathematics* JSS Teacher's Guide 3 is lesson-based. The chapters of the Student's Book are organised into a series of lessons. Chapters include the following features:

- The performance objectives from the curriculum that are covered in the chapter
- A list of suggested resources you will need
- Definitions for the key words in the Student's Book
- Foundation knowledge students need at the start of the chapter
- Suggested focus for each lesson
- Answers to the Puzzle corners and Workbook
- Assessment notes on how to evaluate students on key learning milestones.

The intention behind the puzzle corners is to provide students and the teachers with some challenges that both can engage in. Many of the puzzles are open-ended and therefore do not have a 'final answer'. Think of them as a journey rather than a destination, i.e. a process, not a product.

To save space we have not included solutions that require extensive artwork. However, the authors are happy to engage with readers if they care to get in touch with them via the publisher.

Note: The lesson-based guidelines are suggestions only. You, as the teacher, will need to assess how much your students are able to cover in each lesson.

Additional Preliminary or Enrichment chapters are also provided if you have additional teaching time. These can be done at any point during the year, as you feel necessary.

The Teacher's Guide also includes resources for testing and marking:

- Chapter revision test sheets: these are printable test sheets that you can use for formally assessing your class. They are based on the chapter revision tests at the end of each chapter.
- Chapter revision test answers: the answers for all the chapter revision tests are provided in the Teacher's Guide.
- Term revision test sheets: these are printable test sheets that you can use for formally assessing your class. They are based on the term revision tests at the end of each term.
- Term revision test answers: these are answers that you can use as a guide to formally assess your class. These answers are based on the term revision tests at the end of each term.
- Workbook answer sheets: the answers to the Workbook are given in the form of completed worksheets, with the answers filled in. These can be used as marking memoranda for the worksheets.

Features of the Workbook

The *New General Mathematics* JSS Workbook 3 provides a worksheet for every chapter in the Student's Book. Students use these worksheets to practise the specific mathematical skills and concepts covered in each chapter. It forms as a consolidation of the students' understanding and is a useful resource for homework assignments.

Students can record their answers and calculations in the spaces provided on each of the worksheets. The answers to these worksheets are all provided in the Teacher's Guide.

Methodology

Mathematics teaching and learning goes beyond reaching the correct answer. Many mathematical problems have a range of possible answers. Students need to understand that Mathematics is a tool for solving problems in the real world; not just about giving the correct answers. The Mathematics classroom must therefore provide an environment in which problem-solving is seen as integral to the teaching programme, and where learning activities are designed to provide students with opportunities to think.

Working mathematically involves:

- questioning
- applying strategies
- communicating
- reasoning
- reflecting.

Alongside developing the necessary problem-solving skills and strategies, the New General Mathematics Junior Secondary 3 Teacher's Guide focuses on students to gain specific mathematical knowledge as tools for problem-solving. At Junior Secondary 3, these tools include:

- Revising basic operations in binary system
- Converting numbers in binary numbers to other bases and vice versa
- Using a computer to do simple mathematical calculations
- Translating word problems into numerical expression
- Simplifying expressions involving brackets fractions
- Applying direct and inverse proportions to practical problems
- Applying the use of compound interest in daily life activities
- Identifying rational and non-rational numbers
- Adding two or three 3-digit binary numbers
- Subtracting two 3-digit binary numbers
- Multiplying two 2-digit binary numbers
- Dividing two 2-digit binary numbers
- Factorising simple algebraic expressions
- Factorising quadratic algebraic expressions using quadratic equation box
- Compiling table of values for simultaneous linear functions

- Applying the elimination and substitution methods
- Identifying similar figures: triangles, rectangles, squares, cubes and cuboids
- Identifying the presence of similar shapes in the environment
- Enlarging figures using scale factors
- Calculating lengths, areas and volumes of similar figures
- Identifying sine, cosine, and tangent of an acute angle
- Applying trigonometric ratios when solving problems
- Finding the area of triangles, parallelograms, a trapezium, and circles and sectors
- Constructing angles of 30 and 45
- Using a pair of compasses to copy a given angle
- Constructing simple shapes
- Reviewing work on mean, mode and median
- Calculating the median of given data
- Finding the mode of given data
- Calculating the mean on any given data
- Finding the range of any given data
- Applying measures of central tendency to analyse any given information
- Representing and interpreting information on pie charts.

Puzzle Corners: Strategies, Solutions, Answers

In order to promote discussion between users of New General Mathematics (teachers and students) and where possible between users and the authors, we have provided a selection of solutions, partial solutions and answers to the puzzle corners that appear in the Students Books.

Why include Puzzle Corners?

The inclusion of puzzle corners is to promote the idea that mathematics is not always about 'getting the right answer'. In many cases mathematics is a journey, where we sometimes go along pathways that lead nowhere, or, hopefully more often, that lead to expected and even unexpected discoveries. Think of mathematics as a process, not a product … or as a journey, not a destination.

It is not always necessary to use conventional methods. There are various strategies that often help (in real life as well as in mathematics). For example, you can tell your students to try the following approaches:

- Trial and improvement [sometimes called trial and error]
  Make a guess at the solution and see if it works. If it doesn't, refine your first guess and try again, aiming to get closer to the desired result. This is a perfectly legitimate thing to do.
- Try a simpler version of the problem
  Instead of jumping in at the deep end, try the puzzle with easier numbers or reduced options. You will find some examples below.
- Use knowledge of numbers, geometry and algebra where appropriate
  Don't devalue what you already know and have learned in class!

Section 1: Additional material

Section 1 provides you with optional chapters that you can use with your class.

Preliminary chapters are intended for use as revision and to reinforce foundation knowledge that is needed in the year. You may wish to assign work from this chapter as remedial activities for students who struggle with the main course work.

Enrichment chapters are optional chapters that extend the scope of the work done in the year. If you have time at the end of the year, you can work through this additional chapter with your students. You may wish to assign work from this chapter to stronger students.

Preliminary chapter: Review of previous coursework

Objectives

By the end of this chapter the student should be able to recall, from Books 1 and 2 of New General Mathematics, the facts and methods that relate to the following themes:

- Number and numeration
- Basic operations
- Algebraic processes
- Mensuration and geometry
- Everyday statistics.

Teaching and learning materials

Teacher: Addition and multiplication wall charts; 1–100 number square; metre rule, measuring tape,

Students: Mathematics set

To make the best use of Book 3 of *New General Mathematics*, readers should be familiar with the contents of Books 1 and 2. This chapter contains those themes and topics from Books 1 and 2 that are necessary to understand Book 3.

Number and numeration

For most purposes, we write numbers using the decimal place value system (Fig. P1). The symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 are called digits.

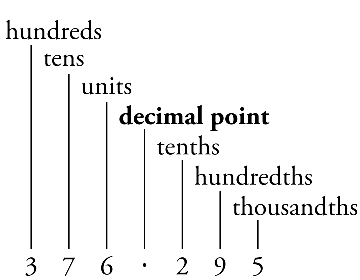


Fig. P1

We use the words thousand, million, billion, trillion for large numbers:

1 thousand	1 000	10^3
1 million	1 000 000	10^6
1 billion	1 000 000 000	10^9
1 trillion	1 000 000 000 000	10^{12}

Similarly we use thousandth, millionth and billionth, for decimal fractions:

1 thousandth	0.001	10^{-3}
1 millionth	0.000 001	10^{-6}
1 billionth	0.000 000 001	10^{-9}

When writing large and small numbers, group the digits in threes from the decimal point, for example: 9 560 872 143 and 0.067 482.

7 is a whole number that divides exactly into another whole number, 28.

7 is a factor of 28. 28 is a multiple of 7.

A prime number has only two factors, itself and 1. 1 is not a prime number. 2, 3, 5, 7, 11, 13, 17… are prime numbers. They continue without end. The prime factors of a number are those factors which are prime. For example, 2 and 5 are the prime factors of 40. 40 can be written as a product of prime factors: either $2 \times 2 \times 2 \times 5 = 40$ or, in index form, $2^3 \times 5 = 40$.

The numbers 18, 24 and 30 all have 3 as a factor. 3 is a common factor of the numbers. The highest common factor (HCF) is the largest of the common factors of a given set of numbers. For example, 2, 3 and 6 are the common factors of 18, 24 and 30; 6 is the HCF.

The number 48 is a multiple of 4 and a multiple of 6. 48 is a common multiple of 4and 6. The lowest common multiple (LCM) is the smallest of the common multiples of a given set of numbers. For example, 12 is the LCM of 4 and 6.

In a fraction, one number (the numerator) is divided by another number (the denominator).

The fraction $\frac{5}{8}$ means $5 \div 8$ (Fig. P2).

5 — numerator
— dividing line
8 — denominator

Fig. P2

Fractions are used to describe parts of quantities (Fig. P3).

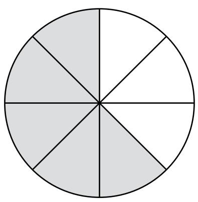


Fig. P3

The fractions $\frac{5}{8}$, $\frac{10}{16}$, and $\frac{15}{24}$ represent the same amount; they are equivalent fractions. $\frac{5}{8}$ is the simplest form of $\frac{10}{16}$, and $\frac{15}{24}$.

Basic operations

To add or subtract fractions, change them to equivalent fractions with a common denominator. For example:

$$\frac{1}{8} + \frac{2}{3} = \frac{3}{24} + \frac{16}{24} = \frac{19}{24}$$
$$\frac{12}{16} - \frac{2}{8} = \frac{12}{16} - \frac{4}{16} = \frac{8}{16} = \frac{1}{2}$$

To multiply fractions, multiply numerator by numerator and denominator by denominator. Then write your answer in the simplest form. For example:

$$\frac{3}{4} \times \frac{2}{5} = \frac{6}{20} = \frac{3}{10}$$

To divide by a fraction, multiply by the reciprocal of the fraction. For example:

$$\frac{8}{10} \div \frac{3}{6} = \frac{8}{10} \times \frac{6}{3} = \frac{48}{30} = 1\frac{18}{30} = 1\frac{3}{5}$$

x% is short for $\frac{x}{100}$. 64% means $\frac{64}{100}$.

To change a fraction to an equivalent percentage, multiply the fraction by 100.

For example, $\frac{6}{20} \times \frac{100}{1} = \frac{600}{20} = 30\%$.

To change a fraction to a decimal, divide the numerator by the denominator. Then multiply the quotient by 100.

For example: $\frac{5}{8}$

$$\begin{array}{r} 0.625 \\ 8\overline{)5.000} \\ -4\,8 \\ \hline 2\,0 \\ -1\,6 \\ \hline 4\,0 \\ -4\,0 \\ \hline 0 \end{array}$$

$$0.625 \times 100 = 62.5$$

When adding or subtracting decimals, write the numbers in a column with the decimal points exactly under one another. For example, add 2.29, 0.084 and 4.3, then subtract the result from 11.06.

$$\begin{array}{r} 2.290 \\ 0.084 \\ +4.300 \\ \hline 6.674 \end{array} \qquad \begin{array}{r} 11.060 \\ -6.674 \\ \hline 4.386 \end{array}$$

To multiply decimals, first ignore the decimal points and multiply the numbers as if they were whole numbers. Then re-insert the decimal point so that the answer has as many digits after the point as there are in the question. For example:

$$0.084 \times 4.3$$

$$\begin{array}{r} 84 \\ \times\ 43 \\ \hline 252 \\ 3360 \\ \hline 3612 \end{array}$$

There are four digits after the decimal points in the question, so, replace the decimal point: 0.3612.

To divide by decimals, change the division so that the divisor becomes a whole number. For example:

$5.6 \div 0.07$
$0.07 \times 100 = 7$
$5.6 \times 100 = 560$
$560 \div 7 = 80$

Numbers may be positive or negative. Positive and negative numbers are called directed numbers. Directed numbers can be shown on a number line (Fig. P4). An integer is any positive or negative whole number as shown in Fig. P4.

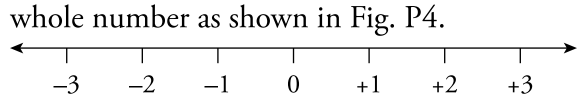


Fig. P4

The following examples show how to add, subtract, multiply and divide directed numbers.

Addition

$(-8) + (-3) = -11$ $(+8) + (-3) = +5$

$(-8) + (+3) = -5$ $(+8) + (+3) = +11$

Subtraction

$(-9) - (+4) = -13$ $(+9) - (+4) = +5$

$(-9) - (-4) = -5$ $(+9) - (-4) = +13$

Multiplication

$(-2) \times (-7) = +14$ $(+2) \times (-7) = -14$

$(-2) \times (+7) = -14$ $(+2) \times (+7) = +14$

Division

$(+6) \div (+3) = +2$ $(-6) \div (+3) = -2$

$(+6) \div (-3) = -2$ $(-6) \div (-3) = +2$

An integer is any positive or negative whole number as shown in Fig. P4.

The number 30 000 is 3×10^4 is in standard form. The first part of the product is a number between 1 and 10. The second part is a power of 10.

When rounding off numbers, the digits 1, 2, 3, 4 are round down and the digits 5, 6, 7, 8, 9 are round up. You must also pay attention to what you are being asked to round off to. For example:
Round off 425 to the nearest 10.
5 is the significant figure, so round the tens column up: 430
Round off 425 to the nearest 100.
2 is the significant figure, so round the hundreds column down: 400

When rounding off decimals, the same rules apply. For example:
Round 7.283 off to 2 decimal places.
3 is the significant figure, so round the hundredths column down: 7.28
Round 7.283 off to 1 decimal place.
8 is the significant figure, so round the tenths column up: 7.3

Round 7.283 off to the nearest whole figure.
2 is the significant figure, so round down to the nearest unit: 7

The everyday system of numeration uses ten digits and is called a base ten, or denary, system. The base two, or binary, system of numeration uses only two digits, 0 and 1. To convert between bases ten and two, express the given numbers in powers of two:

43_{ten}
$= 32 + 8 + 2 + 1$
$= 2^5 + 2^3 + 2^1 + 2^0$
$= 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^1 + 1 \times 2^0$
$= 101011_{\text{two}}$

10110_{two}
$= 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$
$= 16 + 0 + 4 + 2 + 0$
$= 22_{\text{ten}}$

Use the following identities when adding, subtracting and multiplying binary numbers:

Addition:

$0 + 0 = 0$ $1 + 0 = 1$

$0 + 1 = 1$ $1 + 1 = 10$

Multiplication:

$0 \times 0 = 0$ $1 \times 0 = 1$

$0 \times 1 = 0$ $1 + 1 = 1$

Detailed coverage of number and numeration is given in *NGM SB 1*, Chapters 1, 2, 3, 4, 9, 12, 23, 24; and *NGM SB 2*, Chapters 1, 2, 4, 5, 8, 9, 15.

Review Test 1: Number and numeration, and Basic operations

Allow 30 minutes for this test. Students use the answers at the back of the book to check their work. If they do not understand why some of their answers are incorrect, they may ask a friend or teacher.

1 Express each of the following as a product of factors. Hence find their square roots.

a 4 900 **c** 3 969

b 1 296 **d** 5 625

2 Express the following in standard form.

a 5 000 000 **c** 5

b 40 000 **d** 007

3 Round off the following to **i** 1 s.f., **ii** 2 s.f., **iii** 3 s.f.

a 9 405 **c** 29.604

b 20 062 **d** 0.005 207

4 Round off the following to **i** 1 d.p., **ii** 2 d.p., **iii** 3 d.p.

a 14.902 8 **c** 3.876 5

b 0.007 2 **d** 0.007 7

5 Simplify the following.

a $(-6) \times (+3)$ **c** $-38 \div 19$

b $22 \times (-2)$ **d** $(-15) \div 4(-3)$

6 A college has 778 students. The average mass of a student is approximately 52 kg. Estimate, to 1 significant figure, the total mass in tonnes of all the students in the college.

7 Divide the following quantities in the given ratios.

a ₦1 500 in the ratio 1 : 2

b 400 mm in the ratio 4 : 1

c 44 oranges in the ratio 7 : 4

8 Find the discount price if:

a 10% is given on a cost price of ₦500

b 25% is given on a cost price of ₦4 400.

9 Use tables to find:

a 190^2 **c** $\sqrt{3\,998}$

b $8\,300^2$ **d** $\sqrt{705}$

10. Round off the following to the nearest **i** whole number, **ii** tenth, **iii** hundredth.

a 1.054 **b** 89.845

Review Test 2: Number and numeration, and Basic operations

Allow 30 minutes for this test. Students use the answers at the back of the book to check their work. If they do not understand why some of their answers are incorrect, they may ask a friend or teacher.

1 Express each of the following as a product of factors. Hence find their square roots.

a 3 600 **c** 4 356

b 5 184 **d** 6 561

2 Express the following in standard form.

a 8 000 **c** 04

b 200 000 000 **d** 0.009

3 Round off the following to **i** 1 s.f., **ii** 2 s.f., **iii** 3 s.f.

a 546.52 **c** 39 447

b 8.028 6 **d** 0.044 55

4 Round off the following to **i** 1 d.p., **ii** 2 d.p., **iii** 3 d.p.

a 35.228 8 **c** 0.058 4

b 2.096 5 **d** 0.009 2

5 Simplify the following.

a $(-72) \times (-9)$ **c** $65 \div -5$

b -5×12 **d** $(-80) \div (-8)$

6 A typist can type about 33 words per minute. Estimate, to 1 significant figure, how long it will take her to type a letter that is 682 words long.

7 Divide the following quantities in the given ratios.

a ₦300 in the ratio 5 : 1

b 90 ml in the ratio 2 : 3

c 60 eggs in the ratio 5 : 7

8 Find the discount price if:

a 5% is given on a cost price of ₦2 000

b 20% is given on a cost price of ₦420.

9 Use tables to find:

a 572 **c** $\sqrt{8005}$

b 1 0502 **d** $\sqrt{664}$

10 Round off the following to the nearest **i** whole number, **ii** tenth, **iii** hundredth.

a 0.975 **b** 6.295

Algebraic processes

$3y^2 - 2x + 7x$ is an example of an algebraic expression. The letters x and y stand for numbers. $3y^2$, $2x$ and $7x$ are the terms of the expression. $3y^2$ is short for $3 \times y \times y$. 3 is the coefficient of y^2. Algebraic terms may be simplified by combining like terms.
Thus $3y^2 - 2x + 7x = 3y^2 + 5x$ since $2x$ and $7x$ are like terms (i.e. both terms in x).
$3(5x + 2) = 11x$ is an algebraic sentence containing an equals sign; it is an equation in x. x is the unknown of the equation. To solve an equation means to find the value of the unknown that makes the equation true.
Use the balance method to solve equations.

For example,
$3(5x + 2) = 11x$
Clear brackets.
$15x + 6 = 11x$
Subtract 11 from both sides.
$15x - 11x + 6 = 11x - 11x$
Minus 6 from both sides.
$4x + 6 - 6 = -6$
Divide both sides by 4.
$4x = -6$
Simplify.
$x = -\frac{6}{4} = -2\frac{2}{4} = -2\frac{1}{2}$
In general, when solving equations, clear brackets and fractions, use equal additions and/or subtractions to collect unknown terms on one side of the equals sign and known terms on the other, where necessary divide or multiply both sides of the equation by the same number to find the unknown.
An inequality is an algebraic sentence which contains an inequality sign:

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

Inequalities are solved in much the same way as equations. However, when both sides of an inequality are multiplied or divided by a negative number, the inequality sign is reversed.
For example $-3a < 12$
Divide both sides by -3 and reverse the inequality.
$a > -2$
A graph of an algebraic sentence is a picture representing the meaning of the sentence. Graphs of equations and inequalities in one variable can be shown on the number line (Fig. P5).

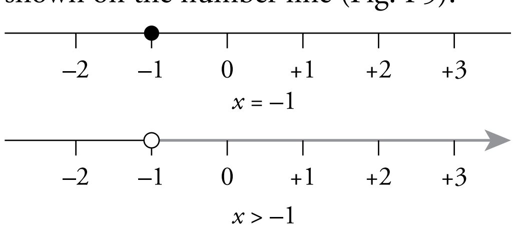


Fig. P5

For graphs connecting two variables, draw two axes at right angles to each other to give a Cartesian plane. The horizontal x-axis and the vertical y-axis cross at their zero-point, the origin of the plane. Fig. P6 is the graph of the equation $y = 2x - 3$.

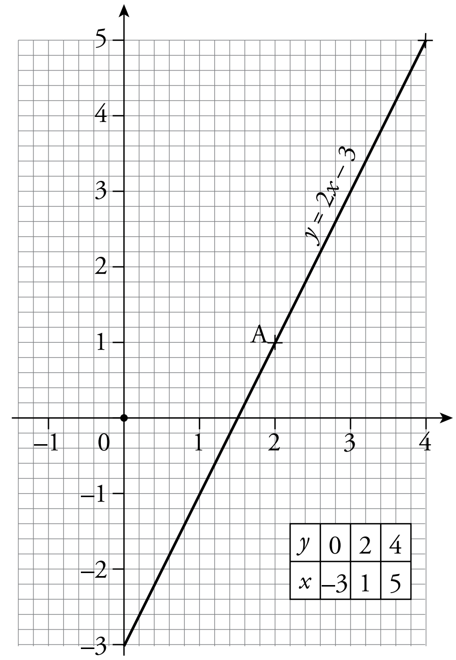


Fig. P6

To draw a straight-line graph, plot at least three points which satisfy the given equation. See the table of values in Fig. P6. At point A in Fig. P6, $x = 2$ and $y = 1$. The coordinates of A are (2, 1). The order of the coordinates is important: give the x-coordinate first, and the y-coordinate second.
We can use straight-line graphs to represent any two connected variables: for example, cost and quantity, distance and time, temperature and time. Straight-line graphs can also show conversions between currencies or between marks and percentages.
Factorise or expand algebraic expressions using the basic rules of arithmetic. See the following examples:

Expansion
$3(a + 2) = 3a + 6b$
$(5 - 8x)x = 5x - 8x^2$
$(a + b)(c + d) = c(a + b) + d(a + b)$
$= ac + bc + ad + bd$
$(3x + 2)(x - 4) = 3x^2 + 2x - 12x - 8$
$= 3x^2 - 10x - 8$
$(a - 5b)^2 = a^2 - 10ab + 25b^2$
Factorisation
$5y + 10y^2 = 5y(1 + 2y)$
$4x - 8 + 3bx - 6b$
$= 4(x - 2) + 3b(x - 2)$
$= (x - 2)(4 + 3b)$

The following laws of indices are true for all values of a, b and x.

$x^a \times x^b = x^{a+b}$ $\quad x^a \div x^b = x^{a-b}$

$x^0 = 1$ $\quad x{-}a = 1$

Detailed coverage of algebraic processes is given in NGM Book 1, Chapters 5, 7, 10, 15, 19; and NGM Book 2, Chapters 5, 7, 11, 12, 13, 14, 22, 23.

Review Test 3: Algebraic processes

Allow 30 minutes for this test. Students use the answers at the back of the book to check their work. If they do not understand why some of their answers are incorrect, they may ask a friend or teacher. Then try Test 4.

1 State the additive inverse of:

a -5 **c** -514

b $+14$ **d** $+\frac{3}{7}$.

2 State the multiplicative inverse of:

a $+7$ **c** $+34$

b $-\frac{6}{7}$ **d** -0.15.

3. Remove brackets and simplify.

a $7(a - b) - 8(a - 2b)$

b $y(y - 3) - 6(y - 3)$

4 Expand the following.

a $(6 - x)(3 + y)$ **b** $(5x - y)(x + 3y)$

5 State the HCF of the following.

a $10x^2$ and $15x^2$ **b** $24ax^2$ and $3a^2x$

6 State the LCM of the following.

a pq and qr **b** $3a^2$ and $8ab$

7 Factorise the following.

a $2a^2 - 9ab$ **b** $-18pq - 12p$

8 Solve the following.

a $51 = 3 + 8x$ **b** $6x + 1 = 26 - 2x$

9 Which symbol, $<$ or $>$, goes in the box to make the statement true?

a $7 + 5 \square 10$ **b** $31 \div 10 \square 3.2$

10 Solve the following.

a $2x = 10$ **b** $27 = 4x$

c $x + 4 \geq 10x - 23$

Review Test 4: Algebraic processes

Allow 30 minutes for this test. Students use the answers at the back of the book to check their work. If they do not understand why some of their answers are incorrect, they may ask a friend or teacher.

1 State the additive inverse of:

a $+3$ **c** $+118$

b -7 **d** -0.27.

2 State the multiplicative inverse of:

a 4 **c** -9

b $\frac{1}{5}$ **d** -0.7.

3 Remove brackets and simplify.

a $x(x + 4) - 5(x - 2)$

b $a(a + b) - b(a + b)$

4 Expand the following.

a $(x + 6)\,(y - 9)$ **b** $(x - 2)(3x + 7)$

5 State the HCF of the following.

a $18xy$ and $6xy$ **b** $12xy^2$ and $3xy$

6 State the LCM of the following.

a $3a$ and $4b$ **b** $18xy$ and $6xy$

7 Factorise the following.

a $3ab + 6ac$ **b** $-5xy + 15y$

8 Solve the following.

a $10g - 7 = 47$ **b** $4x - 6 = 5x - 7$

9 Which symbol, $<$ or $>$, goes in the box to make the statement true?

a $7 + 5 \square 10$ **b** $31 \div 10 \square 3.2$

10 Solve the following.

a $2x < 10$ **b** $-7 = 4x$

c $x + 4 = 10x - 23$

Geometry and mensuration

Fig. P7 gives sketches and names of some common solids.

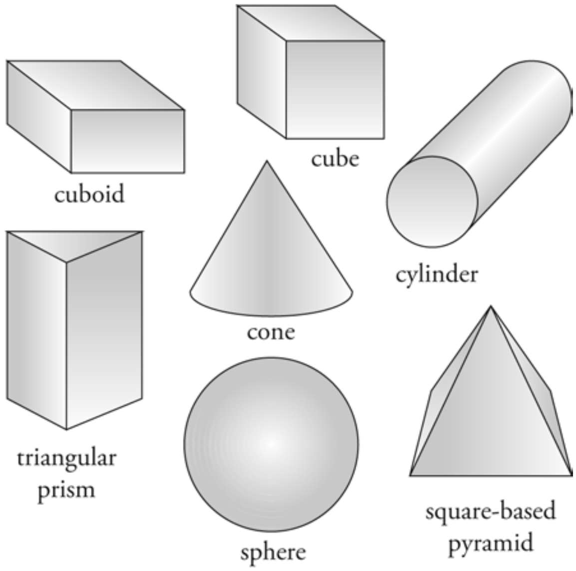


Fig. P7

All solids have faces; most solids have edges and vertices (Fig. P8).

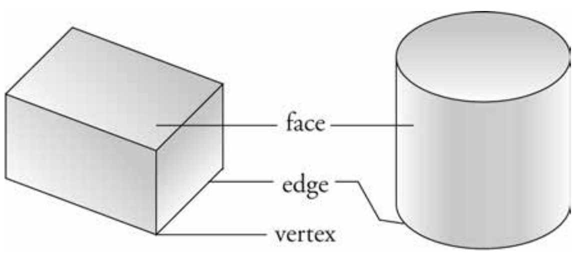


Fig. P8

Table P1 gives the formulae for the surface area and volume of common solids. The net of a solid is the plane shape that can be folded to make the solid.

	Surface area	Volume
Cube edge s		
Cuboid Length l, breadth b, width w		
Prism Height h, base area A		
Sphere Radius r		
Cylinder Base radius r, height h		
Cone Base radius r, height h, slant height l		

An angle is a measure of rotation or turning.
1 revolution = 360 degrees (1 rev = 360°)
The names of angles change with their size.

Fig. P9 lists the angles and their names.

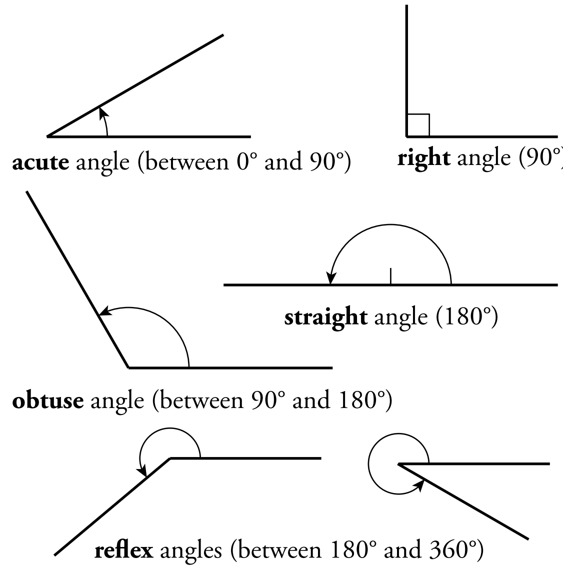
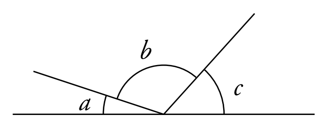
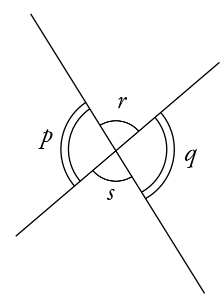


Fig. P9

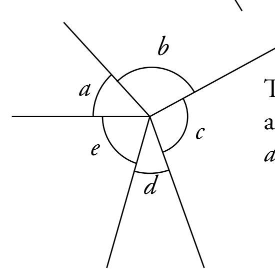
Use a protractor to measure and construct angles. Figure P10 shows some properties of angles formed when straight lines meet.



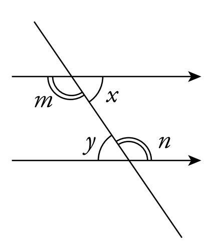
The sum of the angles on a straight line is 180°.
$a + b + c = 180°$



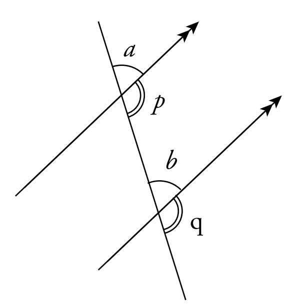
Vertically opposite angles are equal.
$p = q$ and $r = s$



The sum of the angles at a point is 360°.
$a + b + c + d = 360°$



Alternate angles are equal.
$x = y$ and $m = n$



Corresponding angles are equal.
$a = b$ and $p = q$

Fig. P10

In Fig. P11, α is the angle of elevation of the top of the flagpole from the girl and β is the angle of depression of the girl from the boy.

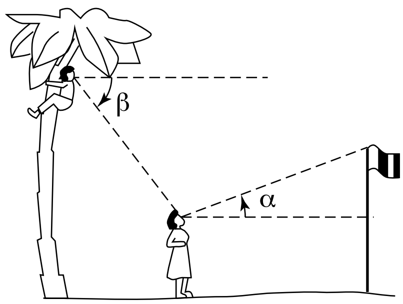


Fig. P11

Directions are taken from the points of the compass as indicated in Fig. P12.

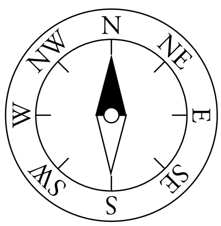


Fig. P12

A 3-figure bearing is a direction given as the number of degrees from north measured in a clockwise direction. See Fig. P13.

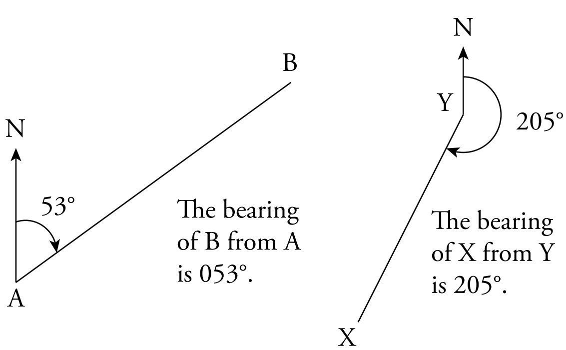


Fig. P13

Fig. P14 shows the names and properties of some common triangles.

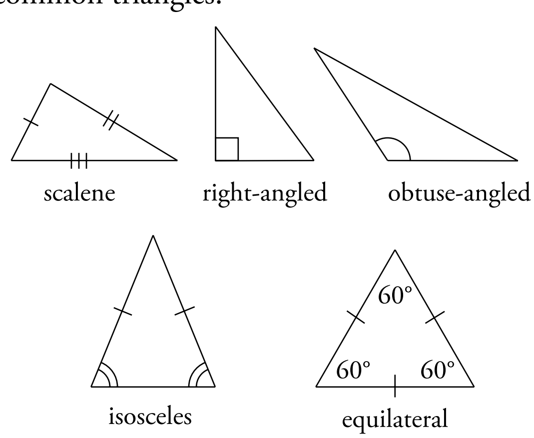


Fig. P14

Fig. P15 shows the names and properties of some common quadrilaterals.

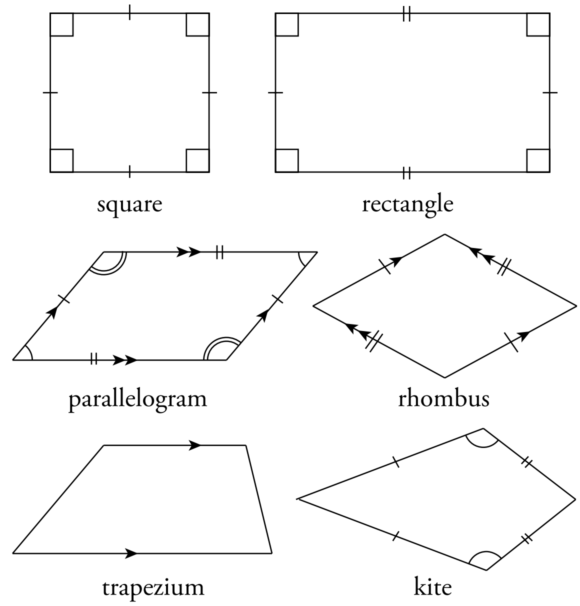


Fig. P15

Fig. P16 gives the names of lines and regions in a circle.

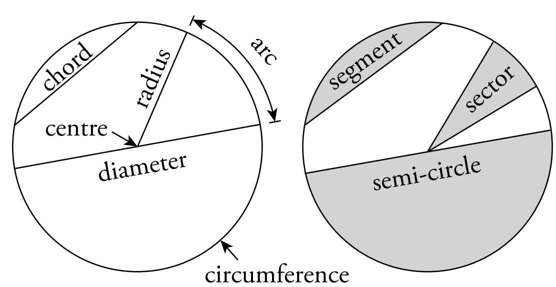


Fig. P16

A polygon is a plane shape with three or more straight sides. A regular polygon has all its sides of equal length and all its angles of equal size. Fig. P17 gives the names of some common regular polygons.

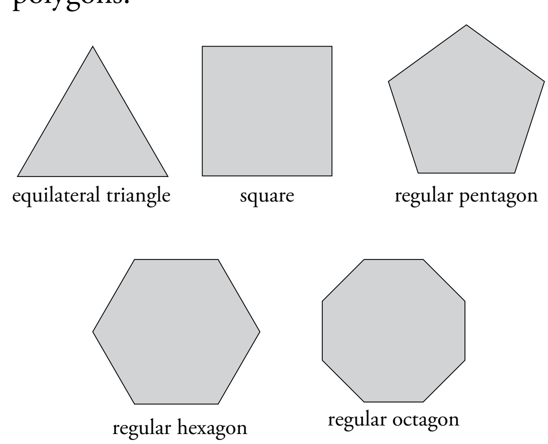


Fig. P17

The sum of the angles of an n-sided polygon is $(n - 2) \times 180°$. In particular, the sum of the angles of a triangle is 180° and the sum of the angles of a quadrilateral is 360°.
To solve a triangle means to calculate the sizes of its sides and angles. Use Pythagoras' rule to solve right-angled triangles.

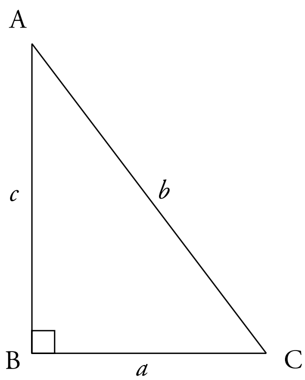


Fig. P18

In Fig. P18, triangle ABC is right-angled at B. Side AC is the hypotenuse.
Pythagoras' rule: $b^2 = a^2 + c^2$

Table P2 contains formulae for the perimeter and area of plane shapes.

	perimeter	area
Square Side s		
Rectangle Length l, breadth b		
Triangle Base b, height h		
Parallelogram Base b, height h		
Trapezium Height h, parallels of length a and b		
Circle Radius r		

The SI system of units is given in the tables in the students book.
Use a ruler and set square to construct parallel lines (Fig. P19).

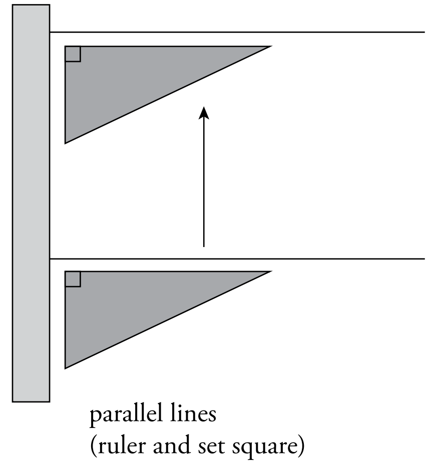


Fig. P19

Detailed coverage of geometry and mensuration is given in NGM Book 1, Chapters 6, 8, 11, 13, 14, 16, 20, 21; and NGM Book 2, Chapters 3, 6, 16, 17, 19, 20, 24.

Review Test 5 Mensuration and geometry

Allow 30 minutes for this test. Students use the answers at the back of the book to check their work. If they do not understand why some of their answers are incorrect, they may ask a friend or teacher. Then try Test 6.

1 One of the angles of a parallelogram is 119°. What are the sizes of its other three angles?

2 How many lines of symmetry does a kite have?

3 Find the values of m, n, p, q, s, in Figure P20.

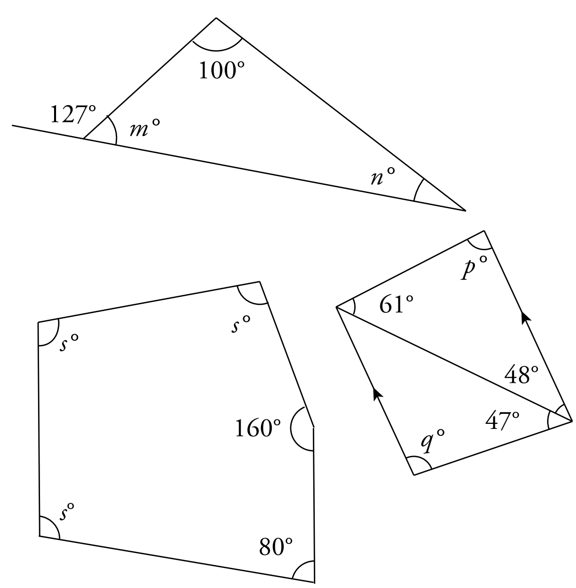


Fig. P20

4 Which one of the following is a Pythagorean triple?

a 3, 8, 9 **b** 4, 10, 11 **c** 5, 12, 13

5 Calculate to 2 s.f. the length of a diagonal of a 30 mm by 20 mm rectangle.

6 Copy and complete the following table of cylinders. Use the value 3 for π.

Cylinder	Radius	Height	Curved surface area	Volume
A	8 cm	6 cm		
B	5.5 cm	16 cm		
C		11 cm	196 cm^2	
D	4 cm			336 cm^3

7 In Fig. P21, BC is horizontal.

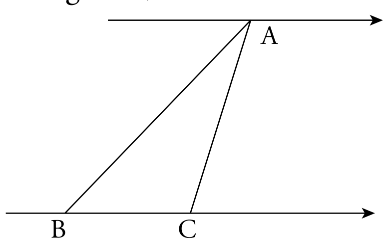


Fig. P21

Measure:

a the angle of elevation of A from B

b the angle of depression of C from A.

8 In Fig. P22, state the bearings of A, B, C and D from the centre.

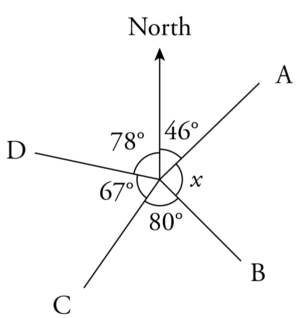


Fig. P22

9 Copy and complete the following table of cones. Complete only the unshaded spaces. Use the value 3 for π.

Cone	Slant height	Angle of sector	Curved surface area	Base radius	Height	Volume
A	10 cm	150°				
B	4 cm	240°				
C				5 cm	18 cm	
D				4 cm	10 cm	

Review Test 6 Mensuration and geometry

Allow 30 minutes for this test. Students use the answers at the back of the book to check their work. If they do not understand why some of their answers are incorrect, they may ask a friend or teacher.

1 One of the angles of a rhombus is 42°. What are the sizes of its other three angles?

2 How many lines of bilateral symmetry does a square have?

3 Find the values of p, q, r, s, t, x in Fig. P23.

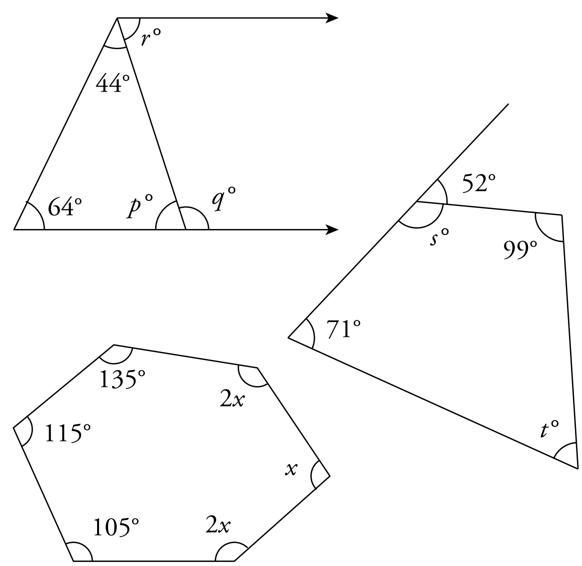


Fig. P23

4 Which one of the following is a Pythagorean triple?

a 2, 3, 4 **b** 3, 4, 5 **c** 5, 12, 13

5 Calculate to 2 s.f. the length of the longest straight line that can be drawn on a rectangular chalkboard that measures 1.2 m by 3.0 m.

6 Copy and complete the following table of cylinders. Use the value 3 for π.

Cylinder	Radius	Height	Curved surface area	Volume
A	4 cm	10 cm		
B	4.5 cm	12 cm		
C		7 cm	126 cm^2	
D	5 cm			300 cm^3

7 In Fig. P24, QR is horizontal. Measure:

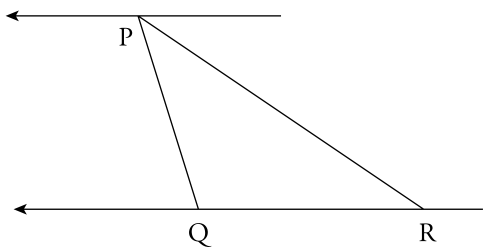


Fig. P24

a the angle of elevation of P from Q

b the angle of depression of R from P.

