Excellence in Mathematics

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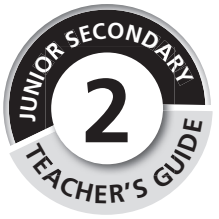

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Introduction

The purpose of the curriculum

The main objectives of the curriculum are to prepare the students to:

- acquire the mathematical literacy necessary to function in an information age
- cultivate the understanding and application of mathematical concepts and skills necessary to thrive in the ever-changing technological world
- develop the essential element of problem-solving, communication, reasoning and connection within the study of mathematics
- take advantage of the numerous career opportunities provided by mathematics
- become prepared for further studies in mathematics and other related fields.

The role of the teacher

One of the principal duties of a Mathematics teacher is to prepare and present good lessons to his or her students. The teacher has to:

- be as well informed as possible on the scheme of work of the subject
- know the aims and objective of each topic
- select appropriate content material
- decide on the best methods of presentation such as group work, worksheets, question-answer sessions, debate, etc.
- keep informed about social and environmental issues and other current news in Nigeria and the rest of the world
- through innovative teaching approaches encourage learning that will promote creativity and critical thinking in students.

To be effective in presentation, the teacher must create a written/typed plan for each lesson. This must include aims, objectives, resources, time frames, content for the lesson, activities, homework, assessment, and ideas/additional worksheets to cater for students requiring extension or learning support (remedial).

Prepare each topic in advance. Many teachers go into the classroom inadequately prepared. It is your responsibility as a Mathematics teacher to involve your students actively in the learning process. It is a proven fact that students learn far more by *doing* than by *listening*.

Mathematics involves being curious and asking questions. Wherever possible, ask questions to engage the students and to encourage independent thought processes and to develop problem-solving skills. Start your lessons by asking the students to write down answers to questions related to your lesson (approximately five). This will settle them into the lesson. You can use different types of questions in your lessons:

- diagnostic, enabling you to determine prior knowledge on the topic
- for consolidation of challenging concepts during the lesson
- for stimulation of interest in the subject
- for concluding the lesson. This will assist you to find out whether students have understood the concepts/terminology in the lesson. It will also highlight any areas that they need to revise at home or for you to revisit in the next lesson.

Teachers must ensure that they do not appear to have favourites in the class, so devise a system to ensure that you ask questions fairly, but be careful not to embarrass weak students if they cannot answer questions.

How to use the scheme of work

A scheme of work is defined as the part of the curriculum that a teacher will be required to teach in any particular subject. Its primary function is to provide an outline of the subject matter and its content, and to indicate how much work a student should cover in any particular class. A scheme of work allows teachers to clarify their thinking about a subject, and to plan and develop particular curriculum experiences that they believe may require more time and attention when preparing lessons. The criteria all teachers should bear in mind when planning a scheme of work are continuity in learning and progression of experience. You can add your own notes to the scheme of work provided on pages viii to xii.

The scheme of work is sequential. The sequence of the scheme of work is aligned with the textbook. Do not be tempted to jump around. Rather spend time carefully planning the term to ensure that you adhere to the scheme of work.

The year is divided into three terms. Each term is divided into 13 weeks. There are 7 topics in Term 1, 4 topics in Term 2 and 6 topics in Term 3. The end of term allows time for revision and an examination. This time frame may vary depending on the planning of your particular school.

Your management of the class will have an enormous influence on your ability to adhere to the time frames. Focus on effective discipline strategies. You will have

less discipline issues if you are: punctual, well prepared, follow a plan (write this on the board at the start of the lesson), keep your word (don't make empty threats) and consistently adhere to rules.

A teacher of Mathematics is a professional instructor who facilitates, promotes and influences students to achieve the outcomes of the scheme of work. It is the wish of the authors that the students will, at the end of each course in the series, attain a level of Mathematics proficiency that will equip them for future studies in this field.

Scheme of work

Term 1

Topic	Lesson objectives Students should be able to:	SB pages	TG pages
1. Whole numbers and decimal numbers	• Express any whole number in standard form • Express decimal numbers in standard form • Find the prime factors of numbers not greater than 200 • Express numbers as products of its prime factors • Find the least common multiples of numbers (LCM) • Find the highest common factor (HCF) of numbers • Identify numbers that are perfect squares • Find squares of any given numbers • Find the square root of perfect squares using the factor method • Solve quantitive reasoning problems related to all of the above	1–17	1–7
2. Fractions	• Convert simple fractions to ratios, decimals and percentages and vice versa • Solve quantitive reasoning problems related to conversion of fractions to ratios, decimals and percentages	18–32	7–12
3. Transactions in the home and office	• Solve problems relating to office and household arithmetic • Solve simple commercial arithmetic relating to profit, interest, discount and commission	33–48	13–19
4. Approximation and estimation	• Approximate numbers to any given degree of accuracy • Solve quantitative reasoning problems related to approximation of numbers	49–54	19–20

Topic	Lesson objectives Students should be able to:	SB pages	TG pages
5. Multiplication and division of directed numbers	• Obtain the squares and square roots of numbers • Interpret and use tables, charts, records and schedules • Carry out correct multiplication and division involving directed number	55–62	21–22
6. Algebraic expressions	• Expand a given algebraic expression • Factorise simple algebraic expressions • Apply the use of quadratic equation box in expanding and factorising algebraic expressions • Solve quantitative reasoning problems • Simplify algebraic expression on fractions with monomial denominators	63–77	23–29
7. Simple equations	• Solve problems on simple equations	78–84	30–33
Term 1 Revision exercises		85–94	34–42

Term 2

Topic	Lesson objectives Students should be able to:	SB pages	TG pages
1. Solve word problems using algebraic fractions	• Interpret and solve word problems involving algebraic fractions	95–98	43–45
2. Linear inequalities	• Identify linear inequality in one variable • Solve linear inequality in one variable • Represent solutions of linear inequalities in one variable on number lines • Solve word problems involving linear inequalities in one variable	99–106	46–49
3. Graphs	• Identify *x*-axis and *y*-axis • Plot points on the Cartesian plane • Prepare table of values • Plot the graph of linear equations in two variables • Interpret the plotted graph	107–117	49–56
4. Plane figures and shapes	• State the properties of parallelogram, rhombus and kite • Identify these shapes in their environment • Draw plane objects to scale • Convert actual length to scales and vice versa • Apply scale drawing to solve measurement problems • Solve quantitative aptitude problems related to plane shapes or figures and scale drawing	118–140	57–70
Term 2 Revision exercises		142–152	71–81

Term 3

Topic	Lesson objectives Students should be able to:	SB pages	TG pages
1. Real-life applications of linear graphs	• Plot linear graphs from real-life situations • Solve quantitative aptitude problems	153–163	82–86
2. Angles and polygons	• Find the sum of angles of triangles • Find sum of angles in a quadrilateral • Find the sum of the interior angles of a polygon • Distinguish between angles of elevation and angles of depression • Use angles of elevation and depression in calculating distances and heights using scale drawings • Identify the relationship between angles of elevation and depression • Solve quantitative aptitude problems related to angles	164–190	87–93
3. Bearing	• Identify the cardinal points • Locate the position of objects • Find distances between objects using scale drawing	191–199	94–99
4. Constructions	• Construct triangles given: – 2 sides and one included angle – 2 angles and a side between them – All 3 sides • Bisect any given angles	200–205	100–102

Topic	Lesson objectives Students should be able to:	SB pages	TG pages
5. Data presentation	• Present data in an ordered form • Construct frequency tables from any given data • Draw pie charts • Read information from pie chart • Generate and use data for statistical purposes • Interpret and use tables, charts, records and schedules	206–227	103–109
6. Probability	• Discuss the occurrence of chance events in everyday life • Determine the probability of certain events • Apply the occurrence of chance events and probabilities in everyday life	228–234	110–111
Term 3 Revision exercises		236–252	112–119

Numbers and numeration

Topic 1: Whole numbers and decimal numbers

Introduction

Topic 1 starts by looking at index notation and the laws of indices. Each law is presented through examples that first deal with numbers and then with variables. Standard form follows this section and it deals with whole numbers and decimal numbers.

The topic then goes on to factors, multiples and prime numbers. The highest common factor (HCF) and lowest common multiple (LCM) are covered along with determining them through prime factorisation. The topic ends with squares and square roots of whole numbers and fractions.

Common difficulties

Often the laws of indices are a difficult concept to grasp. Students make mistakes such as:

$a^m + a^n = a^{(m+n)}$

Remind them that this law only applies to multiplication. Present them with various examples of mistakes and do a few "spot the error" questions.

Students can often get confused with when to apply the different laws. Make sure that they understand the foundational concepts well before presenting them with many mixed examples.

When it comes to standard form, it can be challenging for students to know when to move the decimal point to the left or right. Ensure they understand when a number gets bigger and when it gets smaller.

Preparation

Prepare a chart containing a summary of all the laws of indices. A visual aid showing how to convert to standard form will also

be useful. An enlarged grid showing the prime numbers from 1 to 100 is suggested.

Ask students to write down the multiplication of a number such as 5 times itself 7 times. Explain that this can be written in shorthand by using index form. Explain the base, the index or exponent, and the power. Go on to explain with the help of the examples, each rule for exponents.

Standard form can be introduced by showing students a large number and asking them to think of an easier way to write these numbers. Do the same with decimal numbers.

Introduce factors, multiples and prime numbers by asking learners to write down the factors and multiples of a number between 1 and 10. They have learnt this in previous years, so this will be revision. As an introduction to prime numbers they can complete the Sieve of Eratosthenes.

Answers to exercises

Exercise 1

(SB page 2)

1. a) $9^5 \times 9^7 = 9^{5+7} = 9^{12}$ **b)** $8^6 \times 8^{10} = 8^{6+10} = 8^{16}$
c) $2^8 \times 2^{10} = 2^{8+10} = 2^{18}$

2. a) $v^7 \times v^8 = v^{7+8} = v^{15}$ **b)** $p^3 \times p^5 = p^{3+5} = p^8$
c) $q^6 \times q^{11} = q^{6+11} = q^{17}$

3. a) $\frac{x^{12}}{x^8} = \frac{x^8 \times x^4}{x^8} = x^4$ **b)** $\frac{v^7 \times v^9}{v^6} = \frac{v^7 \times v^6 \times v^3}{v^{10}} = v^{10}$

c) $\frac{v^{12}}{v^{17}} = \frac{v^{12}}{v^{12} \times v^5} = \frac{1}{v^5}$

Exercise 2

(SB page 4)

1. $3^{20} \div 3^7 = 3^{20-7} = 3^{13}$
2. $5^{17} \div 5^{14} = 5^{17-14} = 5^3$
3. $8^{40} \div 8^{27} = 8^{40-27} = 8^{13}$
4. $u^{16} \div u^{13} = u^{16-13} = u^3$
5. $r^{21} \div r^{19} = r^{21-19} = r^2$

Exercise 3

(SB page 5)