8 In Fig. P25, state the bearings of the following from O.

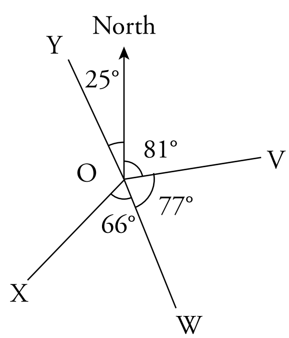


Fig. P25

a V **b** W **c** X **d** Y

9 Copy and complete the following table of cones. Complete only the unshaded spaces. Use the value 3 for π.

Cone	Slant height	Angle of sector	Curved surface area	Base radius	Height	Volume
A	8 cm	210°				
B	5 cm	135°				
C				7 cm	20 cm	
D				3.5 cm	12 cm	

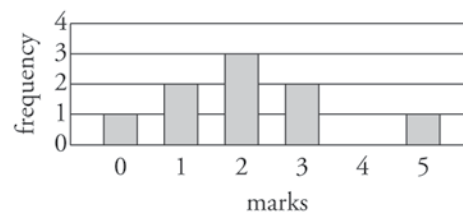
Everyday statistics

Information in numerical form is called statistics. Statistical data may be given in rank order (i.e. in order of size) like these marks out of 5: 0, 1, 1, 2, 2, 2, 3, 3, 5

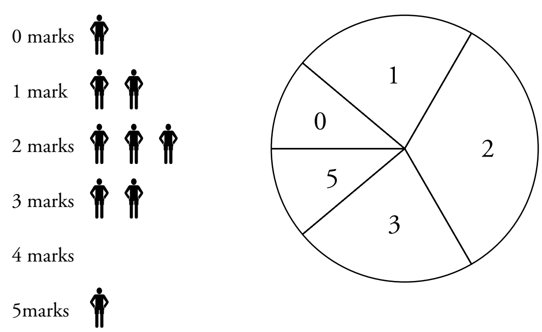
Data may also be given in a frequency table (Table P3).

Mark	0	1	2	3	4	5
Frequency	1	2	3	2	0	1

The frequency is the number of times each piece of data occurs. We also use graphs to show statistics. Figure P26 shows the above data in a pictogram, a bar chart and a pie chart.



barchart



pictogram **pie chart**

Probability is a measure of the likelihood of a required event happening.

$$\text{Probability} = \frac{\text{number of required events}}{\text{number of possible events}}$$

If an event must happen, probability = 1.
If an event cannot happen, probability = 0.
The probability of something happening is a fraction whose value lies between 0 and 1. If the probability of something happening is x, then the probability of it not happening is $1 - x$.
Detailed coverage of statistics is given in *NGM Book 1*, Chapters 17, 18, 22; and *NGM Book 2*, Chapters 18, 21.

Review Test 7: Everyday statistics

Allow 30 minutes for this test. Students use the answers at the back of the book to check their work. If they do not understand why some of their answers are incorrect, they may ask a friend or teacher.

1 For each set of numbers, calculate the mean.

a 12, 14, 1
b 9, 10, 14
c 1, 8, 6, 8, 7
d 7, 7, 3, 2, 11

2 Find the mode, median and mean of each set of numbers.

a 7, 7, 9, 12, 15
b 0, 1, 4, 4, 5, 5, 5, 6, 6, 7
c 10, 8, 5, 12, 8, 11
d 5, 3, 9, 5, 10, 6, 4, 7, 5

3 Table P4 shows the results of a survey of vehicles on a city road in one hour.

	Cars	Lorries	Buses	Others	Total
Number	28	5	7	10	

Table P4

a How many vehicles altogether?
b What is the probability that the next vehicle is a car?
c What is the probability that the next vehicle is not a car?
d What is the probability that the next vehicle is not a car, a lorry or a bus?

Review Test 8: Everyday statistics

Allow 30 minutes for this test. Students use the answers at the back of the book to check their work. If they do not understand why some of their answers are incorrect, they may ask a friend or teacher.

1 For each set of numbers, calculate the mean.

a 18, 6, 8, 12
b 3, 11, 6, 8
c 2, 9, 0, 6, 7, 0
d 9, 10, 12, 13, 16, 18

2 Find the mode, median and mean of each set of numbers.

a 4, 5, 5, 7, 8, 10
b 4, 8, 11, 11, 12, 12, 12
c 3, 1, 17, 1, 8, 12
d 4, 3, 1, 4, 1, 0, 2, 4, 2, 3, 4, 2

3 A school enters candidates for the JSC examination. Table P5 shows the results for the years 2011–2014.

	2011	2012	2013	2014
Candidates entered	86	95	109	110
Number gaining JSC	56	57	65	70

Table P5

During the four years:

a How many candidates were entered for the JSC?
b How many candidates gained a JSC?
c What is the school's success rate as a percentage?
d What is the approximate probability (as a decimal to 1 s.f.) of a student at this school getting a JSC?

Objectives

By the end of this chapter the student should be able to:

- List some of the uses of Information and Communications Technology (ICT)
- Use a computer to perform some simple mathematical operations.

Teaching and learning materials

Teacher/school: Computers and appropriate software

Note: To obtain any benefit from this chapter, it is necessary for students and their teachers to have 'hands-on' access to computers with Excel software.

Enrichment

This is an enrichment chapter that explains the background to current developments in ICT and computing. Most people use ICT and computers for email, social networking, downloading information and word-processing (preparing documents). However, there are many other applications of ICT. In line with the current national curriculum, this chapter contains some advice on the mathematical uses of computers.

Overview of ICT

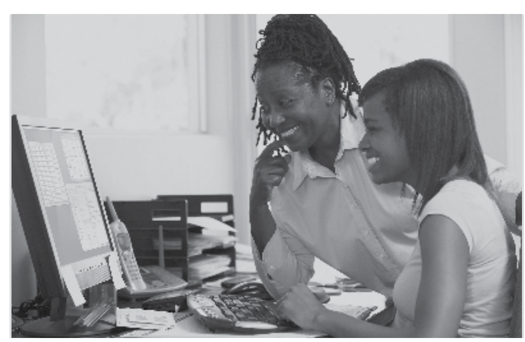
In the past few decades the impact of Information and Communications Technology (ICT) on many people's personal and professional lives has been immense. Mobile phones, computers and computer programs already play a central role in ICT development and will play an even greater role in the future.

Although computers were originally developed to speed up calculation, a huge leap forward in ICT development took place when it became possible to connect them to the internet on a world wide web (www) via telephone, satellite and radio systems.

Think of the Internet as a global communication network that provides national and international access to information and to other people. Millions of people use the internet on a daily basis to access information, to purchase and provide goods and services, and to communicate with one another by electronic mail (email) and through social networks (Facebook, Twitter, etc)

Nowadays, to meet ICT demands, computers have become smaller, faster, more versatile, more reliable and more affordable. Computer chips are used in cars, mobile phones, television sets, music players, and cameras, and are carried by many people in the form of bank cards. The tendency for greater portability, greater connectivity and 'more power for less cost' will continue throughout this century. For example, many mobile phones now have considerable computing, photographic, entertainment and internet capability.

ICT is mainly used for 'connecting people', usually by the spoken or written word. Fig. E1 shows some of the types of computers available, and Fig. E2 shows some of the functions and programs that demonstrate the computer's central place in ICT.



Desktop computer

Lap top computer

Mobile phone with built–in computer

Fig. E1

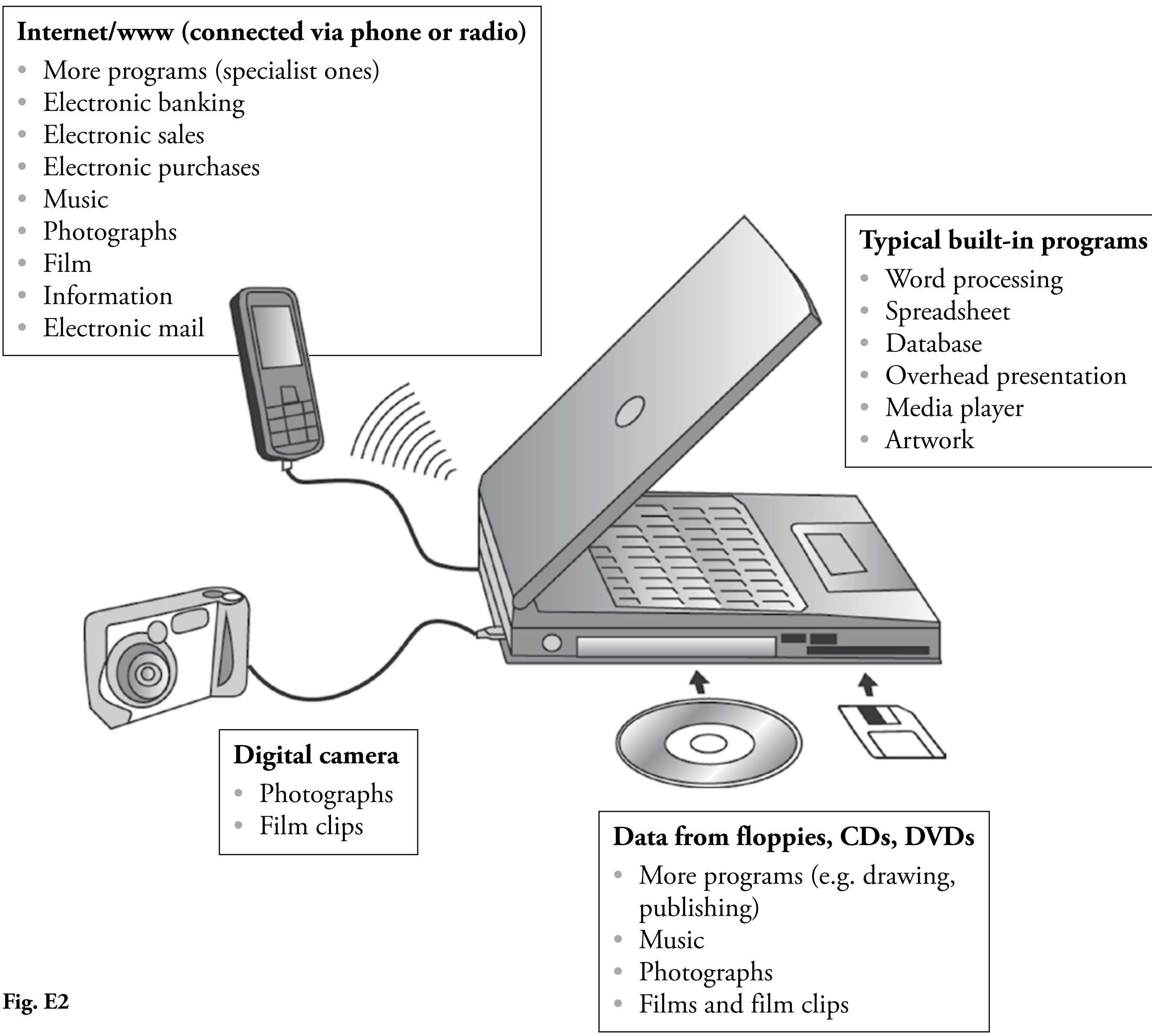


Fig. E2

Computers and mathematics

This section will only be meaningful if you have access to a computer that has a spreadsheet program, for example Microsoft Excel as used here. Follow through the Class Activities on your computer.

As already mentioned, computers had a historically important role in speeding up calculation and handling numerical information. Of the software listed in Fig. E.2, spreadsheet programs currently have the greatest everyday application to mathematics, statistics and economics.

A spreadsheet has the appearance of an extensive matrix of cells (Fig. E.3). Data, either written or numerical, are entered into each cell.

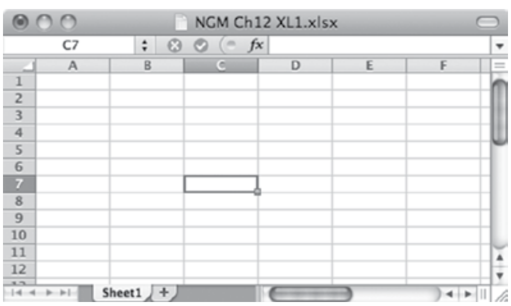


Fig. E3

There are many spreadsheet programs. The one used in this chapter is the most common: Microsoft Excel. In this program we identify each cell by an ordered pair: column letter, row number. The cell highlighted in Fig. E3 is C7. This is similar to an ordered pair, (x, y), on the cartesian plane. Use the arrow keys on the keyboard, or the computer mouse, to locate a cell.

Entering data into a spreadsheet

Class activity (computer activity and discussion)

Table E1 shows the numbers of students by sex from LGA XXX that obtained tertiary education awards for the period 2003–04 to 2007–08.

	2003 –04	2004 –05	2005 –06	2006 –07	2007 –08
Males	1 324	1 421	1 843	1 981	2 102
Females	1 171	1 406	1 316	1 494	1 651

Table E1 Tertiary students by sex in LGA XXX from 2003–04 to 2007–08

Enter the data in Table E1 onto a spreadsheet file. Work through this section, copying the various methodologies given below. At the end, save your file as LGA XXX.

Method:

Open a blank spreadsheet.

- Go to Cell A1. Type in the table title. Press Enter.
- Go to Cell B3. Enter 2003–04. Then, move across to cells C3, D3, E3, F3 one at a time, entering the years from 2004–05 to 2007–08.
- Go to Cell A4. Enter the title Males. Move across from B4 to F4; enter the numerical data for males from Table E.1. 9 Do not put spaces between the digits.
- Go to Cell A5. Enter the title Females, then move across from B5 to F5, entering the numerical data for females from Table E1.

Your spreadsheet should now look like Fig. E4.

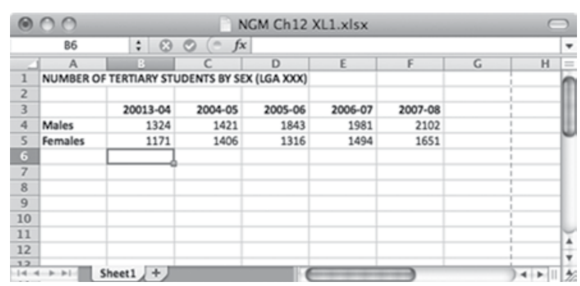


Fig. E4

In Fig. E4 we used the ‘bold’ command to emphasise the title, the years and the left-hand column. To change or edit the contents of a cell, go to that cell, click on it, change the contents as desired, and then press Enter.

Drawing graphs

To draw a graph of the data in Fig. E4:

- Select or highlight all of the relevant cells by clicking and dragging from A3 to F5.
- Click on the Chart Wizard icon.
- Choose a graph type, in this case a bar graph, then follow the instructions on the screen. Fig. E5 is an Excel bar graph of the male and female tertiary students for the given years.

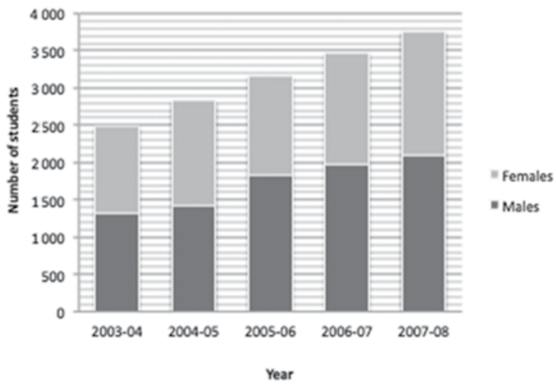


Fig. E5

Alternatively, you may wish to draw a pie chart that shows the proportion of male to female students in a given year, for example 2003/04:

- Select the data for 2003/04 (cells B4 to B5).
- Follow the steps under the Chart Wizard, this time selecting the instructions for a pie chart. Fig. E.6 shows one of many kinds of pie chart that Excel can draw.

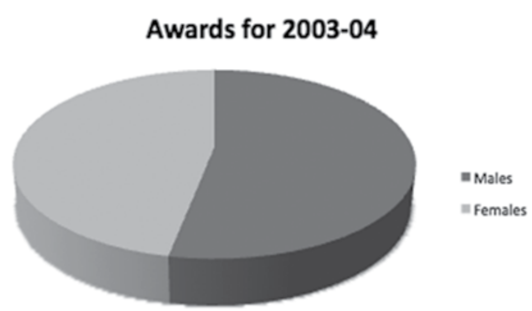


Fig. E6

Depending on the data, we can use the spreadsheet program to draw other graphs, such as a line graph or a scattergram. For example, Fig. E.7 is a line graph of the data, drawn by selecting cells B3 to F5, then following the instructions in the Chart Wizard.

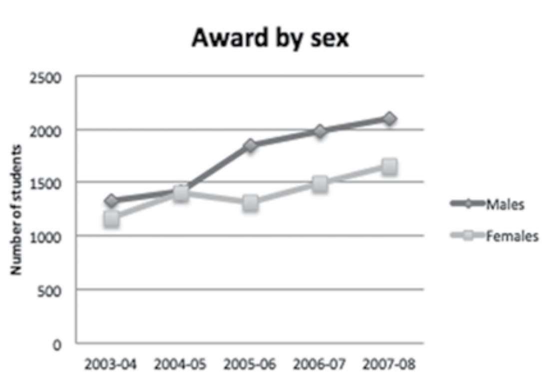


Fig. E7

Using formulae functions

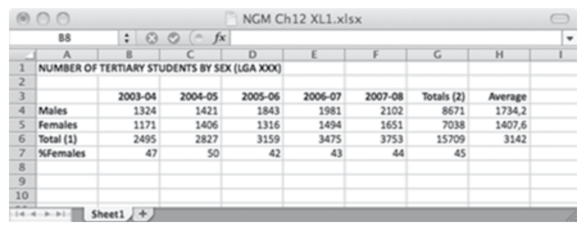
Sum

To find the sum of the numbers in cells B4 to F4 and place the total in Cell G4:

- First click in Cell G4.
- Then type = SUM(B4:F4) and press Enter.

Notice that = SUM(B4:F4) is short for 'the sum of the values in cells B4 to F4'. Another way to find this sum is to select cells B4 to F4 and press the ∑ icon (∑ is the Greek letter S, which is short for 'sum'). Try this for cells B5 to F5.

Use both of these methods to check the data in the Totals (1) row and Totals (2) column in Fig. E.8.


NGM Ch12 XL1.xlsx

	A	B	C	D	E	F	G	H
1	NUMBER OF TERTIARY STUDENTS BY SEX (LGA XXX)							
2								
3		2003-04	2004-05	2005-06	2006-07	2007-08	Totals (2)	Average
4	Males	1324	1421	1843	1981	2102	8671	1734,2
5	Females	1171	1406	1316	1494	1651	7038	1407,6
6	Total (1)	2495	2827	3159	3475	3753	15709	3142
7	%Females	47	50	42	43	44	45	
8								
9								
10								

Fig. E8

Average

To find the average of the numbers from B4 to F4 on the spreadsheet:

- Click the cell where you want the average to go (H4).
- Type = AVERAGE(B4:F4), then press Enter.

The result is shown in Cell H4 in Fig. E.8. Similarly, cells H5 and H6 give the averages of cells B5 to F5 and B6 to F6 respectively.

Percentage

The spreadsheet program allows you to make up your own formula. For example, to find the percentage of females in 2003–04:

- Click in Cell B7.
- Type = B5*100/B6, then press Enter.

The outcome, 47, is the percentage of females to the nearest whole number. Note that the formula = B5*100/B6 is short for (B5 × 100) ÷ B6, i.e. B5 as a percentage of B6. On a computer * and / are the symbols for multiplication and division.

Check the percentage formulae in the other boxes.

Notes:

1. The spreadsheet program that produced Fig. E4 to Fig. E8 was adjusted to give data to the nearest whole number.
2. When writing a formula, always begin with an = sign.
3. The above is a simplified account of some basic operations with a spreadsheet. There are many other operations, clever shortcuts and other ways of working with data on a spreadsheet. Practise on your computer and don't be too proud to ask for tips from other users (especially younger people!).

Exercise E1

1. Puzzle: magic square. Work on a 3 cell × 3 cell grid on a spreadsheet.

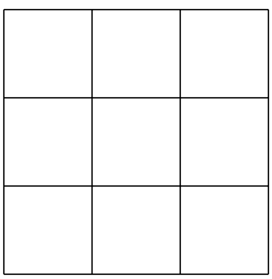


Fig. E9

Enter the digits 1 to 9, one to each cell, so that the three numbers in every row, every column and in the two main diagonals all have the same total.

2. Table E2 gives similar data to Table E1 for LGA YYY.

	2003 –04	2004 –05	2005 –06	2006 –07	2007 –08
Males	2 504	2 701	2 855	3 019	3 186
Females	2 399	2 650	2 777	2 982	3 177

Table E2 Tertiary students by sex in LGA YYY from 2003–04 to 2007–08

a Make a copy of the file you worked on for LGA XXX. Rename the copy LGA YYY.
b Replace the written and numerical data in cells A1 to F5 with the data in Table E.2. (Do not touch the other cells.)
c Notice what happens automatically to the data in the Totals, Average and % Female rows and columns.
d What does this tell you about the power of the spreadsheet program?

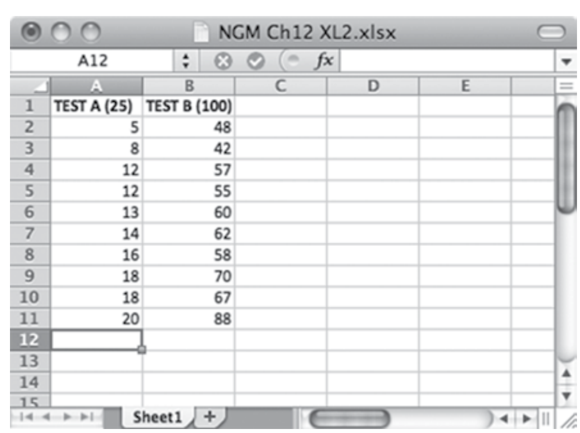
3. Table E3 shows the attendances (days absent) of 10 students during a school term. The table also shows the end of term test results of the same students.

Student	A	B	C	D	E	F	G	H	I	J
Days absent	0	4	0	0	2	15	8	0	10	5
Test result	71	66	80	56	61	43	50	74	44	60

Table E3 Student absences and test results

a Enter the data on a spreadsheet.
b Use the program to find the average score for the test.
c Produce a scattergram of the data. Try to decide whether there appears to be a relationship between days absent and test results.

4. Fig. E10 shows the results of two tests: Test A out of 25 and Test B out of 100, as presented on a spreadsheet. Test A was on the geography of Nigeria and was given before any teaching had taken place. The teacher then taught about the geography of Nigeria and afterwards gave the class Test B. The data show corresponding marks of ten of the students: i.e. the student in Row 4 got $\frac{12}{25}$ in Test A and $\frac{57}{100}$ in Test B.



	A	B	C	D	E
1	TEST A (25)	TEST B (100)			
2	5	48			
3	8	42			
4	12	57			
5	12	55			
6	13	60			
7	14	62			
8	16	58			
9	18	70			
10	18	67			
11	20	88			
12					
13					
14					

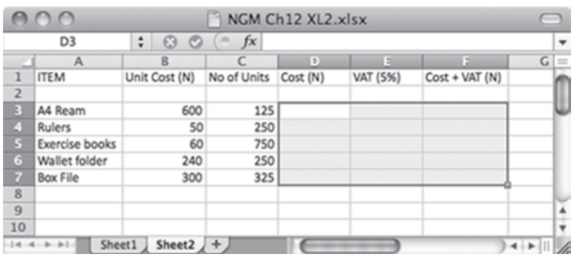
Fig. E10

a In Column C, scale up the scores in Test A to marks out of 100. For example, try = A3*4 for Cell C3 and so on for the rest of the column.

b Produce a scattergram for the data.

c Use the scattergram to decide whether the teacher had been effective.

⑤ A school uses its office computer to keep its accounts. Fig. E11 shows part of the stationery account.



	A	B	C	D	E	F
1	ITEM	Unit Cost (N)	No of Units	Cost (N)	VAT (5%)	Cost + VAT (N)
2						
3	A4 Ream	600	125			
4	Rulers	50	250			
5	Exercise books	60	750			
6	Wallet folder	240	250			
7	Box File	300	325			
8						
9						
10						

Fig. E11

a Open a spreadsheet and enter the data as in Fig. E11.

b In Row 3, the formulae for the Cost, VAT and Cost + VAT columns are, respectively: = B3*C3 (entered into D3), = D3*0.05 (entered into E3) and = D3 + E3 (entered into F3). Apply these formulae to all the rows.

c Use the program to complete the shaded cells, showing the total costs of the stationery.

d How would you change the VAT formula if the Government increases VAT to 12%?

⑥ Challenge: In this challenge you can use a spreadsheet to record your work.

a Complete Fig. E12 so that the cells in every row, every column and every 2 × 2 box each contains the digits 1 to 4. Each digit may only be used once. The digits can be in any order. (Use logic to do this puzzle. As in question 1, you can try this with pencil and paper.)

1			
		4	
	2		
			3

Fig. E12

b Make up a similar puzzle of your own. (But compose the answer first!)

Summary

- The development of dependable, cheaper computers and mobile phones has given rise to the growth of ICT (Information and Communications Technology). ICT enables people to interact using the spoken and written word.
- Historically, computers were developed to improve computation, but today most people use them for creating, sending and storing written files and emails.
- A spreadsheet program helps you to store and operate on numerical data. The outcomes of the operations may be numerical or graphical.
- A spreadsheet is a large matrix of cells, each of which may contain written or numerical data.
- Data within the spreadsheet are operated upon by formulae such as those shown in the class activity.

Section 2: Lesson plans

Section 2 contains suggested lesson plans for each chapter in the Student's Book. These are guidelines for how to break up the content in each chapter into teaching lessons.

Each chapter contains:

- Teaching and learning materials needed for completing the chapter
- Key word definitions for mathematical terminology
- Foundation knowledge needed by students to be able to complete the chapter
- Lesson guidelines
- Answers to the Puzzle Corners and Workbook
- Notes to assess learning milestones.

Chapter 1 Binary System: Operations and Applications

Objectives

By the end of this chapter, each student should be able to:
- Express numbers in bases other than ten
- Convert numbers from base ten to other bases and vice versa
- Express numbers using the binary system
- Convert numbers from base ten to base two and vice versa
- Add, subtract and multiply binary numbers
- Use the binary system in simple computer applications such as punch cards and punch tape.

Teaching and learning materials

- Counters (e.g. bottle tops, matchsticks, pebbles)
- Punch cards (as in Fig. 1.3 to 1.6)

Foundation knowledge

Students needs to be able to:
- Count in tens
- Work with place values
- Add and multiply

Lesson 1 Number bases

Student's Book page 8; Workbook page 5

The focus of this lesson is expressing numbers in bases other than ten and being able to convert numbers from base ten to other bases and vice versa.

Work through Examples 1, 2, 3 and 4 with the class.

All students must complete the 'must do' questions of Exercises 1a, 1b, 1c.

Stronger students can complete Questions 4 and 5 of Exercise 1b.

Assign question 1-9 from Worksheet 1 as homework.

Answers

Worksheet 1

1 $1 \times 125 + 2 \times 25 + 3 \times 5 + 4 \times 1$

2 194_{10} **3** 668_{10} **4** 11_{10} **5** 173_8

6.1 $0_{10} = 0_2$ **6.2** $1_{10} = 1_2$

6.3 $10_{10} = 1010_2$

6.4 $100_{10} = 1\,100\,100_2$

6.5 $-2_{10} = -10_2$

6.6 $1000\,000_{10} = 11\,110\,010\,000\,001\,000\,000$

7.1 $0_2 = 0_{10}$ **7.2** $1_2 = 1_{10}$ **7.3** $10_2 = 2_{10}$

7.4 $100_2 = 8_{10}$

7.5 $-1010_2 = -21_{10}$

8.1 1010_2 **8.2** 14_8 **9.** 253_7

Assessment

Students should be able to express numbers in bases other than ten.
Students should be able to convert numbers from base ten to other bases and vice versa.
Students should be able to express numbers using the binary system.

Lesson 2: The binary system

Student's Book page 10; Workbook page 6

The focus of this lesson is expressing numbers using the binary system, converting numbers from base ten to base two and vice versa, and adding, subtracting and multiplying binary numbers.

Work through Examples 6, 7, 8 and 9 with the class.

All students must complete the 'must do' questions of Exercises 1d and 1e.

Stronger students can complete questions 6, 7 and 8 of Exercises 1d and question 3 of Exercise 1e.

Assign questions 10-16 from Worksheet 1 as homework.

Answers

Worksheet 1

10 Complete the following pattern for binary adding.

+	0	1
0	0 + 0 = 0	0 + 1 = 1
1	1 + 0 = 1	1 + 1 = 10

11 Complete the following pattern for binary subtraction (subtract the number in the row from the number in the column).

–	0	1
0	0 – 0 = 0	1 – 0 = 1
1	0 – 1 = –1	1 – 1 = 0

12 Complete the following pattern for binary multiplication.

×	0	1
0	0 × 0 = 0	0 × 1 = 0
1	1 × 0 = 0	1 × 1 = 1

13.1 10 100

13.2 0001

13.3 110

13.4 11110

14 $10 \times 10 = 100$

15 101_2

16 10^3; 0; 1

Assessment

Students should be able to express numbers using the binary system.
Students should be able to convert numbers from base ten to base two and vice versa.
Students should be able to add, subtract and multiply binary numbers.

Lesson 3: Application of the binary system

Student's Book page 13; Workbook page 7

The focus of this lesson is learning to use the binary system in simple computer applications such as punch cards and punch tape.

Work through the explanations on pages 13 and 14 of the Student's Book with the class.

All students must complete the 'must do' questions of Exercises 1f and 1g.

Stronger students can complete questions 2, 3, 4 and 5 of Exercises 1f , and questions 4 and 5 of Exercise 1g.

Assign questions 17-20 from Worksheet 1 as homework.

Answers

Worksheet 1

17.1 T H H T

17.2 T H H T

18 Polio and measles written under the V's. Mumps and rubella written under the holes. As the nurse performs an inoculation the V is cut out. The right-hand bottom corner is cut off to prevent the cards being inserted 'back-to-front'.

19

J	0	1	0	1	0
O	0	1	1	1	1
E	0	0	1	0	1

20

M	0	1	1	0	1
A	0	0	0	0	1
T	1	0	1	0	0
H	0	1	0	0	0
S	1	0	0	1	1

Assessment

Students should be able to use the binary system in simple computer applications.

Chapter 2 Word Problems

Objectives

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

- Use appropriate symbols for words such as *sum, difference, product*
- Solve word problems involving whole numbers and fractions
- Create an equation from a word problem and solve it.

Teaching and learning materials

- Flash cards with words and symbols

Key word definitions

difference – the result when subtracting one number from another

sum – the total when adding a set of numbers

product – the result when multiplying two or more numbers together

Foundation knowledge

Students need to be able to:

- Complete mechanical operations such as addition, subtraction, multiplication and division, up to and including 3-digit numbers.

Lesson 1: Sum and Difference

Student's Book page 17; Workbook page 8

The focus of this lesson is clarifying the terms sum and difference in relation to addition and subtraction operations.

Work through Examples 1 and 2 with the class.

All students must complete the 'must do' questions of Exercise 2a.

Assign question 1-10 from Solve from Worksheet 2.

Answers

Worksheet 2

1 29 **2** 29 **3** 8 **4** −8

5 45 **6** 45 **7** 3 **8** $\frac{1}{3}$

9 The answers to the sum and the product do not depend on the order. The answers to difference and division do depend on the order.

10 Subtract the product of four and the 1st and 3rd numbers from the 2nd number squared.

Assessment

Students should be able to apply the correct operation when word problems contain the terms *sum* and *difference*.

Lesson 2: Product

Student's Book page 18; Workbook page 9

The focus of this lesson is ensuring that students apply the correct operation when encountering the term product in word problems. Students must also be able to combine operations correctly from word problems.

Work through Examples 3—8 with the class.

All students must complete the 'must do' questions of Exercises 2b and 2c.

Stronger students can complete questions 10–15 of Exercise 2c.

Assign questions 2 and 5 from Worksheet 2. Find the Number, as homework.

Answers

Worksheet 2

2 9; 10 **5** 10; 11; 12

Assessment

Students should be able to apply multiplication when encountering product in a word problem. Students should be able to be able to combine operations correctly from word problems.

Lesson 3: Expressions with fractions

Student's Book page 19; Workbook page 8

The focus of this lesson is expressing fractions from words.

Work through Examples 9, 10, 11 and 12 with the class.

All students must complete the 'must do' questions of Exercise 2d.

Stronger students can complete questions 15–20 of Exercise 2d.

Assign questions 11–16 from Solve, questions 6–10 from Find the Number, from Worksheet 2 as homework.

Answers

Worksheet 2; Solve

11 4.5 **12** 12.1 **13** $\frac{9}{7} = 1\frac{2}{7}$

14 0

15 120 girls

16 5

Worksheet 2; Find the Number

6 $\frac{7}{15}$ **7** $\frac{1}{9}$ **8** $42\frac{6}{7}$ **9** 255

10 $\frac{6}{10}$ or $\frac{3}{5}$

Assessment

Students should be able to identify when a word problem asks them to work with fractions.

Lesson 4: From numbers to words

Student's Book page 20; Workbook page 8

The focus of this lesson is changing numerical statements into word statements.

Work through Example 13 with the class.

All students must complete the 'must do' questions of Exercise 2e.

Stronger students can complete questions 14 –20 of Exercise 2e.

Assign question 10 from Solve, from Worksheet 2 as homework.

Answers

Worksheet 2; Solve

10 There are three numbers represented by A, B and C. Subtract the product of four and the first and third numbers from the second number squared.

Assessment

Students should be able to rewrite numerical statements as word statements.

Lesson 5: Problems involving equations

Student's Book page 21; Workbook page 10

The focus of this lesson is to introduce the use equations to solve problems.

Work through Examples 14, 15 and 16 with the class.

All students must complete the 'must do' questions of Exercise 2f.

Stronger students can complete questions 9–20 of Exercise 2f.

Assign questions 11–13 from Find the Number, from Worksheet 2 as homework.

Answers

Worksheet 2; Find the Number

11 31; 33 **12** 74

13 864 197 532. Uses all the digits from 1 to 9.

Assessment

Students should be able to write an equation from a word problem.
Students should be able to solve the equation they have written.

Chapter 3 Factorisation 1: Common Factors

Objectives

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

- Remove brackets from algebraic expressions
- Factorise algebraic expressions by taking common factors
- Use factorisation to simplify calculations
- Use grouping to factorise expressions with four terms.

Teaching and learning materials

- Factorisation charts (similar to those in QR Box 1 on page 30 of the Student's Book).

Key word definitions

binomial expression: an algebra expression with two terms
factorise: to write a number or expression as a product of its factors
grouping: arranging terms in a more convenient way

Foundation knowledge

Students need to be able to:

- Work with basic mechanical operations
- Decide when terms can or cannot be grouped.

Lesson 1: Removing brackets

Student's Book page 23; Workbook page 11

The focus of this lesson is removing brackets from terms through multiplication.

Work through Example 1 with the class.

All students must complete the 'must do' questions of Exercises 3a.

Assign question 1 from Worksheet 3 as homework.

Answers

Worksheet 3

1.1 $8x - 8$ **1.2** $80x^2 - 30x + 40$
1.3 $30bc - 18ab$

Assessment

Students should be able to multiply terms within a bracket with terms outside the bracket.

Lesson 2: Common factors

Student's Book page 23: Workbook page 11

The focus of this lesson is finding the highest common factors in algebraic terms.

Work through Examples 2-7 with the class.

All students must complete the 'must do' questions of Exercises 3b, 3c, and 3d.

Stronger students can complete questions 11-20 of Exercise 3c and questions 30-40 of 3d.

Assign questions 2 and 3.1-3.12 from Worksheet 3 as homework.

Answers

Worksheet 3

2.1 3 **2.2** xy **2.3** 15 **2.4** xy **2.5** 3
2.6 $9p^2q^3r^2$
3.1 $(5b - 2c)(2a - 3c)$
3.2 $x^2(3 + 2x^2 + 4x)$
3.3 $(x + y)(3x - 3y)$
3.4 $(c - 3)(a + b + 1)$
3.5 $(x - y)(2w - z)$
3.6 $(x + y)(x + y - 2)$
3.7 $(a - x)(3x - 2b)$
3.8 $(y + w)(x - y)$
3.9 $2(u - 2v)(xy - 3by)$
3.10 $(3y + 2v)(2x - 5w)$
3.11 $2(2x - 3y)(m - 2n)$
3.12 $x(3y + z - 4x)$

Assessment

Students should be able to find the highest common factors in algebraic terms.

Lesson 3: Using factorisation to simplify calculations

Student's Book page25; Workbook page 12

The focus of this lesson is factoring to simplify calculations.

Work through Examples 8 and 9 with the class.

All students must complete the 'must do' questions of Exercise 3e.

Assign questions 3.13-3.16 from Worksheet 3 as homework.

Answers

Worksheet 3

3.13 $(a - bx) - bx + a$

3.14 $4x(x + y)$

3.15 $5y(3x + 1)$

3.16 $(5y - 4)(3x + 8)$

Assessment

Students should be able to identify factor.

Lesson 4: Factorisation by grouping

Student's Book page 26; Workbook page 12

The focus of this lesson is learning to correctly regroup terms in an expression in order to factorise.

Work through Examples 10 to 15 with the class.

All students must complete the 'must do' questions of Exercises 3f, 3g, 3h and 3i.

Stronger students can complete questions 3.35-3.45 of Exercise 3i.

Assign questions 3.17-3.26 and 4 from Worksheet 3 as homework.

Answers

Worksheet 3

3.17 $(5y - 4)(3x + 8)$

3.18 $(2x - 3y)(5a + 2)$

3.19 $x(x + y - z)$

3.20 $(a - 2)(ax + by)$

3.21 $x(25x + y - z)$

3.22 $2u(x - y)$

3.23 $(2x - 3y)(2m - 2n + 1)$

3.24 $(2x - y)(50 - a)$

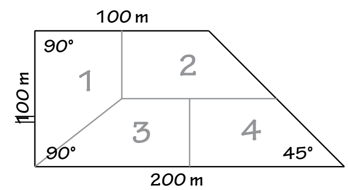
3.25 $(1 - y)(5x + 1)$

3.26 $(a - x)(2x - 3b)$

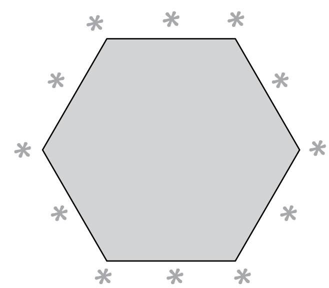
4 $27(5 - 3)$

Puzzle Corner

The inheritance



17s round a hexagon



1, 11, 5, 10, 2, 12, 3, 8, 6, 4, 7, 9

1, 11, 5, 9, 3, 12, 2, 8, 7, 4, 6, 10

1, 11, 5, 8, 4, 10, 3, 12, 2 6, 9 7

Crossing the river

1. The two students cross first, leaving one student on the other side.
2. The first student returns and the first teacher crosses to the other side alone.
3. The second student returns with the boat and the two students cross together again, leaving one student on the other side.
4. The first student returns and the second teacher crosses to the other side alone.
5. The second student returns with the boat to collect the first student.

Assessment

Students should be able to identify the correct method to group terms.
Students should be able to factorise, having grouped terms.

Chapter 4 Geometrical constructions

Objectives

By the end of this chapter, each student should be able to:
- Bisect a straight line segment
- Bisect any angle
- Construct angles of 90° and 45°
- Construct angles of 60° and 30°
- Copy any given angle
- Construct simple shapes.

Teaching and learning materials

- Chalk board instruments (especially ruler and pair of compasses)
- Plain paper
- Old newspapers (for Exercises 4a and 4b)
- Mathematical set (especially ruler, compasses, sharp pencil)

Key word definitions

line segment: the part of a line between two given points
bisect: to cut equally in half
perpendicular bisector: a line which bisects a line segment at right angles
bisector: any line that divides an angle (or a line) into two equal parts
median: a line joining the vertex of a triangle to the mid−point of the opposite side

Foundation knowledge

Students need to be able to:
- Use mathematical instruments, particularly rulers, compasses and protractors.
- Understand some basic geometry terminology, including line, arc, angle.

Answers

Worksheet 4
All answers are constructions and have been omitted from this section. Refer to Section 4 for full answers.

Lesson 1: To bisect a straight line segment

Student's Book page 30; Workbook page 13

The focus of this lesson is learning how, using a pair of compasses to construct the perpendicular bisectors of any straight line segment.

Work through Section 4.1 with the class.

All students must complete the 'must do' questions of Exercise 4a.

Stronger students can complete questions 5, 6, 7, and 8 of Exercise 4a.

Assign questions 1, 3 and 4 from Worksheet 4 as homework.

Assessment

Students should be able to construct the perpendicular of any straight line segment.

Lesson 2: To bisect any angle

Student's Book page 30

The focus of this lesson is demonstrating how to bisect any angle using a pair of compasses and a ruler.

Work through Section 4.2 with the class.

All students must complete the 'must do' questions of Exercise 4b.

Stronger students can complete questions 5, 6, 7 and 8 of Exercise 4b.

Assessment
Students should be able to bisect any angle using a pair of compasses and a ruler.

Lesson 3: To construct angles of 90° and 45°

Student's Book page 34; Workbook page 14

The focus of this lesson is demonstrating how to construct angles of 90° and 45° using a pair of compasses and a ruler.

Work through Section 4.3 with the class.

All students must complete the 'must do' questions of Exercise 4c.

Assign question 5 from Worksheet 4 as homework.

Assessment
Students should be able to construct angles of 90° and 45° using a pair of compasses and a ruler.

Lesson 4: To construct angles of 60° and 30°

Student's Book page 34; Workbook page 15

The focus of this lesson is demonstrating how to construct angles of 30° and 60° using a pair of compasses and a ruler.

Work through Section 4.4 with the class.

All students must complete the 'must do' questions of Exercise 4d.

Stronger students can complete questions 4-8 of Exercise 4d.

Assign question 6 from Worksheet 4 as homework.

Assessment
Students should be able to construct angles of 30° and 60° using a pair of compasses and a ruler.

Lesson 5: To copy any angle

Student's Book page 35; Workbook page 13

The focus of this lesson is demonstrating how to copy any angle.

Work through Section 4.5 with the class.

All students must complete the 'must do' questions of Exercise 4e.

Stronger students can complete question 2 of Exercise 4e.

Assign question 2 from Worksheet 4 as homework.

Assessment
Students should be able to copy any angle using a pair of compasses.

Lesson 6: Construction of simple shapes

Student's Book page 37; Workbook page 17

The focus of this lesson is demonstrating how to construct simple shapes.

Work through Examples 1 and 2 with the class.

All students must complete the 'must do' questions of Exercise 4f.

Stronger students can complete questions 10-12 of Exercise 4f.

Assign questions 7-18 from Worksheet 4 as homework.

Puzzle Corner

Zeros are not allowed!
64 and 15 625

Rose, Sule and the die
Five spots

Assessment
Students should be able to construct simple shapes, including parallelograms and trapeziums.