1. a) 1 **b)** 1 **c)** 1 **d)** 1 **e)** 1
2. a) 3^{-10} **b)** 5^{-4} **c)** $1\,000^{-1}$ **d)** 6^{-4} **e)** 34^{-3}
3. a) $\frac{1}{3^7}$ **b)** $\frac{1}{7^4}$ **c)** $\frac{1}{11^4}$

4. a) $\frac{y^7}{y^9}$

$= y^{7-9}$

$= y^2$

$= \frac{1}{y^2}$

b) $\frac{x^5y^7}{x^7y^{12}}$

$= \frac{x^{5-7}}{y^{7-12}}$

$= x^{-2}y^{-5}$

$= \frac{1}{x^2y^5}$

Exercise 4

(SB page 6)

1. $(5^3)^7 = 5^{3\times 7} = 5^{21}$

2. $(8^6)^5 = 8^{6\times 5} = 8^{30}$

3. $(2^{-3})^{-6} = 2^{-3\times -6} = 2^{18}$

4. $(2^{-8})^{-\frac{1}{2}} = 2^{-8\times -\frac{1}{2}}$

5. $(7^3)^{-2}$

$= 7^{3\times -2}$

$= 7^{-6}$

$= \frac{1}{7^6}$

Exercise 5

(SB page 7)

1.

a)	9.2×10^4	67 000	6×10^3	0.076	4×10^{-3}
b)	203	47.6	3.1×10^1	2×10^{-1}	0.09
c)	2×10^7	4×10^5	45 000	5.7×10^{-6}	9×10^{-8}
d)	0.9	3×10^{-2}	6.4×10^{-3}	0.004	8×10^{-4}
e)	0.5	0.09	5.4×10^{-2}	5×10^{-3}	8×10^{-4}

2.

a)	140	**b)**	2 000	**c)**	63
d)	452	**e)**	70 000	**f)**	56 000
g)	45 600	**h)**	83	**i)**	3.5
j)	4 760 000	**k)**	200 000	**l)**	7 020

3.

a)	2.35×10^1	**b)**	9.34×10^4	**c)**	2.07×10^2
d)	7.21×10^6	**e)**	1.32×10^0	**f)**	9.3×10^8
g)	4.6×10^4	**h)**	9.7×10^9	**i)**	6.6×10^1
j)	5×10^5	**k)**	1.702×10^5	**l)**	4.32×10^1

4.

a)	0.2	**b)**	0.000041	**c)**	5.63
d)	0.00031	**e)**	0.06	**f)**	0.0018
g)	0.0000043	**h)**	0.67	**i)**	0.00004071
j)	0.00878	**k)**	0.38	**l)**	1.67

5.

a)	4×10^{-1}	**b)**	2.3×10^{-3}	**c)**	4.5×10^{-2}
d)	9×10^{-1}	**e)**	8.3×10^{-1}	**f)**	6×10^{-3}
g)	5.6×10^{-3}	**h)**	3.12×10^{-2}	**i)**	2.04×10^{-4}
j)	8.1×10^{-4}	**k)**	$3\ 0.3 \times 10^{-1}$	**l)**	4×10^{-5}

6. 4.63×10^4 people at the football match

7. 0.0000305 seconds

8. 3 675000 km/h

Exercise 6

(SB page 9)

1. **a)** 1, 2, 5, 10
b) 1, 2, 3, 6, 9, 18
c) 1, 37
d) 1, 2, 4, 13, 26, 52
e) 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120

2. Student's own work.

3. 3, 5, 7, 11, 13, 17, 19

4. **a)** 12 is composite because it has more than two factors.
b) 19 is prime because it has only 1 and itself as factors.
c) 81 is composite because it has more than two factors.

5. **a)** 1, 2, 4, 12
b) 12, 24, 48, 84, 96
c) 2, 3, 7, 19
d) 2

Exercise 7

(SB page 10)

1. **a)** $2 \times 2 \times 3 = 2^2 \times 3$
b) $2 \times 3 \times 3 \times 5 = 2 \times 3^2 \times 5$
c) $3 \times 5 \times 5 \times 7 = 3 \times 5^2 \times 7$
d) $5 \times 5 \times 7 \times 7 \times 13 \times 13 = 5^2 \times 7^2 \times 13^2$

2.

2	120
2	60
2	30
3	15
5	5
	1

$\therefore 120 = 2 \times 2 \times 2 \times 3 \times 5$
$= 2^3 \times 3 \times 5$

3. **a)** $50 = 2 \times 5^2$
b) $225 = 3^2 \times 5^2$
c) $216 = 2^3 \times 3^3$
d) $486 = 2 \times 3^5$
e) $965 = 5 \times 193$

Exercise 8

(SB page 12)

1. a) HCF is $2 \times 2 \times 3 = 12$

b) HCF is $2 \times 3 \times 3 \times 7 = 126$

c) HCF is 5

d) HCF is $2^3 \times 5 \times 7 = 280$

e) HCF is $2^2 \times 3^2 = 36$

2. a) $75 = 3 \times 5^2$
$90 = 2 \times 3^2 \times 5$
$\therefore$ HCF $= 3 \times 5 = 15$

b) $84 = 2^2 \times 3 \times 7$
$92 = 2^2 \times 2^3$
$\therefore$ HCF $= 2^2 = 4$

c) $216 = 2^3 \times 3^3$
$360 = 2^3 \times 3^2 \times 5$
$\therefore$ HCF $= 2^3 \times 3^2 = 72$

d) $288 = 2^5 \times 3^2$
$360 = 2^3 \times 3^2 \times 5$
$\therefore$ HCF $= 2^3 \times 3^2 = 72$

Exercise 9

(SB page 13)

1. 625 cm^2; 374 tiles

2. 120 m; 2 tiles

3. 12 children

4. 6 m × 6 m × 6 m; 12 285 boxes

5. 11 cm × 11 cm × 11 cm; 24 cubes of sugar

6. $308 = 22 \times 7 \times 11$
$228 = 22 \times 3 \times 19$
HCF = 4. This is the length of each square plot.
One square plot $= 4 \times 4 = 16$
Total area of field $= 308 \times 228 = 70\ 224\ m^2$
Number of plots to be marked out $= \frac{70\ 244}{16}$
$= 4\ 389$

7. $15 = 3 \times 5$ $\quad 9 = 3^2$ $\quad 18 = 2 \times 3^2$
HCF = 3
She can put three pieces of fruit in each basket and have five baskets of oranges, three baskets of peaches, six baskets of pears.

Exercise 10

(SB page 14)

1. **a)** 4, 8, 12, 16, 20, 24
b) 8, 16, 24, 32, 40, 48
c) 9, 18, 27, 36, 45, 54
d) 15, 30, 45, 60, 75, 90
e) 20, 40, 60, 80, 100

2. **a)** LCM is $2^3 \times 3^3 \times 5 \times 7 = 7\,560$
b) LCM is $2^2 \times 3^3 \times 5 = 540$
c) LCM is $2^3 \times 3^3 \times 5 \times 7 = 7\,560$
d) LCM is $2^4 \times 3^3 \times 5^2 \times 7^2 = 529\,200$
e) LCM is $2^2 \times 3^2 \times 5^2 = 900$

3. **a)** $12 = 2^2 \times 3$
$18 = 2 \times 3^2$
$\text{LCM} = 2^2 \times 3^2 = 36$

b) $6 = 2 \times 3$
$16 = 24$
$\text{LCM} = 2^4 \times 3 = 48$

c) $30 = 2 \times 3 \times 5$
$128 = 2^7$
$\text{LCM} = 2^7 \times 3 \times 5$
$= 1\,920$

d) $15 = 3 \times 5$
$30 = 2 \times 3 \times 5$
$45 = 3^2 \times 5$
$\text{LCM} = 2 \times 3^2 \times 5 = 90$

e) $32 = 2^5$
$40 = 2^3 \times 5$
$48 = 2^4 \times 3$
$\text{LCM} = 2^5 \times 3 \times 5 = 480$

4. Find the LCM of 6, 7 and 14.
$6 = 2 \times 3$
$7 = 7 \times 1$
$14 = 2 \times 7$
$\text{LCM} = 2 \times 3 \times 7 = 42$ trees

5. Find the LCM of 18, 27 and 36.
$18 = 2 \times 3^2$
$27 = 3^3$
$36 = 2^2 \times 3^2$
$\text{LCM} = 2^2 \times 3^3$
After 108 s, the drums will beat together.

6. Find the LCM of 6 and 10.
$6 = 2 \times 3$
$10 = 2 \times 5$
$\text{LCM} = 2 \times 3 \times 5$
$= 30$
There can be 30 band members.

Exercise 11

(SB page 16)

1. $\sqrt{81} = \sqrt{3^2} = 3$

2. $\sqrt{196} = \sqrt{(2^2 \times 7^2)} = 14$

3. $\sqrt{676} = \sqrt{(2^2 \times 13^2)} = 26$

4. $\sqrt{484} = \sqrt{(2^2 \times 11^2)} = 22$

5. $\sqrt{841} = \sqrt{29^2} = 29$

6. $\sqrt{289} = \sqrt{17^2} = 17$

7. $\sqrt{729} = \sqrt{3^6} = 27$

8. $\sqrt{400} = \sqrt{(2^4 \times 5^2)} = 20$

Exercise 12

(SB page 16)

1. $\frac{5}{14}$ **2.** $\frac{9}{7}$ **3.** $\frac{11}{9}$ **4.** $\sqrt{\frac{1}{64}} = \frac{1}{8}$

5. $\sqrt{\frac{64}{9}} = \frac{8}{3}$ **6.** $\sqrt{81} = 9$ **7.** $\sqrt{\frac{25}{9}} = \frac{5}{3}$ **8.** $\sqrt{\frac{25}{26}} = \frac{5}{4}$

Exercise 13

(SB page 17)

1. **a)** 25, 29, 33 **b)** 49, 54, 60 **c)** 24, 21, 18
d) 14, 6, 2 **e)** 73, 82, 91

2. **a)** 51, 46 **b)** 37, 43 **c)** 63, 45
d) 120, 96, 84 **e)** 42, 32, 22

3. **a)** –6, –12, –18 **b)** 5, 0, –5 **c)** –20, –10, 0
d) 4, 2, 0 **e)** 32, 64, 108 **f)** 33, 55, 129
g) –32, 64, 108 **h)** 15, 21, 28

4. **a)** 25. Square each term
b) 15. Add on more than the previous term
c) 42. Add the previous two terms together
d) 65. Add double the difference between the previous two terms
e) 0. The pattern is 3^5, 3^4, 3^3 and so on.

Topic 2: Fractions

Introduction

Revision of types of fractions is dealt with first in Topic 2. This includes converting between improper and mixed fractions. Next it looks at fractions and decimals and converting between the two. It then goes on to cover converting between fractions, decimals and percentages. Ratio, proportions and rate are also covered in this topic.

Common difficulties

Often students find it challenging to work with fractions. Concentrate on teaching concepts, instead of memorising rules of how operations on fractions should be performed. Use visual as much as possible to help students grasp the concepts.

The relationship between a fraction, decimal and percentage is often unclear. Explain that these can only be compared if they are in the same form. Make sure they understand that one hundred per cent is a whole.