Chapter 5 Area of plane shapes

Objectives

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

- Recall, use and apply the formulae for the area of triangles, quadrilaterals and circles
- Calculate the areas of shapes
- Calculate the area of sectors and segments of a circle
- Use addition and subtraction methods to find the areas of composite shapes
- Apply area formulae to real-life problems in the home, in the environment and in relation to land measure.

Teaching and learning materials

- Cardboard models of plane shapes
- Charts with area formulae

Key word definitions

formulae (singular: formula): equations showing relationships between quantities
area: a measure of the surface covered by a plane or curved shape
trapezium: a quadrilateral with one pair of parallel sides
ring: a circular shape with a hole in the middle
sector: region of a circle contained by two radii and an arc
subtended by: standing on (or held by)
segment: region of a circle contained by a chord and the arc on the chord
quadrant: a sector of a circle with an angle of 90° (quarter of a circle)
hectare: an area of land 100 m by 100 m (= 10 000 m^2)

Foundation knowledge

Students need to be able to:

- Do basic mechanical calculations
- Identify the properties of basic plane shapes
- Work with the formulae for area of basic shapes including rectangles, parallelograms, triangles and circles.

Lesson 1: Area of basic shapes

Student's Book page 40; Workbook page 18

The focus of this lesson is revising the formulae for the area of basic shapes. Students may need additional guidance to identify basic shapes in composite shapes such as question 4, in Exercise 5a.

Work through Fig. 5.1 with the class.

All students must complete the 'must do' questions of Exercise 5a.

Stronger students can complete questions 8, 9 and 10 of Exercise 5a.

Assign questions 1-4 and 8 from Worksheet 5 as homework.

Answers

Worksheet 5

1 750 bricks **2** 0.8 m^2 **3** 29 m^2
4 30.3 mm^2. This depends on measurement of printed picture. In this answer the distance between flats was 35 mm.
8 1 944 cm^2

Assessment

Students should be able to calculate the area of basic shapes using the given formulae.
Students should be able to calculate the area of composite shapes by using the area of basic shapes.

Lesson 2: Area of a trapezium

Student's Book page 40; Workbook page 19

The focus of this lesson is demonstrating how to calculate the area of a trapezium.

Work through Examples 1, 2 and 3 with the class.

All students must complete the 'must do' questions of Exercise 5b.

Stronger students can complete question 2 of Exercise 5b.

Assign question 5 from Worksheet 5 as homework.

Answers

Worksheet 5

5 31.5 cm^2

Assessment

Students should be able to calculate the area of a trapezium.

Lesson 3: Areas of circles, rings and sectors

Student's Book page 42; Workbook page 19

The focus of this lesson is demonstrating how to calculate the areas of circles, rings and sectors.

Work through Examples 4-10 with the class.

All students must complete the 'must do' questions of Exercise 5c.

Stronger students can complete question 5 of Exercise 5c.

Assign questions 6-8 from Worksheet 5 as homework.

Answers

Worksheet 5

6 5.04 m^2

7 0.672 m^2

8 972 cm^3

Assessment

Students should be able to calculate the area of a circle, a ring and a sector.

Lesson 4: Area in the home and environment

Student's Book page 45 ; Workbook page 20

The focus of this lesson is showing students how area is widely used in practical applications.

Work through Examples 11 and 12 with the class.

All students must complete the 'must do' questions of Exercise 5d.

Stronger students can complete questions 7-15 of Exercise 5d.

Assign questions 9-13 from Worksheet 5 as homework.

Answers

Worksheet 5

9.1 36 m^2

9.2 3 cans

10.1 138,6 m^2 glass

10.2 22 400 tiles

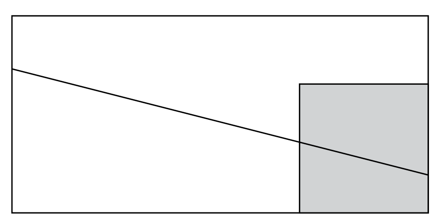
11 5.04 m^2

12 25 m

13 15 400 cm^2 cut out and 246 400 cm^2 remaining

Puzzle Corner

Only one straight cut



Assessment

Students should be able to identify the use of area calculations in the home and the environment.

Students should be able to calculate area from real-world examples from home and the environment.

Chapter 6 Formulae: Substitution; change of subject

Objectives

By the end of this chapter, each student should be able to:
- Substitute values in a formula
- Change the subject of a formula.

Teaching and learning materials
- Flash cards with formulae for discussion

Key word definitions
formula (plural – formulae): an equation showing a relationship between quantities
substitute: to replace letters with numerical values
table of values: a table showing corresponding values within a formula
subject (of formula): the unknown on its own in a formula, e.g. $x = \ldots$
change the subject (of formula): to make another letter the subject of a formula

Foundation knowledge
Students need to be able to:
- Understand that a formula reflects the relationship between variables.

Lesson 1: Formulae and substitution
Student's Book page 49; Workbook page 22

The focus of this lesson is teaching students how to substitute values into a formulae.

Work through Examples 1 and 2 with the class.

All students must complete the 'must do' questions of Exercise 6a.

Assign questions 5 and 6 from Worksheet 6 as homework.

Answers
Worksheet 6
5.1 5.15 cm **5.2** 19.8 cm
6 $V = \frac{1}{100}$ litre

Assessment

Students should be able to substitute values into a formula and solve.

Lesson 2: Using tables to solve formulae
Student's Book page 51; Workbook page 24

The focus of this lesson is showing students how to use tables to solve formulae.

Work through Examples 3-5 with the class.

All students must complete the 'must do' questions of Exercise 6b.

Stronger students can complete questions 7-10 of Exercise 6b.

Assign questions 7, 8 and 9 from Worksheet 6 as homework.

Answers
Questions 7, 8 and 9 from Worksheet 6
7 1.5

x	–2	–1	0	1	2
y	–7	–5	–3	–1	1

8

x	–2	–1	0	1	2
y	7	5	3	1	–1

8.1 3
8.2 In Q 6 y increases with increasing x, in Q 7 y decreases with increasing x.

8.3 $x = \frac{(3-y)}{-2}$

9

x	-2	-1	0	1	2
$2x^2$	8	2	0	2	8
$-x$	4	1	0	-1	-2
3	3	3	3	3	3
y	15	6	3	4	9

Assessment

Students should be able to draw up a suitable table to solve formulae.

Lesson 3: Solving an equation with one variable given

Student's Book page 52 ; Workbook page 25

The focus of this lesson is demonstrating how to solve an equation with one variable given.

Work through Examples 6 and 7 with the class.

Stronger students can complete questions 1-10 of Exercise 6c.

Assign questions 10, 11, 14-17 from Worksheet 6 as homework.

Answers

Worksheet 6

10 8 cm
11.1 55
11.2 12
11.3 49
14 $y = 8$
15 15
16 9.789
17.1 36 km/h
17.2 8.3 seconds
17.3 No, only when the car begins to accelerate for acceleration cannot increase forever.

Assessment

Students should be able to solve an equation with one variable given.

Lesson 4: Change of subject of simple formulae

Student's Book page 53; Workbook page 22

The focus of this lesson is changing the subject of a simple formula.

Work through Examples 8, 9 and 10 with the class.

All students must complete the 'must do' questions of Exercises 6d and 6e.

Stronger students can complete questions 6-10 of Exercise 6e.

Assign questions 1-4, 12 and 13 from Worksheet 6 as homework.

Answers

Worksheet 6

1 $C = \frac{F - 32}{9}$ **2** $F = 9\frac{C}{5} + 32$
3 $-40^{o.}$ Either °C or °F.
4 $r = 3\sqrt{\frac{3V}{4\pi}}$
12 $x = \frac{y - c}{m}$
13.1 $r = -\sqrt{x^2 + y^2}$
13.2 5

Assessment

Students should be able to change the subject of a simple formula.

Lesson 5: Changing the subject of more complex formulae

Student's Book page 56

The focus of this lesson is changing the subject of more complex formulae.

Work through Examples 11-14 with the class.

All students must complete the 'must do' questions of Exercises 6f, 6g and 6h.

Stronger students can complete questions 7-20 of Exercise 6g and 5-10 of Exercise 6h.

Assessment

Students should be able to change the subject of more complex formulae.

Chapter 7 Similarity 1: Similar shapes and scale factors

Objectives

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

- Decide whether plane shapes are similar or not
- Decide whether solid shapes are similar or not
- Recall and apply the properties of similar triangles
- Name similar figures correctly
- Draw an enlargement of a shape, given the centre of enlargement and the scale factor of the enlargement
- Identify the centre of enlargement and scale factor from a given enlargement.

Teaching and learning materials

- Models of similar solids
- Charts of similar plane shapes

Key word definitions

similar: same shape but different size
equiangular: having equal angles
enlargement (in geometry): a shape similar to another
centre of enlargement: a point used to draw enlargements (e.g. O in Fig. 7.24)
scale factor: the ratio of corresponding sides in similar figures

Foundation knowledge

Students need to be able to:

- Recognise and name basic shapes
- Recall and apply the properties of basic shapes.

Lesson 1: Similarity

Student's Book page 59; Workbook page 26

The focus of this lesson is teaching criteria for similarity in plane shapes.

Work through Examples 1-3 with the class.

All students must complete the 'must do' questions of Exercise 7a.

Assign question 1 from Worksheet 7 as homework.

Answers

Worksheet 7

Pair 1 Similar
Pair 2 Not similar
Pair 3 Similar

Assessment

Students should be able to identify similar shapes.

Lesson 2: Similar triangles angles and corresponding sides

Student's Book page 61; Workbook page 27

The focus of this lesson is teaching two aspects for similarity – equal angles and naming sides in relation to angles.

Work through section 4.2 and Examples 4 and 5 with the class.

All students must complete QR 5 and Exercise 7b.

Assign questions 2-4 from Worksheet 7 as homework.

Answers

Worksheet 7

2 DF = 20 mm, $\hat{F} = 60°$

3 $\hat{D} = 54°$; $\hat{E} = 38°$, $\hat{F} = 88°$

4.1 Lengths 126 cm, 44.1 cm and 128.8 cm
Angles 76°, 20° and 84°

4.2 44.1 cm **4.3** 84°

Assessment
Students should be able to identify whether triangles are similar based on given angles.
Students should be able to correctly name corresponding sides in relation to angles.

Lesson 3: Ratio of corresponding lengths

Student's Book page 65 ; Workbook page 27

The focus of this lesson is that equi-angular triangles have corresponding sides in the same ratio.

Work through Examples 6 and 7 with the class.

All students must complete the 'must do' questions of Exercises 7c and 7d.

Stronger students can complete questions 7-13 of Exercise 7d.

Assign questions 5 and 6 from Worksheet 7 as homework.

Answers

Worksheet 7

5.1 ABC $\equiv$ MNC **5.2** $\frac{4}{9}$

5.3 BC = 78.75 cm, AB = 67.5 cm

6.1 Scale factor 2.5

6.2 680 m^2 and 4 250 m^2

6.3 A is the centre of the enlargement.

6.4 6.25

Assessment
Students should be able to calculate the length of the sides of triangle, given the length of sides of a similar triangle, using ratios.

Lesson 4: Similar plane shapes and solids

Student's Book page 68

The focus of this lesson is the relationship between sides and angles in other plane shapes for similarity.

Work through Examples 8 and 9 with the class.

All students must complete the 'must do' questions of Exercise 7e.

Stronger students can complete questions 5-10 of Exercise 7e.

Assessment
Students should be able to calculate lengths of sides based on given ratios.
Students should be able to solve word problems using similar shapes and ratios.

Lesson 5: Enlargement and scale factor

Student's Book page 69; Workbook page 28

The focus of this lesson is demonstrating how to scale a triangle up, to create a larger, similar triangle.

Work through Section 7.4 and Example 10 with the class.

All students must complete the 'must do' questions of Exercise 7f.

Stronger students can complete questions 4 and 5 of Exercises 7f and 7g.

Assign questions 7-9 from Worksheet 7 as homework.

Answers

Worksheet 7

7 Construction
8 Construction
9 Construction

Assessment
Students should be able to construct a similar enlargement of a triangle.
Students should be able to calculate the length of the sides of a plane shape using ratios and given a similar shape with known sides.

Chapter 8 Trigonometry 1: Tangent of an angle

Objectives

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

- Define the tangent of an angle in a right-angled triangle
- Use measurement to find the tangent of an angle
- Use tangents of angles to calculate lengths and angles in a right-angled triangle
- Define and use the complement of an angle
- Use tangent tables to find the tangents of angles from 0° to 90°
- Solve practical problems using tangents of angles and tangent tables.

Teaching and learning materials

- Cardboard models of right-angled triangles (as in Fig. 8.2
- Tangent tables

Key word definitions

tangent (of angle): ratio of opposite side to adjacent side in a right-angled triangle
tan A: abbreviation of tangent of angle A
hypotenuse (hyp): side opposite the right-angle in a right-angled triangle
opposite (opp): side opposite an angle in a triangle
adjacent (adj): a side* containing an angle in a right-angled triangle (*not the hypotenuse)
solve (a triangle): calculate lengths and angles in a triangle
degree of accuracy: a measure of how accurate a value is
complement (of an angle): the complement of $\Theta°$ is $90° - \Theta°$
four-figure tables: tables in which data is correct to 4 s.f.
undefined number: any number where we cannot be sure of its size
vertical angle: angle at the top of a cone or pyramid

Foundation knowledge

Students need to be able to:

- Work with right-angled triangles.

Lesson 1: Understanding and calculating the tangent of an angle

Student's Book page 74; Workbook page 31

The focus of this lesson is defining the tangent of an angle and calculating the tangent of an angle.

Work through Sections 8.1 and 8.2 and then Examples 1 and 2 with the class.

All students must complete the 'must do' questions of Exercises 8a, 8b and 8c.

Assign questions 2-4 from Worksheet 8 as homework.

Answers

Worksheet 8
2.1 hyp: AC, opp: BC, adj: AB
2.2 hyp: AC, opp: AB, adj: BC
2.3 $\tan A = \frac{BC}{AB}$ **2.4** $\tan C = \frac{AB}{BC}$
2.5 0.645
4 57.7 m

Assessment

Students should be able to define and calculate the tangent of a given angle.
Students should be able to draw and calculate an angle, given a tangent.

Lesson 2: Use of the tangent of an angle to calculate the opposite side

Student's Book page 76; Workbook page 30

The focus of this lesson is using tangent tables to find the length of sides.

Work through Example 3 with the class.

All students must complete the 'must do' questions of Exercise 8d.

Assign question 1 from Worksheet 8 as homework.

Answers

Worksheet 8

1.1.1	0.6275	**1.1.2**	3.018	**1.1.3**	1.731
1.2	Bigger. The tan increases with angle size.				
1.3.1	32.5°	**1.3.2**	32.86°	**1.3.3**	59.88°
1.3.4	59.87° or 59.88°				

Assessment

Students should be able to use a tangent table and a given side of a triangle to calculate the side opposite the given angle.

Lesson 3: Use of the tangent of an angle to calculate the adjacent side

Student's Book page 77; Workbook page 32

The focus of this lesson is using the tangent of an angle to calculate the adjacent side.

Work through Examples 4 and 5 with the class.

All students must complete the 'must do' questions of Exercise 8e.

Assign question 3 from Worksheet 8 as homework.

Answers

Worksheet 8

3 Triangle 1: 4.4 cm   Triangle 2: 8.9 cm
Triangle 3: 5 cm

Assessment

Students should be able to use the tangent of an angle to calculate the adjacent side.

Lesson 4: Tangent tables

Student's Book page 78

The focus of this lesson is using the tables to find the tangents of angles.

Work through Examples 6 and 7 with the class.

All students must complete the 'must do' questions of Exercise 8f and 8g.

Stronger students can complete questions 24-36 of Exercise 8f and questions 20-30 of Exercise 8g.

Assessment

Students should be able to use the tables to find the tangents of angles.

Lesson 5: Applying tangents to practical problems

Student's Book page 80; Workbook page 32

The focus of this lesson is applying tangents to practical problems.

Work through Examples 8 and 9 with the class.

All students must complete the 'must do' questions of Exercise 8h.

Stronger students can complete questions 2-20 of Exercise 8h.

Assign question 5-9 from Worksheet 8 as homework.

Answers

Worksheet 8

5 114.3 m	**6** 112.4 m	**7** 686.7 m
8 437.5 m	**9** 368.1 m	

Assessment

Students should be able to use the tangent of an angle to calculate the adjacent side.

Chapter 9 Factorisation 2: Quadratic expressions

Objectives

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

- Multiply two binomials together to give a quadratic expression
- Expand products directly
- Factorise quadratic expressions where the coefficient of x^2 is 1
- Expand and factorise expressions involving perfect squares
- Expand and factorise expressions involving difference of two squares
- Use factorisation to solve simple word problems.

Teaching and learning materials

- Cardboard models of Figs. 9.1 and 9.2
- Factorisation chart
- Quadratic equation boxes

Key word definitions

expand (in algebra): to multiply binomials together
terms in x: terms that contain an x (i.e. x^1)
coefficient: the number multiplying the unknown in an algebraic term
quadratic expression: an expression where 2 is the highest power of the unknown(s)
factor (algebra): any number or expression that divides exactly into another expression
factorise: to express an algebraic expression as a product of its factors
trial and improvement: try something, improve it, then try again until you succeed

Foundation knowledge

Students need to be able to:

- Understand algebraic terminology including expression, terms and binomials
- Be able to work with highest common factors
- Expand algebraic expressions.

Lesson 1: Revising expansion of algebraic expressions

Student's Book page 88; Workbook page 34

The focus of this lesson is finding the product of two binomials.

Work through Examples 1-5 with the class.

All students must complete the 'must do' questions of Exercise 9a.

Assign question 1 from Worksheet 9 as homework.

Answers

Worksheet 9

1.1.1 $x^2 - 6x - 27$
1.1.2 $y^2 - 6y + 8$
1.1.3 $m^2 + 5m + 6$
1.1.4 $-6x^2 + 13x - 6$
1.1.5 The third term is positive if the signs in the factors are the same.
1.2.1 $x^2 - 10x + 25$
1.2.2 $y^2 - 4$
1.2.3 $6x^2 - 13x + 6$
1.2.4 $6x^2 - 13x + 6$
1.2.5 $4y^2 + 12xy + 9x^2$
1.2.6 $x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$
1.2.7 $s^2 - x^2 + 2st + 2xt$
1.2.8 $x - 6\sqrt{x} + 6$

Assessment

Students should be able to find the product of two binomials

Lesson 2: Finding the product of binomials

Student's Book page 88

The focus of this lesson is finding the product of two binomials directly, using the eyebrow, eyebrow, nose and mouth method.

Work through Examples 4-6 with the class.

All students must complete the 'must do' questions of Exercise 9b.

Stronger students can complete questions 17-32 of Exercise 9b.

Assessment

Students should be able to find the product of two binomials directly.

Lesson 3: Understanding coefficients of terms

Student's Book page 89

The focus of this lesson is calculating the coefficients of the unknowns.

Work through Examples 7 and 8 with the class.

All students must complete the 'must do' questions of Exercise 9c.

Assessment

Students should be able to calculate the coefficients of the unknowns.

Lesson 4: Factorisation of quadratic expressions

Student's Book page 90; Workbook page 34

The focus of this lesson is expressing a quadratic equation as a product of its factors.

Work through Examples 9-13 with the class.

All students must complete the 'must do' questions of Exercises 9d, 9e and 9f.

Stronger students can complete questions 9-12 of Exercises 9e and 11-18 of Exercise 9f.

Assign question 2 from Worksheet 9 as homework.

Answers

Worksheet 9

2.1 $(x - 3)(x + 2)$
2.2 $(x + 5)(x + 20)$
2.3 $(t + 5)(t - 20)$
2.4 $(x - 5)(2 - x)$
2.5 $(3r - 2)(2r + 4)$
2.6 $(2x + y)(x + 2y)$
2.7 $(x - 2)(x + 2)$
2.8 $(m - 6)(2m + 3)$
2.9 $6(x - 7)(x + 7)$

Assessment

Students should be able to factorise a quadratic equation.

Lesson 5: Perfect squares

Student's Book page 92; Workbook page 35

The focus of this lesson is ensuring that students understand the relationship between squares.

Work through Examples 15, 16 and 17 with the class.

All students must complete the 'must do' questions of Exercises 9g, 9h, and 9i.

Stronger students can complete questions 11-18 of Exercise 9g, questions 7-12 of Exercise 9h and questions 11-18 of Exercise 9i.

Assign question 3-6 from Worksheet 9 as homework.

Answers

Worksheet 9

3 27
4 2
5.1 $61^2 - 39^2 = 2\ 200$
5.2 $1\ 007^2 - 49 = 1\ 014\ 000$
6 $w + 4$

Assessment

Students should be able to expand a term by squaring it.
Students should be able to factorise an expression that is the product of squaring a term.

Lesson 6: Difference of perfect squares

Student's Book page 93; Workbook page 34

The focus of this lesson is to ensure that students understand that the difference of the squares of two terms is equal to the product of their sum and their difference.

Work through Examples 18 and 19 with the class.

All students must complete the 'must do' questions of Exercise 9j and QR 6.

Stronger students can complete questions 12-24 of Exercise 9j.

Assign question 2.10-2.17 from Worksheet 9 as homework.

Answers

Question 2 from Worksheet 9 as homework.

2.10 $(w + 8)(w - 10)$
2.11 $(w^2 + w + 8)(w^2 + w - 15)$
2.12 $(11v - 21)(3v + 8)$
2.13 $x^2(x + 2)(x - 3)$
2.14 $(r + 8)(r - 6)$
2.15 $(x - 4y)(x + 9y)$
2.16 $(\sqrt{2} - 8)(\sqrt{x} + 4)$
2.17 $(7x + 3)(5x - 1)$

Assessment

Students should be able to factorise perfect squares.

Lesson 7: Calculations and word problems

Student's Book page 94: Workbook page

The focus of this lesson is applying the difference of perfect squares to word problems.

Work through Examples 20 and 21 with the class.

All students must complete the 'must do' questions of Exercise 9k.

Stronger students can complete question 11-15 of Exercise 9k and Exercise 9l.

Assign questions 7-9 from Worksheet 9 as homework.

Answers

Worksheet 9

7 704 cm^2
8.1 91π
8.2 No
9 33 000 cm^3

Puzzle Corner

Hexagon in a hexagon

$\frac{1}{2}$

Assessment

Students should be able to apply the difference of perfect squares to word problems.

Chapter 10 Equations 1: Equations with fractions

Objectives

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

- Clear fractions in algebraic equations
- Solve equations with unknowns in the denominator
- Solve word problems involving fractions
- Solve equations with binomials in the denominator.

Teaching and learning materials

- Charts of equations and word problems involving fractions

Key word definitions

numerator – the number above the line in a common fraction
denominator – the number below the line in a common fraction
improper fraction – a fraction where the numerator is larger than the denominator
mixed number – contains a whole number and a proper fraction

Foundation knowledge

Students need to be:

- able to solve equations expressed using whole numbers
- Familiar with algebraic terminology such as term, expression, coefficient etc.

Lesson 1: Clearing fractions

Student's Book page 97; Workbook page 37

The focus of this lesson is revising clearing fractions before solving an equation.

Work through Example 1 with the class.

All students must complete the 'must do' questions of Exercise 10a.

Assign questions 1.1 and 1.2 from Worksheet 10 as homework.

Answers

Worksheet 10

1.1 25 **1.2** $-\frac{2}{3}$

Assessment

Students should be able to successfully clear fractions with no unknowns in the denominator.

Lesson 2: Fractions with unknowns in the denominator

Student's Book page 97; Workbook page 37

The focus of this lesson is learning how to clear unknown terms from the denominator by treating them as numbers.

Work through Examples 2 and 3 with the class.

All students must complete the 'must do' questions of Exercise 10b.

Stronger students can complete questions 18-30 of Exercise 10b.

Assign questions 1.3, 1.4, 1.8-1.10 from Worksheet 10 as homework.

Answers

Worksheet 10

1.3 $\frac{3}{10}$ **1.4** $\frac{13}{60}$ **1.8** $\frac{3}{2}$

1.9 $\frac{9}{14}$ **1.10** $\frac{16}{3}$

Assessment
Students should be able to solve equations with an unknown term in the denominator.

Lesson 3: Word problems involving fractions

Student's Book page 98; Workbook page 39

The focus of this lesson is applying algebraic equations to word problems.

Work through Examples 4 and 5 with the class.

All students must complete the 'must do' questions of Exercise 10c.

Stronger students can complete questions 8 – 10 of Exercise 10c.

Assign questions 2-4 from Worksheet 10 as homework.

Answers

Worksheet 10

2 $f = \frac{6}{5}$
3 27
4 $v = \frac{150}{t}$ so $v = 75$ km

Assessment
Students should be able to successfully construct an equation from a word problem.
Students should be able to solve an equation constructed from a word problem.

Lesson 4: Fractions with binomials in the denominator

Student's Book page 100; Workbook page 39

The focus of this lesson solving an equation with a binomial term in the denominator.

Work through Examples 6-10 with the class.

All students must complete the 'must do' questions of Exercises 10d and 10e.

Stronger students can complete questions 15-20 of Exercise 10d and questions 11-30 of Exercise 10e.

Questions 1.5 to 1.7 from Worksheet 10.

Answers

Worksheet 10

1.5 16 **1.7** $\frac{13}{5}$ **1.6** -1

Assessment
Students should be able to solve an equation with a binomial term in the denominator.

Lesson 5: Further word problems involving fractions

Student's Book page 102; Workbook page 39

The focus of this lesson is creating algebraic equations to solve word problems.

Work through Examples 11 and 12 with the class.

All students must complete the 'must do' questions of Exercise 10f.

Stronger students can complete questions 8-18 of Exercise 10f.

Assign questions 5-11 from Worksheet 10 as homework.

Answers

Worksheet 10

5 2 min 55 sec
6 80 k/h, 100 k/h, 2 hours 90 k/h
7 30 ₦2 **8** 28 students **9** 17 chairs
10 8 chairs 2 tables
11 $\frac{13.87}{x}$, 19 chickens

Assessment
Students should be able to create algebraic equations to solve word problems.

Chapter 11 Compound interest

Objectives

By the end of this chapter, each student should be able to:
- Recall and use the simple interest formula
- Find the amount that a principal will reach over a given time period and rate of simple interest
- Find the amount that a principal will reach over a given time period and rate of compound interest
- Apply the principles of compound interest to daily life problems, including inflation and depreciation.

Teaching and learning materials

- Simple interest and compound interest chart
- Newspaper advertisements for mortgage loans, savings accounts, and pension schemes
- Newspaper articles on inflation and depreciation

Key word definitions

interest: payment for saving money, or cost of borrowing money
simple interest: interest calculated on a basic sum of money
principal: money saved or borrowed
rate (of interest): the percentage by which money grows over time (usually 1 year)
time: period for which money is saved (or borrowed)
amount: the total of the principal and interest it makes
compound interest: interest is added to the principal progressively over time
mortgage: a loan given to buy a house
depreciation: loss in value of an item over time
inflation: loss in value of money over time

Foundation knowledge

Students need to:
- Understand the concept of interest and simple interest.

Lesson 1: Revising Simple interest

Student's Book page 105; Workbook page 41

The focus of this lesson is ensuring that students understand interest as a concept and can calculate simple interest. Students are introduced to the term *amount*.

Work through Examples 1 and 2 with the class.

All students must complete the 'must do' questions of Exercises 11a and 11b.

Stronger students can complete question 15 of Exercise 11a and questions 12-15 of Exercise 11b.

Assign questions 1-7 from Worksheet 11 as homework.

Answers

Worksheet 11

1 ₦2 000
2 ₦29 500
3 20 years
4 6%
5 ₦220 000
6 Interest ₦12 986, Value ₦62 986
7 2 years

Assessment

Students should be able to calculate simple interest.
Students should be able to calculate amount.

Lesson 2: Compound interest

Student's Book page 106; Workbook page 42

The focus of this lesson is explaining how compound interest works and being able to calculate compound interest.

Work through Examples 3-7 with the class.

All students must complete the 'must do' questions of Exercises 11c and 11d.

Stronger students can complete question 15 of Exercise 11c and questions 10-15 of Exercise 11d.

Assign questions 8-10 from Worksheet 11 as homework.

Answers

Worksheet 11

8 10%

9 First year ₦700 000

10 29.5%

Assessment

Students should be able to explain what compound interest is and how it works. Students should be able to calculate compound interest using the formula.

Chapter 12 Similarity 2: Area and volume of similar shapes

Objectives

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

- Use scale factors to find the areas of similar plane shapes
- Use scale factors to find the volumes of similar solid shapes
- Derive area and volume factors from given scale factors and vice versa.

Teaching and learning materials

- Similar plane shapes
- Similar solid shapes
- Graph paper
- Mathematical set

Key word definitions

scale factor: ratio of corresponding lengths on similar shapes

area factor: ratio of corresponding areas on similar surfaces (= scale factor^2)

volume factor: ratio of corresponding volumes on similar solids (= scale factor^3)

Foundation knowledge

Students need to:

- Understand similarity in plane shapes.

Lesson 1: Areas of similar shapes

Student's Book page 111; Workbook page 43

The focus of this lesson is demonstrating that the ratio of the areas of two similar shapes is the square of the scale factor of the two shapes.

Work through Section 12.1 and Examples 1-4 with the class.

All students must complete the 'must do' questions of Exercises 12a.

Stronger students can complete questions 7-12 of Exercise 12a.

Assign questions 1-3, 6 and 9 from Worksheet 12 as homework.

Answers

Worksheet 12

1.1 $1\frac{1}{2}$

1.2 4

2.1 12 mm

2.2 180 mm^2

2.3 80 mm^2

3.1 4 : 5

3.2 16 cm

6 4 618 m^2

9 2 000 ha

Assessment

Students should be able to calculate the area of similar shapes.

Lesson 2: Volumes of similar shapes

Student's Book page 113; Workbook page 43

The focus of this lesson is demonstrating that the ratio of the volumes is the cube of the scale factor of the two shapes.

Work through section 12.2 and Examples 5-7 with the class.

All students must complete the 'must do' questions of QR7 and Exercise 12b.

Stronger students can complete questions 8-10 of Exercise 12b.

Assign questions 4 and 5, 7 and 8, and 10-12 from Worksheet 12 as homework.

Answers

Worksheet 12

4.1 50 cm
4.2 4
4.3 8
4.4 942.8 cm^2
4.5 3 771.2 cm^2
4.6 16 761.9 cm^3
4.7 2 095.2 cm^3
5.1 846 cm^2
5.2 1 620 cm^3
7.1 100 cm
7.2 250 cm^2
8.1 No
8.2 589 cc 764 cc
8.3 58.9 min, 76.4 min
10 120 cm by 240 cm
11 Volumes = 118.16 cm^3 and 4 183.14 cm^3
scale factor = 3.28
12 ₦201

Assessment

Students should be able to calculate the volume of two similar shapes.

Puzzle Corner

Four nines

Variety of answers are possible.

Chapter 13 Proportion: Direct; inverse; reciprocal

Objectives

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

- Solve problems on direct and inverse proportion
- Draw and interpret graphical representations of direct and inverse proportion
- Find and apply reciprocals of numbers, using four-figure tables where necessary
- Use reciprocals to simplify calculations.

Teaching and learning materials

- **Teacher:** Charts on direct and inverse proportion; reciprocal tables (SB page 124)
- **Student:** Reciprocal tables (SB page 124)

Key word definitions

ratio: comparison between two quantities
direct proportion: quantities changing in the same ratio
varies directly: as one quantity changes, so does another quantity
reciprocal: the reciprocal of x is
inverse proportion: as one quantity increases, another decreases (or vice versa)
varies inversely: as one quantity increases, another decreases (or vice versa)
ready reckoner: a calculating device
multiplicative inverse (of a number): the reciprocal of the number

Foundation knowledge

Students need to be able to:

- Understand problems with two variables.

Lesson 1: Direct and inverse proportion

Student's Book page 117; Workbook page 48

The focus of this lesson is teaching the difference between direct and indirect proportion.

Work through Examples 1-3 with the class.

All students must complete the 'must do' questions of Exercise 13a.

Stronger students can complete questions 10-16 of Exercise 13a.

Assign question 1 from Worksheet 13 as homework.

Answers

Worksheet 13

1

Speed km/hour	50	80	100	120
Time in hours	1.6 hours	1 hour	0.8 hours	0.667 hours
Time in hours and minutes	1 hr 36 min	1 hr	48 min	40 min

Assessment

Students should be able to explain the difference between direct and indirect proportion.
Students should be able to express direct and indirect relationships between variables using a table or algebraic expression.

Lesson 2: Graphical representation

Student's Book page 119; Workbook page 48

The focus of this lesson is representing direct and indirect relations using graphs.

Work through Example 4 with the class.

All students must complete the 'must do' questions of Exercise 13b.

Stronger students can complete questions 6-10 of Exercise 13b.

Assign questions 2-4 from Worksheet 13 as homework.

Answers

Worksheet 13

2.1 Inverse

2.2 Students answers may vary depending on axes of graphs.

3.1

Speed km/hour	50	80	100	120
Distance travelled km	175	280	350	420

3.2 Direct

3.3 Students answers may vary depending on axes of graphs.

4.1.1 Inverse

4.1.2 Direct

4.2 $13\frac{1}{3}$ l per 100 km

4.3 7.5 km per litre

Assessment

Students should be able to draw graphs representing direct and indirect relations.

Lesson 3: Reciprocals of numbers

Student's Book page 122

The focus of this lesson is identifying and calculating reciprocals, and using reciprocal tables.

Work through Examples 5-8 with the class.

All students must complete the 'must do' questions of Exercises 13c and 13d.

Assessment

Students should be able to is identify and calculate reciprocals, and use reciprocal tables.

Lesson 4: Calculations using reciprocals

Student's Book page 126; Workbook page 51

The focus of this lesson is understanding how to use reciprocals to work with problems that require division with "difficult" numbers.

Work through Examples 10 and 11 with the class.

All students must complete the 'must do' questions of Exercise 13e.

Stronger students can complete questions 10-15 of Exercise 13e.

Assign questions 5-7 from Worksheet 13 as homework.

Answers

Worksheet 13

5.1 15

5.2 7 (not 7.5)

6.1 160 tiles per day

6.2

Number of tilers	1	2	3	4	5
Number of days to complete the task	75	37.5	25	18.75	15

6.3 7.5 so he needs 8 tilers

7.1 1 800 kl

7.2 55 800 kl

7.3 200 days, about 7 months

Assessment

Students should be able to identify when to use reciprocals in problems.
Students should be able to use reciprocals in calculations.

Chapter 14 Equations 2: Simultaneous linear equations

Objectives

By the end of this chapter, each student should be able to:
- Compile a table of values for a linear equation in two variables
- Represent a linear equation in two variables on a graph
- Solve simultaneous linear equations graphically
- Solve simultaneous linear equations algebraically using substitution and elimination methods
- Use simultaneous linear equation methods to solve word/real-life problems.

Teaching and learning materials

- **Teacher:** Charts of tables of values; graph board and ruler; graph paper for class use
- **Student:** Graph paper or graph exercise book; Ruler

Key word definitions

equation in x and y: an algebra statement with an = sign and unknowns x and y
graph: a picture
table of values: a table with corresponding values of variables
variables: letter(s) standing for unknowns in an algebraic expression
ordered pair: two numbers arranged in a specific order
substitution (method): replacing an unknown with a value
elimination (method): removing an unknown by subtraction or addition

Foundation knowledge

Students need to be able to:
- Substitute into an equation correctly.
- Plot a graph

Lesson 1: The graph of an equation

Student's Book page 128

The focus of this lesson is on drawing a table of values to plot a graph.

Work through Example 1 with the class.
Note: there is a typing error in question b of the example. Question b should read 'the value of x when $y = -2$'.

All students must complete the 'must do' questions of Exercise 14a.

Stronger students can complete question 8 of Exercise 14a.

Assessment

Students should be able to complete a table of values using an equation.
Students should be able to plot the values correctly onto a Cartesian plane.

Lesson 2: Simultaneous linear equations

Student's Book page130; Workbook page 52

The focus of this lesson is solving simultaneous linear equations using a table of values and plotting the graph.

Work through Example 2 with the class.

All students must complete the 'must do' questions of Exercise 14b.

Stronger students can complete questions 11-20 of Exercise 14b.

Assign questions 1-2 from Worksheet 14 as homework.

Answers

Questions 1 and 2 from Worksheet 14 are solved on a graph. Check that students have drawn up the necessary tables and that points on the table match points on the graph. Check for conventions in drawing graphs such as labelling of axes, neatness etc.

Assessment

Students should be able to use tables of value to plot the graphs and identify the solution to the simultaneous equation.

Lesson 3: Method of substitution

Student's Book page 131; Workbook page 53

The focus of this lesson is solving simultaneous equations through substitution without drawing the graph.

Work through Examples 3 and 4 with the class.

All students must complete the 'must do' questions of Exercise 14c.

Stronger students can complete questions 11-20 of Exercise 14c.

Assign question 3 from Worksheet 14 as homework.

Answers

Worksheet 14

3.1 $x = 2; y = 8$ **3.2** $x = \frac{1}{3}; y = 4$

3.3 $x = 13; y = 13$ **3.4** $x = 2; y = 3$

3.5 $x = 3; y = \frac{1}{3}$

Assessment

Students should be able to solve simultaneous equations through substitution without drawing the graph.

Lesson 4: Method of elimination

Student's Book page 133

The focus of this lesson is solving simultaneous equations through elimination without drawing the graph.

Work through Examples 6 and 7 with the class.

All students must complete the 'must do' questions of Exercise 14d.

Stronger students can complete questions 11 – 20 of Exercise 14d.

Assessment

Students should be able to solve simultaneous equations through elimination without drawing the graph.

Lesson 5: Word problems

Student's Book page 134; Workbook page 54

The focus of this lesson is to construct and then solve simultaneous equations from word problems.

Work through Examples 8 and 9 with the class.

All students must complete the 'must do' questions of Exercise14e.

Stronger students can complete questions 9-20 of Exercise 14e.

Assign questions 4-9 from Worksheet 14 as homework.

Answers

Worksheet 14

4 $x = \frac{3}{5}$ mm; $y = 1$ mm; area = 150 mm^2

5 They are the same equation. The second is 2.5 times the first.

6 ₦11 250

7 200 chairs; ₦252 000

8 A = ₦600; B = ₦620

9 $x = 2$ hours; $y = 4$ hours

Assessment

Students should be able to construct simultaneous equations from word problems. Students should be able to solve the equations created from word problems.

Chapter 15 Trigonometry 2: Sine and cosine of angles

Objectives

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

- Define the sine and cosine of an angle in a right-angled triangle
- Use measurement to find the sine and cosine of acute angles
- Use sines and cosines of angles to calculate lengths and angles in right-angled triangles
- Use four-figure tables to find the sines and cosines of angles from 0° to 90°
- Solve practical problems using sines and cosines of angles
- Solve right-angled triangles using Pythagoras' rule and the three trigonometrical ratios (sine, cosine, tangent).

Teaching and learning materials

- Cardboard models of right-angled triangles (as in Fig. 15.2);
- Trigonometrical tables (see SB pages 269 to 271)

Key word definitions

sine: a trigonometrical ratio
cosine: a trigonometrical ratio
hypotenuse: side opposite right angle in a triangle
opposite (in trigonometry): side opposite a given angle in a triangle
adjacent: side next to a given angle in a triangle
four-figure tables: numerical data rounded to four figures
tangent (tan): a trigonometrical ratio

Foundation knowledge

Students need to be able to:

- Identify key terms in relation to a right–angled triangle such as hypotenuse, opposite and adjacent sides.

Lesson 1: Sine and cosine

Student's Book page 138; Workbook page 55

The focus of this lesson is using the sine and cosine ratios to calculate lengths of unknown sides in triangles.

Work through Examples 1-5 with the class.

All students must complete the 'must do' questions of Exercises 15a and 15b.

Stronger students can complete questions 6-8 of Exercise 15b.

Assign questions 1-6 from Worksheet 15 as homework.

Answers

Worksheet 15

1.1 hyp: 88; opp: 38; adj: 80
1.2 hyp: 88: opp: 80: adj: 38
1.3 0.43 **1.4** 0.91
1.5 0.91
1.6 0.43
2 AB = 57.36 cm; AC = 81.92 cm
3 30.52 cm and 17.51 cm
4 sin 35° = cos 55°; sin 55° = cos 35°
5 sin A = cos (90 – A); cos A = sin (90 – A)
6.1 1
6.2 Yes

Assessment

Students should be able to use the sin and cosine ratios to calculate lengths of unknown sides in triangles.

Lesson 2: Using sine and cosine tables

Student's Book page 141

The focus of this lesson is practising using sine and cosine tables.

Work through Example 6 with the class.

All students must complete the 'must do' questions of Exercises 15c and 15d.

Assessment

Students should be able to use sine and cosine tables to find values and angles.

Lesson 3: Applications of sine and cosine

Student's Book page 143; Workbook page 57

The focus of this lesson is applying sine and cosine to real-life problems.

Work through Examples 7 – 9 with the class.

All students must complete the 'must do' questions of Exercise 15e

Stronger students can complete questions 4 – 14 of Exercise 15e.

Assign questions 10 – 12 from Worksheet 15 as homework.

Answers

Worksheet 15

10 8 872 m
11 37.59 m; 13.68 m
12 15.32 m

Assessment

Students should be able to apply sine and cosine to real-life problems.

Lesson 4: Solving right-angled triangles

Student's Book page145; Workbook page 56

The focus of this lesson is solving right–angled triangles completely using Pythagoras' rule and the trigonometrical ratios.

Work through Example 10 with the class.

All students must complete the 'must do' questions of Exercise 15f.

Stronger students can complete questions 8-10 of Exercise 15f.

Assign questions 7-9 from Worksheet 15 as homework.

Answers

Worksheet 15

7 $\sin 30 = \frac{1}{2}$

8 $\cos 60 = \frac{1}{2}$

9 $\sin 45 = \frac{1}{\sqrt{2}}$; $\cos 45 = \frac{1}{\sqrt{2}}$

Puzzle Corner

Patterns from cubes

$100^3 = 9\,901 + 9\,903 + 9\,905 + 9\,907 + \ldots + 10\,099$

$\left(\frac{1}{2} \times n \times (n+1)\right)^2 = \left(\frac{1}{2} \times 100 \times 101\right)^2$

$= 25\,502\,500$

Assessment

Students should be able to solve right–angled triangles completely using Pythagoras' rule and the trigonometrical ratios.

Chapter 16 Everyday statistics

Objectives

By the end of this chapter, each student should be able to:
- Present data in frequency tables, pictograms, bar charts and pie charts
- Interpret statistical graphs
- Find the mean, median and mode of given data sets
- Apply measures of central tendency (mean, median, mode) to everyday issues
- Find the range of a given set of data.