Ratio as a fraction is sometimes difficult for students to understand. Help students to understand that a ratio is the comparison between two quantities using division.

Preparation

Some of the diagrams in the Student's Book can be used for graphics. Concrete objects such as blocks or apples to be cut in fractions can also be used. Charts showing the different methods of conversion can also be made. Since ratios are also fractions, make a chart that shows this relationship.

Explain to students why fractions occur in real life and that they are expressed as part of a whole. Explain the concepts of the numerator and the denominator.

When converting between fractions, percentages and decimals, explain that mathematical operations are easier to perform when percentages are converted to fractions. Explain percentages and use some examples from everyday life.

Use real-life examples to introduce ratio. Define ratio and explain that a ratio is the same as a fraction so we can reduce them the same way we would a fraction. Explain that proportion is a statement of equality between two ratios.

Answers to exercises

Exercise 1

(SB page 18)

Proper fractions: $\frac{5}{12}$, 12, $\frac{999}{1\,000}$

Improper fractions: $\frac{11}{7}$, $2\frac{7}{8}$

Exercise 2

(SB page 19)

1. **a)** $\frac{11}{9}$ **b)** $\frac{5}{2}$ **c)** $\frac{27}{8}$ **d)** $\frac{18}{5}$ **e)** $\frac{76}{11}$

f) $\frac{229}{15}$ **g)** $\frac{1\,007}{10}$ **h)** $\frac{19}{5}$ **i)** $\frac{47}{7}$

2. **a)** $1\frac{4}{11}$ **b)** $4\frac{2}{3}$ **c)** $1\frac{1}{3}$ **d)** $1\frac{6}{7}$ **e)** $4\frac{1}{5}$

f) $71\frac{4}{7}$ **g)** $30\frac{10}{33}$ **h)** $2\frac{5}{6}$ **i)** $5\frac{5}{9}$ **j)** $3\frac{3}{8}$

Exercise 3

(SB page 20)

1. **a)** $\frac{3}{4}$ **b)** $\frac{3}{5}$ **c)** $\frac{3}{4}$ **d)** $\frac{24}{28} = \frac{6}{7}$

e) $\frac{9}{12}$ and $\frac{15}{20}$ are the same as $\frac{3}{4}$

2. **a)** $\frac{1}{5}$ **b)** $\frac{5}{9}$

3. **a)** $\frac{1}{2}, \frac{5}{8}, \frac{3}{4}$ **b)** $\frac{5}{8}, \frac{5}{6}, \frac{4}{3}$

4. $\frac{1}{3}$

Exercise 4

(SB page 21)

1. 0.07 **2.** 0.18 **3.** 0.051 **4.** 1.5

Exercise 5

(SB page 22)

1. 0.6 **2.** 0.25 **3.** 0.64

4. $1\frac{1}{5} = 1.2$ **5.** $\frac{136}{250} = 0.544$ **6.** $\frac{28}{500} = 0.056$

Exercise 6

(SB page 22)

1. **a)** 0.52 = 0 units, 5 tenths and 2 hundredths

b) 4.07 = 4 units, 0 tenths and 7 hundredths

c) Thirty-eight hundredths = 0.38

d) 11.42 = eleven and forty two hundredths

2. **a)** 0.375 **b)** 0.52 **c)** 0.9375

d) 1.4 **e)** 1.25

3. **a)** $\frac{3}{100}$ **b)** $\frac{11}{25}$

c) $\frac{21}{200}$ **d)** $2\frac{1}{40}$

e) $\frac{1\,523}{10\,000}$

Exercise 7

(SB page 24)

1.

Fraction	$\frac{50}{100}$	$\frac{33}{100}$	$\frac{87}{100}$	$\frac{36}{100}$	$\frac{67}{100}$	$\frac{3}{4}$	$\frac{8}{100}$	$\frac{19}{100}$	$\frac{3}{1}$	$1\frac{1}{2}$
Decimal	0.50	0.33	0.87	0.36	0.67	0.75	0.08	0.19	3.0	1.5
Per cent	50%	33%	87%	36%	67%	75%	8%	19%	300%	150%

2. **a)** 40% **b)** 19%
c) 34% **d)** 2%
e) 32% **f)** 65%
g) 200% **h)** 114%
i) 55% **j)** 125%

3. **a)** 25% **b)** 83.1%
c) 17% **d)** 4%
e) 87.5% **f)** 49%
g) 57% **h)** 9%
i) 67% **j)** 11%

4. **a)** $\frac{1}{10}$ **b)** $\frac{4}{25}$
c) $\frac{1}{4}$ **d)** $\frac{14}{25}$
e) $\frac{33}{100}$ **f)** $\frac{1}{3}$
g) $\frac{3}{400}$ **h)** $1\frac{9}{10}$
i) $\frac{1}{9}$ **j)** $\frac{2}{3}$

5. **a)** 0.8 **b)** 0.34
c) 0.19 **d)** 0.13
e) 0.71 **f)** 0.005
g) 0.01 **h)** 0.43
i) 0.007 **j)** 0.64

6. **a)** 100 **b)** $\frac{100}{100}$
c) 1.00
d) **i)** yes **ii)** yes
iii) yes
e) 100% **f)** 100%

Exercise 8

(SB page25)

1. $\frac{3}{4}$, 70%, 30.76 **2.** 0.87, 85%, $\frac{5}{6}$

3. 25%, 0.23, $\frac{1}{5}$ **4.** 0.35, $\frac{7}{20}$, 12%

5. $\frac{2}{5}$, 0.375, 37%

Exercise 9

(SB page 26)

1. **a)** 1 050 **b)** 2 320

2. ₦48 000

3. **a)** 62.5% **b)** 37.5%

4. **a)** 93.75% **b)** 250 (6.25%)

5. 15%

6. **a)** ₦50 000 **b)** 40% **c)** 20%

7. **a)** 27 **b)** 9

Exercise 10

(SB page 29)

1. 1 : 2

2. 4 : 1

3. 5 : 9

4. 45 : 120
3 : 8

5. **a)** 2 : 5 **b)** 1 : 6 **c)** 3 : 5
d) 1 : 8 **e)** 7 : 1 000

6. 10 : 8
5 : 4
∴ 67 : 33 oranges

7. 12 : 9 : 21

Exercise 11

(SB page 29)

1. **a)** 2 cm : 5 cm **b)** 15 g : 8 g
c) 1 m : 6 m **d)** 11% : 17%
e) 7 : 8 **f)** 2 : 3

2. **a)** 4 : 5 **b)** 6 : 4 = 3 : 2
c) 6 : 5 **d)** 5 : 4
e) 4 : 6 : 5

f) $\frac{4}{9} : \frac{5}{9}$

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

$\frac{6}{11} : \frac{5}{11}$

$\frac{5}{9} : \frac{4}{9}$

$\frac{4}{15} : \frac{3}{5} : \frac{1}{3}$

3. **a)** **i)** 1 : 2 **ii)** 4 : 1
iii) 1 : 8

b) **i)** 0.33 : 0.67 **ii)** 0.8 : 0.2
iii) 0.11 : 0.89

4. **a)** **i)** 8 : 7 **ii)** 7 : 15

b) **i)** boys: 53.3% **ii)** girls: 46.67%

5. **a)** Akiakeme: ₦28 000
Edidiong: ₦24 000

b) **i)** $\frac{7}{13}$, $\frac{6}{13}$ **ii)** 0.54, 0.46
iii) 54%, 46%

6. Blue: 10; green: 10; yellow: 15

7. **a)** **i)** 3 : 4 **ii)** 3 : 1 : 4

b) ₦150 000 **c)** 20%

d) ₦30 000

8. **a)** 2 : 1
b) 2 377

Exercise 12

(SB page 32)

1. 3.5 bags of fertiliser

2. 12 bags of cement

3. 3 kg of flour, $10\frac{1}{2}$ eggs

Exercise 13

(SB page 32)

1. **a)** ₦120/hour
b) ₦1 440

2. ₦960

3. **a)** 5 hours
b) 1.67 hours

4. ₦12 500

5. 70 litre

6. Student's own work.

Topic 3: Transactions in the home and office

Introduction

Topic 3 starts off with a unit on household arithmetic. The focus of Unit 1 is on financial documents, tariffs, income and expenditure, budgets and interest. Financial documents include statements from household accounts and school fees whilst a cell phone account is used as an example of a tariff system. Personal income and expenditure is explained before household budgets are dealt with. The exercise that follows provides the student with various examples and contexts to explore these concepts. The final part of the unit looks at simple interest and how it applies to hire purchase. The following unit is on commercial arithmetic and begins with profit and loss followed by cost price and selling price and discounts.

Common difficulties

Sometimes it might be difficult for students to understand the context of financial calculations as it is not part of their everyday experience. Encourage students to talk to their parents about it so that they can explain how household finances and budgets are done in their homes. Setting a project or investigation where students have to complete a budget, work with income and expenditure and tariffs will also be beneficial. Similarly a project that explores the operations of a small business can provide students with practical context of performing the calculations.

Preparation

Prepare various statements, tariff accounts, budgets and examples from newspapers of hire purchase advertisements, discounted items on sale and so on.

Introduce household arithmetic by asking students about their household expenses and income. Explain that all households

need to work on a budget in order to make sure there is enough money to cover expenses. Ask students to name a few household expenses. Introduce commercial arithmetic by asking students how businesses operate and make profit. Work through the examples in the Student's Book as an introduction to the calculations.

Answers to exercises

Exercise 1

(SB page 37)

1.

Fixed expenses	Variable expenses
Rent	Food
Gym fees	Water
Car repayment	Telephone
Household insurance	Chemist
	Car repairs
	Clothes
	Electricity
	Petrol
	Bus

2. **a)** Variable income

b) Friday: 4 hours × 3 500 = ₦14 000
Saturday: 6 hours × (3 500 × 1.5) = ₦31 500
Sunday: 5 hours × (3 500 × 2) = ₦35 000
Total: 14 000 + 31 500 + 35 000
= ₦80 500

c) Saturday wage = 31 500
$\frac{31\,500}{3\,500}$ = 9 hours extra

3. **a)** Total income = 15 000 + 3 500 + 1 500
= ₦20 000

b) Clothes: 15% × 20 000 = ₦3 000
Entertainment: 40% × 200 000 = ₦8 000
Transport: 10% × 20 000 = ₦2 000
Food: 15% × 20 000 = ₦3 000
Unforeseen cost: 10% × 20 000 = ₦2 000

4. **a)** Monthly saving = 9% × 479 000
= ₦43 110

b) Total expenditure = ₦365 210

c) Holiday savings = 479 000 – 365 210
= ₦113 790 a month
Over six months: 113 790 × 6 = ₦682 740

5. Commission: = 38% × 1 500 = ₦570

6. **a)** Insurance = 3 880 × 12 = ₦46 560
b) Four tyres = 11 800 × 4 = ₦47 200
c) Car maintenance
= 3 740 + 47 200 + 7 260 + 46 560 + 2 910 + 5 335
= ₦113 005
d) Cost/km = $\frac{113\,005}{10\,265}$ = ₦11/km