Teaching and learning materials

- Charts on mean, median and mode; frequency tables; bar charts; pie charts; real statistics from newspapers and official publications;
- Chalk-board instruments (pair of compasses, protractor, ruler)
- Mathematical set
- Numerical data collected from newspapers

Key word definitions

frequency table: a table showing how often things happen
pictogram: a graph with pictures showing the frequency
bar chart: a circular graph where the length of the bar shows the frequency
pie chart: a circular graph where the size of the sector shows the frequency
average: a single number that represents a set of data
mean: the sum of the numbers in a set divided by n where n is the number of numbers in the set
mode: the number that appears most often in a set of numbers
median: the middle value when numbers are arranged in order of size

Foundation knowledge

Students need to be able to:
- Work with percentages.

Lesson 1: Revision of presentation of data

Student's Book page149; Workbook page 59

The focus of this lesson is revising the four important ways that data can be presented: a frequency table, a pictogram, a bar chart, and a pie chart.

Work through Example 1 with the class.

All students must complete the 'must do' questions of Exercise 16a.

Assign questions 1 – 4 from Worksheet 16 as homework.

Answers

Worksheet 16

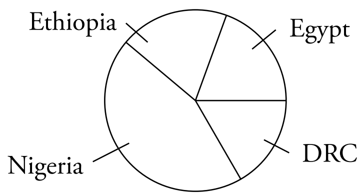
1

	Boys	Girls
Orange juice	16	13
Cola	20	12
Apple juice	3	8

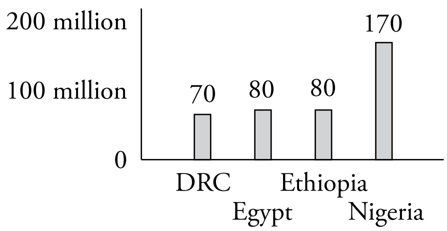
2

Animal	Pictogram
Cattle	7 of these cattle
Sheep	3 of these sheep
Goats	2 of these goats

3.1



3.2



4.1 Mean 18, Median 18.5 Mode 15, 20
4.2 Mean uses all values and no outliers. Median is acceptable. Mode does not use all values.

> **Assessment**
> Students should be able to present data in each of the four key ways.

Lesson 2: Measures of central tendency (mean, median, mode)

Student's Book page 151; Workbook page 59

The focus of this lesson is introducing students to measures of central tendency including mean, median and mode.

Work through Examples 2-5 with the class.

All students must complete the 'must do' questions of Exercise 16b.

Assign questions 5-9 from Worksheet 16 as homework.

Answers

Worksheet 16
5 65 **6** 96 k/h **7** 85 k/h
8 In question 6, longer time at faster speed
9 Mean both 60. Use range 53 for numeracy, 4 for literacy.

> **Assessment**
> Students should be able to calculate mean, median and mode as indicators of central tendency.

Lesson 3: Interpretation of averages

Student's Book page 154; Workbook page 60

The focus of this lesson is learning to interpret averages using range.

Work through Examples 7-10 with the class.

All students must complete the 'must do' questions of Exercise 16c.

Stronger students can complete questions 8 and 9 of Exercise 16c.

Assign questions 10 and 11 from Worksheet 16 as homework.

Answers

Worksheet 16
10.1 ₦8 593
10.2 Median. Better when there are outliers like the directors' earnings
11.1 60
11.2 3.73

Puzzle: How many triangles? (2)

13 triangles
5×5 lattice: 25 triangles
6×6 lattice: 41 triangles
General term: $2(n - 1)(n - 2) + 1$

Puzzle: Remainders

101
Occurs every LCM ($5 \times 6 \times 7 = 210$) thereafter.

> **Assessment**
> Students should be able to calculate mean, median and mode and interpret these results as a measure of central tendency.

Chapter 17 Rational and non-rational numbers

Objectives

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

- Distinguish between rational and non-rational numbers
- Use trial and improvement methods to calculate approximate values of square roots.
- Find an approximate value for π.

Teaching and learning materials

- Number chart showing rational and non-rational numbers
- Posters based on Fig. 20.2 and 20.3 in the SB
- Various bottles and empty tins
- Thread or string
- Chalk-board instruments
- Graph paper

Key word definitions

rational number: any number that is an exact fraction
non-rational number: any number that is not an exact fraction
irrational number: a non-rational number
square root: the value that, when multiplied by itself, gives the number
approximate value: a rough value
trial and improvement: a method of finding an approximate value
pi (π): ratio of a circle's circumference to its diameter

Foundation knowledge

Students need to be:

- Familiar with number system terminology

Lesson 1: Rational and non-rational numbers

Student's Book page 159; Workbook page 61

The focus of this lesson is on introducing the concept of rational and non-rational numbers.

Work through Example 1 with the class.

All students must complete the 'must do' questions of Exercise17a.

Assign question 1 from Worksheet 17 as homework.

Answers

Worksheet 17

1 16 Rational
32 Rational
$\sqrt{16}$ Rational
$\sqrt{32}$ Non–rational
0.326 Rational
$\frac{1}{7}$ Rational
$\frac{4}{15}$ Rational

Assessment

Students should be able to identify rational and non-rational numbers.

Lesson 2: Square roots

Student's Book page 160; Workbook pages 61 and 62

The focus of this lesson is finding the value of the approximate value of non-rational square roots.

Work through Examples 2 and 3 with the class.

All students must complete the 'must do' questions of Exercise 17b.

Assign questions 2-5 and 7-10 from Worksheet 17 as homework.

Answers

Worksheet 17

2 3.162
3 0.33
4 1.73
5 2.83
7.1 1.333
7.2 1.154
8 $\frac{1}{3}$
9 1.22 recurring
10 $\frac{13}{19}$
11 $\frac{4}{9}$

Assessment

Students should be able to identify rational and non-rational numbers.

Lesson 3: Pi (π)

Student's Book page 161; Workbook page

The focus of this lesson is finding the value of pi.

Work through Example 4 with the class.

All students must complete the 'must do' questions of Exercises

Assign questions 6, 12 and 13 from Worksheet 17 as homework.

Answers

Worksheet 17

6 Between 2 and 4
12.1 Between 2.6 and 3.46
12.2 Yes
13.1 3.16
13.2 Students to plot own graphs using the table.

Assessment

Students should be able to understand how to calculate the value.

Section 3: Revision tests

Section 3 provides additional resources for the Chapter and Term revision tests found in the Student's Book. The Chapter and Term tests have been recreated into easy to print test sheets that you can use for formal assessment with your class.

The answers to the Chapter and Term tests were not given in the Student's Book answer section, so you can conduct your assessments knowing that the students can't copy the answers from their Student's Book.

There are four subsections:

1 chapter revision test sheets for printing
2 answers to the chapter revision tests
3 term revision test sheets for printing
4 answers to the term revision tests.

Chapter revision test sheets

Teacher's name: __________ Class name: __________

Student's name: __________ Date: __________

Chapter 1 Revision test

1 What should go in the boxes?

$3\,042_{\text{five}} = \square \times 5^3 + \square \times 5^2 + \square \times 5^1 + \square \times 5^0$

$11\,010_{\text{two}} = 1 \times \square + 1 \times \square + 0 \times \square + 1 \times \square + 0 \times \square$

2 Expand $56\,934_{\text{ten}}$ in powers of ten.

3 Use repeated division to convert 733_{ten} to a:

a base eight

a base five

4 Convert the following to base ten:

a 65_{eight}

b 503_{six}

c $2\,030_{\text{four}}$

d $10\,101_{\text{two}}$

5 Convert 43_{five} to a:

a denary number

b binary number.

6 Use repeated multiplication to convert $111\,011_{\text{two}}$ to base ten.

7 Do the following binary addition and subtraction.

a
$$\begin{array}{r} 1\ 001 \\ \underline{+\ 1\ 001} \end{array}$$

b
$$\begin{array}{r} 11\ 010 \\ \underline{-\ 111} \end{array}$$

8 Do the following binary multiplications.

a
$$\begin{array}{r} 1\ 101 \\ \underline{\times\ 11} \end{array}$$

b
$$\begin{array}{r} 11\ 010 \\ \underline{\times\ \ 101} \end{array}$$

9 Use long multiplication to check whether $(101_{\text{two}})^3 = 1\ 111\ 101_{\text{two}}$ is true or false.

10 Use the code that you made in Table 1.2 of the SB and graph paper to write the following in binary code: PLAN X.

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Chapter 2 Revision test

1 Find:

a the sum of –3.25 and 7.75. ______________________

b the positive difference between –2 and –13 ______________________

2 The difference between –6.4 and a number is 8.5. Find two possible values for the number.

____

3 Find the product of 16 and the positive difference between $-1\frac{1}{3}$ and $1\frac{2}{3}$.

____

4 Find the sum of the product of 4 and 5 and the positive difference between 3 and 10.

____

5 Find one-sixth of the sum of 13, 17 and 18.

____

6 Divide 56 by the sum of 3 and 5^2.

____

7 Find the sum of the square of 4 and the square root of 4. Divide the result by 9.

____

8 Change the following into words.

a 8(9 – 2)

____

b $\frac{7 + 11}{2 \times 3}$

____

9 I think of a number. I add 14 to the number and multiply the result by 3. If my final answer is 51, what number did I think of?

____

10 The sum of two numbers is 34. $\frac{2}{7}$ of one number is equal to $\frac{1}{5}$ of the other. Find the two numbers.

____

Teacher's name: ____________________ Class name: ____________________

Student's name: ____________________ Date: ____________________

Chapter 3 Revision test

1 Remove brackets from:

a $28a(a - \frac{1}{2}b)$ ____________________ **b** $(7 - 2n)\,3m$ ____________________

2 Find the HCF of:

a $12ab^2$ and $14a^2b$ ____________________ **b** $9xy$ and $24x^2$ ____________________

3 Use factorisation to help you to calculate.

a $28 \times 37 - 28 \times 17$

____

b $2\pi r^2 + 2\pi rh$, when $\pi = \frac{22}{7}$, $r = 7$ and $h = 13$.

____

4 Factorise the following by grouping in pairs.

a $b^2 + 2b + 3b + 6$

____

b $a^2 - 4a - a + 4$

____

5 Regroup, then factorise the following.

a $18 - xy + 9y - 2x$

____

b $x^2 + 20 - 5x - 4x$

____

Factorise questions 6-10 where possible. (One of them does not factorise.)

6 $ab - db + 3ac - 3cd$ ____

7 $4pq + 8rs - qr - 4ps$ ____

8 $2n^3 + 2n^2 + 2n + 2$ ____

9 $xy - 3zy - 3xk + 9zk$ ____

10 $2pq + 4pr - 3q^2 - 6qr$ ____

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Chapter 4 Revision test

Unless told otherwise, use a *ruler and pair of compasses only* in this exercise.
In each case, make a sketch of the information, before doing the accurate construction.

1 Draw any circle, centre O and radius OR. Construct the perpendicular bisector of OR such that it cuts the circle at P and Q. What type of quadrilateral is OPRQ?

____

2 Draw any quadrilateral. Construct the mid-points K, L, M, N of the sides of the quadrilateral. Join KL, LM, MN, NK. Use a ruler and set square to check whether KL//NM and LM//KN. What type of quadrilateral is KLMN?

____

3 Use a protractor to draw an angle of 82°. Then use a ruler and pair of compasses to bisect this angle. Use your protractor to check the accuracy of your construction.

4 Draw any triangle XYZ. Construct the bisectors of $\hat{X}$, $\hat{Y}$ and $\hat{Z}$. What do you notice about the three bisectors?

5 Construct a ΔPQR such that $\hat{Q} = 90°$. Construct the perpendicular bisectors of PQ and QR so that they meet at M. What do you notice about M?

6 Construct an isosceles triangle ABC such that AB = BC = 12 cm and $\hat{B} = 45°$. Measure AC.

7 Construct angles of 60° and 75°.

8 Construct a kite PQRS such that diagonal PR = 12 cm, side PS = 5 cm and $S\hat{P}R = 30°$. Measure side QR and PR.

9 Construct ΔXYZ with $XY = 56$ mm, $\hat{Y} = 105°$ and $XZ = 85$ mm. Measure YZ.

10 Construct a triangle PQR with sides 6 cm, 8 cm and 9 cm. Draw a line $AB = 10$ cm. Copy the smallest angle of ΔPQR onto point A. Hence draw isosceles ΔCAB where $C\hat{A}B =$ the smallest angle of ΔPQR. Measure BC.

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Chapter 5 Revision test

Questions 1-5: Calculate the areas of the shapes in Fig. 5.23. Use the value 3·1 for π where necessary.

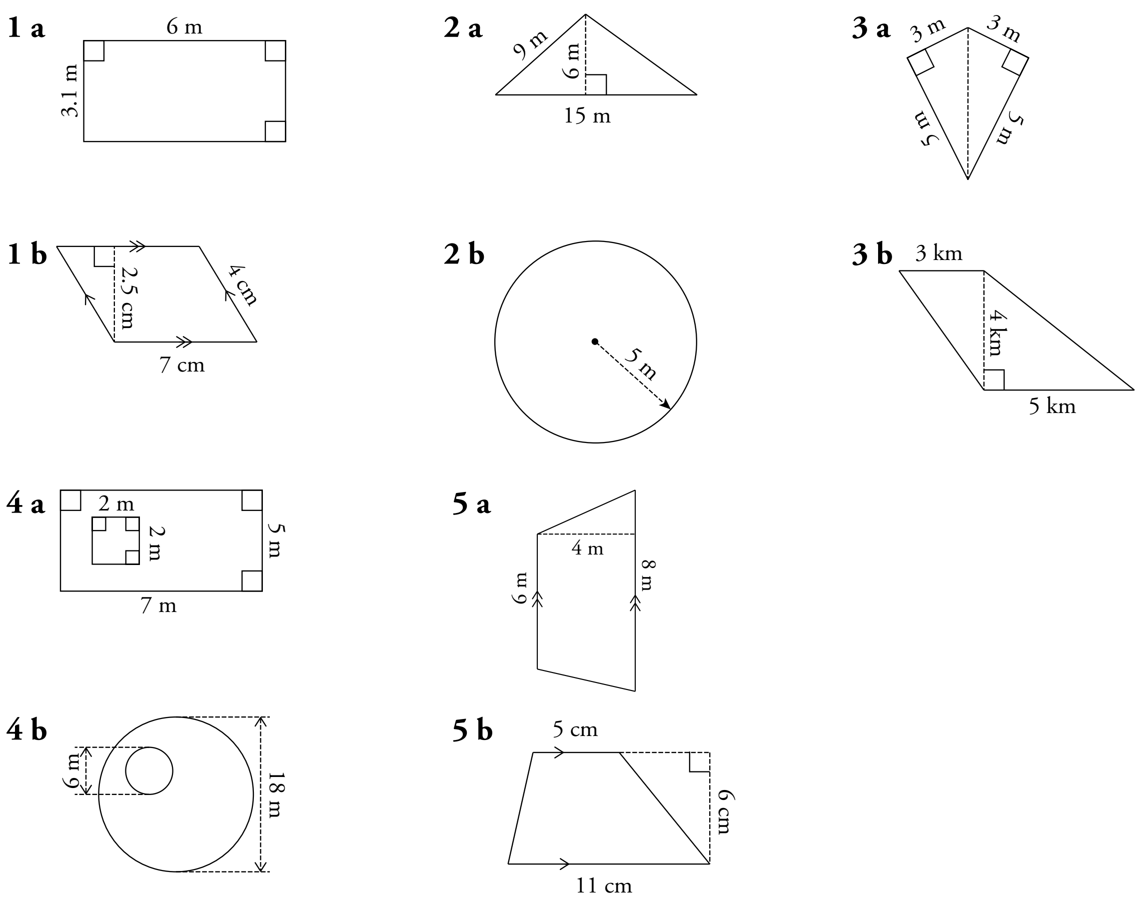


Fig. 5.23

1 Calculate:

a ______________________ **b** ______________________

2 Calculate:

a ______________________ **b** ______________________

3 Calculate:

a ______________________ **b** ______________________

4 Calculate:

a ______________________ **b** ______________________

5 Calculate:

a ______________________ **b** ______________________

6 A trapezium has an area of 135 m^2. Its two parallel sides are 19 m and d m long and the distance between them is 9 m. Find the value of d.

____

7 Using the value $\frac{22}{7}$ for π, calculate the area of a flat ring whose inside and outside diameters are 4 cm and 10 cm respectively.

8 A circle has a radius of 8 cm. Use the value 3.1 for π to calculate:

a the area of a sector of the circle if the angle at the centre is 150°

____

b the angle at the centre of the circle of a sector of area 124 cm^2

____

9 How many tiles, each 30 cm by 30 cm, are needed to cover a floor 4 m by 5 m? (Allow for wastage.)

____

10 A city park contains gardens, paths (about 10%), a lake (about 15%) and tennis courts. If the park is 2.4 ha and the tennis courts occupy a rectangular plot 60 m by 50 m, how many hectares are left for gardens?

____

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Chapter 6 Revision test

1 If $y = 3x - 8$,

a find y when $x = 0$ ______________________

b find x when $y = 22$ ______________________

2 Given that $y = 15 - 2x$.

Copy and complete the table, giving values of y for $x = -4, 0, 4, 8, 12$.

x	-4	0	4	8	12
15	15	15	15		
$-2x$	$+8$	0			
$y = 15 - 2x$	23				

3 The formula $C = 600\ t + 5\ 000$ gives the cost, C naira, of making a dress that takes t hours to make.

a Find the cost of a dress that takes 3 hours to make. ______________________

b If a dress costs ₦8 300, how long did it take to make? ______________________

4 If $m = n^2 + 25$, find:

a m when $n = -2, 0, +2, +4$ ______________________

b n when $m = 26, 34, 50$ ______________________

5 The formula $V = \frac{1}{3}s^2h$ gives the volume, V cm^3, of a pyramid of height h cm with a square base s cm by s cm.

a Find V when $s = 5$ cm and $h = 9$ cm. ______________________

b Find s when $V = 196\ cm^3$ and $h = 12$ cm. ______________________

6 Make x the subject of $y = mx + c$.

____

7 a Make R the subject of the formula IR = V. ______________________

b Find R when V = 240 and I = 15. ______________________

8 If $N = \frac{b}{d^2}$, write down in terms of b and d:

a the square of N ______________________

b the square root of N ______________________

c the reciprocal of N. ______________________

9 Make v the subject of the formula $\frac{1}{2}(u + v)t$.

____

10 If $9 = \left(\frac{x-4}{z^2}\right)$:

a Express z in terms of x ______________________

b Hence find z when $x = 40$. ______________________

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Chapter 7 Similarity 1

1 Measure the length and breadth of this textbook to the nearest cm. Draw a similar, but smaller, rectangle.

2 If ΔJKL is similar to ΔYZX, which side corresponds to the following?

a JL ______________________ **b** XY ______________________

c JL ______________________ **d** XY ______________________

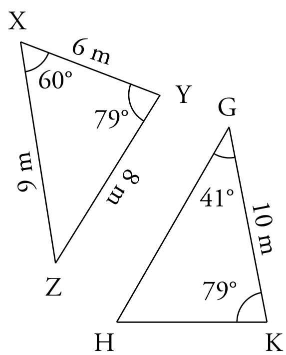


Fig. 7.32a

3. Refer to Fig. 7.32a:

a Name the triangle that is similar to ΔXYZ. ______________________

b Calculate the angles and sides that are not given. ______________________

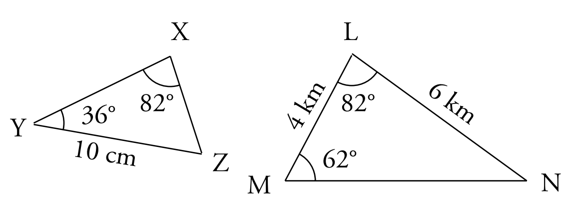


Fig. 7.32b

4 Refer to Fig. 7.32b:

a Name the triangle that is similar to ΔXYZ. ______________________

b Calculate the angles and sides that are not given. ______________________

5 Sketch two triangles ABC and PQR in which AB = 6 cm, BC = 10 cm, AC = 12 cm and PQ = 9 cm, QR = 15 cm, PR = 18 cm.

a Say why ΔABC is similar to ΔPQR.

____

____

b Complete the following by rewriting them:

$\frac{AB}{PQ} = \frac{\square}{q} = \square, \frac{PQ}{QR} = \frac{\square}{15} = \square$ ______________________________

$\frac{AC}{BC} = \frac{\square}{10} = \square, \frac{PR}{QR} = \frac{\square}{15} = \square$ ______________________________

$\frac{AB}{BC} = \frac{\square}{\square} = \square, \frac{QR}{PR} = \square/\square = \square$ ______________________________

6 A cuboid is of length 6 cm, width 3 cm and height 5 cm. A similar cuboid is of length 14 cm. Calculate its width and height.

____

7 A shop sells coffee in similar small and large jars. The small jars are of height 9 cm and diameter 6 cm. If the radius of the large jar is 5 cm, calculate its height.

____

8 Refer to Fig. 7.33 in the SB:

a Name the triangle which is similar to ΔOAB, and give reasons.

____

b If OA = 10 cm, OB = 8 cm, OK = 6 cm and AB = 7 cm, calculate OH and HK.

____

9 Refer to Fig. 7.33 in the SB. If OH = 9 m, HA = 5 m, HK = 6 m and AB = 8 m, calculate OK and KB.

____

10 ΔABC has coordinates A(2, 2), B(4, 10) and C(2, 6).

a Choose a suitable scale and draw ΔABC on graph paper.

(Teacher to provide graph paper.)

b With the origin as the centre of enlargement, enlarge ΔABC by scale factor $-\frac{1}{2}$.

____

c Write down the coordinates of the vertices of the enlargement, $\Delta A'B'C'$.

____

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Chapter 8 Revision test

1 Use drawing and measurement to find the value of tan 55°.

2 Use drawing and measurement to find θ if $\tan\theta = \frac{7}{11}$.

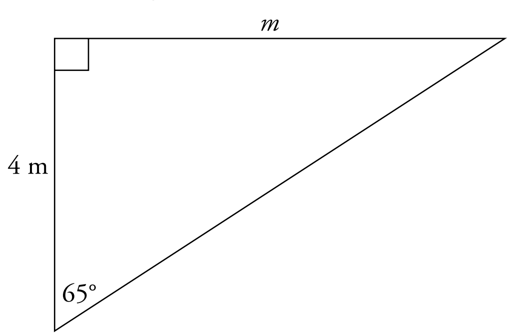


Fig 8.27

3 Use Table 8.1 to find the value of side m in Fig. 8.27.

____

4 Use the tables to find the tangents of:

a 43° ______

b 62.1° ______

c 18.24° ______

5 Use the tables to find the angles whose tangents are:

a 1.376 ______

b 0.4578 ______

c 2.549 ______

6 Point A is due north of point B. Point C is 10 km east of A. If the bearing of C from B is 032°, calculate the distance from A to B to the nearest km.

______

7 In ΔPQR, $\hat{P} = 90°$, $\hat{R} = 38.8°$ and PQ = 9 cm. Sketch ΔPQR and calculate the length of PR. (Hint: the complement of $\hat{R}$ may be useful.)

______

8 Calculate the angles marked α and β in Fig. 8.28 of the SB.

a α ______

b β ______

9 Calculate the angle of elevation of the sun when the shadow of a flagpole which is 6.2 m high has a length of 3.4 m.

______

10 A rectangle has sides of length 8 m and 3.2 cm. Calculate the angle between its diagonal and its shorter side.

______

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Chapter 9 Revision test

1 Expand the following.

a $(m + 4)(m + 6)$ ______________________

b $(x - 9)^2$ ______________________

c $(3b + 8)(b - 5)$ ______________________

d $(7 + y)(7 - y)$ ______________________

2 Find the coefficient of xy in the expansion of:

a $(2x + 3y)(4x - y)$ ______________________

b $(5x - 2y)^2$ ______________________

3 Factorise.

a $x^2 + 18x + 17$ ______________________

b $d^2 + 9d + 14$ ______________________

4 Factorise.

a $x^2 + 8x + 17$ ______________________

b $d^2 - 5d - 24$ ______________________

5 Factorise.

a $x^2 - 18x + 17$

b $d^2 - 5d - 24$

6 [QR] Expand the following.

a $(x + 8)^2$ ______________________

b $(2d - 5e)^2$ ______________________

7 Use a short method to find the values of the following.

a 82^2 ______________________

b 59^2 ______________________

8 Factorise the following.

a $x^2 - 16$ ______________________

b $8m^2 - 50n^2$ ______________________

9 Use difference of two squares to find the values of the following.

a $72^2 - 28^2$ ______________________

b $85^2 - 25$ ______________________

10 A flat circular silver pendant has an outside diameter of 18 mm. It has a small circular hole of diameter 4 mm. Use the value $\frac{22}{7}$ for π to calculate the area of the silver in the pendant. (A pendant is an ornament on a necklace.)

____

Teacher's name: ____________________ Class name: ____________________

Student's name: ____________________ Date: ____________________

Chapter 10 Revision test

1 Solve the following.

a $\frac{3}{5} = \frac{x}{15}$ ____________________

b $\frac{x+2}{3} + \frac{x-1}{4} = x$ ____________________

2 Solve $\frac{2}{x} = \frac{16}{3}$.

____

3 Solve $\frac{7}{x} - \frac{1}{2} = \frac{5}{x}$.

____

4 A car travels 120 km at a certain average speed. If the journey takes $2\frac{1}{2}$ hours, find the average speed. (Let the speed be v km/h.)

____

5 A pencil costs ₦x and a notebook costs ₦$4x$. I spend ₦1 000 on pencils and ₦1 000 on notebooks.

a Write down the number of pencils I get in terms of x.

____

b Write down the number of notebooks I get in terms of x.

____

c If I get 15 more pencils than notebooks, how much does one pencil cost?

____

6 Solve the following.

a $\frac{11}{3x-2} = \frac{1}{2}$ ____________________

b $\frac{3}{7} - \frac{5}{2x-1} = 0$ ____________________

7 Solve $\frac{x}{x-4} = \frac{2}{5}$. ____________________

8 Solve $\frac{3}{2x+1} + \frac{4}{x-1} = 0$. ____________________

9 The masses of a mother and daughter differ by 27 kg and are in the ratio of 8 : 5.

Find the mass of each.

____

10 A man drives 156 km from P to Q at an average speed of v km/h. He then drives 180 km from Q to R. Between Q and R, his average speed increases by 8 km/h.

a Express the time taken between P and Q in terms of v.

____

b Give the average speed between Q and R in terms of v.

____

c Hence express the time taken between Q and R in terms of v.

____

d If the times for each part of the journey are the same, find the value of v.

____

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Chapter 11 Revision test

1 Find the simple interest on ₦95 000 for 4 years at $2\frac{1}{2}$% per annum.

____

2 Find how much ₦250 000 amounts to if it saved for 3 years at 4% simple interest.

____

3 After 1 year, a principal of ₦55 000 amounts to ₦56 100. What is the rate of interest?

____

4 Use the method of Example 4 in the SB to find the amount that ₦700 000 becomes if saved for 2 years at 6% p.a. compound interest. Give your answer to the nearest naira.

____

5 Use the method of Example 5 in the SB to find what ₦156 000 amounts to in 2 years at $4\frac{1}{2}$% per annum. Give your answer to the nearest naira.

____

6 Mister M saves ₦900 000 at 6% compound interest.

a Calculate the amount after 3 years to the nearest ₦100. ______________________

b Hence find the compound interest. ______________________

7 Madam R borrows ₦1 million to pay for a wedding. A finance company agrees to lend her the money for 2 years at 12% compound interest. How much does she have to pay back at the end of the 2 years?

____

8 A person saves ₦650 000 at 4% compound interest and adds ₦150 000 to the amount at the end of each year. What are the total savings after 3 years, to the nearest ₦100?

____

9 The population of a town increases by 2% each year. Three years ago the population was 447 000. What is the population now? (Give your answer to 3 s.f.)

____

10 Due to depreciation, a moped loses 20% of its value every year. If a new moped cost ₦540 000, find its value 2 years later.

____

Teacher's name: ______________ Class name: ______________

Student's name: ______________ Date: ______________

Chapter 12 Revision test

1 A metal tray measuring 40 cm by 30 cm costs ₦256. What should be the price of a similar tray that is 50 cm long?

____

2 Two plastic cups are similar in shape and their heights are 7.5 cm and 12.5 cm. If the plastic needed to make the first cost ₦72, find the cost for the second.

____

3 In Question 2, if the second cup holds $1\frac{7}{8}$ litres, find the capacity of the first cup in ml.

____

4 A cylindrical oil drum 70 cm long is made of sheet metal which costs ₦750. Find the cost of the metal for a similar oil drum 84 cm long.

____

5 A statue stands on a base of area 1.08 m^2. A scale model of the statue has a base of area 300 cm^2. Find the mass of the statue (in tonnes) if the scale model is of mass 12.5 kg.

____

6 A railway engine is of mass 72 tonnes and is 11 m long. An exact scale model of the engine is 44 cm long. Find the mass of the model.

____

7 In Question 6, if the tanks of the model hold 0·8 litres of water, find the capacity of the tanks of the railway engine.

____

8 A compound has an area of 3 025 m^2, and is represented on a map by an area of 16 cm^2.

a Find the scale of the drawing.

____

b Find the area of the compound if the corresponding area on the plan is 2 025 cm^2.

____

9 In a scale drawing of a school compound, a path 120 cm wide is shown to be 15 mm wide.

a Find the scale of the map.

____

b Find the true length of a wall which is represented on the map by a line 2.8 cm long.

____

10 A model car is an exact copy of a real one. The windscreen of the model measures 35 cm by 10 cm and the real car has a windscreen of area 0.315 m^2. The mass of the model is 25 kg. Find the mass of the real car.

____

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Chapter 13 Revision test

1 1 ha of land costs ₦250 000.

a Draw a table showing the cost of 1, 3 and 8 ha of land.

b Is the cost of land directly or inversely proportional to area?

____

2 A school has ₦180 000 to spend on textbooks.

a Draw a table showing the number of books it can buy if they cost ₦500, ₦600 and ₦800 each.

b Is the cost per book directly or inversely proportion to the number of books that could be bought?

____

3 A clinic can vaccinate 270 children in 3 days. How many children could it vaccinate in 5 days?

____

4 I have enough money to buy 4 exercise books at ₦120 each. How many pencils costing ₦80 each can I buy for the same amount?

____

5 A car travels a distance of 240 km. Table 13.14 gives times which correspond to different average speeds for the journey.

average speed (km/h)	40	60	80
time (h)	6		

Table 13.14

a Copy Table 13.14 and add an extra line for $\frac{1}{\text{time}}$. Complete all the empty boxes in your table.

b With speed on the horizontal axis, draw a graph connecting speed and reciprocal of time.

c Use your graph to find the time taken if the average speed is 90 km/h.

____

6 Use Table 13.14 to find the reciprocals of:

a 1.83 ________ **b** 5.88 ________ **c** 1.667 ________

7 Use Table 13.14 to find the reciprocals of:

a 18.5 ________ **b** 565 ________ **c** 0.063 63 ________

8 Use the reciprocal tables on page 124 to find the reciprocals of:

a 3.645 ________ **b** 36.45 ________ **c** 0.003 645 ________

9 Find the value of f to 2 s.f. if $\frac{1}{f} = \frac{1}{18} + \frac{1}{31}$.

____

10 It costs ₦6 billion to construct 22 km of motorway. What is the cost per km? Give your answer in ₦ million to 2 s.f.

____

Teacher's name: ____________________ Class name: ____________________

Student's name: ____________________ Date: ____________________

Chapter 14 Revision test

Tables 14.5 and 14.6 are incomplete tables of values for the equations $y = 3x - 1$ and $y = 2 - x$. Use these tables when answering questions 1, 2, 3.

x	-2	0	$+2$
$y = 3x - 1$	-7		

Table 14.5

x	-2	0	$+2$
$y = 2 - x$	4		

Table 14.6

1 Copy and complete Tables 14.5 and 14.6.

2 Using a scale of 1 cm to 1 unit on both axes, draw the graphs of the lines $y = 3x - 1$ and $y = 2 - x$ on the same set of axes.

3 Find the coordinates of the points where:

a the line $y = 3x - 1$ cuts the two axes ____

b the line $y = 2 - x$ cuts the two axes ____

c the lines $y = 3x - 1$ and $y = 2 - x$ intersect. __________________________________

4 Solve graphically the following pair of simultaneous equations.

$x + 2y = 3$ and $2x + y = 0$ ____

5 Use substitution to solve the simultaneous equations.

$4x + 3y = -1$ and $2x - y = 7$ ____

6 Use elimination to solve the simultaneous equations.

$2x + 7y = 3$ and $2x - y = 3$ ____

7 The sum of two numbers is 14. Their difference is 8. Find the numbers.

____

8 I have ₦460 less than Dotun. Altogether we have ₦1 280. How much do we each have?

____

9 A rectangle of perimeter 42 cm is p cm long and q cm broad. If the difference between the length and breadth is 9 cm, find:

a p and q ____

b the area of the rectangle. ____

10 A car travels for 2 hours at x km/h and 3 hours at y km/h. In total, it travels 310 km. If the average of x and y is 60 km/h, find x and y.

____

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Chapter 15 Revision test

Refer to Table 15.1 in the SB when answering questions 1 – 4.

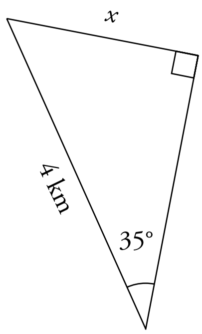


Fig. 15.32

1 Find the value of x in Fig. 15.32. ______________________

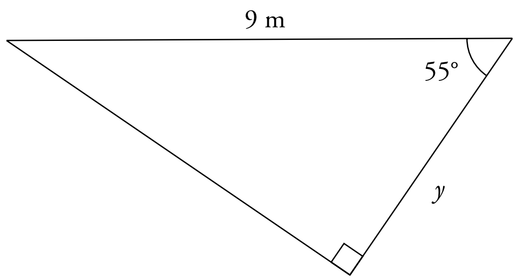


Fig. 15.33

2 Find the value of y in Fig. 15.33. ______________________

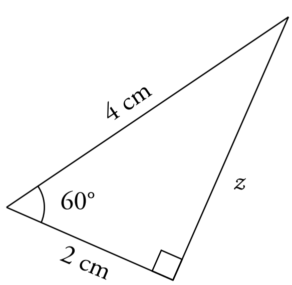


Fig. 15.34

3 Find the value of z in Fig. 15.34. ______________________

4 An isosceles triangle has equal sides of 8 cm. The angle between these sides is 40°.

a What are the sizes of its two other angles? ______________________

b Calculate the height of the triangle. ______________________

5 Use 4-figure tables to find the angle whose sine is:

a 0.374 6 ______________________

b 0.942 6 ______________________

c $\frac{3}{5}$ ______________________

6 Use 4-figure tables to find the angle whose cosine is:

a 0.390 7 ______

b 0.937 3 ______

c $\frac{1}{3}$ ______

7 Study the figures below.

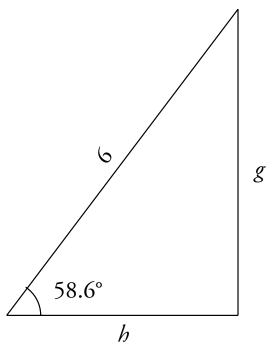


Fig. 15.35 a

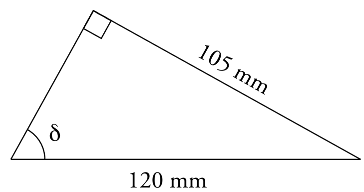


Fig. 15.35 b

a Calculate the lengths *g* and *h* in Fig. 15.35 a. ______

b Calculate the angle in Fig. 15.35 b. ______

8 Make a suitable construction line, then calculate the length of PQ in Fig. 15.36.

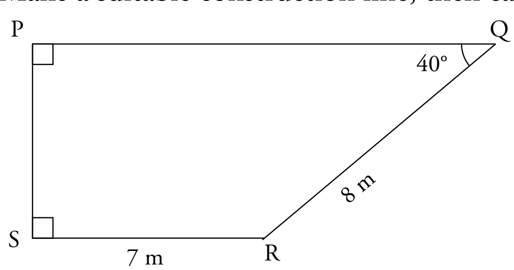


Fig. 15.36

9 Figure 15.37 is a side view of table supported by legs inclined at Θ to the horizontal. If the table is 76 cm high and each leg is 80 cm long, calculate the value of Θ.

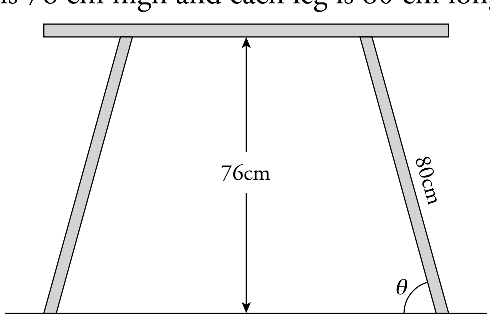


Fig. 15.37

______

10 An isosceles triangle has sides of length 10 cm, 12 cm and 10 cm.

a Use Pythagoras' rule to calculate the height of the triangle.

______

b Use trigonometry to calculate the angles of the triangle.

______

Teacher's name: ____________________ Class name: ____________________

Student's name: ____________________ Date: ____________________

Chapter 16 Revision test

Fig. 16.8 is a pie chart showing the proportion of space given to topics in a health magazine.
Use Fig. 16.8 to answer questions 1-4.

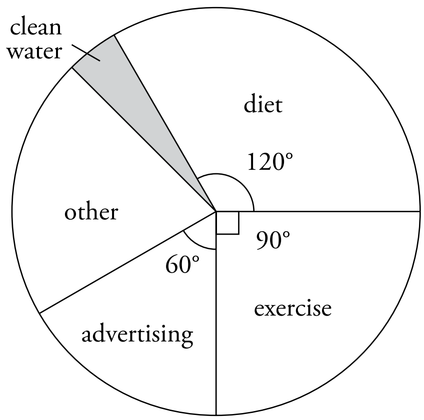


Fig. 16.8

1 What fraction of the magazine was given to diet topics?

____

2 Exercise topics took up what percentage of the magazine?

____

3 The magazine has 96 pages. How many of the pages were used for advertising?

____

4 The magazine included a 4-page article on the importance of clean water. What is the angle of the sector for water?

____

5 Here are the marks of some students in a test marked out of 20.
17, 13, 14, 18, 13, 14, 19, 15, 11, 18, 13

a How many students took the test?

____

b Arrange the marks in rank order.

____

c What is the range of the marks?

____

d Find the mean, median and mode of the marks.

____

6 There are eight men and a woman in a boat. The average mass of the nine people is 79 kg. Without the woman, the average is 81.5 kg. What is the mass of the woman?

____

7 The ages of a family of six children are 16.4, 14.8, 13.6, 11.10 and the twins are 9.1. Find the mean, median and modal ages of the family. (Take 16.4 to mean 16 years 4 months.)

____

8 A woman drives for $\frac{1}{2}$ hour in a car at an average speed of 40 km/h. For the next $\frac{1}{2}$ hour her average speed is 60 km/h. What is her average speed for the whole journey?

____

9 Five students took a test in four subjects. Table 16.12 shows their results.

	English	History	Maths	Science
Rose	52	69	54	57
Sule	68	60	67	73
Tayo	80	73	49	42
Uche	26	14	37	35
Vera	34	44	38	48

Table 16.12

Find:

a the mean mark of each student ______________________________

b the mean mark in each subject ______________________________

c the median mark in each subject. ______________________________

10 A club collected money from its members to buy a games player. 30 members made the following contributions (Table 16.13).

amount in ₦	100	200	500	1 000	5 000
frequency	4	10	8	5	3

Table 16.13

a Find the mean, median and modal amounts of money contributed.

Mean ______________________________

Median ______________________________

Mode ______________________________

b Which average is most representative of the data? Give reasons.

____

____

____

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Chapter 17 Revision test

1 Which of the following numbers are rational?

a 13 ______________________

b $\sqrt{13}$ ______________________

c 1.3 ______________________

d $\frac{3}{5}$ ______________________

e 16 ______________________

f $\sqrt{16}$ ______________________

g 1.6 ______________________

h $\sqrt{1.6}$ ______________________

i π ______________________

j $\frac{22}{7}$ ______________________

k 0.7 ______________________

l $0.\dot{7}$ ______________________

2 Which of the following numbers are non-rational?

a 13 ______________________

b $\sqrt{13}$ ______________________

c 1.3 ______________________

d $\sqrt{\frac{9}{25}}$ ______________________

e 25 ______________________

f $\sqrt{25}$ ______________________

g $\sqrt{2.5}$ ______________________

h π ______________________

i $\sqrt{\frac{9}{5}}$ ______________________

j $\frac{22}{7}$ ______________________

k 0.5 ______________________

l $0.\dot{5}$ ______________________

3 Write $0.\dot{4}$ as a rational number. ______________________

4 Write $2.\dot{4}$ as a rational number. ______________________

5 Write $3.\dot{8}\dot{5}$ as a rational number. ______________________

6 A student writes: "All recurring decimals are rational." Do you think she is correct? Give reasons for your answer.

____

____

7 Find the first digit of the square root of:

a 5.3 ______________________ **b** 53 ______________________

8 Use the method of Example 2 in the SB to find the value of $\sqrt{5}$ correct to 2 s.f.

____

9 Use the method of Example 3 in the SB to find the value of $\sqrt{53}$ correct to 1 d.p.

____

10 Follow the instructions below to find the approximate value of π.

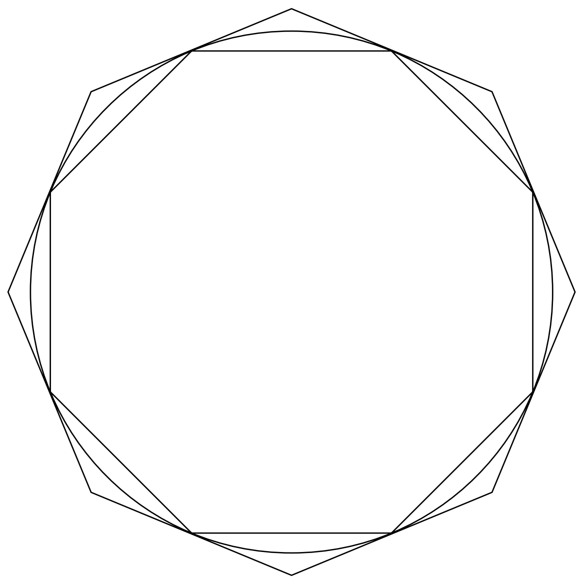


Fig. 20.5

Using Fig. 20.5:

- **a** Measure the perimeter of the outer octagon: H = __________ cm
- **b** Measure the perimeter of the inner octagon: h = __________ cm
- **c** Find the mean, c, of H and h: $c =$ __________ cm
- **d** Circumference of circle: $c =$ __________ cm
- **e** Measure the diameter of the circle: $d =$ __________ cm
- **f** Approximate value of $\pi = \frac{c}{d} =$ __________ cm

Chapter revision test answers

In Terms 1 and 2, each chapter concludes with an end-of-chapter revision test. This tests student attainment of the learning objectives for the chapter topic. There are a number of ways of managing the end-of-chapter revision tests:

- As a formal class test on completion of the work of the chapter
- As homework, after completing the work of the chapter
- As classwork, where students, in pairs or small groups, work through the test in discussion with each other and the teacher
- As a formal test at some point in the school year after revising the chapter topic

Given the time constraints of the school year, we strongly recommend that methods (2) or (3) be considered. As the only person with direct access to the answers, teacher participation is essential.