7. **a)** 28 kl used in September
b) ₦1 634.14 in December
c) November (₦1 099.2)
d) **i)** 25.10 – 5.6 = 19.5 kl **ii)** 19 × 73.28 = ₦1 392.32
iii) $\frac{881.19}{73.28}$ = 12.02 kl
iv) 12.02 + 5.6 =17.62 kl
e) $\frac{28 - 22}{22}$ × 100 = 27.27% increase
f) Total (Jan–Aug) = ₦10 327.70

8. **a)** Variable expenses. It will change depending on how many calls are made.
b) Call 1 (off peak) = 12.5 × 4 = ₦50
Call 2 (off peak) = 20 × 3 = ₦60
Call 3 (Peak) = 2 × 25 = ₦50
Sms (Peak) = ₦12
Call 4 (Peak) = 1 × 25 = ₦25
Call 5 (Peak) = 3 × 40 = ₦120
Total = ₦317

Exercise 2

(SB page 41)

1. SI = $\frac{PRT}{100}$
= $\frac{65\,000 \times 11.5 \times 4.5}{100}$
= ₦7 475.05

2. SI = $\frac{PRT}{100}$
= $\frac{10\,000 \times 12 \times 3}{100}$
= ₦3 600
Final amount = 1 000 + 3 600
= ₦13 600

3. $SI = \frac{PRT}{100}$

$= \frac{60\,000 \times 7.5 \times 2}{100}$

$= ₦9\,000$

Total amount = 60 000 + 9 000

$= ₦69\,000$

4. a) $SI = \frac{PRT}{100}$

$= \frac{80\,000 \times 8 \times 1}{100}$

$= ₦6\,400$

Total = 80 000 + 6 400

$= ₦86\,400$

b) $SI = \frac{PRT}{100}$

$= \frac{50\,000 \times 12.5 \times 6}{100}$

$= ₦412\,500$

Total amount

= 550 000 + 412 500

$= ₦962\,500$

5. $SI = \frac{PRT}{100}$

$= \frac{16\,000 \times 9 \times 3}{100}$ (36 months = 3 years)

$= ₦4\,320$

Total = 16 000 + 4 320

$= ₦20\,320$

Exercise 3

(SB page 42)

1. Deposit = $75\,000 \times \frac{10}{100}$

$= ₦7\,500$

Balance = ₦67 500

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

$= \frac{67\,500 \times 15 \times 3}{100}$

$= ₦30\,375$

Monthly repayments = $\frac{67\,500 + 30\,375}{36 \text{ months}}$

$= ₦2\,718.75$ per month

2. a) Deposit = $37\,000 \times \frac{15}{100}$

$= ₦5\,550$

Balance = 37 000 – 5 550

$= ₦31\,450$

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

$= \frac{31\,450 \times 16 \times 2}{100}$

$= ₦10\,064$

b) Total = 31 450 + 5 550 + 10 064
= ₦47 064

c) Monthly instalments = $\frac{47\,064}{24}$
= ₦1 961 per month

3. a) Deposit = 220 000 × $\frac{12}{100}$
= ₦26 400

b) Balance = 220 000 – 26 400
= ₦193 600

c) SI = $\frac{PRT}{100}$

= $\frac{193\,600 \times 11 \times 3}{100}$

= ₦63 888

d) $\frac{193\,600 + 63\,888}{36}$
= ₦7 152.44 per month

e) Total payment: 193 600 + 63 888 + 26 400
= ₦283 888

Exercise 4

(SB page 44)

1. a) loss = 10 000 – 9 000
= ₦1 000

b) % loss = $\frac{1\,000}{1\,000} \times 100$
= 10%

2.

Item	Workbook	TV set	Dress	Car
Cost price in ₦	1 500	100 000	28 000	1 200 000
Sale price in ₦	1 750	140 000	24 500	1 105 000
Profit or loss in ₦	250	40 000	–3 500	95 000
Percentage profit or loss	$16\frac{2}{3}$	40	₦$12\frac{1}{2}$	$7\frac{11}{12}$

3. Loss = 4 000 – 2 500 = 15 000

% loss = $\frac{1\,500}{400} \times 100 = 37.5\%$

4. Amount increase = 200 × $\frac{20}{100}$ = ₦40

New price = 200 + 40 = ₦240

5. Loss = 2 000 000 – 175 000
= ₦250 000

% loss = $\frac{250\,000}{2\,000\,000} \times 100 = 12.5\%$

Exercise 5

(SB page 46)

1. **i)** **a)** ₦1 000 **b)** ₦5 000
ii) **a)** ₦135 **b)** ₦1 035
iii) **a)** ₦15 **b)** ₦360
iv) **a)** ₦750 000 **b)** ₦6 750 000

2. **i)** **a)** ₦450 **b)** 16.1%
ii) **a)** –₦70 **b)** 16.67% (loss)
iii) **a)** –₦720 000 **b)** 10% (loss)
iv) **a)** ₦36 000 **b)** 37.5%

3. Loss = 40 000 – 33 000 = ₦7 000

$$\% \text{ loss} = \frac{7\,000}{40\,000} \times 100$$

$$= 17.5\%$$

4. Cost = 18 000 + 6 000 = ₦24 000
Profit = 30 000 – 24 000 = ₦6 000

$$\% \text{ profit} = \frac{6\,000}{24\,000} \times 100$$

$$= 25\%$$

5. Cost price $= \frac{\frac{100\,000}{(100-13)}}{100}$

= ₦114 942.53

6. Cost price $= \frac{51\,000}{\frac{170}{100}}$

= ₦30 000

Exercise 6

(SB page 47)

1.