Chapter 1 Revision Test

1 a 3, 0, 4, 2
b $2^4, 2^3, 2^2, 2^1, 2^0$
2 $5 \times 10^4 + 6 \times 10^3 + 9 \times 10^2 + 3 \times 10^1 + 4 \times 10^0$
3 a $1\,335_{\text{eight}}$ **b** $10\,413_{\text{five}}$
4 a 53 **b** 183
c 140 **d** 21
5 a 23 **b** 10 111
6 59
7 a 10 010 **b** 10 011
8 a $100\,111_{\text{two}}$ **b** $1\,000\,010_{\text{two}}$
9 true
10 10 000
01 100
00 001
01 110
11 000

Chapter 2 Revision Test

1 a 4.5 **b** 11
2 2.1 or −14.9
3 48
4 27
5 8
6 2
7 2
8 a The product of 8 and the difference between 9 and 2.
b The sum of 7 and 11 divided by the product of 2 and 3.
9 3
10 14 and 20

Chapter 3 Revision Test

1 a $4ab - 8a^2$ **b** $21m - 6mn$
2 a $2ab$ **b** $3x$
3 a 560 **b** 880
4 a $(b + 2)(b + 3)$ **b** $(a - 4(a - 1)$
5 a $(9 - x)(2 + y)$ **b** $(x - 4)(x - 5)$
6 $(a - d)(b + 3c)$
7 does not factorise
8 $2(n^2 + 1)(n + 1)$
9 $(x - 3z)(y - 3k)$
10 $(q + 2r)(2p - 3q)$

Chapter 4 Revision Test

1 OPQR is a rhombus.
2 KLMN is a parallelogram.
4 The three bisectors meet at one point.
5 M is at the mid-point of the hypotenuse PR.
6 AC = 9.2 cm
8 QR = 8.1 cm, PR = 132°
9 YZ = 51 mm
10 BC = 6.6 cm

Answer Chapter 5 Revision Test

1 a 18.6 m^2 **b** 24.5 m^2

2 a 45 m^2 **b** 77.5 m^2
3 a 15 cm^2 **b** 16 km^2
4 a 31 cm^2 **b** 223.2 m^2
5 a 28 m^2 **b** 48 cm^2
6 $d = 11$
7 66 cm^2
8 a $82\frac{2}{3}$ cm^2 **b** 225°
9 238 tiles
10 1.5 ha

Chapter 6 Revision Test

1 a $y = -8$ **b** $x = 10$
2

x	-4	0	4	8	12
15	15	15	15	15	15
$-2x$	$+8$	0	-8	-16	-24
$y = 15 - 2x$	23	15	7	-1	-9

3 a ₦6 800 **b** $5\frac{1}{2}$ hours
4 a 29, 25, 29, 41
b ±1, ±3, ±5
5 a V = 75 cm^3 **b** $s = 7$ cm
6 $x = \frac{y - c}{m}$
7 a $R = \frac{V}{1}$ **b** R = 16
8 a $\frac{b^2}{d^4}$
b $\frac{\sqrt{b}}{d}$
c $\frac{d^2}{b}$
10 a $z = \pm\frac{1}{3}\sqrt{(x - 4)}$ **b** $z = \pm 2$

Chapter 7 Revision Test

2 a YX **b** ZY **c** LJ **d** ZX
3 a ΔHKG
b 41°, 60°, $7\frac{1}{2}$ m, $11\frac{1}{4}$ m
4 a ΔLNM **b** 62°, 36°, 9 cm, $6\frac{2}{3}$ km
5 Sketch two triangles ABC and PQR in which AB = 6 cm, BC = 10 cm, AC = 12 cm and PQ = 9 cm, QR = 15 cm, PR = 18 cm.
a Corresponding sides are in the same ratio.
b $\frac{AB}{PQ} = \frac{6}{9} = \frac{2}{3}; \frac{PQ}{QR} = \frac{9}{15} = \frac{3}{5}$
$\frac{AC}{BC} = \frac{12}{10} = \frac{6}{5}; \frac{PR}{QR} = \frac{18}{15} = \frac{6}{5}$
$\frac{AB}{AC} = \frac{6}{12} = \frac{1}{2}; \frac{QR}{PR} = \frac{15}{18} = \frac{5}{6}$

6 width = 7 cm, height = $11\frac{2}{3}$ cm
7 height = 15 cm
8 a ΔOKH, 3 common angles
b $4\frac{4}{5}$ cm
c $4\frac{1}{5}$ cm
9 $10\frac{1}{2}$ m, $1\frac{1}{2}$ m
10 c A′(−1, −1) B′(−2, −5) C′(−1, −4)

Chapter 8 Revision Test

1 1.4 **2** 35°
3 8.6 km
4 a 0·9325 **b** 1.889 **c** 0.3296
5 a 54° **b** 24.6° **c** 68.58°
6 25 km **7** 11.2 cm
8 $\alpha = 54.8°$, $\beta = 35.2°$
9 61.3° **10** 68.2°

Chapter 9 Revision Test

1 a $m^2 + 10m + 24$ **b** $x^2 - 18x + 81$
c $3b^2 - 7b - 40$ **d** $49 - y^2$
2 a 10 **b** −20
3 a $(x + 17)(x + 1)$ **b** $(d + 7)(d + 2)$
4 a $(x - 17)(x - 1)$ **b** $(d - 7)(d - 2)$
5 a $(x + 9)(x - 1)$ **b** $(d - 8)(d + 3)$
6 a $x^2 + 16x + 64$ **b** $4d^2 - 20de + 25e^2$
7 a 6 724 **b** 3 481
8 a $(x + 8)(x - 8)$ **b** $2(2m + 5n)(2m - 5m)$
9 a 4 400 **b** 7 200
10 242 mm^2

Chapter 10 Revision Test

1 a $x = 9$ **b** $x = 1$
2 $x = \frac{3}{8}$
3 $x = 4$
4 48 km/h
5 a $\frac{1\,000}{x}$ **b** $\frac{1\,000}{x}$ or $\frac{250}{x}$ **c** ₦50
6 a $x = 8$ **b** $x = 6\frac{1}{3}$
7 $x = -2\frac{2}{3}$
8 $x = -\frac{1}{11}$
9 72 kg and 45 kg
10 a $\frac{186}{v}$ **b** $(v + 8)$ km/h
c $\frac{180}{v + 8}$ **d** $v = 52$

Chapter 11 Revision Test

1 ₦9 500 **2** ₦280 000 **3** 2%
4 ₦786 520 **5** ₦170 355.90
6 a ₦1 071 900 **b** ₦171 900
7 ₦1 254 400 **8** ₦1 199 400
9 474 000 **10** ₦345 600

Chapter 12 Revision Test

1 ₦400 **2** ₦200
3 405 ml **4** ₦1 080
5 2.7 t **6** 4.608 kg
7 12 500 litres
8 a 1 : 1375 **b** 0.38 km^2
9 a 1 : 80 **b** 2.24 m
10 2 025 kg

Chapter 13 Revision Test

1 a

area (ha)	1	3	8
cost (₦ '000)	250	750	2 000

b directly proportional

2 a

cost/book (₦)	500	600	800
no of books	360	300	225

b inversely proportion

3 450 children
4 6 pencils
5

average speed (km/h)	40	60	80
time (h)	6	4	3
	0.17	0.25	0.33

d $2\frac{2}{3}$ hours (2 hours 40 minutes)

6 a 0.546 4 **b** 0.170 1 **c** 0.599 8
7 a 0.050 45 **b** 0.001 77 **c** 15.71
8 a 0.274 3 **b** 0.027 43 **c** 274.3
9 $f = 11$ to 2 s.f.
10 ₦270 million to 2 s.f.

Chapter 14 Revision Test

1

x	-2	0	$+2$
$y = 3x - 1$	-7	-1	$+5$

x	-2	0	$+2$
$y = 2 - x$	4	2	0

3 Find the co-ordinates of the points where:
a $(0, -1)$ and $(\frac{1}{3}, 0)$
b $(0, 2)$ and $(2, 0)$ **c** $(0.75, 1.25)$
4 $x = -1, y = 2$
5 $x = 2, y = -3$
6 $x = 1\frac{1}{2}, y = 0$
7 11 and 3
8 Dotun has ₦870, I have ₦410.
9 a $p = 15$ cm, $q = 6$ cm **b** 90 cm^2
10 $x = 50, y = 70$

Chapter 15 Revision Test

1 2.3 km **2** 5.2 cm
3 3.5 cm
4 a 70° each **b** 7.5 cm
5 a 22° **b** 70.5° **c** 36.86°
6 a 67° **b** 20.4° **c** 70.53°
7 a $g = 5.1$ cm **b** $h = 3.1$ cm **c** 61°
8 PQ = 13 m **9** 71.8°
10 a 8 cm **b** 53.13°, 53.13°, 73.74°

Chapter 16 Revision Test

1 $\frac{1}{3}$ **2** 25%
3 16 pages **4** 15°
5 a 11 students
b 11, 13, 13, 13, 14, 14, 15, 17, 18, 18, 19
c range = 19 − 11 = 8
d mean = 15, median = 14, mode = 13
6 59 kg **7** 12-5, 12-8, 9-1
8 50 km/h
9 a Rose 58, Sule 67, Tayo 61, Uche 28, Vera 41
b Eng 52, Hist 52, Math 49, Sci 51
c Eng 52, Hist 60, Math 49, Sci 48
10 a ₦880, ₦500, ₦200
b the median (₦500). The mean is not representative. It is affected by the three members who gave ₦5 000.

Chapter 17 Revision Test

1 13, 1.3, 16, $\sqrt{16}$, 1.6, 0.7, 0
2 $\sqrt{13}$, $\sqrt{2.5}$, π
3 $\frac{4}{9}$ **4** $\frac{24}{9}$ or $\frac{22}{9}$
5 $\frac{382}{99}$ **6** yes
7 a 2 **b** 7
8 2.2 **9** 7.3
10 The final answer should be close to 3.1 or 3.15.

Term revision test sheets

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Term revision test 1 (Chapters 1, 2, 5)

Select from *a-c* the correct answer.

1 Change 342_{six} to a number in base ten.

A 34.2 **B** 44 **C** 57 **D** 134 **E** 420

2 Change the number $10\ 010_{two}$ to base ten.

A 40_{ten} **B** 34_{ten} **C** 18_{ten} **D** 10_{ten} **E** 36_{ten}

3 Express in base two, the square of 11_{two}.

A 1 001 **B** 1 010 **C** 1 011 **D** 1 101 **E** 1 100

4 The sum of three consecutive even numbers is 72. The highest of the three numbers is:

A 12 **B** 14 **C** 22 **D** 24 **E** 26

5 A sector of a circle of radius 12 cm has an angle of 160°. What is its area in cm^2 in terms of π?

A $5\frac{1}{3}$ **B** $10\frac{2}{3}$ **C** 16π **D** 64π **E** 144π

6 Change the following base ten numbers to base two.

a 30 **b** 57 **c** 100

7 The product of two numbers is $7\frac{1}{5}$. If one of the numbers is 9, find the other.

8 Find one-sixth of the positive difference between 36 and 63.

9 A classroom ceiling is 6.8 m by 4.7 m. It is covered by boards 1 m by 1 m.

a How many boards are needed altogether?

b How many of them will be cut?

c Find the total cost if each board costs ₦700.

10 A village is roughly in the shape of rectangle 540 m by 1.3 km. What is the approximate area of the town to the nearest hectare?

Teacher's name: __________ Class name: __________

Student's name: __________ Date: __________

Term revision test 2 (Chapters 3, 6)

1 The highest common factor of $10a^2b$ and $8ab$ is:

A $80a^2b$ **B** $2ab\ 5a$ **C** $1\frac{1}{4}a$ **D** 4

2 Which of the following are factors of $6x^2 - 21xy$?

I 3; II x; III $(2x - 7y)$.

A I only **B** II only **C** I and II only **D** All of them **E** None of them

3 If $y = \dfrac{x+9}{x-3}$, find the value of y when $x = 5$.

A -5 **B** -2 **C** 5 **D** 6 **E** 7

4 If $a = 2b - c$, find the value of b when $a = 11$ and $c = 23$.

A 17 **B** 7 **C** 8 **D** 14 **E** 16

5 If $A = \frac{1}{2}(a + b)h$, express h in terms of A, a and b:

A $A - \frac{1}{2}(a + b)$

B $\frac{1}{2}(a + b)A$

C $\dfrac{2A}{a + b}$

D $\dfrac{A}{2(a + b)}$

E $\dfrac{a + b}{2A}$

6 Factorise the following.

a $7x - 28$ __________

b $8\ m - 8\ mn$ __________

c $27ab + 36b^2$ __________

d $35p^2q - 14pq^2$ __________

7 Factorise the following, simplifying where possible.

a $3a^2 + a(2a + b)$ __________

b $(5x - 2y)(a - b) - (2x - y)(a - b)$ __________

c $pq - pr + 8q - 8r$ __________

d $5x + ky + 5y + kx$ __________

8 **a** Factorise $\pi r^2 + 2\pi rh$.

____

b Hence find the value of the expression when $\pi = \frac{22}{7}$, $r = 4$ and $h = 5$.

____

9 Given that $y = 9 - 2x$, copy and complete Table R1.

x	-2	-1	0	1	2
$9 - 2x$	9	9	9	9	9
y					

Table R1

10 The cost, c naira, of having a car repaired is given by the formula $c = 250 + 150t$, where t is the number of hours the work takes.

a Find the cost when the work takes $2\frac{1}{2}$ hours.

____

b If the cost of repairs is ₦850, how long did the work take?

____

Teacher's name: ____________________ Class name: ____________________

Student's name: ____________________ Date: ____________________

Term revision test 3 (Chapters 4, 7, 8)

1 Which one of the following angles can be constructed using ruler and compasses only?

A 115° **B** 125° **C** 135° **D** 145° **E** 155°

2 Two similar triangles are such that AB and CB in the first correspond to RT and ST in the second. Complete the statement: ΔABC is similar to Δ __________.

A RST **B** TSR **C** SRT **D** TRS **E** RTS

3 With the data as given in Fig. R6, calculate YQ.

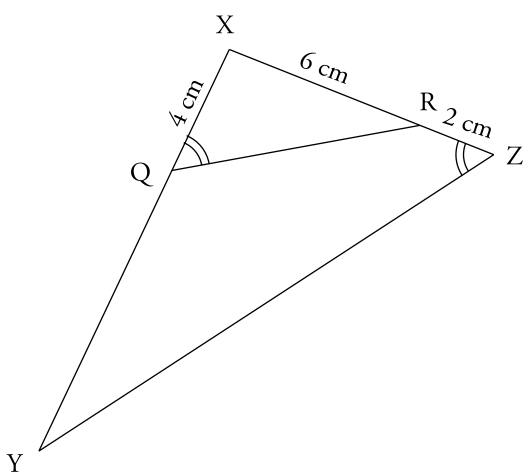


Fig. R6

A 6 cm **B** 8 cm **C** 10 cm **D** 12 cm **E** 16 cm

4. In Fig. R7, the tangent of $\hat{X}$ is given by the ratio:

A $\frac{XY}{YZ}$ **B** $\frac{XZ}{XY}$ **C** $\frac{XZ}{YZ}$ **D** $\frac{YZ}{XZ}$ **E** $\frac{YZ}{XY}$

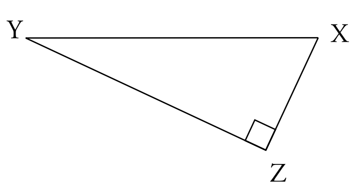


Fig. R7

5 Using 4-figure tables, find the angle with a tangent equal to 0.2796.

A 15.3° **B** 15.4° **C** 15.6° **D** 15.7° **E** 15.8°

6 Complete the following:

a Draw a line AB 6 cm long.

b Construct the perpendicular bisector of AB.

c Hence construct an isosceles triangle ACB such that CA = CB = 8 cm.

d Measure $\hat{C}$.

7 Construct ΔABC such that BC = 6.5 cm, $\hat{B}$ = 45° and BA = 7.5 cm. Measure AC.

8 In Fig. R8, name the triangle which is similar to ΔOAB. If OA = 3 cm, OX = 7.5 cm and AB = 4 cm, calculate XY.

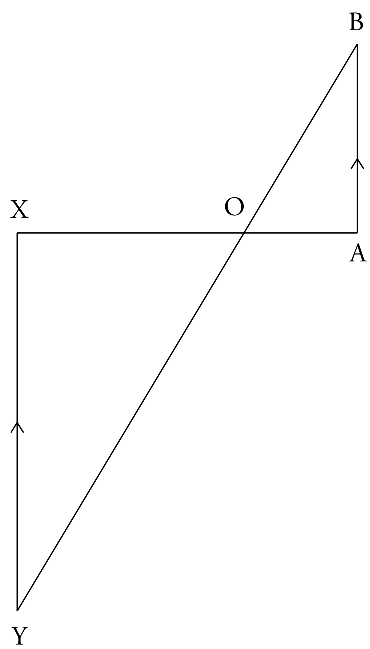


Fig. R8

9 Find, by drawing and measurement, the angle whose tangent is $\frac{3}{5}$.

10 In ΔABC, $\hat{B} = 90°$, $\hat{A} = 23°$ and BC = 6 cm.

a Calculate $\hat{C}$.

b Hence or otherwise calculate AB correct to 2 decimal places.

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

General revision test A

1 Find the value of $(101_{two})^2$ in base two.

A 1 010 **B** 1 111 **C** 10 100 **D** 10 101 **E** 11 001

2 Find the product of the square of $\frac{1}{2}$ and the sum of 13 and 19.

A 8 **B** 16 **C** 32 **D** 64 **E** 128

3 What is the area of the trapezium in Fig. R9?

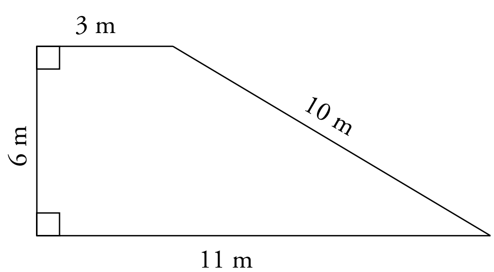


Fig. R9

A 33 m^2 **B** 42 m^2 **C** 56 m^2 **D** 66 m^2

E More information is needed

4 Which of the following are factors of $6a^2 - 2ab - 3ab + b^2$?

I $(3a - b)$; II $(2a + b)$; III $(2a - b)$.

A I only **B** I and II only **C** I and III only **D** II and III only **E** None of them

5 If $S = 2(n - 2)$, find n when $S = 18$.

A 7 **B** 10 **C** 11 **D** 18 **E** 32

6 If $P = 2(l + b)$, express b in terms of P and l : $b =$

A $2(l + P)$ **B** $P - 2l$ **C** $\frac{P}{2} = 1$ **D** $2P - l$ **E** $\frac{P-2}{l}$

7 If ΔRXS is similar to ΔTPQ, which one of the following angles must equal $\hat{X}$?

A $\hat{P}$ **B** $\hat{Q}$ **C** $\hat{R}$ **D** $\hat{S}$ **E** $\hat{T}$

8 In Fig. R10, calculate the length of BX.

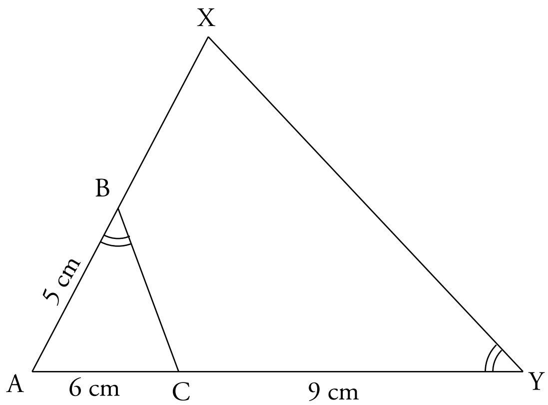


Fig. R10

A 7.5 cm **B** 8 cm **C** 10.8 cm **D** 13 cm **E** 18 cm

9 Using 4-figure tables, find X° where tan X° = 0·4549.

A 24.3° **B** 24.4° **C** 24.5° **D** 24.6° **E** 24.7°

10 Using 4-figure tables, the value of tan 37·7° is:

A 0.7536 **B** 0.7563 **C** 0.7646 **D** 0.7701 **E** 0.7729

11 **a** Starting at 001, write down the first seven binary numbers as 3-digit numerals. Label these A, B, C, D, E, F, G.

____

b Hence find the words that the following represent.

i	**ii**	**iii**
010	011	110
001	001	101
111	110	101
	101	100

____

12 The difference between two numbers is 10. If one of the numbers is 7, find two possible values for the other number.

____

13 Calculate the area of a ring whose inside and outside diameters are 13 cm and 8 cm. Use the value $\frac{22}{7}$ for π.

____

14 Factorise the following, simplifying brackets where necessary.

a $18ab - 63$ ______________________________

b $52x - 8x^2$ ______________________________

c $5a^2 + a(2b - 3a)$ ______________________________

d $(2x + y)(2a + b) - (2a + b)(x - 5y)$ ______________________________

15 Factorise the following.

a $22ab - 11ac + 6rb - 3rc$

b $x^2 + 5x - 9x - 45$

c $6ax - 2by + 4ay - 3bx$

16 Factorise $\pi rs + \pi r^2$. Hence find the value of the expression when $\pi = \frac{22}{7}$, $r = 5$ and $s = 16$.

17 Given that $3x + 4y = 26$:

a express x in terms of y and thus find x when $y = 5$.

b express y in terms of x and thus find y when $x = 10$.

18 Using ruler and pair of compasses only, construct ΔPQR such that PQ = 8.4 cm, $\hat{Q} = 60°$ and QR = 4.2 cm. Measure $\hat{P}$ and find the length of PR.

19 The two shorter sides of a right-angled triangle are 12 cm and 15 cm long. Calculate the sizes of the acute angles in the triangle.

20 From a point on level ground 60 m away, the angle of elevation of the top of a tree is $24\frac{1}{2}°$. Calculate the height of the tree to the nearest metre.

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Term revision test 4 (Chapters 9, 10, 14)

1 The coefficient of x in the expansion of $(x - 2)(x + 9)$ is:

A -18 **B** -2 **C** $+1$ **D** $+7$ **E** $+9$

2 The exact value of 2852 – 2152 is:

A 70 **B** 140 **C** 500 **D** 4900 **E** 3500

3 If $\frac{6}{5} = \frac{3}{d}$ then $d =$

A $\frac{5}{18}$ **B** $\frac{2}{5}$ **C** $2\frac{1}{2}$ **D** $3\frac{3}{5}$ **E** 90

4 A girl gets x marks in a test. Her friend gets 4 marks less. The ratio of the two marks is 4 : 3. Which one of the following equations can be solved for x?

A $\frac{x}{x-4} = \frac{4}{3}$ **B** $\frac{x-4}{x} = \frac{4}{3}$ **C** $\frac{x}{x+4} = \frac{4}{3}$ **D** $\frac{x+4}{x} = \frac{4}{3}$ **E** $\frac{x+4}{x-4} = \frac{4}{3}$

5 If $x + 3y = 7$ and $x - 3y = 7$, then $y =$

A $-4\frac{2}{3}$ **B** $-2\frac{1}{3}$ **C** 0 **D** $2\frac{1}{3}$ **E** $4\frac{2}{3}$

6 Simplify $(a + 5b)(a - 2b) + (a - 3b)(a - 4b)$.

____

7 Factorise the following.

a $x^2 + 10x + 16$ ______________________

b $r^2 - 16r + 28$ ______________________

c $m^2 - 7m - 18$ ______________________

d $y^2 - 8y - 20$ ______________________

e $a^2 + 8a + 16$ ______________________

f $\pi a^2 - \pi b^2$ ______________________

8 Solve the following.

a $\frac{2}{x-10} + \frac{1}{3} = 0$ ______________________

b $\frac{23 - 3x}{x+1} = \frac{4}{3}$ ______________________

9 Solve the following pairs of simultaneous equations.

a $8y + 4z = 7$, $6y - 8z = 41$ ______________________

b $2y = 3x + 2$, $9x + 8y = 1$ ______________________

10 A nut and a bolt together have a mass of 98 g. The mass of four bolts and two nuts is 336 g. Find the mass of a nut and of a bolt.

____

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

Term revision test 5 Chapters 11, 13, 15, 16, 17

1 A new table costs ₦10 000. Find the cost of buying the same kind of table in 2 years' time if the rates of inflation for those years are 20% and 10%.

A ₦10 000 **B** ₦11 500 **C** ₦12 000 **D** ₦13 000 **E** ₦3 200

2 A bookshelf can hold 84 books each 3 cm wide. How many books of width 4 cm can it hold?

A 56 **B** 63 **C** 84 **D** 105 **E** 112

3 The reciprocal of 0.02 is

A 500 **B** 50 **C** 5 **D** 0.5 **E** 0.05

4 Use Fig. R9 to answer questions 4 and 5.

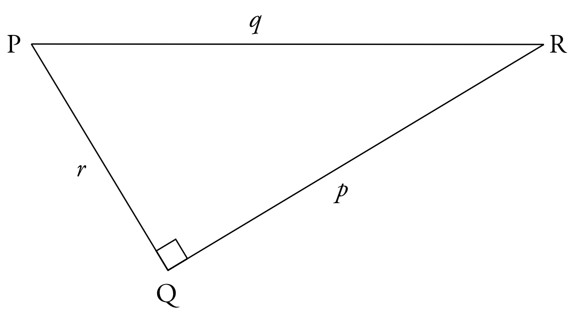


Fig. R9

In Figure 9, $\sin \hat{P} =$

A $\frac{p}{q}$ **B** $\frac{q}{p}$ **C** $\frac{r}{q}$ **D** $\frac{p}{r}$ **E** $\frac{r}{p}$

5 Which of the following statements is (are) true in Fig. R9?

I $\sin \hat{P} = \cos \hat{R}$

II $\cos \hat{P} = \sin \hat{R}$

III $\tan \hat{P} = \tan \hat{R}$

A none of them **B** I and II only **C** II and III only **D** I and III only **E** all of them

6 The average age of 21 students is 14 years 3 months. If the oldest student is not counted, the average drops to 14 years 2 months. The age of the oldest student is:

A 14 years 4 months **B** 14 years 5 months **C** 15 years 11 months **D** 16 years **E** 21 years

7 Fig. R10 is a pie chart of the information in Table R3.

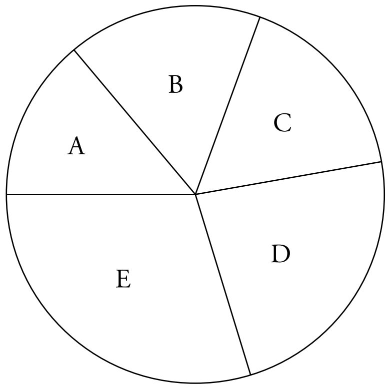


Fig. R10

shoe size	6	7	8	9	10
number of people	5	6	9	10	6

Which sector in Fig. R10 represents the people who wear size 8 shoes?

____

8 ₦200 000 is saved at 10% per annum compound interest. Find:

a the amount ____

b the interest, after 3 years. ____

9 Table R4 gives some average speeds and corresponding times for a certain journey.

speed (km/h)	15	30	50
time (h)	10	5	3

Table R4

a Copy Table R4 and add an extra line for values of $\frac{1}{\text{time}}$.

b Draw a graph connecting speed and reciprocal of time on grid paper.

c Use your graph to find the time taken when the speed is 45 km/h.

____

10 Use reciprocal tables to find the value of $\frac{1}{3.69}$ correct to 2 s.f.

Hence write down the values of:

a $\frac{1}{369}$ ____

b $\frac{1}{0.369}$ ____

11 By drawing and measurement, find approximately **a** the value of sin 37°, **b** the size of the angle whose cosine is $\frac{7}{10}$.

____

12 A ladder 6 m long leans against a vertical wall and makes an angle of 80° with the horizontal ground. Calculate, to 2 s.f., how far up the wall the ladder reaches.

13 The ages of 14 students in years and months are:

15,5; 15,0; 15,3; 14,5; 14,7; 15,4; 15,10; 14,9; 15,2; 13,11; 15,1; 16,1; 15,5; 14,11.

a State the range of these ages.

b Calculate the average of the highest and lowest ages and use this as a working mean to find the average age of all the students.

c What is the greatest deviation from the mean, **i** above, **ii** below?

14 After 12 games a basketball player's points average was 18.5. How many points must he score in the next game to raise his average to 20?

Teacher's name: ______________________ Class name: ______________________

Student's name: ______________________ Date: ______________________

General revision test B (Chapters 9-17)

1 If $x^2 + 14x + k$ is a perfect square, then $k =$

A 4 **B** 7 **C** 28 **D** 49 **E** 196

2 Which of the following is (are) factors of $3x^2 - 6x - 9$?

I 3

II $(x - 3)$

III $(x + 1)$

A one of them **B** I and II only **C** II and III only **D** I and III only **E** all of them

3 If $\frac{5}{f} = 4 - \frac{7}{f}$ then $f =$

A -1 **B** $\frac{1}{3}$ **C** $\frac{1}{2}$ **D** 1 **E** 3

4 A herdsman bought a cow for ₦25 000. He sold it to a butcher at a profit of 20%. The butcher then sold it at a profit of 20%. What was the final selling price of the cow?

A ₦29 000 **B** ₦29 200 **C** ₦32 000 **D** ₦35 000 **E** ₦36 200

5 When a sum of money is shared between 40 people they each get ₦800. If the same money is shared equally between 50 people, how much will each get?

A ₦600 **B** ₦640 **C** ₦810 **D** ₦960 **E** ₦1000

6 The reciprocal of 0.08 is 12.5. The reciprocal of 80 is

A 0.00125 **B** 0.0125 **C** 0.125 **D** 1.25 **E** 125 000

7 If $x = 2y - 1$ and $2x = 3y + 2$, then $x =$

A -9 **B** -4 **C** 4 **D** 7 **E** 9

8 Two of the angles of a triangle are $x°$ and $(90 - x)°$. Which of the following is (are) correct?

I $\sin x° = \cos(90 - x)°$

II $\cos x° = \sin(90 - x)°$

III $\tan x° = \frac{1}{\tan(90 - x)°}$

A I only **B** I and II only **C** III only **D** all of them **E** none of them

Table R5 gives the approximate hand spans of 20 students.

hand span (cm)	19	20	21	22	23
frequency	3	2	5	8	2

Table R5

Use Table R5 to answer questions 9 and 10.

9 What is the median size of hand span?

A 20.8 cm **B** 21 cm **C** 21.2 cm **D** 21.5 cm **E** 22 cm

10 What is the mean hand span?

A 20.8 cm **B** 21 cm **C** 21.2 cm **D** 21.5 cm **E** 22 cm

11 Expand the brackets in $(4a + 3)(a - 2) - (2a - 3)(2a + 3) = 0$ and hence solve the equation.

____

12 Factorise the following.

a $n^2 + 12n + 32$ ______________________________

b $x^2 - 14x + 33$ ______________________________

c $z^2 + 11z - 26$ ______________________________

d $y^2 - 9y - 36$ ______________________________

e $16 + 8h + h^2$ ______________________________

f $9 - (a + 2)^2$ ______________________________

13 Solve the following.

a $\frac{15}{k} = \frac{3}{k} + 3$ ______________________________

b $\frac{15}{k} = \frac{3}{k + 2}$ ______________________________

c $\frac{1}{x + 5} - \frac{1}{4x - 7} = 0$ ______________________________

14 A motor bike costs ₦750 000. It depreciates by 20% in the first year and by 15% in each of the following years. Find the value of the motor bike to the nearest ₦10 000 after 3 years.

____

15 A man saves ₦200 000 at 6% per annum compound interest. At the end of each year he adds ₦18 000 to his total savings. Find his total amount after 3 years.

____

16 A long straight road makes an angle of 7° with the horizontal. Two posts are 1 km apart on the road. Calculate in metres:

a the horizontal distance between the posts

____

b the difference in height between the posts.

____

17 First simplify, then solve, the following simultaneous equations:

a) $3(2x - y) = x + y + 5$

b) $5(3x - 2y) = 2(x - y) + 1$

18 A cyclist travels for x hours at 20 km/h and then for y hours at 12 km/h. Altogether she travels 60 km in 4 hours.

a Express the total time taken in terms of x and y.

b Express the total distance travelled in terms of x and y.

c Hence find x and y.

19 The acute angles of a rhombus are 76°. If the shorter diagonal is of length 8 cm, calculate the length of the sides of the rhombus to the nearest mm. (First make a good sketch on a separate piece of paper.)

20 A small factory employs 10 workers, two supervisors and one manager. The workers get ₦7 000 per week, the supervisors get ₦11 000 per week and the manager gets ₦17 200 per week.

a Calculate the mean weekly wage at the factory.

b Compare this result with the modal wage. Which average is most representative of the weekly wages?

Teacher's name: ____________________ Class name: ____________________

Student's name: ____________________ Date: ____________________

Course revision test (Chapters R1–R4, Books 1 & 2)

1 What is the value of the digit 5 in the number 624.95?

A 5 hundreds **B** 5 tens **C** 5 units **D** 5 tenths **E** 5 hundredths

2 The highest common factor of 36, 72 and 90 is:

A 9 **B** 18 **C** 36 **D** 90 **E** 360

3 486 kg expressed in tonnes is

A 48.6 t **B** 4.86 t **C** 0.486 t **D** 0.048 6 t **E** 0.004 86 t

4 If 0.68 is expressed as a fraction in its lowest terms, its denominator will be:

A 17 **B** 25 **C** 34 **D** 50 **E** 68

5 When $x = 9$, the value of $3x - 5$ is

A 17 **B** 12 **C** 22 **D** 32 **E** 34

6 The number which is 3 greater than n is:

A $n + 3$ **B** $3n$ **C** $n - 3$ **D** $\frac{1}{3}n$ **E** $3 - n$

7 A prism has three rectangular faces. Its other faces are in the shape of a:

A rectangle **B** square **C** pentagon **D** triangle **E** hexagon

8 The obtuse angle between the hands of a clock at 2.30 a.m. is:

A 105° **B** 120° **C** 135° **D** 150° **E** 165°

9 $490 \div 19\,999 =$

A 0.000 049 **B** 0.000 49 **C** 0.004 9 **D** 0.049 **E** 0.49

10 The sum of ₦ and y kobo expressed in kobo is:

A $\frac{x}{100} + y$ **B** $x + 100y$ **C** $x + y$ **D** $100x + y$ **E** $x + \frac{y}{100}$

11 Which of the following statements about diagonals is (are) true for all rectangles?

I They are equal in length.

II They cross at right angles.

III They bisect each other.

A I only **B** I and II only **C** II only **D** I and III only **E** III only.

12 $8 - 9 - (-5) =$

A -6 **B** -4 **C** $+4$ **D** $+6$ **E** $+12$

13 The perimeter of a rectangle is 20 cm. If the breadth of the rectangle is 2 cm, its area is:

A 16 cm^2 **B** 18 cm^2 **C** 20 cm^2 **D** 32 cm^2 **E** 40 cm^2

14 Laraba has x naira. Kunle has 15 naira less than Laraba. Together, the number of naira they have is:

A $x - 15$ **B** $2x$ **C** $2x - 15$ **D** $2x + 15$ **E** 15

15 An equilateral triangle of side 16 cm has the same perimeter as a square. The area of the square, in cm^2, is:

A 48

B 64

C 96

D 144

E 256

16 A thread is wound 200 times round a reel of diameter 5 cm. Use the value 3 for π to find the approximate length of the thread in metres:

A 15 **B** 30 **C** $37\frac{1}{2}$ **D** 60 **E** 75

Use the following set of numbers to answer questions 17, 18, 19: 8, 9, 5, 6, 2, 4, 8, 0

17 The mode of the above numbers is:

A 4 **B** 5 **C** 6 **D** 7 **E** 8

18 The median of the above numbers is:

A 5 **B** 5.5 **C** 6 **D** 6.5 **E** 7

19 The mean of the above numbers is:

A 4 **B** 5.5 **C** 6 **D** 7 **E** none of these

20 If $2x + 1 = 15$, then:

A 7 **B** 8 **C** 12 **D** 14 **E** 16

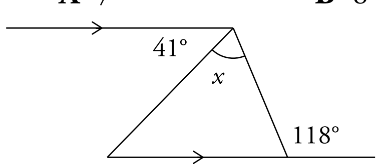


Fig. RT1

21 In Fig. RT1, $x =$

A 41 **B** 49 **C** 62 **D** 77 **E** 139

22 8.048 to the nearest tenth is:

A 10

B 8

C 8.0

D 8.

E 8.05

23 Four lines meet at a point. The sum of three of the angles at the point is 267°. The size of the other angle is:

A 87° **B** 89° **C** 90° **D** 91° **E** 93°

24 Solve $15 = 3y + 7$. $y =$

A $2\frac{2}{3}$ **B** 5 **C** $7\frac{1}{3}$ **D** 8 **E** 24

25 250 g of sugar costs ₦150 at shop X. 100 g of sugar costs ₦95 at shop Y. The difference in cost per kg is:

A ₦55 **B** ₦220 **C** ₦250 **D** ₦260 **E** ₦350

26 The next term in the sequence 1, 4, 10, 19, 31, …

A 32

B 34

C 43

D 46

E 50

27 The square root of $5\frac{4}{9}$ is:

A $\frac{7}{9}$ **B** $2\frac{1}{3}$ **C** $2\frac{13}{8}$ **D** $5\frac{2}{3}$ **E** $16\frac{1}{3}$

28 482 000 in standard form is:

A 4.82×10^{-6} **B** 4.82×10^{-5} **C** 4.82×10^{3} **D** 4.82×10^{5}

E 4.82×10^{6}

29 0.009 238 to 3 significant figures is:

A 0.01

B 0.009

C 0.009 23

D 0.009 24

E 0.923

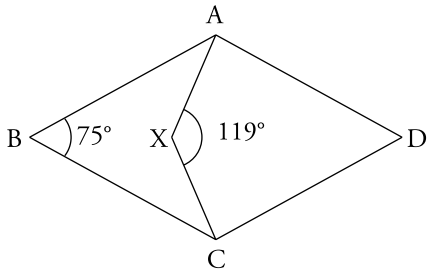


Fig. RT2

30 In Fig. RT2, ABCD is a rhombus and AXCD is a kite. What is the size of $X\hat{A}D$?

A 77° **B** 83° **C** 97° **D** 103° **E** 105°

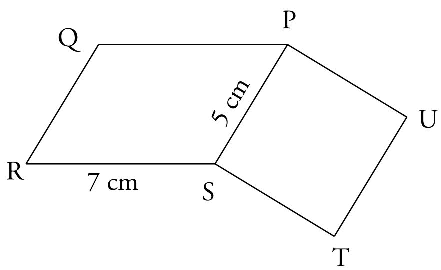


Fig. RT3

31 In Fig. RT3, PQRS is a parallelogram and STUP is a square.
If PS = 5 cm and RS = 7 cm, the perimeter of PQRSTU is:

A 24 cm **B** 29 cm **C** 34 cm **D** 39 cm

E Not enough information

32 Find the value of $\frac{a - 3b}{a}$ when $a = 2$ and $b = -8$.

A -18 **B** -11 **C** $12\frac{1}{2}$ **D** 13 **E** 24

33 Simplify $3(x - 2y) - 4(x - 5y)$.

A $7x - 26y$ **B** $14y + x$ **C** $-x - 26y$ **D** $14y - x$ **E** $x + 26y$

34 In an examination, 35 out of 125 students failed. What percentage passed?

A 28% **B** 35% **C** 65% **D** 72% **E** 90%

35 How much simple interest does ₦6 000 make in 3 years at 7% per annum?

A ₦70 **B** ₦180 **C** ₦210 **D** ₦420 **E** ₦1 260

36 There are 180 girls in a mixed school. If the ratio of girls to boys is 4 : 3, the total number of students in the school is:

A 225 **B** 315 **C** 360 **D** 405 **E** 420

37 Express $\frac{a}{3} + \frac{4}{b}$ a single fraction.

A $\frac{3a + 4b}{3b}$ **B** $\frac{a + 4}{3 + b}$ **C** $\frac{ab + 12}{3b}$ **D** $\frac{ab + 12}{3 + b}$ **E** $\frac{(a + 4)}{3b}$

38 Solve $\frac{2x - 1}{5} + 2x = 19$. $x =$

A $1\frac{2}{3}$ **B** $2\frac{1}{2}$ **C** 5 **D** 8 **E** 24

39 A man is four times as old as his son. In 5 years' time he will be three times as old as his son. What is the present age of the son in years?

A 8 **B** 9 **C** 10 **D** 12 **E** 15

40 Which of the points in Fig. RT4 has co-ordinates $(-4, 1)$? ______________________

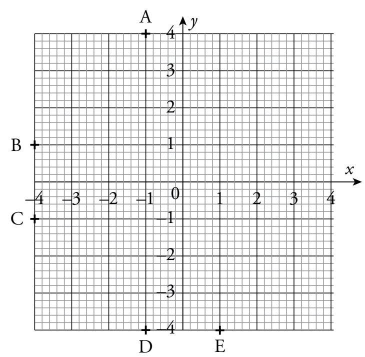


Fig. RT4

41 Use tables to find the value of $\sqrt{940}$.

A 3.070 **B** 9.695 **C** 30.66 **D** 32.06 **E** 96.95

42 A map is drawn to a scale 2 cm to 100 km. On the map the distance between two towns is 2.5 cm. What is their true distance apart?

A 40 km **B** 80 km **C** 125 km **D** 250 km **E** 500 km

43 ABCD is a rectangle with sides 6 cm and 8 cm. If its diagonals cross at X, the length of AX is

A 5 cm **B** 6 cm **C** 7 cm **D** 8 cm **E** 10 cm

44 Which of the following gives the volume of a cylinder of height h and base radius r?

A $2\pi r^2 h$ **B** $\frac{1}{3}\pi r^2 h$ **C** πrh **D** $\pi r^2 h$ **E** $2\pi rh$

45 Fig. RT5 is a graph giving the cost of hiring a car in terms of distance travelled. Use Fig. RT5 to answer questions 45-48.

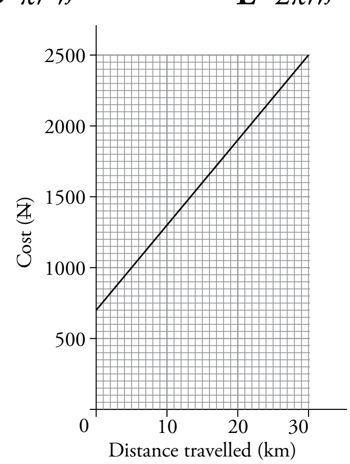


Fig. RT5

46 How much does it cost to hire the car for a 15 km journey?

A ₦1 500 **B** ₦1 600 **C** ₦1 700 **D** ₦1 750 **E** ₦1 800

47 If the cost of hiring the car is ₦2 350, the approximate distance travelled is:

A 24 km

B 25 km

C 27 km

D 29 km

E 30 km

48 How much does it cost to hire the car even if no distance is travelled?

A 0

B ₦500

C ₦700

D ₦750

E ₦900

49 Find the range of values of x for which $7 - 2x < 19$.

A $x > 6$ **B** $x > -6$ **C** $x < 6$ **D** $x < -6$ **E** $x > -13$

Fig. RT6 shows a right triangular prism resting so that its triangular base is horizontal.

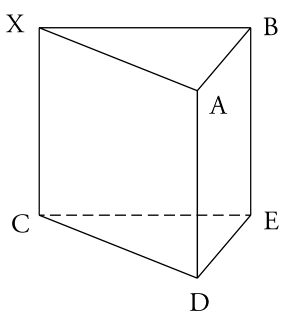


Fig. RT6

50 The bearing of X from Y is 148°. The bearing of Y from X is:

A 032° **B** 058° **C** 148° **D** 212° **E** 328°

51 Change 47_{ten} to base two.

A 100 111 **B** 100 011 **C** 101 111 **D** 110 001 **E** 111 101

52 Change $100\,100_{two}$ to base ten.

A 20 **B** 34 **C** 36 **D** 44 **E** 900

53 Subtract 18 from the product of 20 and 3.

A 1 **B** 5 **C** 6 **D** 42 **E** 78

54 Calculate $(4 \times 10^3) \times (8 \times 10^2)$, giving the answer in standard form.

A 3.2×10^2 **B** 3.2×10^4 **C** 3.2×10^5 **D** 3.2×10^6 **E** 3.2×10^7

55 Calculate $0.126 \div 36$, giving the answer in standard form.

A 3.5×10^{-4}

B 3.5×10^{-3}

C 3.5×10^{-2}

E 3.5×10^2

E $3.5\ 3\ 10^3$

56 Which of the following is (are) factor(s) of $15pr - 10qs - 30qr + 5ps$?

I 5

II $3r - s$

III $p - 2q$

A I only **B** I and II only **C** II only **D** I and III only **E** III only

57 If $f = \frac{uv}{u + v}$, find f when $u = 20$ and $v = -30$.

A -60 **B** -12 **C** -1 **D** 12 **E** 60

58 If $\mathrm{I} = \frac{\mathrm{E}}{\mathrm{X + Y}}$, express X in terms of I, E and Y. X =

A $\frac{\mathrm{E}}{1 + \mathrm{Y}}$ **B** $\frac{\mathrm{Y - E}}{\mathrm{IY}}$ **C** $\frac{\mathrm{E - IY}}{\mathrm{I}}$ **D** $\frac{\mathrm{E - Y}}{\mathrm{IY}}$ **E** $\frac{\mathrm{EI - IY}}{\mathrm{I}}$

59 Which of the sketches in Fig. RT7 show(s) how to construct a perpendicular at P on line XY

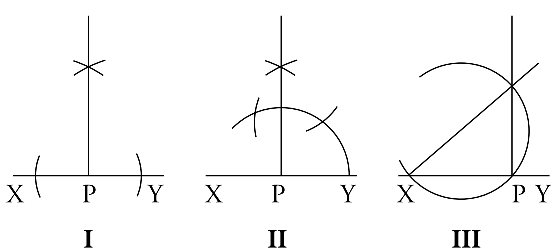


Fig. RT7

A All three **B** I only **C** III only **D** I and III only **E** II only

60 Given the data of Fig. RT8, find the length of XQ.

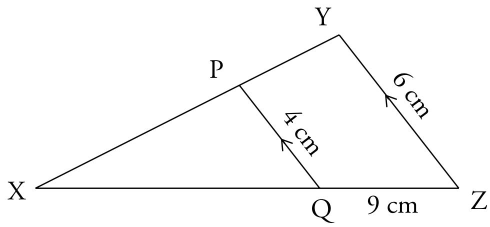


Fig. RT8

A 6 cm **B** 7 cm **C** 11 cm **D** 15 cm **E** 18 cm

61 Find cos 55.55° from tables.

A 0.565 0 **B** 0.565 7 **C** 0.566 4 **D** 0.567 1 **E** 0.573 6

62 Use tables to find the angle whose tangent is $4\frac{4}{9}$.

A 24° **B** 55.2° **C** 77.2° **D** 77.3° **E** impossible

63 Factorise $x^2 - 7x - 30$.

A $(x + 1)(x - 30)$

B $(x + 2)(x - 15)$

C $(x + 3)(x - 10)$

D $(x + 5)(x - 6)$

E $(x + 6)(x - 5)$

64 If $\frac{9}{2x} = 10 - 8x$, then $x =$

A $\frac{7}{20}$ **B** $1\frac{1}{4}$ **C** $1\frac{1}{2}$ **D** $1\frac{4}{5}$ **E** $1\frac{7}{10}$

65 If $3x - y = 14$ and $7x - y = 46$, then $x =$

A 6 **B** 8 **C** 15 **D** 22 **E** 28

66 When 27 people share a sack of rice, they each get 4 kg of rice. When 12 people share the same sack of rice, how much does each get?

A 3 kg **B** 8 kg **C** 9 kg **D** 10 kg **E** 12 kg

67 The average mass of six people is 58 kg. The lightest person has a body mass of 43 kg. What is the average mass of the other five people?

A 58 kg **B** 59 kg **C** 61 kg **D** 64 kg **E** 68 kg

68 In Fig. RT9, which one of the following is an expression for h in terms of d and α?

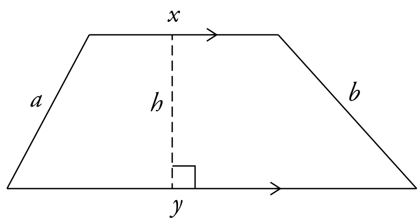


Fig. RT9

A $d \sin \alpha$ **B** $\frac{d}{\sin a}$ **C** $\mathrm{d} \cos \alpha$ **D** $\frac{d}{\cos a}$ **E** $\mathrm{d} \tan \alpha$

69 ₦10 000 is saved at compound interest of 11% per annum. The interest after 2 years is:

A ₦1 100 **B** ₦1 221 **C** ₦2 200 **D** ₦2 321 **E** ₦2 442

70 The reciprocal of 173 is

A 0.005 78 **B** 0.057 8 **C** 0.578 **D** 57.8 **E** 578

71 Which of the following expressions gives the area of the trapezium in Fig. RT10?

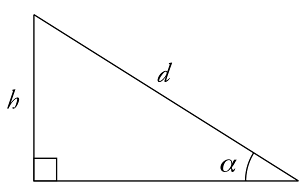


Fig. RT10

A $\frac{1}{2}(a + b)h$ **B** $\frac{1}{2}(x + y)h$ **C** $\frac{1}{2}(a + b)x$ **D** $\frac{1}{2}(a + b)y$ **E** $ay + ax$

72 The surface area of a cylinder is 31 cm^2. The surface area of a similar cylinder three times as high is:

A 34 cm^2 **B** 62 cm^2 **C** 93 cm^2 **D** 124 cm^2 **E** 279 cm^2

73 The scale of a model aeroplane is 1 : 20. The area of the wings on the model is 600 cm^2. Find the area of the wings of the aeroplane in m^2.

A 12 m^2 **B** 24 m^2 **C** 48 m^2 **D** 72 m^2 **E** 120 m^2

74 p varies directly with T and $p = 105$ when T $= 400$. When T $= 500$, $p =$

A 1.25×10^4 **B** 8×10^4 **C** 1.25×10^5 **D** 8×10^5 **E** 10^6

75 x varies inversely with y and $x = 9$ when $y = 36$. The formula connecting x and y is:

A $x = \frac{324}{y}$ **B** $x = \frac{4}{y}$ **C** $x = \frac{1}{4y}$ **D** $x = \frac{1}{4}y$ **E** $x = 324y$

Teacher's name: ____________________ Class name: ____________________

Student's name: ____________________ Date: ____________________

Course revision test (Chapters R1–R4, Books 1 & 2)

For ease of marking, provide students with a copy of the grid below and instruct them to write only the letter corresponding to the correct answer.

1		2		3		4		5	
6		7		8		9		10	
11		12		13		14		15	
16		17		18		19		20	
21		22		23		24		25	
26		27		28		29		30	
31		32		33		34		35	
36		37		38		39		40	
41		42		43		44		45	
46		47		48		49		50	
51		52		53		54		55	
56		57		58		59		60	
61		62		63		64		65	
66		67		68		69		70	
71		72		73		74		75	

Term revision test answers

Please note that the multiple choice detractors (A, B, C, D, E) in the Student's Book have mistakenly been written with lower case letters. Explain to your students that these should always be captial letters, and that their answers to the multiple choice questions should also be in capital letters.

On completion of the assessment teachers should look for correct answers and mistakes individual learners make. Teachers should also check to see if there is a pattern that indicates that any particular question is causing a significant number of students' difficulties.

An analysis of the results of an assessment enables teachers to identify any weaknesses, so that they can provide the necessary support, and strengths, so that they can provide more challenging activities. Teachers are also able to identify any weaknesses in their teaching programme and make adjustments as necessary.

Revision test 1 (Chapters 1, 2, 5)

1 D **2.** C **3.** A **4.** E **5.** D

6 $x = 26$; $y = 33$

7 90 cm^2

8 154 tiles

9 88 m^2

10 26.4 cm^2

Revision test 2 (Chapters 3, 6)

1 B **2.** C **3.** E **4.** A **5.** C

6 **a** $7(x - 4)$
b $m(5 + 8n)$
c $9b(3a + 4b)$
d $7pq(5p - 2q)$

7 **a** $a(5a + b)$
b $(a - b)(3x - y)$
c $(q - r)(p + 8)$
d $(5 + k)(x + y)$

8 **a** $\pi r(r + 2h)$
b 176

9

x	–2	–1	0	1	2
9	9	9	9	9	9
$-2x$	+4	+2	0	–2	–4
y	13	11	9	7	5

10 **a** ₦625
b 4 hours

Revision test 3 (Chapters 4, 7, 8)

1 C **2** E **3** B **4** D **5** C

6 **a** Construction
b Construction
c Construction
d 44°

7 5.4 cm

8 ΔOXY, XY = 10 cm

9 31°

10 **a** 67°
b 14.14 cm

General revision test A (Chapters 1 - 8)

1 E **3** B **5** C **7** A **9.** C

2 A **4** C **6** C **8** D **10** E

11 **a** A(001), B(010), C(011), D(100), E(101), F(110), G(111)
b **(i)** BAG, **(ii)** CAFE, **(iii)** FEED

12 −3 or 17

13 $82\frac{1}{2}$ cm^2

14 **a** $9(2ab - 7)$
b $4x(13 - 2x)$
c $2a(a + b)$
d $(2a + b)(x + 6y)$

15 **a** $(11a + 3r)(2b - c)$
b $(x + 5)(x - 9)$
c $(3x + 2y)(2a - b)$

16 $\pi r(s + \ )$, 330

17 **a** $x = \frac{1}{3}(26 - 4y)$, $x = 2$ when $y = 5$
b $y = \frac{1}{4}(26 - 3x)$, $y = -1$ when $x = 10$
18 P = 30°, PR = 7.3 cm
19 51.3°, 38.7°
20 27 m

Revision test 4 (Chapters 9, 10, 14)

1 D **2** E **3** C **4** A **5** C
6 $2(a - b)^2$
7 **a** $(x + 2)(x + 8)$
b $(r - 2)(r - 14)$
c $(m + 2)(m - 9)$
d $(y + 2)(y - 10)$
e $(a + 4)^2$
f $\pi(a + b)(a - b)$
8 V
a $x = 4$
b $x = 5$
9 **a** $y = 2\frac{1}{2}$, $z = -3\frac{1}{4}$
b $x = -\frac{1}{3}$, $y = \frac{1}{2}$
10 nut: 28 g, bolt: 70 g

Revision test 5 (Chapters 11, 13, 15, 16)

1 E **2** B **3** B **4** D **5** B
6 C **7.** D
8 **a** ₦266 200
b ₦66 200
9 **a**

speed (km/h)	15	30	50
time (h)	10	5	3
$\frac{1}{\text{time}}$	0.1	0.2	0.33

b Construction
c 3.3 hours
10 **a** 0.27
b 0.002 7
c 2.7
11 **a** 0.6
b 45°
12 5·9 m
13 **a** a range of 2 years 2 months (from 13.11 to 16.1)
b working mean = 15 years, average age = 15 years 1 month
14 38 points

General revision test B (Chapters 9-17)

1 D **3** E **5** B **7** D **9** D
2 E **4** E **6** B **8** D **10** E
11 $a = \frac{3}{5}$
12 n
a $(n + 4)(n + 8)$
b $(x - 3)(r - 11)$
c $(z + 13)(z - 2)$
d $(y + 3)(y - 12)$
e $(4 + h)^2$
f $(5 + a)(1 - a)$
13 **a** $k = 4$
b $k = -2\frac{1}{2}$
c $x = 4$
14 ₦430 000 (₦433 500)
15 ₦295 508
16 **a** 993 m
b 122 m
17 Simplifies to $5x - 4y = 5$, $13x - 8y = 1$, $x = -3$, $y = -5$
18 **a** $x + y = 4$
b $20x + 12y = 60$
c $x = 1\frac{1}{2}$, $y = 2\frac{1}{2}$
19 6.5 cm
20 **a** mean wage = ₦84 000
b modal wage = ₦70 000. The mode is more representative since most people (10 out of 13) receive this wage.

Course revision test (Chapters R1–R4, Books 1 & 2)

1 A **2** E **3** C **4** B **5** C
6 A **7** D **8** A **9** D **10** D
11 D **12** C **13** A **14** C **15** D
16 A **17** E **18** B **19** E **20** A
21 D **22** C **23** E **24** A **25** E
26 D **27** B **28** D **29** D **30** B
31 C **32** D **33** D **34** D **35** E
36 E **37** C **38** D **39** C **40** B
41 C **42** C **43** A **44** D **45** B
46 C **47** C **48** B **49** C **50** E
51 C **52** C **53** D **54** B **55** A
56 D **57** E **58** C **59** A **60** E
61 B **62** D **63** C **64** B **65** B
66 C **67** C **68** E **69** D **70** A
71 B **72** E **73** B **74** C **75** A

Section 4: Workbook answer sheets

Section 4 contains the completed Worksheets from the NGM Workbook.

The final answers have been overlaid onto the actual Workbook pages, making these quick and easy memoranda that you can use when marking.

1 Binary system: Operations and applications

Convert

① Look at the number 1 234^5. Write this number in powers of five. Remember: any number to the power 0 is 1.

$1 \times 5^3 + 2 \times 5^2 + 3 \times 5^\circ + 4 \times 5^\circ$

② Convert 1 234^5 to base ten (a decimal number).

$1 \times 125 + 2 \times 25 + 3 \times 5 + 4 \times 1 = 125 + 50 + 15 + 4 = 194_{10}$

③ Write 1 234_8 in powers of eight and convert it to base ten. (Numbers to base eight are sometimes called octal numbers.)

$1 \times 8^3 + 2 \times 8^2 + 3 \times 8 + 4 \times 8^\circ = 1 \times 512 + 2 \times 64 + 3 \times 5 + 4 = 512 + 128 + 24 + 4 = 668_{10}$

④ Write 10112 in powers of two and convert it to base ten.

$1 \times 2^3 + 0 \times 2^2 + 1 \times 2 + 1 \times 2^\circ = 1 \times 8 + 0 \times 4 + 1 \times 2 + 1 = 8 + 0 + 2 + 1 = 11_{10}$

⑤ Convert 1 23_{10} to base eight.

$1 \times 28^2 + 7 \times 8^1 + 3 + 5^\circ = 1 \times 64 + 7 \times 8 + 3 = 173_8$

⑥ Convert the decimal numbers to binary numbers.

6.1 0_{10}
0_2

6.2 1_{10}
1_2

6.3 10_{10}
$1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 0$

6.4 100_{10} 1 100 100_2

6.5 -2_{10} -10_2

6.6 1 000 000_{10}
11 110 000 001 000 000_2

Note for question **6.4**: For 100^{10} use the method of continuing to divide by two.

Note for question **6.6**: Try it on a separate piece of paper. It is tedious to evaluate but will show how many digits are needed in binary to represent a number as big as 1 000 000 in decimal.

⑦ Convert the binary numbers to decimal numbers.

7.1 0_2
0_{10}

7.2 1_2
1_{10}

7.3 100_2
2_{10}

7.4 10 101_2
-21_{10}

⑧ Convert 1 2_{10} to:

8.1 a binary number.
1 010_2

8.2 an octal number (base 8).
$12_6 = 1 \times 8^1 + 4 \times 8^0 = 14_8$

⑨ Convert 1 36_{10} to a base 7 number.

7 | 136

7|136
7|19 remainder 3
7|2 remainder 5
7|0 remainder 2

Binary arithmetic

⑩ Complete the pattern for binary adding.

+	0	1
0	$0 + 0 = 0$	$0 + 1 = 1$
1	$1 + 0 = 1$	$1 + 1 = 10$

⑪ Complete the pattern for binary subtraction [subtract the number in the row (horizontal) from the number in the column (vertical)].

–	0	1
0	$0 - 0 = 0$	$1 - 0 = 1$
1	$0 - 1 = -1$	$1 - 1 = 0$

⑫ Complete the pattern for binary multiplication.

$\times$	0	1
0	$0 \times 0 = 0$	$0 \times 1 = 0$
1	$1 \times 0 = 0$	$1 \times 1 = 1$

⑬ Calculate in binary arithmetic – all numbers are binary.

13.1 1010 + 1010 10100

13.2 1010 – 1001 0001

13.3 10×11 110

13.4 101×110 11110

⑭ $(1010)_2$ (Binary number). Think about it and write down the answer.

$10 \times 10 = 100$

⑮ Write the equation in binary numbers $\sqrt{25_{10}} = 5_{10}$

$25_{10} = 11001_2$ $5_{10} = 101_2$

$\sqrt{11001_2} = 101_2$

⑯ Fill in the boxes: $1011_{10} = 1 \times \boxed{10^3} + \boxed{0} \times 10^2 + \boxed{1} \times 10^1 + 1 \times 10^0$

Binary problems

17 Consider four coins. Let 'tails' represent 0 and 'heads' represent 1.

17.1 Use the four coins to represent the number 610 as a binary number.

T H H T

17.2 Use the four coins to represent the number 6^8 as a binary number.

T H H T

18 Consider the figure. What would be written on the card to show that Joe has been inoculated against polio and measles, but not against mumps and rubella? What does the nurse do to a card when performing an inoculation on Joe?
Why is the bottom right-hand corner cut off?

Polio and measles written under the V's. Mumps and rubella written under the holes. As a nurse performs an innoculation, the V is cut out. Bottom right corner is cut off to prevent the cards being inserted 'back to front'.

19 Using the binary code in the table write the name 'Joe'.
The J has been done for you.

J	0	1	0	1	0
O	0	1	1	1	1
E	0	0	1	0	1

20 Using the grid write the word 'maths,' using a binary code.

M	0	1	1	0	1
A	0	0	0	0	1
T	1	0	1	0	0
H	0	1	0	0	0
S	1	0	0	1	1

2 Word problems

Worked example

What is ten added to four, then divided in half?	$10 + 4 \div 2$ Write the number sentence from the word problem. $(10 + 4) \div 2$ Solve the number sentence. $14 \div 2 = 7$

Solve

For questions 1 to 8, write the number sentence and solve the problem.

① What is the sum of fourteen and fifteen?

$14 + 15 = 29$

② What is the sum of fifteen and fourteen?

$15 + 14 = 29$

③ What is the difference between twenty one and thirteen?

$21 - 13 = 8$

④ What is the difference between thirteen and twenty one?

$15 - 21 = -8$

⑤ What is the product of fifteen and three?

$15 \times 3 = 45$

⑥ What is the product of three and fifteen?

$3 \times 15 = 45$

⑦ What is twenty-one divided by seven?

$21 \div 7 = 3$

⑧ What is seven divided by twenty one?

$7 \div 21 = \frac{1}{3}$

⑨ Write down what you have learnt from the 8 questions above.

The answers to sum and product do not depend on the order.
The answers to subtraction and division do.

⑩ Write in words: $B^2 - 4 \times A \times C$

Three numbers, A, B and C. Four times the product of the first and third numbers is subtracted from the square of the middle number.

⑪ What is the positive difference between 3.8 and 8.3?

-4.5 Positive difference is 4.5

⑫ What is the sum of 3.8 and 8.3?

$12 - 1$

⑬ What is the square root of $1\frac{32}{49}$?

$1\frac{32}{49} = \frac{81}{49} = \sqrt{\frac{81}{49}} = \frac{9}{7}$

⑭ What is five plus five multiplied by five multiplied by five multiplied by zero?

$5 + 5 \times 5 \times 5 \times 0 = 5$

⑮ Find the square root of the product of 288 and two-thirds and one-third.

$\sqrt{288 \times 2\frac{1}{3} \times \frac{1}{3}} = \sqrt{\frac{576}{9}} = \sqrt{64} = 8$

⑯ Find the square root of the difference between the square of thirteen and the square of twelve.

$13^2 = 169,\ 12^2 = 144{,}844\sqrt{169 - 144} = \sqrt{25} = 5$

Find the number

① The sum of a number and its half is thirty. Find the number.
$x + \frac{x}{2} = 30 \quad x = 20$

② The product of two consecutive numbers is ninety. What are the numbers?

$x \times x + 1 = 90 \quad 9 + 10$

③ The sum of three consecutive numbers is thirty three. What is the middle number?

$x + x + 1 + x + 2 = 33$; $x = 10$, middle number $= 11$

④ The sum of three consecutive even numbers is sixty. What is the smallest of the three numbers?

$x + x + 2 + x + 4 = 60$; $x = 18$

⑤ The product of three consecutive numbers is 1 320. The sum of the numbers is thirty three. What are the numbers?

$x = 10$, 11 & 12

⑥ The product of two numbers is $\frac{1}{15}$. One of the numbers is $\frac{1}{7}$, find the other number.
$\frac{7}{18}$

⑦ The product of two numbers is $4\frac{2}{9}$. If one of the numbers is 38, find the other number.

$38 \times x = \frac{38}{9} = x = \frac{1}{9}$

⑧ The product of two numbers is $8\frac{4}{7}$. One of the numbers is $\frac{1}{5}$. What is the other number?
$\frac{5}{1} \times \frac{1}{2}x = \frac{60}{7} \times \frac{5}{1} \quad x = \frac{300}{7}; - x = 42\frac{6}{7}$

⑨ The product of two numbers is 85. One of the numbers is $\frac{1}{3}$, what is the other number?

$\frac{1}{3}x = 85; \quad x = 255$

⑩ The product of three numbers is 0.03. Two of the numbers are 0.2 and 0.3. What is the other number?

0.5

⑪ The product of two consecutive odd numbers is 1 023. What are the numbers?

$x \times x + 1 = 1\ 023$

⑫ Two is added to a certain number and this sum is doubled. The result is 36 less than the original number multiplied by four. What is the number?

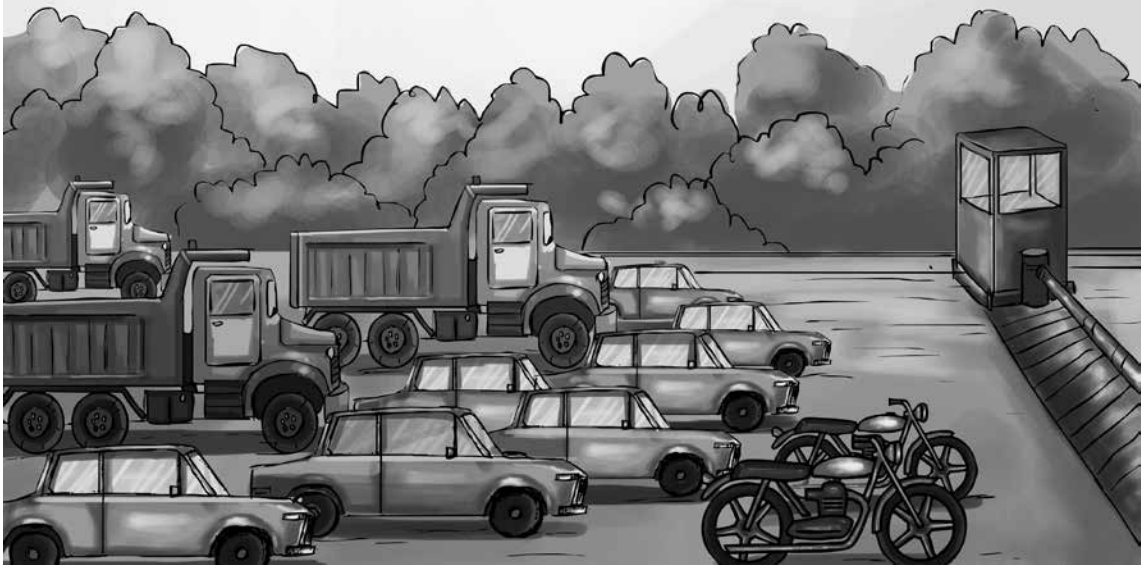
$2(2 + x) = 4(x - 36)$ $4 + 2x = 4x - 144$ $2x = 143; x = 74$

⑬ What is the difference between the largest number that you can write using the digits 1-9 (each digit is used only once) and the smallest number you can write using the digits 1-9 (each digit used only once)? What do you notice about the answer?

8 6 4 1 9 7 5 3 2 Uses all the digits from 1-9 once.

Everyday word problems

⑭ A checkpoint on a major road is used to count the number of vehicles that pass in a minute. In a particular minute 8 cars, 3 trucks (with 6 wheels each) and 2 motorcycles cross the checkpoint. How many wheels crossed the checkpoint?



$6 \times 4 + 3 \times 6 + 2 \times 2 = 54$

⑮ At a certain school there are twice as many boys as there are girls. The total number of students is 360. How many girls are at the school?

$2x + x = 360$ $x = 120$ 120 girls

⑯ The sum of the ages of a girl and her mother is 38. Next year the mother will be four times as old as her daughter. How old was the mother when her daughter was born?

$x + y = 38$ $y + 1 = 4 \times (x + 1), 4x + 4 = y + 1$ $4x = y - 3; 4x = (38 - x) - 3$ $x = 7; y = 31$

When the daughter was born the mother was $31 - 7 = 24$ years old.

3 Factorisation 1: Common factors

Worked example

Factorise $18x^2 + 6xy$	**Solution:** $6x(3x + 2y)$ Take out $6x$ which is common to both terms.

Brackets

① Remove the brackets.

1.1 $(3x - 5) + (5x - 3)$ $8x - 8$

1.2 $(8x^2 - 3x + 4)$ $80x^2 - 30x + 40$

1.3 $-6b(3a - 5c)$ $30bc - 18ab$

HCF

② Find the highest common factor (HCF) of:

2.1 $3x^2$ and $6y^2$

3

2.2 xy^2 and yx^2

xy

2.3 15, 30 and 90

15

2.4 $8xyz$ and $15wxy$

xy

2.5 15, 27, 36 and 108

3

2.6 $81p^2q^3r^4$ and $27p^4q^3r^2$

$9p^2q^3r^2$

Factorise

③ Factorise.

3.1 $2a(5b - 2c) - 3c(5b - 2c)$

$(5b - 2c)(2a - 3c)$

3.2 $3x^2 + x^3(2x + 4)$

$x^2 (3 + 2x^2 + 4x)$

3.3 $(x + y)(2x - 3y) + (x + y)^2$

$(x + y)(3x - 3y)$

3.4 $(a + b)(c - 3) - c + 3$

$(c - 3)(a + b - 1)$

3.5 $(x - y)(z + w) - (x - y)(2z - w)$

$(x - y)(2w - z)$

3.6 $(x + y)^2 - 2(x + y)$

$(x + y)(x + y - 2)$

3.7 $3ax - 2ab + 2bx - 3x^2$
$(a - x)(3x - 2b)$

3.8 $xy + wx - wy - y^2$
$(y + w)(x - y)$

3.9 $2xyu - 4xyv - 12tyv + 6tyu$
$2(u - 2v)(xy - 3by)$

3.10 $6xy - 15yw + 10wv - 4xv$
$(3y + 2v)(2x - 5w)$

3.11 $(2x - 3y)(3m - 4n) - (2x - 3y)(m + 2n)$
$2(2x - 3y)(m - 2n)$

3.12 $x(3y+z) - 4x^2$
$x(3y + z - 4x)$

3.13 $(a - bx)^2 - bx + a$
$(a - bx)(a - bx + 1)$

3.14 $16x^2 + 4xy$
$4x\,(x + y)$

3.15 $15xy + 5y$
$5y\,(3x + 1)$

3.16 $3x(5y - 4) + 8(5y - 4)$
$(5y - 4)(3x + 8)$

3.17 $3x(5y - 4) + 40y - 32$
$(5y - 4)(3x + 8)$

3.18 $10ax + 4x - 15ay - 6y$
$(2x - 3y)(5a + 2)$

3.19 $x^2 + x(y - z)$
$x(x + y - z)$

3.20 $a(ax + by) - 2ax - 2by$
$(a - 2)(ax + by)$

3.21 $25x^2 + x(y - z)$
$x(25x + y - z)$

3.22 $(x - y)(u + v) + (x - y)(u - v)$
$2u(x - y)$

3.23 $(2x - 3y)(2m - 2n) + 2x - 3y$
$(2x - 3y)(2m - 2n + 1)$

3.24 $100x + ay - 50y - 2ax$
$(2x - y)(50 - a)$

3.25 $5x - y + 1 - 5xy$
$(1 - y)(5x + 1)$

3.26 $2ax - 2x^2 - 3ab + 3bx$
$(a - x)(2x - 3b)$

4. Simplify $5 \times 27 - 27 \times 3$ using factorisation.

$27(5 - 3)$

Factorisation problems

5. Factorise $3xy - 2xy + 6x^2 - y^2$.
Test. Once you have completed the factorisation, substitute $x = 4$ and $y = 5$ into the expression in the question and then into the expression you obtained after factorising and see that they are the same.

$(y + 2x)(3x - y)$ Test answer is 91

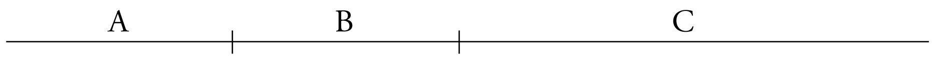
6. The total surface area of a cylinder is $2\pi r^2 + 2\pi rh$ where r is the radius, h the height and $\pi = \frac{22}{7}$.
Factorise $2\pi r^2 + 2\pi rh$ and find the total surface area of a cylinder of radius 10 cm and height 20 cm.

$2\pi r(r + h)$, $60\pi^2$ cm^2

4 Geometrical constructions

Measure

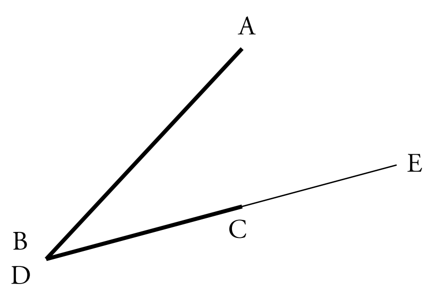
① Look at the straight line. Measure the length of the line. Then bisect the line using a pair of compasses and bisect the left-hand in half again, using the compasses. This will divide the line into three sections. Call these sections A, B and C. Measure A, B and C and compare this with the length of the whole line.



Length of line 12.2 cm Length A 3.05 cm Length B 3.05 cm

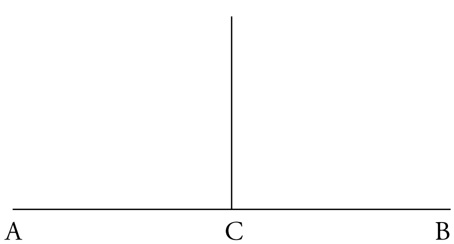
Length C 6.1 cm Length of A + B + C 12.2 cm

② Copy the angle ABC onto the line DE. Measure the two angles with a protractor to check that they are the same.

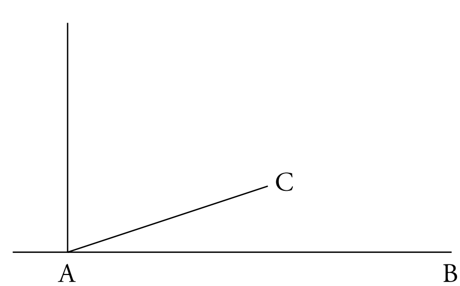


Construct

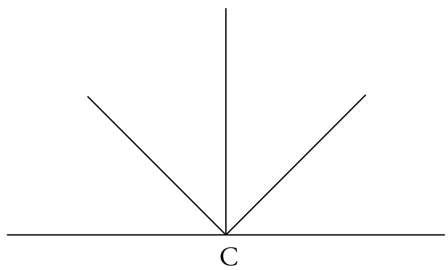
③ Look at the straight line AB. Construct a vertical line (at 90° to AB) that meets AB at C.



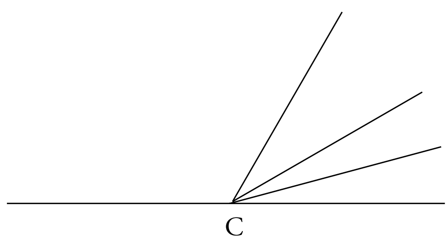
④ Look at the straight line AB. Construct a vertical line (at 90° to AB) that meets AB at C.



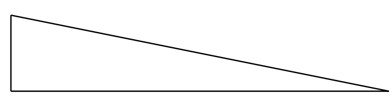
⑤ Construct angles of 45°, 90° and 135° at C. Check with a protractor.



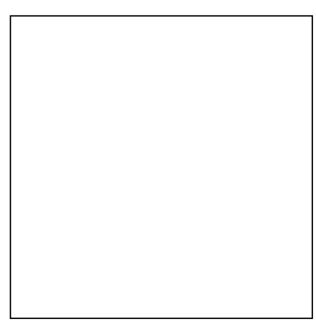
⑥ Construct angles of 60°, 30° and 15° at C. Check with a protractor.



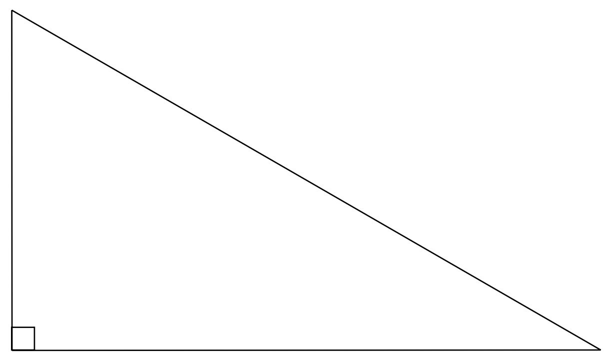
⑦ Construct a triangle with sides equal to 10 mm, 51 mm and 50 mm.



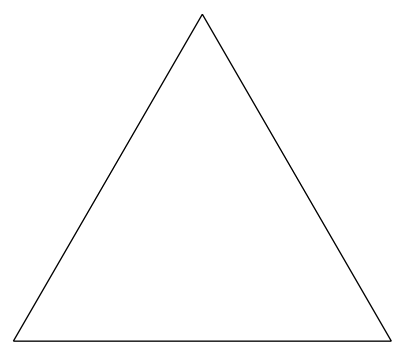
⑧ Construct a square with sides equal to 40 mm.



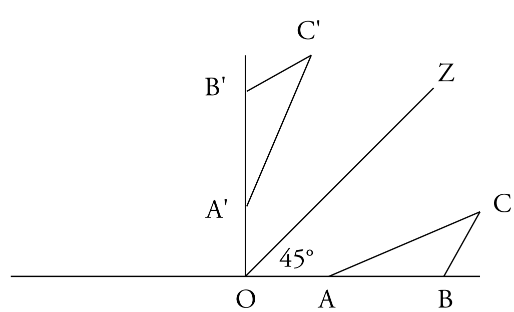
⑨ Construct a triangle with angles 30°, 60° and 90° and with one side equal to 90 mm.



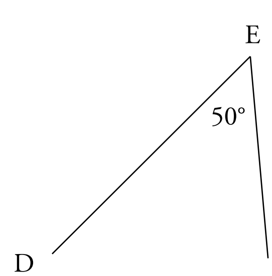
⑩ Construct an equilateral triangle with sides equal to 100 mm.



⑪ Construct a triangle DEF that is a reflection of triangle ABC in the given axis of reflection OZ.

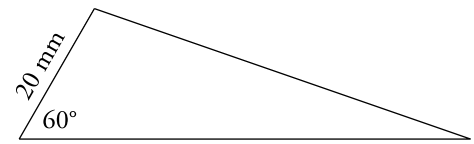


⑫ Construct an angle on the line DE that is the same size as the angle B.

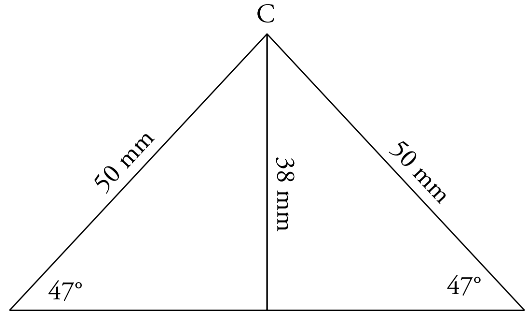


Construct and measure

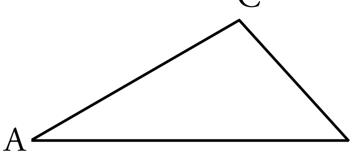
⑬ Construct a triangle with adjacent sides equal to 20 mm and 60 mm and the angle between them equal to 60°.



⑭ An isosceles triangle has two sides of equal length. Construct an isosceles triangle ABC with side AB equal to 70 mm and the other two sides each equal to 50 mm. Construct the perpendicular CD from C to the line ADB. Measure the angles of the triangle and the length of CD.



⑮ Copy triangle ABC. Construct a triangle DEF such that the length of DE is equal to that of AB, the length of DF is the same as AC and the angle D = A.



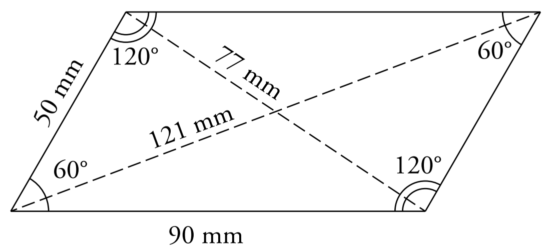
15.1 Measure the length of lines BC and EF and check that they are equal.

lines shall be equal

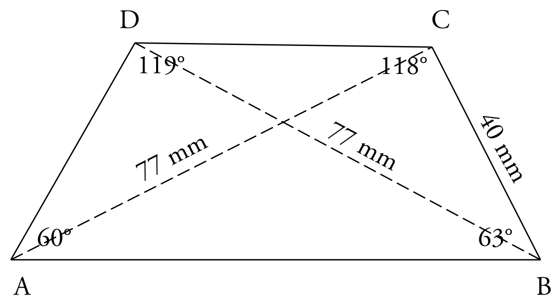
15.2 Measure angles $\hat{F}$ and $\hat{E}$ and compare them with angles $\hat{C}$ and $\hat{B}$.

The angles are the same size

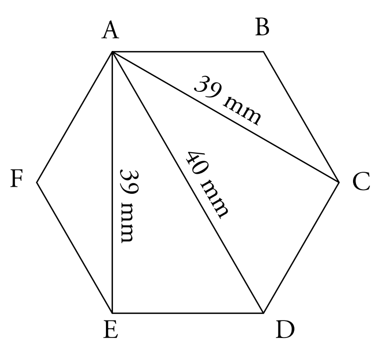
⑯ Construct a parallelogram with sides equal to 50 and 90 mm and an angle equal to 60º. Measure all four angles and the lengths of the diagonals for each of the parallelograms.



⑰ Construct a trapezium ABCD with AB equal to 90 mm, AD equal to 40 mm, and DC equal to 50 mm. Angle A is 60º. DC is parallel to AB. Measure all the angles and the length of the diagonals AC and BD.



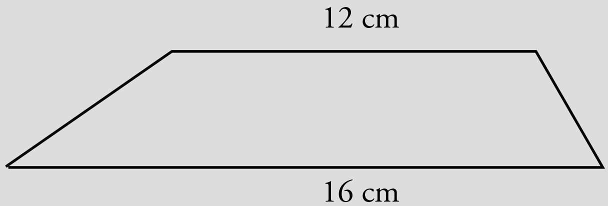
⑱ A regular hexagon is a six-sided figure with all the sides of equal length and all the angles equal to 120º. Construct a regular hexagon ABCDEF with sides equal to 20 mm. Measure the length of the lines AC, AD and AE.



5 Area of plane shapes

Worked example

In the trapezium, what is the distance between the parallel lines if the area is 93 cm^2. (Not to scale.)



$$A = \left(\frac{a+b}{2}\right)h$$

$$93 = \left(\frac{12+16}{2}\right)h$$

$$93 = 14h$$

$$h = 6.64$$

Find the area

① A builder builds a brick wall that is 10 m long and 1.5 m high. The face of a brick is 20 cm by 10 cm. How many bricks will be needed to complete the wall?

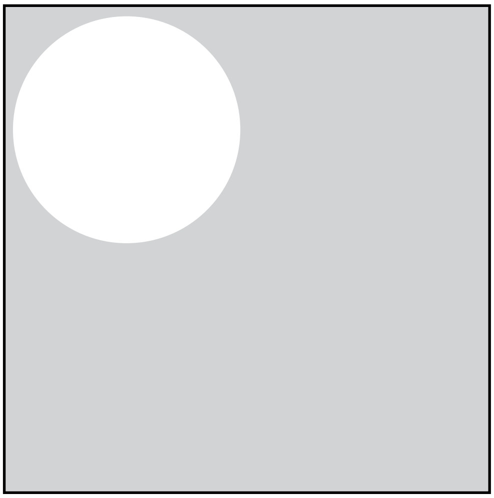
Hint

Use $\sqrt{3} = 1.73$

750 bricks

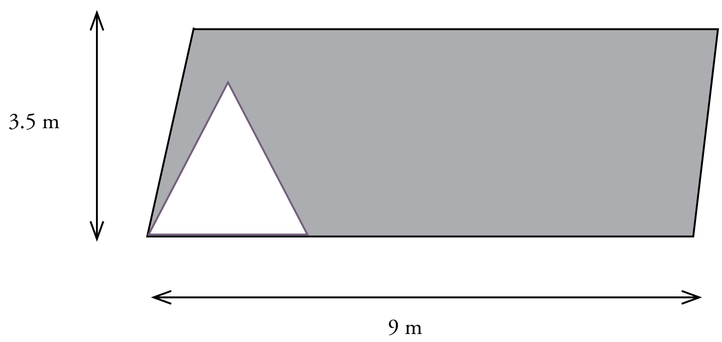
② Find the area of the shaded part where the square has a side of 1 m and the circle has a diameter of 50 cm.

$= 0.8\ m^2$



③ Find the area of the shaded part where the height of the triangle is 2 m and its base is 2.5 m.

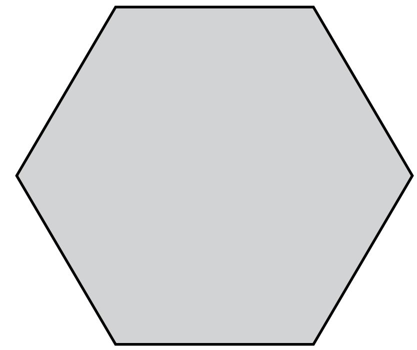
$29\ m^2$



④ The area of a regular hexagon can be found by the equation

$A = \frac{\sqrt{3}}{2}d^2$ where d is the distance between the parallel side.

Use $\sqrt{3}$ = 1.73 and use a ruler to measure any distances you require and then calculate the area of the regular hexagon.



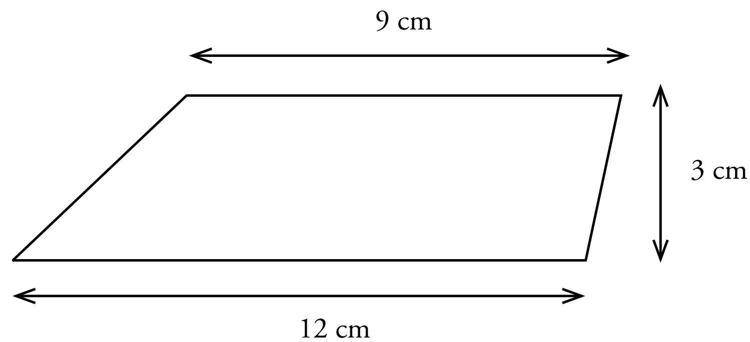
30.3 mm^2

⑤ Find the area of the trapezium. (Not to scale.)

$A = \frac{(a + b)}{2} \times h$

$= \frac{(9 + 12)}{2} \times 3$

$= 31.5\ cm^2$

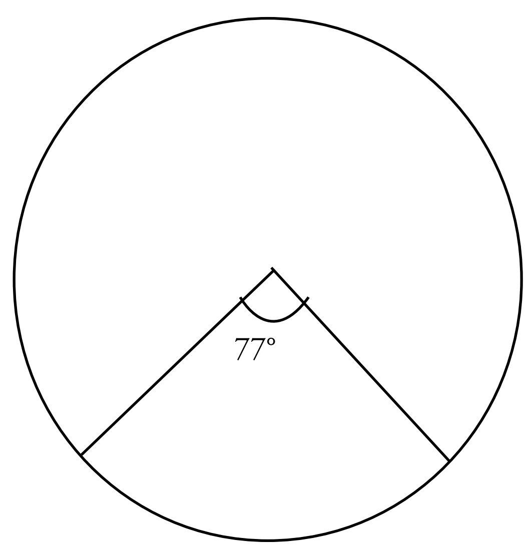


⑥ Find the area of the sector of a circle with a diameter of 2 m where the angle between the radii of the sector is 77°.

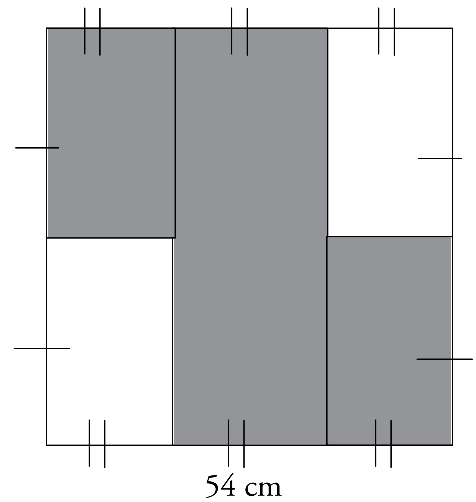
5.04 m^2

⑦ Find the area of a segment of a circle of radius 56 cm.

0.672 m^2



⑧ Find the total shaded area where the side of the square is 54 cm.



$54 \div 2 = 27; 54 \div 3 = 18$

Rectangle $= 1 \times b$

$= 27 \times 18 = 486$

A. of 2 rectangles $= 2 \times 486$

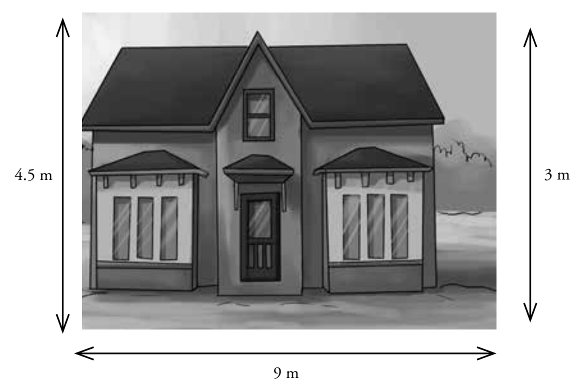
$= 972 \text{ cm}^2$

Area and everyday examples

⑨ The front of a house has this shape (not to scale) with a door and two windows. The dimensions of the door are 3 m by 1 m, and windows of 1 m by 1.5 m.

9.1 Find the area of the front of the house.

36 m^2



9.2 If a can of paint can cover 12 m^2, how many cans of paint would be needed to give the front of the house two coats of paint?

3 cans

⑩ A ten-storey building has 84 glass windows of 1.5 m^2 on each floor. The building contractor buys glass by the square metre.

10.1 If he allows for breakages of 10%, what area of glass must he buy for the entire building?

$(84 \times 10 \times 1.5) = 1\,260 + 10\% \text{ of } 1\,260$

$= 1\,260 + 126 = 138{,}6 \text{ m}^2$

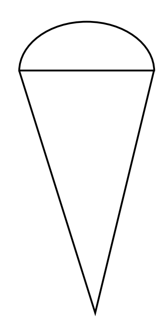
10.2 Each floor of the building is 30 m by 40 m. The floors need to be tiled using square tiles that are 75 by 75 cm. It is necessary to order 5% more tiles than needed to cover the area as some tiles need to be cut and there can be wastage. How many tiles must be ordered?

22 400 tiles

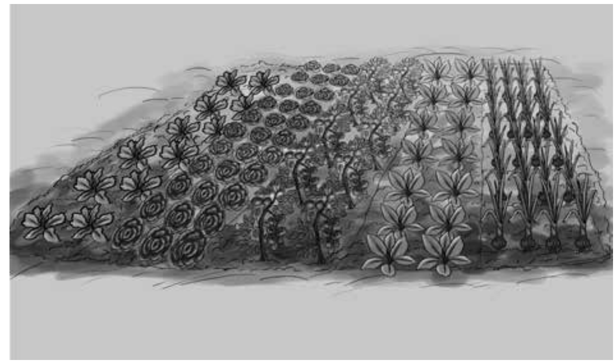
⑪ An ice cream shop has a picture of a giant ice cream cone on its window. The

diameter of the semi-circle is 1.5 m and the height of the cone is 2 m. What is the area of the picture?

5.04 m^2



⑫ A vegetable garden is in the shape of a trapezium. One of the two parallel sides is twice as long as the other side. The distance between the two parallel sides is 16 m. Find the lengths of the parallel sides if the area of the garden is 600 m^2.



$A = \left(\frac{a+b}{2}\right)h$

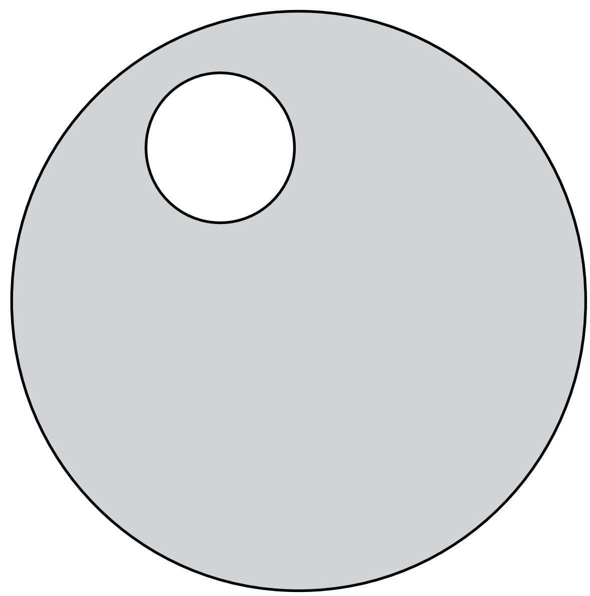
$600 = \left(\frac{a+2a}{2}\right)16$

$75 = 3a \therefore a = 25$ m

⑬ A circular piece of glass has a circular hole cut out of it to fit a fan. The glass has a diameter of 700 cm and the hole has a diameter of 140 cm. What is the area of the hole and the total area of remaining glass? (Not to scale.)

15 400 cm^2 cut out

246 400 cm^2 remaining



6 Formulae: Substitution; change of subject

Worked example

In the equation $x - y = -4$, what is the value of y when $x = 1$ and what is the value of x when $y = 2$?

Solution

When $x = 1$: $1 - y = -4$

$-y = -4 - 1$

$-y = -5$

$y = 5$

When $y = 2$: $x - 2 = -4$

$x = -4 + 2$

$x = -2$

Measures of temperature

Hint

There are two common measures of temperature, Celsius and Fahrenheit (C and F). They are related by the formula. $\frac{C}{5} = \frac{F - 32}{9}$

① Write the equation for temperature, making C the subject of the formula.

$$\frac{\mathrm{C}}{5} = \frac{\mathrm{F} - 32}{9}$$

$$\mathrm{C} = 5\left(\frac{\mathrm{F} - 32}{9}\right)$$

② Write the equation for temperature making F the subject of the formula.

$$\frac{\mathrm{C}}{5} = \frac{\mathrm{F} - 32}{9}$$

$$\frac{9\mathrm{C}}{5} = \mathrm{F} - 32$$

$$\mathrm{F} = \frac{9\mathrm{C}}{5} + 32$$

③ At what temperature will the Celsius and Fahrenheit temperatures be the same?

240 °C and −40 °F represent the same temperature

Volume

④ The volume of a sphere is given by the formula (where r is the radius of the sphere) $\mathrm{V} = \frac{4}{3}\pi r^2$

Write the equation making r the subject of the formula.

$$\mathrm{V} = \frac{4}{3}\pi r^2 \qquad \frac{\mathrm{V}}{\pi} = \frac{4}{3}r^2$$

$$\frac{3\mathrm{V}}{4\pi} = r^2 \qquad r = \sqrt{\frac{3\mathrm{V}}{4\pi}}$$

Hint

1 litre is 1 000 cubic centimetres

⑤ The volume of a cylinder is given by the formula $\mathrm{V} = \pi r^2 h$

Where you can use $\frac{22}{7}$ to represent π, r is the radius and h is the height of the cylinder.

5.1 A manufacturer wishes to make a cylindrical vessel to hold 1 *l* and is considering two cylindrical vessels. If he chooses h to be 12 cm, find the radius.

$V = \pi r^2 h$

$r = 5.15$ cm

5.2 If he chooses the radius to be 4 cm find the height.

$h = 19.8$ cm

⑥ Boyle's law states that the product of the volume and pressure for a gas is constant. This is expressed by the formula $P_1V_1 = P_2V_2$.

Where P and V are the pressure and volume of the gas under conditions 1 and 2. If the pressure of gas in a cylinder is one atmosphere and the gas occupies 1 *l*, find the volume of the gas under a pressure of 100 atmospheres.

$V = \frac{1}{100}$

Functions and equations

⑦ A function is given by the equation $y = 2x - 3$. Complete the table for this function. Estimate the value of x when $y = 0$.

x	−2	−1	0	1	2
y	−7	−5	−3	−3	1

When $y = 0$

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

⑧ A function is given by the equation $y = 3 - 2x$. Complete the table. Estimate the value of y when $x = 0$.

x	−2	−1	0	1	2
y	7	5	3	1	−1

8.1 When $y = 0$

$x = 3$

8.2 What do you notice about the values of y for the examples in questions 6 and 7?

In Q6, y increases as x increases. In Q7, y decreases as x increases.

8.3 Make x the subject of the formula $y = 3 - 2x$.

$-3 + y = -2x$

$x = \frac{3 - y}{2}$

⑨ A function is given by the equation $y = 2x^2 - x + 3$. Complete the table.

x	–2	–1	0	1	2
$2x^2$	8	2	0	2	8
$-x$	4	1	0	–1	–2
3	3	3	3	3	3
y	15	6	3	4	9

⑩ The lengths of the side of a right-angled triangle are related by the formula $c^2 = a^2 + b^2$ where a, b and c are the lengths of the sides of the triangle (Pythagoras' theorem). Find the length of side a if side b is 15 and side c is 17 cm.

$c^2 - b^2 = a^2$

$17^2 - 15^2 = a^2$

$289 - 225 = 64 = a^2 \qquad a = 8$ cm

⑪ An arithmetic progression (AP) is a series where each term is found by adding a constant to the previous term. The sum of an AP the first number a and the last number l is given by the equation $s = \frac{n}{2}(l + a)$.

11.1 Find the sum of the first ten numbers if $s = \frac{9}{2}(20 + 2)$.
55

11.2 An AP 3 + 6 + 9 + 12 +……36 has a sum of 234. How many terms are there in the AP?

12 terms

11.3 An AP 1 + 5 + 11 + 16 +…. has 13 terms and a sum of 325. What is the last number in the series?

49

⑫ Write the equation $y = mx + c$ making x the subject of the formula.

$y - c = mx$

$x = \frac{y - c}{m}$

⑬ The equation of a circle is $x^2 + y^2 = r^2$, where r is the radius of the circle.

13.1 Write this equation making r the subject of the formula.

$r = \sqrt{x^2 + y^2}$

13.2 If $x = 3$ and $y = 4$ find r.

$r = \sqrt{3^2 + 4^2}$

$= \sqrt{9 + 16} = \sqrt{25} = 5 \quad r = 5$

⑭ In the equation $x - y = -8$ what is the value of x when $y = 0$ and what is the value of y when $x = 0$?

$x = -8$ when $y = 0$

$y = 8$ when $x = 0$

⑮ If $x = 2$ and $y = 3$, find the value of $(3x^2 + 2xy - y^2)$.

$3 \times 2^2 + 2 \times 2 \times 3 - 3^2$

$12 + 12 - 9$

15

⑯ Galileo noted that the period of a pendulum was given by the equation $T = 2\pi\sqrt{\frac{l}{g}}$ where l is the length of the pendulum and g is a constant due to gravity. He noted that a seconds pendulum (that for which T = 2 seconds, one second for the swing one way, the other for the swing the other way) had a length of 0.994 m. What was the value of g that Galileo found?

$g = 9.8$ m/s

⑰ The speed of a car in kilometres per hour, t seconds, after starting is given by the formula $s = 12t$ where t is in seconds.

17.1 What is the speed of the car when $t = 3$ seconds.

36 k/hr

17.2 How long does it take the car to reach a speed of 100 km per hour?

8.3 sec

17.3 Is the formula $s = 12t$ realistic for a car? Justify your answer.

No, only when the car begins to accelerate. Cars acceleration cannot increase forever.

7 Similarity 1: Plane shapes and scale factors

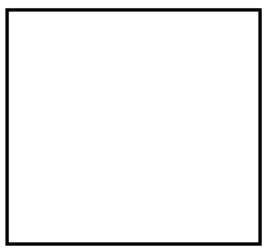
Worked example

Triangles ABC and XYZ are similar. Angle A = 82°, Angle C = 47°, side a = 15.4 cm, side b = 14.9 cm and side c = 14.0 cm. In triangle XYZ side z = 21.0 cm.
Find the lengths of the sides and the angles of triangle XYZ.
Scale factor 1.5

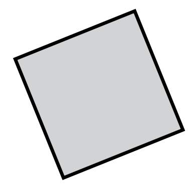
Similarity

(1) Which pairs of drawings are similar to each other?

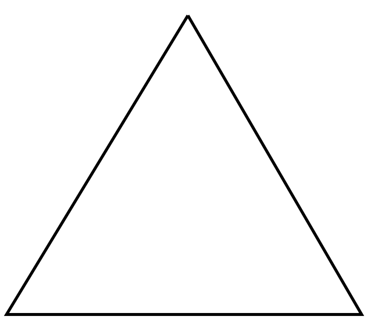
Pair 1



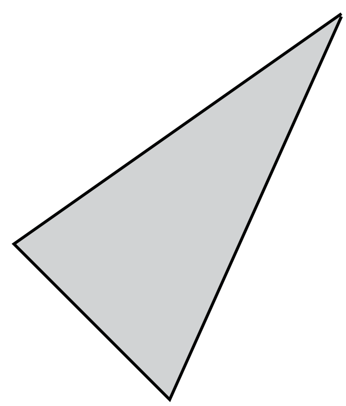
Similar



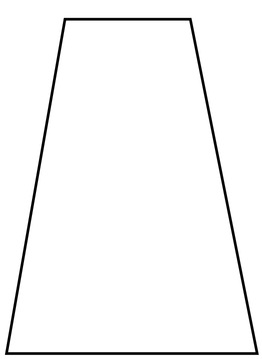
Pair 2



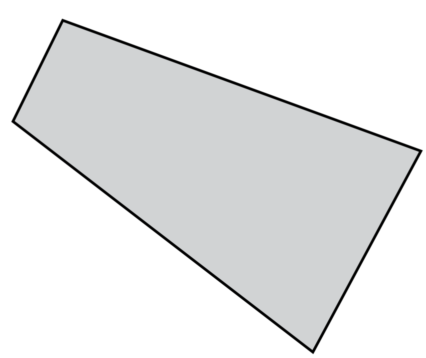
Not similar



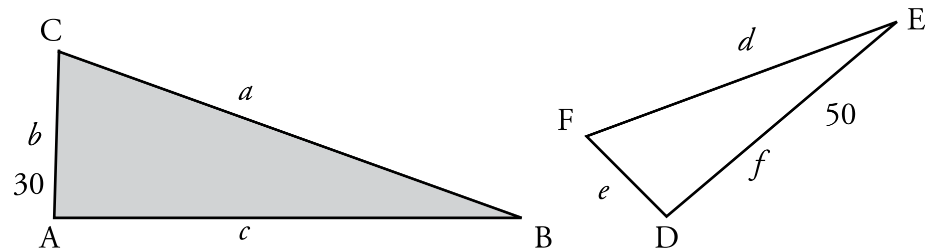
Pair 3



Similar



② The two right-angled triangles ABC and DEF are similar. (They are not to scale.)



AB (side c) is 75 mm, AC (b) is 30 mm, DE (f) is 50 mm and angle B is 30°. What is the length of DF and how many degrees is angle F?

20 mm, 60°

③ In the similar triangles ABC and DEF, angle A = 54° and angle B = 38°. How many degrees are angles D, E and F?

54°; 38°; 88°

④ Triangles ABC and PQR are similar. Angle A = 76°, Angle B = 20°, side $a = 18.0$ cm, side $b = 6.3$ cm and side $c = 18.4$ cm. In triangle PQR side $q = 44.1$ cm.

4.1 Find the lengths of the sides and the angles of triangle PQR.

$\hat{P} = 76$, $\hat{Q} = 20°$; $\hat{R} = 84°$; $q = 44.1$ cm; $p = 126$ cm; $r = 128.8$ cm

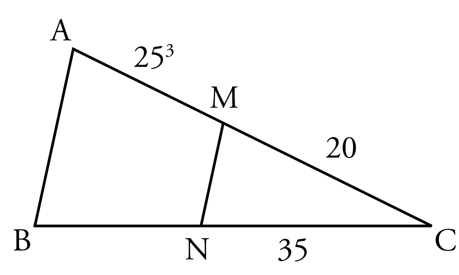
4.2 What is the length of the side in triangle PQR that corresponds to side b in triangle ABC?

44.1 cm

4.3 What is the size of the angle in triangle PQR that corresponds to angle C in triangle ABC?

84°

⑤ In triangle ABC a line, MN, is drawn such that MN is parallel to AB. (Not to scale.)



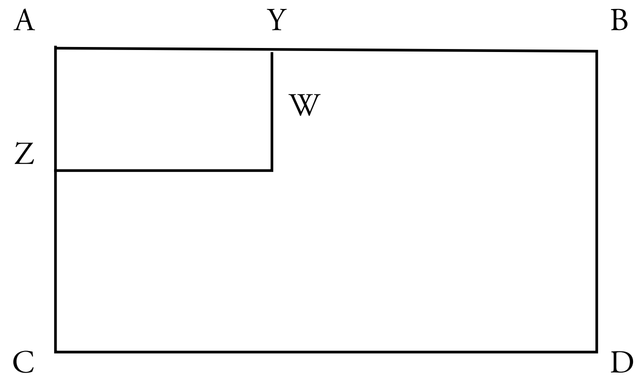
5.1 Name two similar triangles:

ΔABC is similar to ΔMNC.

5.2 If AM = 25 cm, MC = 20 cm, MN = 30 cm, NC = 35 cm, what is the scale factor?

$\frac{4}{9}$

⑥ **5.3** Find the lengths of BC and AB.



BC = 78.75 cm
AB = 67.5 cm

6.1 If the quadrilaterals are similar, find the scale factor and the lengths of all the sides.

2.5

6.2 Find the area of each of the two quadrilaterals 680 m² and 4 250 m².

680 m² and 4 250 m²

6.3 What is the centre of enlargement?

A

6.4 What is the ratio of the areas of the quadrilaterals?

6.25

Draw

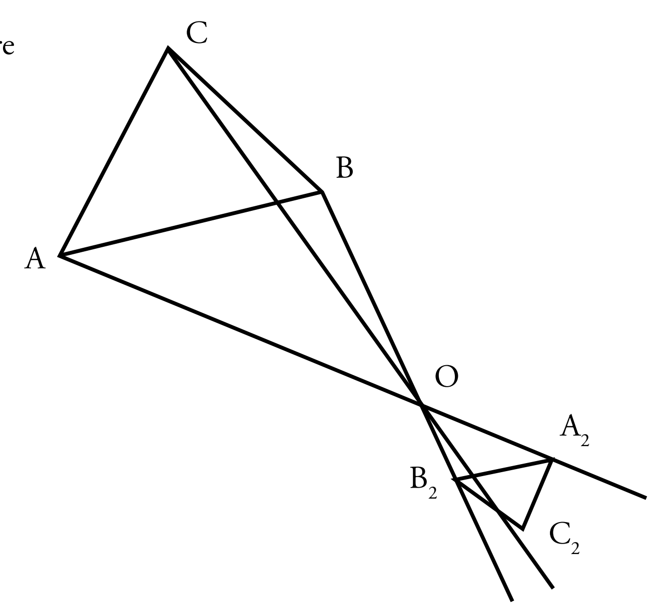
⑦ In the diagram, ABC is a triangle and O is the centre of enlargement.

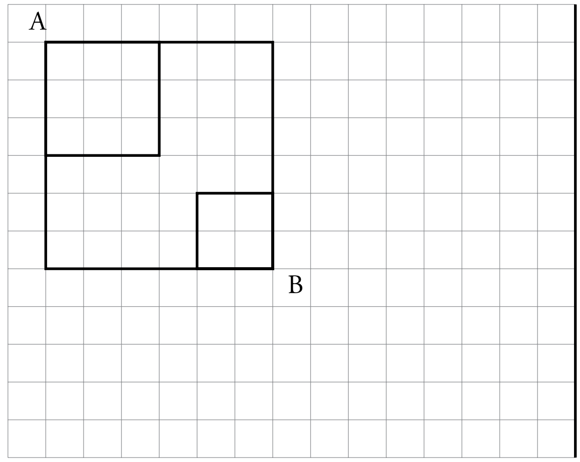
7.1 On the diagram add three further triangles $A_3B_3C_3$, $A_4B_4C_4$ and $A_5B_5C_5$ where the scale factor is positive but less than 1, positive but greater than 1, and negative.

7.2 Anywhere on the graph paper draw a square of side 3 cm.

7.3 Enlarge the square with a scale factor 2 and the centre of enlargement at A.

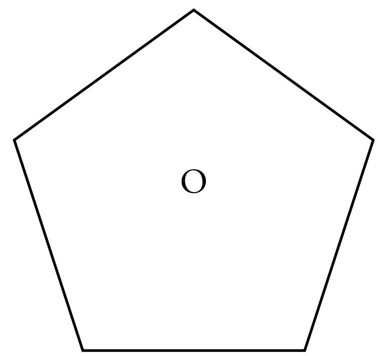
7.4 Reduce the square with a scale factor $\frac{1}{3}$ and the centre of enlargement (reduction) at B.





8 For the pentagon label the points. Using O as the centre of enlargement draw a similar pentagon using a scale factor of 3.

Check student's drawings.



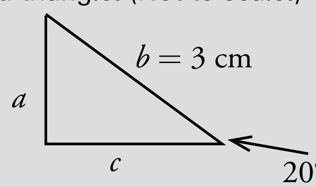
9 For the oil barrel, choose a centre of enlargement and draw another oil barrel with a scale factor of 3.

Check student's drawings.

8 Trigonometry 1: Tangent of an angle

Worked example

Find the length of c in the right-angled triangle. (Not to scale.)



Shortened tangent table

										Add difference								
x	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
12	0.2126	0.2144	0.2162	0.2180	.0.2199	0..2217	0.2235	0.2254	1.2272	0.2290	2	3	5	7	8	10	11	13	15
32	0.6249	0.6273	0.6297	0.6322	0.6346	0.6371	0.6395	0.6420	0.6445	0.6469	2	5	7	10	12	15	17	20	22
59	1.664	1.671	1.678	1.684	1.691	1.698	1.704	1.711	1.718	1.725	1	1	2	3	3	4	5	5	6
71	2.904	2.921	2.937	2.954	2.971	2.989	3.006	3.024	3.042	3.060	2	3	5	7	9	10	12	14	16

1 Consider the shortened tangent table.

1.1 From the table find the tangent of:

1.1.1 32.11°
0.6275

1.1.2 71.63°
3.018

1.1.3 59.99°
1.731

1.2 Will the tangent of 60° be bigger than, smaller than or equal to tan 59.99°. Explain your answer.
Bigger because tangent increases at that point.

1.3 Find:

1.3.1 angle B where tan B = 0.6371
32.5°

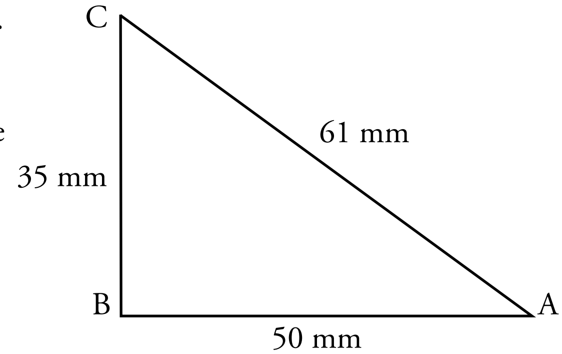
1.3.2 angle C where tan C = 0.6460
32.86°

1.3.3 angle D where tan D = 1.723
59.88°

1.3.4 Explain why you chose this answer.
59.88° is closer in value to 59.89° shown in table.

Measure

② Consider the right-angled triangle ABC. Measure the sides.



2.1 Consider angle A. Write down the (hyp), the opposite side (opp) and the adjacent side (adj) for this angle.

hyp AC opp BC
adj AB

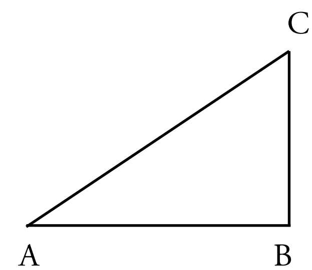
2.2 Consider the angle C. Write down the hyp, opp and adj for this angle.

hyp AC opp AB adj BC

2.3 What is the tangent of angle A? $\tan A = \frac{BC}{AB} = \frac{35}{50}$

2.4 What is the tangent of angle C? $\tan C = \frac{AB}{BC} = \frac{50}{35}$

2.5 Look at the triangle.



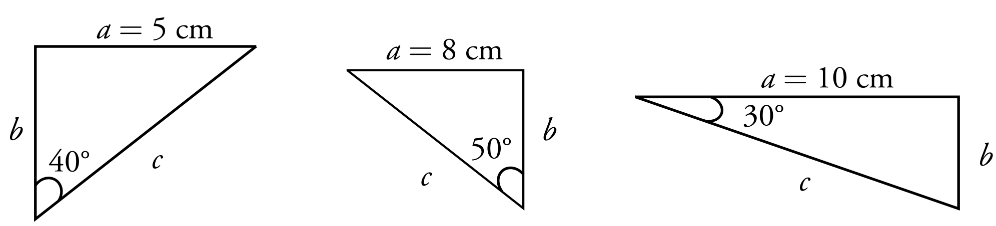
Use your protractor to measure angle A. Measure the length of the sides of the triangle and calculate tan A.

Angle A by protractor 39°

AB = 31 mm AC = 32 mm BC = 20 mm

$\tan A = \frac{20}{31} = 0.645$

③ Find the length of *b* in each of the right-angled triangles. (Not to scale.)



Triangle 1 Triangle 2 Triangle 3

Triangle 1 4.4 cm

Triangle 2 8.9 cm

Triangle 3 5 cm

④ The height of a building is 57.7 m tall and casts a shadow of 57.7 m.

4.1 How far is the end of the shadow from the building?

57.7 m

4.2 Do you notice that the shadow from a second building is 63 m. How high is the second building?

63 m

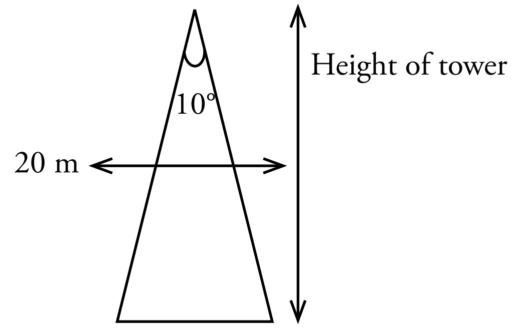
4.3 You walk 3.2 km due North from your home. You then turn right and walk a further 5.7 km. What is your bearing from home?

55°

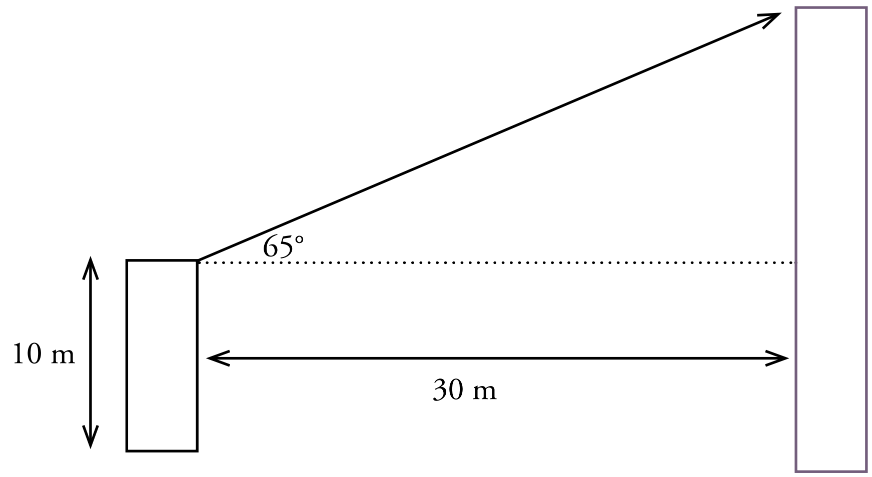
Tangents of angles, trigonometry and everyday examples

5 An engineer wishes to construct a conical tower. She chooses to have the diameter of the base 20 m and decides to have a vertical angle of 10°. How high will she make the tower?

114.3 m



6 A man is on the third floor of a building that is 10 m above the ground. He notes that the angle of elevation from where he is to the top of the building across the road is 65°. If the road is 30 m wide, how high is the building across the road?

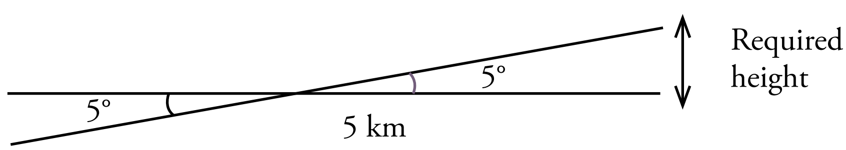


112.4 m

⑦ A surveyor wishes to find the width of a river. She notes that there are two trees exactly opposite one another on the banks of the river. She measures a distance of 250 m from the tree and measures the angle from where she is to the tree on the far side as 70°. How wide is the river between the trees? (Not to scale.)

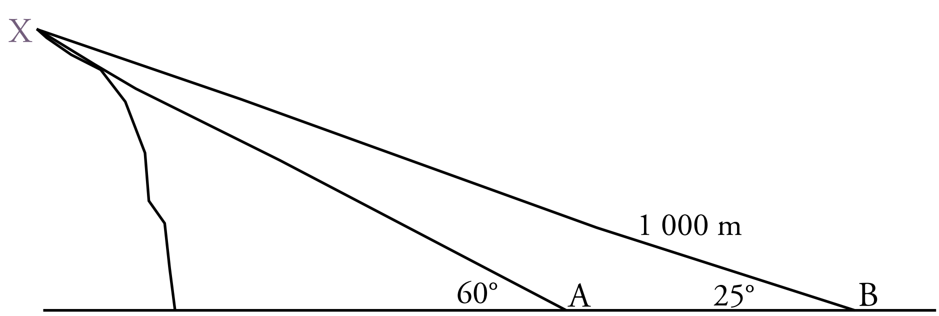
686.7 m

⑧ It is very inefficient to build a railway line that has an incline of greater than 5° as the engine will need too much power to haul a train up a greater slope. What is the maximum height that an engineer can design for a railway line that is 5 km long?



437.5 m

⑨ A surveyor wishes to find the height of a mountain. He measure the angle of inclination from a certain point A and finds the angle to be 60°. He then measures a distance of 1 000 m to B and measures the angle of inclination to be 25°. How far is A from the base of the mountain and how high is the mountain?



368.1 m

9 Factorisation 2: Quadratic expressions

Worked example

Expand the expression: $(x - 4)^2$

① Expand.

1.1 Expand the expressions.

1.1.1 $(x - 9)(x + 3)$

$x^2 - 6x - 27$

1.1.2 $(y - 4)(y - 2)$

$y^2 - 6y + 8$

1.1.3 $(m + 3)(m + 2)$

$m^2 + 5m + 6$

1.1.4 $(-3x + 2)(2x - 3)$

$-6x^2 + 13x - 6$

1.1.5 What have you noticed about the sign of the third term in the answers?

The third term is positive if the signs in the factors are the same.

1.2 Expand the expressions.

1.2.1 $(x - 5)^2$

$x^2 - 10x + 25$

1.2.2 $(y - 2)(y + 2)$

$y^2 - 4$

1.2.3 $(2x - 3)(3x - 2)$

$6x^2 - 13x + 6$

1.2.4 $(2 - 3x)(3 - 2x)$

$6 - 13x + 6x^2$

1.2.5 $(2y + 3x)^2$

$4y^2 + 12xy + 9x^2$

1.2.6 $(x + y - z)^2$

$x^2 + y^2 + z^2 + 2x + 2yz + 2zx$

1.2.7 $(s + t)^2 - (x - t)^2$

$s^2 - x^2 + 2st + 2xt$

1.2.8 $(\sqrt{x} - 2)(\sqrt{x} - 3)$

$x - 6\sqrt{x} + 6$

② Factorise.

2.1 $x^2 - x - 6$

$(x - 3)(x + 2)$

2.2 $x^2 + 25 + 100$

$(x + 5)(x + 20)$

2.3 $t^2 - 15t + 100$

$(t - 20)(t + 5)$

2.4 $-x^2 - 7x - 10$

$(x - 5)(2 - x)$

2.5 $6r^2 + 8r - 8$

$(3r - 2)(2r + 4)$

2.6 $2x^2 + 5xy + 2y^2$

$(2x + y)(x + 2y)$

2.7 $x^2 - 4$

$(x - 2)(x + 2)$

2.8 $2m^2 - 9m - 18$

$(m - 6)(2m + 3)$

2.9 $6x^2 - 294$

$6(x - 7)(x + 7)$

2.10 $(w + 1)^2 - 3(w + 1) - 88$

$(w + 8)(w - 10)$

Hint

Put $x = w + 1$ and work this out. Then substitute back so that the answer contains w.

2.11 $(w^2 + w - 12)^2 + (w^2 + w - 12) - 12$

$(w^2 + w + 8)(w^2 + w - 15)$

2.12 $33v^2 - 25v - 168$

$(11v - 21)(3v + 8)$

2.13 $x^4 - x^3 - 6x^2$

$x^2(x + 2)(x - 3)$

2.14 $r^2 + 2r - 48$

$(r + 8)(r - 6)$

2.15 $x^2 + 5xy - 36y^2$

$(x - 4y)(x + 9y)$

2.16 $x - 4\sqrt{x} - 32$

$(\sqrt{2} - 8)(\sqrt{x} + 4)$

2.17 $(350x^3 + 220x^2 + 30x)$ divided by $10x$

$(7x + 3)(5x - 1)$

Hint

First factorise 384 and then 294 and then evaluate the HCF using the factors.

3. Evaluate $(14^2 - 13^2)$ by first factorising.

27

4. Find the HCF of 384 and 294.

2

5. Use the difference of two squares to find the value of:

5.1 $61^2 - 39^2$

2 200

5.2 $1007^2 - 49$

1 014 000

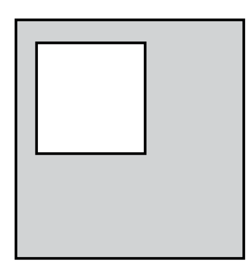
6. Divide the expression $(w^2 + 6w + 8)$ by $(w + 2)$.

$w + 4$

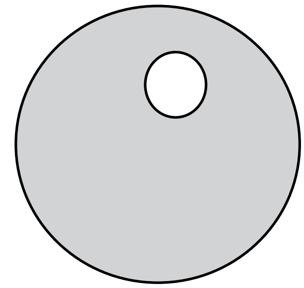
Area

7. Consider the diagram of a square piece of paper with side 30 cm and a square hole of side 14 cm cut out of it. Find the area of the paper that remains.

704 cm^2



⑧ Consider the piece of coloured glass with radius 43 cm. It has a circular hole of 7 cm cut from it as in the diagram.



8.1 Find the area of the glass that remains.

91π

8.2 Would it make any difference to the area if the two circles had the same centre?

No

⑨ Consider a metal pipe with an outer radius of 13 cm and an inner radius of 8 cm. If the length of the pipe is 100 cm, find the volume of metal needed. The volume of a cylinder is given by the equation, $v = \pi r^2 h$. Where is the radius and the height?

33 000 cm^3

Hint
Use $\pi = \frac{22}{7}$

10 Equations 1: Equations with fractions

Worked example

Solve the equation and check:

$\frac{4}{x+2} = \frac{2}{x-2}$

Solve

① Solve the equations.

1.1 $\frac{x+3}{4} = \frac{x-4}{3}$

$x = 25$

1.2 $\frac{3x+2}{7} = \frac{3x+2}{8}$

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

1.3 $\frac{3}{2x} = 5$

$x = \frac{3}{10}$

1.4 $\frac{2}{3x} + \frac{3}{2x} = 10$

$x = \frac{13}{60}$

1.5 $\frac{7}{x-2} = \frac{1}{2}$

$x = 16$

1.6 $\frac{x-2}{3} + \frac{x-4}{4} = x$

$x = -1$

Hint

When solving equations always substitute the answer back in the original equation(s) to check that the answer is correct.

1.7 $\frac{2}{x-3} + \frac{3}{x-2} = 0$

$x = \frac{13}{5}$

1.8 $\frac{1}{x} - \frac{1}{2x} = \frac{1}{3}$

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

1.9 $\frac{3}{x-2} = \frac{8}{3}$

$x = \frac{9}{14}$

1.10 $\frac{x}{4} = x - 4$

$x = \frac{16}{3}$

2 If $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$ and u =3 and v = 2, find f.

$f = \frac{6}{5}$

Fractions, equations and everyday examples

3 The average mass of a group of students is 70.3 kg. The total mass of the group is 1 898 kg. How many students are in the group?

27

4 A taxi travels at 150 km at v kilometres per hour. Write an equation for the time taken in terms of the speed. If the trip took the taxi two hours, what was the speed?

$v = \frac{d}{t}$, so $v = 75$ km/h

⑤ An athlete completes a marathon (42.2 km) at a pace of 3 min per kilometre. What was his speed (in kilometres per minute)? If the world record for the marathon is 2 hours 3 minutes and 23 seconds, what pace (minutes per kilometre) must an athlete achieve in order to break the world record?

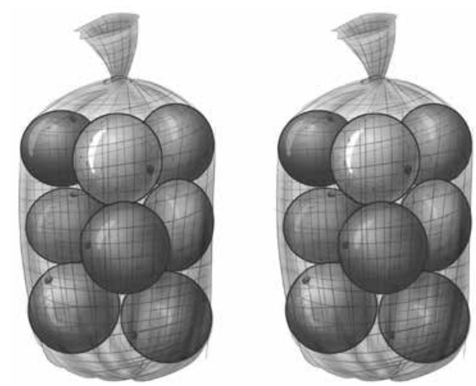
2 min 55 sec

⑥ A taxi travels 80 km at an average speed between towns A and B. The driver then increases the speed by 20 km per hour and travels in the same time a 100 km from B to C. Find the speed for each part of the journey. How long did the total journey take? What was the average speed for the total journey?

80 km/h   100 km/h   2 hours   90 km/h

⑦ A vendor bought two bags of oranges at the market. The bags contained the same number of oranges and cost the same. In the one bag four oranges were bad and he sold the rest for ₦52. From the other bag six were bad and he sold the rest for ₦48. How many oranges were in each bag? How much did he charge for an orange?

30 oranges   ₦2



⑧ A group of students asked Pythagoras how many students were in his class. "One half study mathematics, one quarter study natural philosophy, one seventh observe absolute silence and there are three others." How many students did he have?

28 students

⑨ A trader bought a number of chairs for ₦17 748. If each chair cost him ₦1 044, how many chairs did he buy?

17 chairs

⑩ A table costs five times as much as a chair. A trader bought six more chairs than tables and spent ₦18 594. If a chair costs ₦1 033, how many chairs and tables did he buy?

8 chairs 2 tables

⑪ A farmer takes x chickens to the market. The total mass of the chickens is 13.87 kg. Write the average mass of chickens in terms of x.
$13.81 \div x$

If the average mass of a chicken is 0.73 kg, how many chickens did the farmer take to the market?

19

11 Compound interest

Worked example

How much interest will be earned if an investment of ₦50 000 is invested for three years at 8%? What will the investment be worth?

Solution:

I = Principal × Rate × Time

I = 50 000 × 0.08 × 3

I = 12 000

That is the amount of interest you will earn, now add it to the original investment to get the total worth after 3 years.

50 000 + 12 000 = 62 000

Hint

Interest must always be regarded as compound unless it states that it is simple interest. Answers should be rounded to the nearest ₦.

① Find the simple interest on ₦10 000 at 5% for 4 years.

₦2 000

② If you borrow ₦25 000 from a bank at 6% simple interest for three years, how much will you need to repay?

₦29 500

③ If a merchant borrows ₦100 000 from a bank at 5% simple interest and repays ₦200 000, how long has he had the loan?

20 years

④ The simple interest earned on a loan of ₦120 000 after five years is ₦36 000. What was the interest rate?

6%

⑤ A woman borrows ₦200 000 from a bank for 2 years at 5% interest. How much does she need to repay at the end of the loan?

₦220 000

⑥ A student wishes to have ₦15 000 in two years. He is able to invest a sum of money at 8% for the period. How much does he need to invest today to have the ₦15 000?

₦12 860

⑦ An investment of ₦100 000 attracts interest of 8% and matures at the end of a fixed period. If the investment is worth ₦116 640 at the end of the period, for how long was the money invested?

2 years

⑧ A shop owner borrows ₦1 000 000 for three years. At the end of the three years he repays ₦1 331 000. What interest rate did the bank charge him?

10%

Hint
Guess an interest rate and calculate if it is too high or too low.

⑨ A man borrows ₦10 000 000 to buy a house and is charged 7%. The loan is to be paid off over a period of twenty years.

9.1 How much interest will he have paid in the first year?

9.2 His repayments are ₦943 929 per year. How much interest will he have paid over the entire 20 year period?

₦700 000

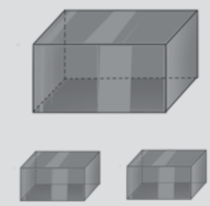
⑩ An investment on the Nigerian Stock Exchange made three years ago has achieved an annual growth rate of 9%. What is the percentage increase in this investment after the three years?

29.5%

12 Similarity 2: Area and volume of similar shapes

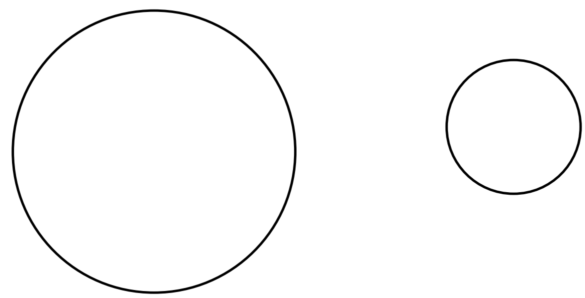
Worked example

Two cuboids are similar. The smaller has sides 10, 20 and 30 cm. The larger cuboid has its smallest side equal to 20 cm. Find the volume of the smaller cuboid, and by using the volume factor write down the volume of the larger cuboid.



Area

① The two circles have diameters of 1 000 mm and 500 mm. (Not to scale).

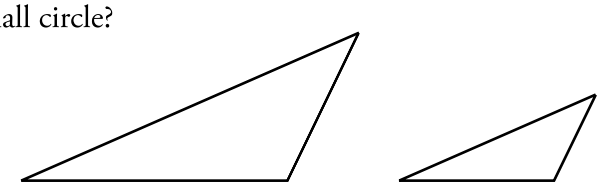


1.1 What is the scale factor of the small circle to the big circle?

$\frac{1}{2}$

1.2 What is the area factor of the big circle to the small circle?

4



② The two triangles are similar. (Not to scale.)

The length of the base of the bigger triangle is 30 mm and that of the smaller triangle is 18 mm. The height of the bigger triangle is 20 mm.

2.1 Calculate the height of the smaller triangle.

12 mm

2.2 Calculate the area of the bigger triangle.

180 mm^2

2.3 Use the area factor to find the area of the smaller triangle.

80 mm^2

③ **3.1** The ratio of the area of two circles is 16:25. What is the ratio of their diameters?

4 : 5

3.2 What is the radius of the smaller circle if the larger circle has an area of 1 257 cm?

16 cm

Volume and area

④ A right circular cone has a base radius of 10 cm and a height of 20 cm. A second cone is similar to it and has a base radius of 20 cm.

> **Hint**
> Lateral surface area of cone = $\pi r l$ where l is the lateral height.

4.1 What is the height of the second cone?

50 cm

4.2 What is the area factor?

4

4.3 What is the volume factor?

8

4.4 Calculate the area of the smaller cone.

942.8 cm^2

> **Hint**
> This is the area of the surface area plus the area of the base.

4.5 Using the area factor write down the area of the bigger cone.

3 771.2 cm^2

4.6 Calculate the volume of the bigger cone.

16 761.9 cm^3

4.7 Using the volume factor write down the volume of the smaller cone.

2 095 2 cm^2

⑤ A cuboid has dimensions of 3, 4 and 5 cm. A larger cuboid has its smallest side equal to 9 cm.

5.1 Find the surface area of the larger cuboid.

846 cm^3

5.2 Find the volume of the larger cuboid.

1 620 cm^3

Similarity, area, volume and everyday examples

⑥ A tennis court and a football field are similar. A tennis court is 78 feet long and 36 feet wide. If a football field has a length of 100 m, find the area.

Hint
One foot (plural feet) is 0.3048 m.

4 618 m^2

⑦ A paint manufacturer supplies paint in similar containers.

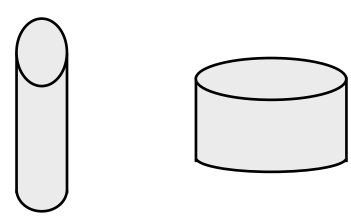
7.1 If the height of a 5 ℓ container is 20 cm, find the height of a 125 ℓ container.

100 cm

7.2 If a litre is 1 000 cc, find the area of the base of the 5 ℓ container.

250 cm^2

⑧ Two cylindrical candles have radii of 2.5 cm and 4.5 cm and heights of 30 cm and 12 cm. (Drawings not to scale.)



8.1 Are the candles similar?

No

8.2 Find the volume of each candle correct to the nearest cc.

539 cc 764 cc

8.3 If a candle burns 1 cc every minute how long will each candle take to burn out?

58.9 min 76.4 min

⑨ A map of a city is drawn to a scale 1:20 000. On the map a school has a rectangular area of 5 cm^2. What is the area of the school in hectares?

2 000 ha

⑩ The area of a picture is 28 800 cm^2. A photograph of the picture has a shorter side of 10 by 5 cm. What are the dimensions of the picture?

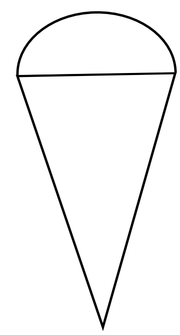
120 cm by 240 cm

⑪ A tennis ball has a diameter of 6.7 cm and a football has a diameter of 22 cm. Show that the volume scale factor is the cube of the scale factor.

Volumes: 118.16 cm^3 and 4 183.14 cm^3 Scale 3.28

Volume scale factor: $\frac{4\,183.17}{118.16} = 35.3$ (rounding off)

⑫ An ice cream cone has a height of 16 cm and a radius of 4 cm. Ice cream fills the cone and has a hemisphere of ice cream on top.



If a vendor sells ice cream for 0.5 ₦ per cc, how much should she charge for a full ice cream cone?

₦201

13 Proportion: Direct; inverse; reciprocal

Reciprocal proportion

Hint

The tables are used for finding reciprocals.
These are used in some of the exercises.

										SUBTRACT Differences								
x	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
10	1 000	9 901	9 804	9 709	9 615	9 524	9 434	9 346	9 259	9 174	9	18	28	37	46	55	64	74	83
11	9 091	9 009	8 929	8 850	8 772	8 696	8 621	8 547	8 475	8 403	8	15	23	31	38	46	53	61	69
12	8 333	8 264	8 197	8 130	8 065	8 000	7 937	7 874	1813	7752	7	13	20	26	33	39	46	52	59
13	7 692	7 634	7 576	7 519	7 463	7 407	7 353	7 299	7 246	7 194	6	11	17	22	28	33	39	44	50
14	7 143	7 092	7 042	6 993	6 944	6 897	6 849	6 803	6 757	6 711	5	10	14	19	24	29	33	38	43
15	6 567	6 623	6 579	6 536	6 494	6 452	6 410	6 369	6 329	6 289	4	8	13	17	21	25	29	33	38
16	6 250	6 211	6 173	6 135	6 098	6 051	6 024	5 988	5 952	5 917	4	7	11	15	18	22	26	29	33
17	5 882	5 848	5 814	5 780	5 747	5 714	5 682	5 650	5 618	5 587	3	7	10	13	16	20	23	26	29
18	5 556	5 525	5 495	5 464	5 435	5 405	5 376	5 348	5 319	5 291	3	6	9	12	15	17	20	23	26
19	5 263	5 236	5 208	5 181	5 155	5 128	5 102	5 076	5 051	5 025	3	5	8	11	13	16	18	21	24

										SUBTRACT Differences								
x	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
55	1 818	1 815	1 812	1 808	1 805	1 802	1 799	1 795	1 792	1 789	0	1	1	1	2	2	2	3	3
56	1 786	1 783	1 779	1 776	1 773	1 770	1 767	1 764	1 761	1 757	0	1	1	1	2	2	2	3	3
57	1 754	1 751	1 748	1 745	1 742	1 739	1 736	1 733	1 730	1 727	0	1	1	1	1	2	2	2	3
58	1 724	1 721	1 718	1 715	1 712	1 709	1 706	1 704	1 701	1 698	0	1	1	1	1	2	2	2	3
59	1 695	1 692	1 689	1 686	1 684	1 681	1 678	1 675	1 672	1 669	0	1	1	1	1	2	2	2	3
60	1 667	1 664	1 661	1 658	1 656	1 653	1 650	1 647	1 645	1 642	0	1	1	1	1	2	2	2	3
61	1 639	1 637	1 634	1 631	1 629	1 626	1 623	1 621	1 618	1 616	0	1	1	1	1	2	2	2	2
62	1 613	1 610	1 608	1 605	1 603	1 600	1 597	1 595	1 592	1 590	0	1	1	1	1	2	2	2	2
63	1 587	1 585	1 582	1 580	1 577	1 575	1 572	1 570	1 567	1 565	0	0	1	1	1	1	2	2	2
64	5 263	5 236	5 208	5 181	5 155	5 128	5 102	5 076	5 051	5 025	3	5	8	11	13	16	18	21	24

Worked example

What is the reciprocal of 60

The reciprocal of 60 is 0.01667

60 = 1 667

60 = 0.1667

This is found by looking at 60 in the left-hand column and noting the value in the table 1 667.

The decimal point needs to be placed by inspection.

Example

The reciprocal of 0.5635 is 1.778.

Use the table to find the reciprocals of:

0.05647	
0.5647	
5.647	
56.47	
564.7	
5647	

Direct, indirect and inverse proportion

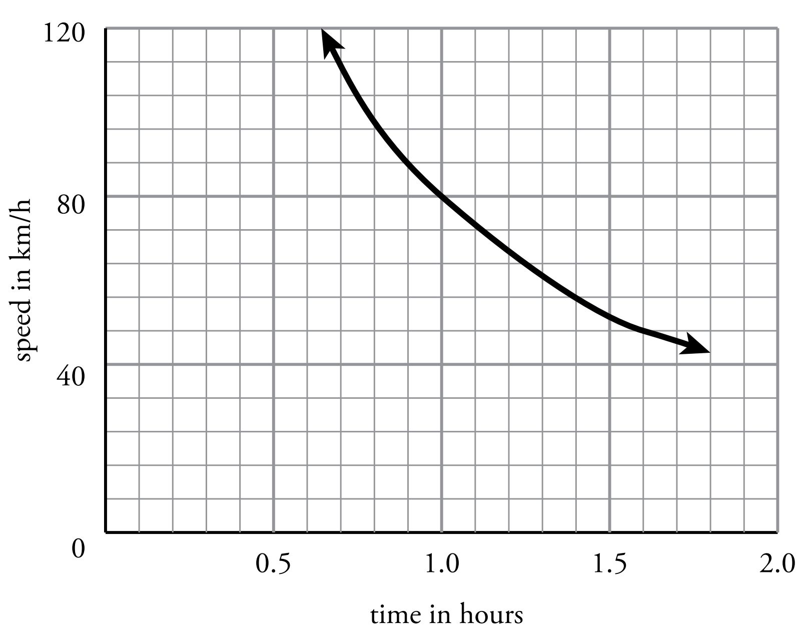
① A taxi travels between two towns that are 80 km apart. Complete the table.

Speed km/hour	50	80	100	120
Time in hours	1.6 hours	1 hour	0.8 hours	0.667 hours
Time in hours and minutes	1 hr 36 min	1 hr	48 min	40 min

② **2.1** Are the speed and time in direct or inverse proportion?

Inverse

2.2 Plot a graph of the speed vs time in hours.



③ A taxi driver travels for 3 hours 30 minutes.

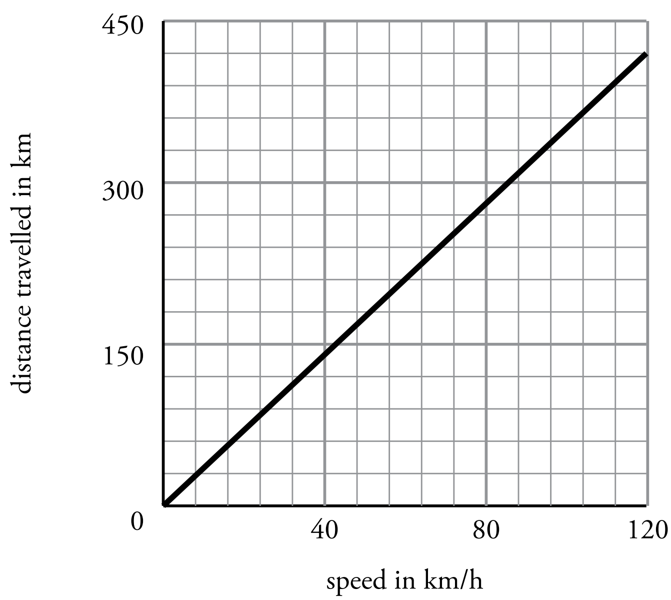
3.1 Complete the table.

Speed km/hour	50	80	100	120
Distance travelled km	175	280	350	420

3.2 Is the speed and distance in direct or inverse proportion?

Direct

3.3 Plot this information on the graph paper.



④ A taxi driver travels 450 km on a tank of petrol. The tank holds 60 ℓ of petrol. There are two methods of measuring the efficiency of the taxi. The first method is the number of litres per 100 km driven, the other is the number of kilometres per litre of petrol.

4.1 Are these methods in direct or inverse proportion to distance:

4.1.1 Litres per hundred kilometres?

Inverse

4.1.2 Kilometres per litre?

Direct

4.2 For the taxi, how many litres per kilometre are used?

13.5 ℓ/100 km

4.3 For the taxi, what is the number of kilometres per litre?

7.5 km per litre

5 A manufacturer of pipes manufactures standard lengths of pipe that are 60 m long. He then cuts the pipe into shorter pieces.

5.1 How many pieces of 4 m lengths can be cut from a standard length of pipe?

15

5.2 If he cuts a standard length of pipe into 8 m lengths, what is the maximum number of pieces that can be obtained?

7 (not 7.5)

6 A tiler can lay twenty tiles per hour.

6.1 If he works 8 hours a day, how many tiles can he lay in a day?

160 per day

6.2 The foreman wishes to have 12 000 tiles laid. Complete the table to show how long the task will take.

Number of tilers	1	2	3	4	5
Number of days to complete the task	75	37.5	26	18.75	15

6.3 If the foreman wishes the task to be completed in 10 days, how many tilers need to be employed? (Remember that he cannot employ part of a tiler!)

7.5. So he needs 8 tilers

7. A dam that supplies water to a game park for use by elephants holds 396 000 kl (kilo litres) of water and is filled when it rains. There are 120 elephants in the game park and each elephant drinks about 15 kl of water a day.

7.1 What is the total usage of water a day?

1 800 kl

7.2 How much water is used in a 31-day month?

55 800 kl

7.3 How long will the water in the dam last if there is no rain?

220 days, about 7 months

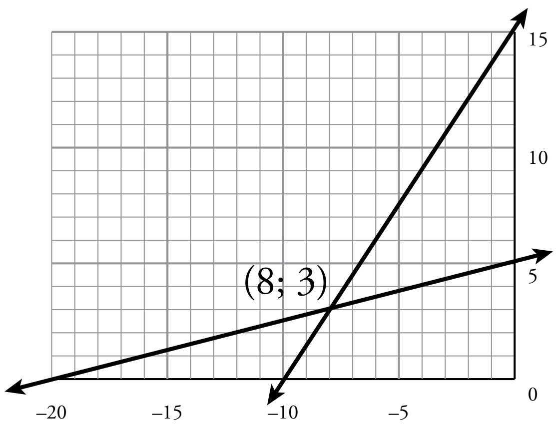
14 Equations 2: Simultaneous linear equations

Worked example

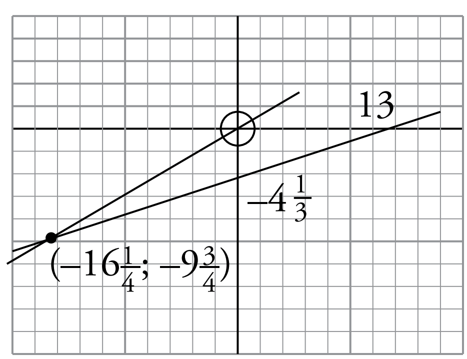
Solve the equations and check: $2x + y = 7$ and $3y - 3x = 9$

Solve graphically and check

① Solve graphically the simultaneous equations.
$4y - x = 20$ and $2y - 3x = 30$



② Solve graphically the simultaneous equations.
$y = 0.6x$ and $3y = x - 13$



Solve and check

③ Solve the equations and check.

3.1 $x + 5y = 42$ and $3x - 2y = -1$

$x = 2; y = 8$

3.2 $3x - y = -1$ and $6x - 3y = -1$

$x = \frac{1}{3}; y = 4$

3.3 $x + y = 26$ and $2x - 3y = 65$

$x = 13; y = 13$

3.4 $4x - 3y = 6$ and $3x - 4y = -6$

$x = 2; y = 3$

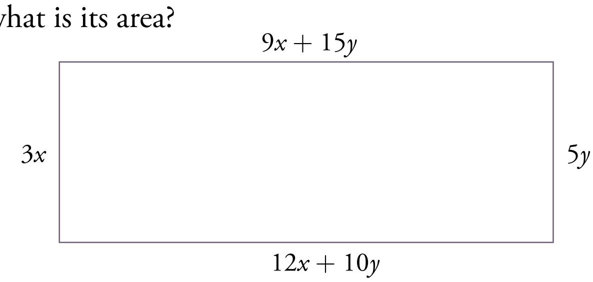
3.5 $5x + 3y = 16$ and $3x - 12y = 5$

$x = 3; y = \frac{1}{3}$

④ A rectangle has sides (all measured in mm).

4.1 What are the lengths of the sides of the rectangle and what is its area?

$x = \frac{5}{3}$ mm; $y = 1$ mm; area = 150 mm^2



⑤ Why is it not possible to solve the equations $17x + 2y = 8$ and $42.5x + 5y = 20$?

They are the same equation. The second is 2.5 times the first.

Equations and everyday examples

⑥ A table and four chairs cost ₦19 500. Two tables and six chairs cost ₦33 000. What is the price for one table and one chair?

₦11 250

⑦ A manufacturer of chairs finds that her costs for making a chair are a fixed cost of ₦18 000 and a variable cost of ₦1 600 for each chair she makes. She can sell the chairs for ₦2 500 each.
How many chairs must she sell in order to start making a profit? How much profit will she make if she sells 300 chairs?

1 200 chairs ₦252 000

⑧ Uzezi buys 3 packets of washing powder A, and 5 packets of washing powder B, and spends ₦4 900. Uzezi has 3 packets of washing powder B that is not needed and returns these to the shop and gets a full refund. He also buys 6 further packets of washing powder A.
Uzezi pays an ₦1 740 in addition to the money received as refund. How much does a packet of each washing powder cost?

A costs ₦600 B costs ₦620

⑨ A taxi travels for x hours at 80 km per hour (km/h) and y hours at 100 km/h. The average speed for the journey of 560 km is $93\frac{1}{3}$ km/h. Find x and y.

$x = 2$ hours; $y = 4$ hours

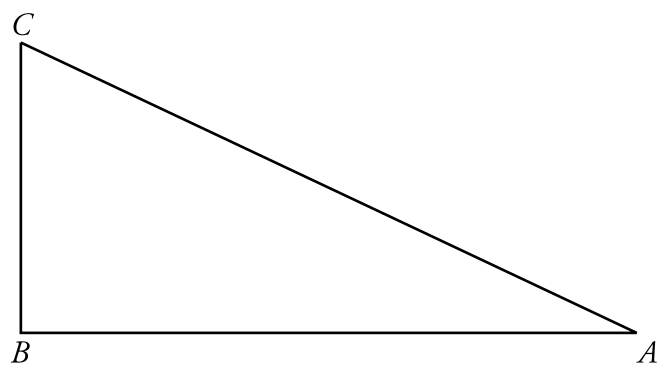
15 Trigonometry 2: Sine and cosine of angles

Worked example

A right-angled triangle has an angle of 55° and a hypotenuse of 20 cm. What are the lengths of the other sides?

Measure and find

① Consider the right-angled triangle ABC. Measure the sides.



B ———————————— A

1.1 Consider angle A. Write down the hypotenuse (hyp), the opposite side (opp) and the adjacent side (adj) for this angle.

hyp 88 opp 38 adj 80

1.2 Consider the angle C. Write down the hyp, opp, and adj for this angle.

hyp 88 opp 80 adj 38

1.3 What is the sine of angle A (use two decimal places)?

0.43

1.4 What is the sine of angle C (use two decimal places)?

0.91

1.5 What is the cosine of angle A (use two decimal places)?

0.9

1.6 What is the cosine of angle B (use two decimal places)?

0.43

② A right-angled triangle has an angle of 35° and a hypotenuse of 10 cm. What are the lengths of the other sides?

AB = 57.36 cm

AC = 81.92 cm

③ Consider a right-angled triangle with one side equal to 25 cm. If one of the other angles is 55° find the lengths of the other sides.

30.52 cm; 17.51 cm

④ What do you notice about the sine and cosine of the angles 35° and 55° in questions 5 and 6?

sin 35° = cos 55°

sin 55° = cos 35°

⑤ Can you note anything similar for other angles from the table at the start of this worksheet?

sin A = cos (90 − A)

cos A = sin (90 − A)

⑥ **6.1** Consider the square of the sin of 35° plus the square of the cosine of 35°. What do you note?

1

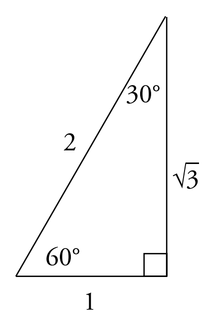
6.2 Is this true of any other angles in the table?

Yes

Find by drawing

⑦ Find by drawing the angle whose sin is $\frac{1}{2}$.

$\sin 30 = \frac{1}{2}$



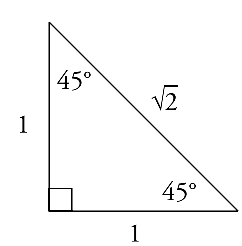
⑧ Find by drawing the angle whose cos is $\frac{1}{2}$.

$\cos 60 = \frac{1}{2}$

⑨ A right-angled triangle has one angle of 45°. Find by drawing the sin and cos of 45°.

$\sin 45 = \frac{1}{\sqrt{2}}$

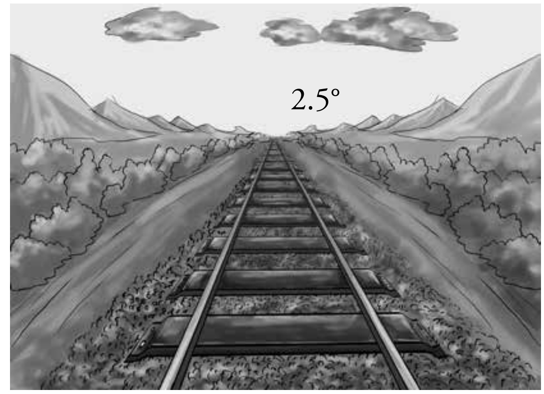
$\cos 45 = \frac{1}{\sqrt{2}}$



Trigonometry, sine and cosine of angles, and everyday examples

⑩ A railway line runs at an angle of 2.5° to the horizontal. How high does it climb if the length of the track is 20 km?

8 872 m



20 km

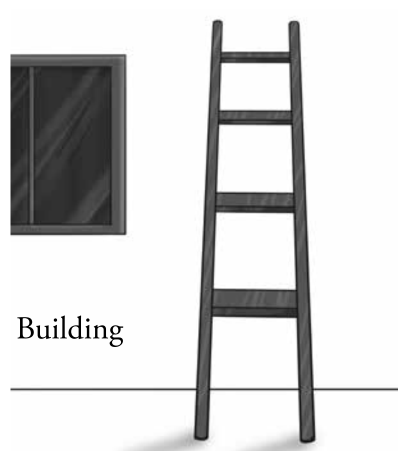
⑪ A window cleaner has a ladder of length 40 m.

11.1 If the ladder is at an angle of 70° to the vertical, what height can the ladder reach?

37.59 m

11.2 How far from the wall must the ladder be placed in this case?

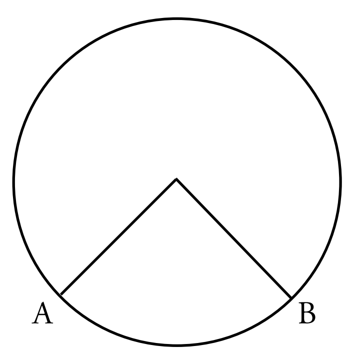
13.68 m



Ladder

⑫ If the circle has a radius of 10 cm and the angle between the two radii is 100º, find the length of the chord AB and its distance from the centre of the circle. (Not to scale.)

15.32 m



16 Everyday statistics

Worked example

Amanda records the number of telephone calls she receives each day for two weeks.
10 12 15 10 15 2 4 9 8 12 0 15 16 12

1 Determine the mean, median and the mode.
The mean is 10, the median is 12, and the modes are 12 and 15.

2 Show this data by completing the frequency table.

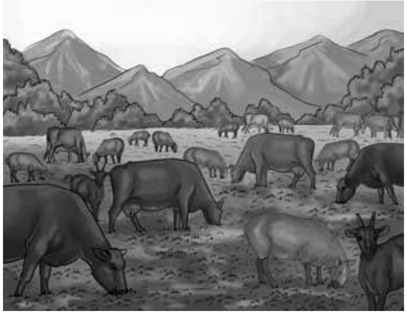
Number of calls	0–4	5–9	10–14	15+
Frequency	3	2	5	4

① The tuck shop at a school notes that for a certain grade the following drinks were sold.
Show this information using a frequency chart.
Girls: Orange juice 13, Cola 12, Apple juice 8
Boys: Orange juice 16, Cola 20, Apple juice 3

	Orange juice	Cola	Apple juice
Boys	16	20	3
Girls	13	12	8

② A large farm has 140 head of cattle, 60 sheep and 40 goats. Show this information using a pictogram.
Use a picture to represent 20 animals.

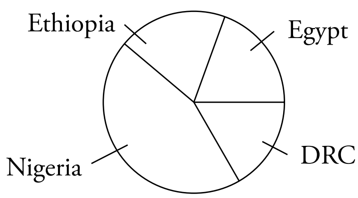
Animal	Pictogram
Cattle	7 cattle
Sheep	3 sheep
Goats	2 goats



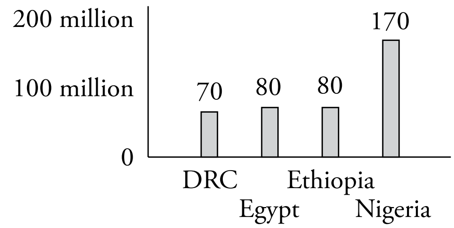
③ Four countries in Africa with their approximate populations are:

Country	Million
DRC	70
Egypt	80
Ethiopia	80
Nigeria	170

3.1 Draw a pie chart to show this data.

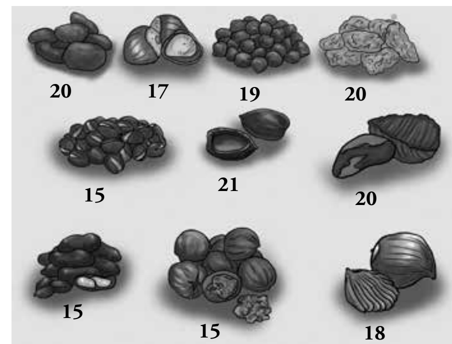


3.2 Draw a bar chart to represent this data.



4 Ten packets of nuts from a market were surveyed and the number of nuts per packet are shown.

4.1 Find the mean, median and mode of the number of nuts per packet.



Mean 18

Median 18.5

Mode 15, 20

4.2 Which do you believe is the best measure of central tendency? Give reasons for your answer.

Mean uses all values and no outliers. Median acceptable. Does not use all values. Mode two values, does not use all values.

5 In a mathematics test, the results for 30 students were:

Number of students	Mark for the test
2	100
7	75
5	65
13	60
3	40

5.1 What was the average mark for the class? (The mean)

65

6 A taxi driver drove for 60 km at 40 km/h, he then drove a further 60 km at 80 km/h. What was the average speed of the taxi? (Answer to one decimal place.)

96 km/h

7 A taxi driver drove at 40 km/h for 45 minutes and then a further 45 minutes at 80 km/h. What was the average speed of the taxi? (Answer to one decimal place.)

85 km/h

⑧ Are the answers to questions 6 and 7 the same? Explain.

In 6, its a longer time at a faster speed.

⑨ The marks for five students in numeracy and literacy are:

The mean for the two subjects are the same (check this). However, there is a difference in the performance between the two subjects. Show how this difference can be represented.

Mean both 60

use range 53 for numeracy

4 for literacy

Number	Literacy
22	58
63	59
66	60
74	61
75	62

⑩ A bus company employs 25 bus drivers who earn ₦5 000 per week. There are also 5 supervisors earning ₦10 000 per week and two directors earning ₦50 000 per week.

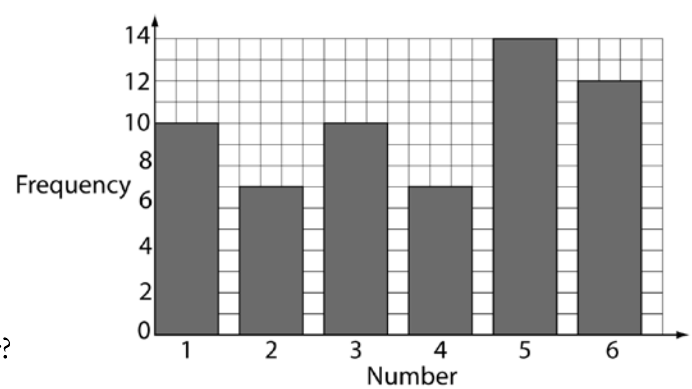
10.1 What is the mean weekly salary for the bus company?

₦8 593

10.2 Would you recommend a different measure of central tendency? Explain your reason.

Median. Better when there are outliers like the directors' earnings.

⑪ Bobby tests a six-sided spinner (dice). He draws a bar chart to show the results.



11.1 How many times did he spin the spinner?

60

11.2 Calculate the mean score for the spinner.

3.73

17 Rational and non-rational numbers

Worked example

Which of the numbers are rational and which are non-rational? 0; $\frac{3}{5}$

① Which of the numbers are rational and which are non-rational?

16 Rational

32 Rational

$\sqrt{16}$ Rational

$\sqrt{32}$ Non-rational

0.326 Rational

$\frac{1}{7}$ Rational

$\frac{4}{15}$ Rational

Find

② Find the square root of 10 rounded off to two decimal places.

3.162

③ Find $\frac{1}{3}$ rounded off to two decimal places.

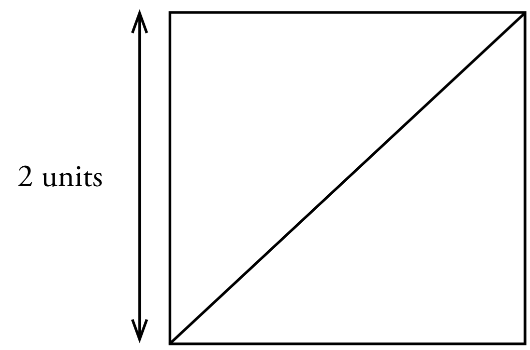
0.33

④ Find the square root of 3 to two significant figures.

1.73

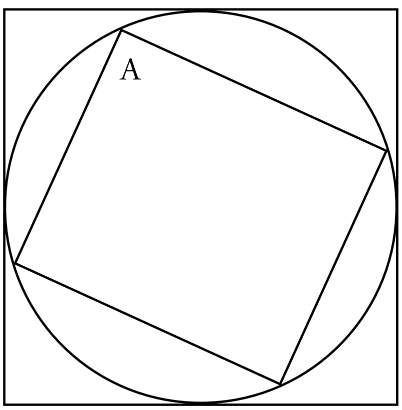
⑤ Find the length of the diagonal of a square of side 2 units to two significant figures.

2.83



⑥ Find the limits to the area of a circle of radius 1 by considering a square outside the circle and one inside the circle. Then estimate the value for π.

Between 2 and 4



Calculate and find

⑦ **7. 1** Calculate $\frac{16}{9}$ to three decimal places.

1.333

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

7. 2 Find the square root of the answer. What is the actual square root?

1.154

Write

⑧ Write 0.3 as a rational number.

$\frac{1}{3}$

⑨ Write $\frac{11}{9}$ as a recurring decimal.

1.22 recurring

Convert

⑩ Convert 0.131313 to a rational number.

$\frac{13}{19}$

⑪ Convert 0.4 recurring to a rational number.

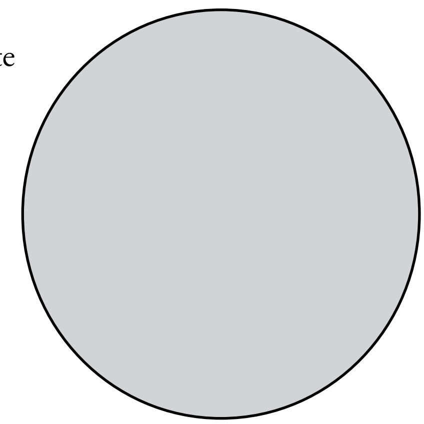
$\frac{4}{9}$

Draw and calculate the area

⑫ The area of a regular hexagon is given by two equations $\sqrt{\frac{3}{2}}d^2$ where d is the distance between two flat sides of the hexagon, and $\frac{3\sqrt{3}}{2}r^2$ where t is the length of a side.

12.1 Draw two hexagons, one outside and the other inside the circle. Assume that the radius of the circle is 1 unit. Calculate the areas of the two hexagons and use these to estimate the value for π. Use $\sqrt{3} = 1.732$.

Between 2.6 and 3.46



12.2 Is this a better estimate than you found in question 12?

Yes

Rational and non-rational numbers and everyday examples

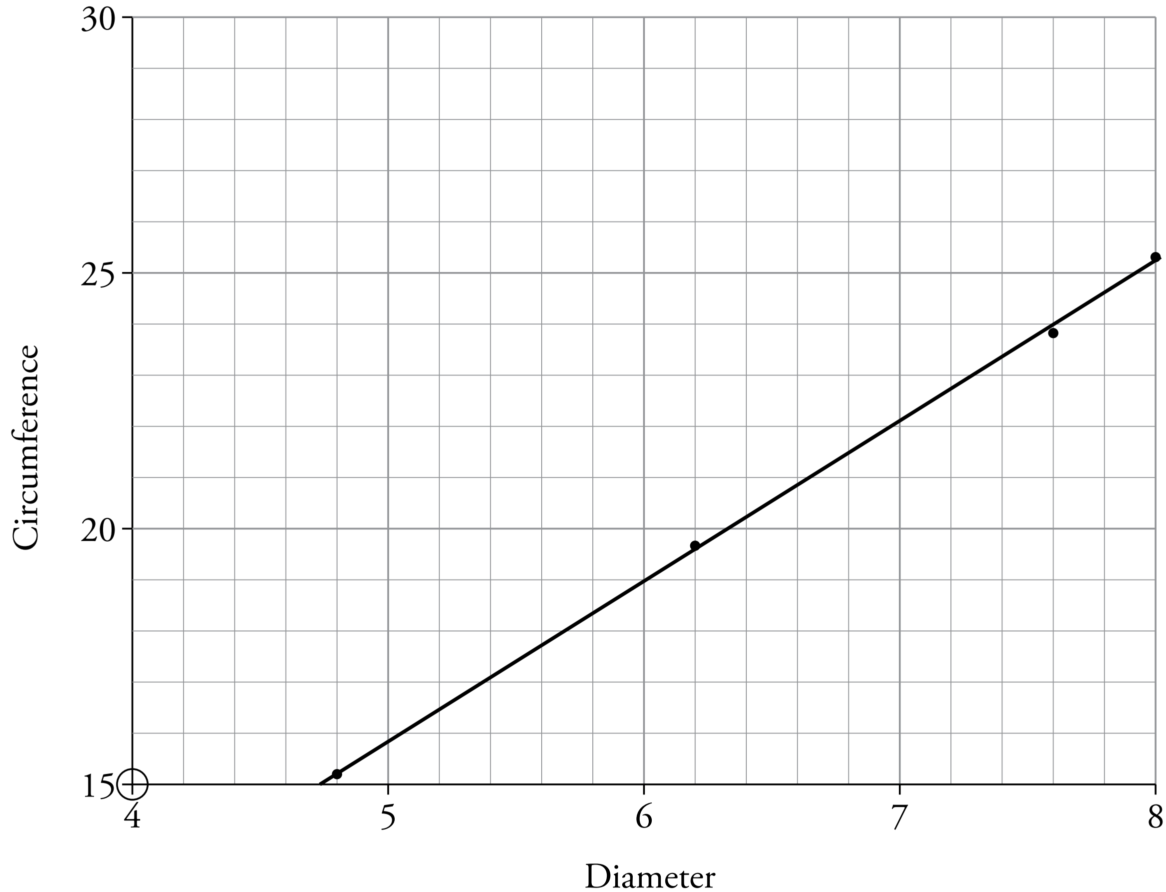
⑬ A student looked at a number of circular objects and noted the following:

	Diameter	Circumference	Workings
Large bottle	8.0	25.2	
Small bottle	6.2	19.5	
Cool drink bottle	4.8	15.1	
Honey jar	7.6	23.8	

13.1 Use the values in the table to estimate π.

3.16

13.2 Plot the points from the table on the graph paper and draw a straight line through the points. Draw a vertical line and a horizontal line to make a right-angled triangle with the graph. Measure the vertical and horizontal lines and estimate the value for π.



Estimate for π is 3.156 (gradient of line)

Index

A
algebraic processes 5–7
area factor 44
area of plane shapes
basic shapes 29
circles, rings and sectors 30
in the home and environment 30
plane shapes 29–30
a trapezium 30
and volume of similar shapes 44–45
area (surface) of common solids 8
average 52

B
bar charts 12, 52
basic operations 3–5
binary system 21–22
application of 22
number bases 21
binomials 25
finding the product of binomials 38
fractions with binomials in the denominator 41

C
centre of enlargement 33
change the subject (of formula) 31, 32
coefficients of terms 38
common factors see factorisation: common factors
common solids 8
complement (of an angle) 35
compound interest 43
computers and mathematics 16–19
constructions see geometrical constructions
cosine see sine and cosine of angles

D
decimal place value system 2
depreciation 42
difference 23
of perfect squares 39
direct and inverse proportion and reciprocals 46
calculations using reciprocals 47
direct and inverse proportion 46
graphical representation 46–47
reciprocals of numbers 47

E
elimination (method) 48, 49
enlargement and scale factor 33, 34
equations, simultaneous linear 48–49
graph of an equation 48
method of elimination 49
method of substitution 49
word problems 49
equations with fractions 40–41
clearing fractions 40
fractions with binomials in the denominator 41
fractions with unknowns in the denominator 40–41
word problems involving fractions 41
equiangular 33, 34
everyday statistics 12, 52–53
interpretation of averages 53
measures of central tendency (mean, median and mode) 53
revision of presentation of data 52–53
expand (in algebra) 37

F
factorisation: common factors 25–26
common factors 25
factorisation by grouping 26
factorisation to simplify calculations 26
factorisation: quadratic expressions 37–38
calculations and word problems 39
coefficients of terms 38
difference of perfect squares 39
factorisation of quadratic expressions 38
finding the product of binomials 38
perfect squares 38–39
factorise 37
factors 2
formulae: substitution, change of subject 31–32
change of subject of more complex formulae 32
change of subject of simple formulae 32
formulae and substitution 31
solving an equation with one variable given 32
using tables to solve formulae 31–32
four-figure tables 35, 36, 50, 51
fractions
basic operations 3
word problems 24, 41, 49
see also equations with fractions
frequency table 52

G
geometrical constructions 27–28
bisect any angle 27–28
bisect a straight line segment 27
construct angles of 30° and 60° 28
construct angles of 90° and 45 28
construction of simple shapes 28
copy any angle 28
geometry and mensuration 7–12
graphs 6–7
direct and inverse proportion 46
graph of an equation 48
and spreadsheets 16–17

H
hypotenuse 10, 35, 50

I
improper fraction 39
inflation 42

Information and Communications Technology (ICT) 14–15
computers 14–18
interest 42–43
irrational numbers 54

L

line segment 27

M

mean, median and mode 52, 53
mensuration and geometry 7–12
mixed number 40
multiplicative inverse 46

N

non-rational numbers 54
see also rational and non-rational numbers
number and numeration 2–3
number bases 4, 21

O

ordered pair 48

P

percentages (spreadsheet) 17
pi (π) 54, 55
pictograms 12, 52
pie charts 12, 17, 52
prime numbers 2
probability 12
product 23
of binomials 37, 38
proportion see direct and inverse proportion

Q

quadratic expressions 37
see also factorisation: quadratic expressions
quadrant 29

R

ratio 44, 46
of corresponding lengths 34
rational and non-rational numbers 54–55
pi (π) 54, 55
square roots 54–55
ready reckoner 46
reciprocal 46
reciprocals of numbers 47
calculations using 47
rounding off numbers 4

S

scale factor 33, 34
scattergram 17
sector 29, 30
segment 9, 27, 29
similarity: area and volume of similar shapes 44–45
areas of similar shapes 44
volumes of similar shapes 44–45
similarity: similar shapes and scale factors 33–34
enlargement and scale factor 34
ratio of corresponding lengths 34
similarity 33
similar plane shapes and solids 34
similar triangles angles and corresponding sides 33–34
simple interest 42
sine and cosine of angles 50–51
applications of sine and cosine 51
sine and cosine 50
solving right-angled triangles 51
using sine and cosine tables 51
solids, common 8
spreadsheets 16–17
square roots 54–55
statistics see everyday statistics
subject (of formula) 31, 32
substitution 31
see also under formulae: substitution, change of subject
subtended by 29
sum
of angles 8, 10
and spreadsheets 17
and word problems 23–24

T

table of values 6, 48
tangent of an angle 35–36
applying tangents to practical problems 36
calculating the tangent of an angle 35
tangent tables 36
using tangent of an angle to calculate adjacent side 36
using tangent of an angle to calculate opposite side 36
trapezium 29
area of 30

V

variables 48
vertical angle 35
volume
of common solids 8
of similar shapes 44–45
volume factor 44

W

word problems 23–24
expressing fractions 24
fractions 24, 41, 49
from numbers to words 24
problems involving equations 24
product 23–24
quadratic expressions 39
sum and difference 23