	Amount	Selling price
Soccer ball	$2\,000 \times \frac{40}{100}$ = ₦800	2 000 – 800 = ₦1 200
Cheeseburger	$1\,700 \times \frac{9.75}{100}$ = ₦165.75	1 700 – 165.75 = ₦1 534.25
Skateboard	$6\,800 \times \frac{11.5}{100}$ = ₦782	6 800 – 782 = ₦6 018
Jacket	$39\,850 \times \frac{6.25}{100}$ = ₦2 490.63	39 850 – 2 490.63 = ₦37 359.38

2. Discount $= 1\,900 \times \frac{5}{10}$

= ₦95

3. Discount $= 3\,700 \times \frac{15}{100}$

= ₦555

Selling price = 3 700 – 555

= ₦3 145

4. Discount = $2\,935 \times \frac{33}{100}$
= ₦968.55
Selling price = 2 935 – 968.55
= ₦1 966.45

5. Discount = 223 – 215 = ₦8
% discount = $\frac{8}{233} \times 100$
= 3.59%

Exercise 7

(SB page 48)

1. ₦240 000 **2.** 40% **3.** ₦18 750
4. ₦378 497 **5.** ₦2 664.90

Topic 4: Approximation and estimation

Introduction

This short topic deals with approximation and estimation. Rounding off, significant figures and degree of accuracy are discussed. Examples and exercises are focussed on giving students ample time to practise the concepts.

Common difficulties

Make sure students understand the basic principles of rounding as this will assist them in performing the calculations.

Preparation

Charts of the rules for rounding up and down and explanations of terms will be useful as visual aids.

Provide students with a scenario where big or small numbers need to be approximated. The examples on page 50 of the Student's Book will work well. Discuss how the approximations can be performed before going on to the actual calculations.

Answers to exercises

Exercise 1

(SB page 51)

1. **a)** 18 **b)** 91 **c)** 31 **d)** 0
e) 1 **f)** 4 **g)** 103 **h)** 286
i) 21 **j)** 312

2. **a)** 20 **b)** 40 **c)** 130 **d)** 380
e) 480 **f)** 450 **g)** 1 590 **h)** 2 600
i) 1 040 **j)** 8 080

3. **a)** 1 **b)** 21 **c)** 12 **d)** 189
e) 299 **f)** 390 **g)** 3 **h)** 130
i) 241 **j)** 546

4. **a)** 1 000 **b)** 6 000 **c)** 2 600 **d)** 0
e) 100 **f)** 900 **g)** 1 000 **h)** 9 000
i) 900 **j)** 1 900

5. **a)** 2 000 **b)** 2 000 **c)** 2 000 **d)** 1 000
e) 6 000 **f)** 29 000 **g)** 31 000 **h)** 21 000
i) 55 000 **j)** 70 000

Exercise 2

(SB page 52)

1. **a)** **i)** 5 000 **ii)** 20.0
iii) 0.4 **iv)** 0.07
v) 0.009

b) **i)** 200.0 **ii)** 95.00
iii) 370.00 **iv)** 0.070
v) 0.0490

c) **i)** 28.700 **ii)** 37.1
iii) 12.1 **iv)** 0.0476
v) 0.00941

2. **a)** **i)** 4 631.0 **ii)** 6.5
iii) 0.3 **iv)** 0.1
v) 0.0

b) **i)** 56.38 **ii)** 66.52
iii) 0.75 **iv)** 0.01
v) 0.0

c) **i)** 0.007 **ii)** 0.070
iii) 0.438 **iv)** 66.518
v) 74.167

3. **a)** 1 200 **b)** 3 000
c) 400 **d)** 1 400
e) Between 10 and 12.5 **f)** Between 20 and 22.5
g) 0.16 **h)** 42.85

4. **a)** 70.56 **b)** 19.53
c) 2.4 **d)** 0.31
e) 210.21 **f)** 129.9
g) 62.52

Topic 5: Multiplication and division of directed numbers

Introduction

In Topic 1 square roots were found by using prime factorisation. Here it is shown how to obtain square roots by using a table. The topic then goes on to operations with directed numbers. Students are already familiar with directed numbers. Here addition and subtraction of directed numbers are first covered followed by multiplication and division. Addition and subtraction of directed numbers are shown on a number line to explain moving left and right when adding and subtracting. In multiplication and division of directed numbers emphasis is placed on knowing the rules of how signs change when multiplied or divided.

Common difficulties

Often students can confuse a negative sign with the subtraction operation, for example –2 is mistaken for – instead of signifying a directed number. It is important for students to grasp movement up and down the number line when adding and subtracting. This forms the basis of operations with integers. Also make sure that students understand that when moving further to the left the number is getting smaller even though the value after the negative sign becomes bigger. Explain that it signifies movement further and further to the left. It will also help if students are familiar with the rules for multiplying and dividing integers in order to work correctly with the signs. Provide enough practise for students to master the calculations.

Preparation

Have number lines to display on the board and also for use by students. Have a chart with the rules for multiplying and dividing integers.

Introduction for students

Draw a number line, beginning at zero. Then mark off equally spaced points in the opposite direction. Ask students to explain what integers are. State that 0 is the origin and numbers to the right are positive integers and numbers to the left are negative

integers. Explain that numbers increase to the right and decrease the left.

Answers to exercises

Exercise 1 (SB page 55)

1. 1.84 **2.** 6 687 **3.** 5 916 **4.** 9.445
5. 7.072 **6.** 9.11 **7.** 2.649 **8.** 3.042

Exercise 2 (SB page 56)

1. Point A is $^{-}7$ units from D.
2. The point 0 is $^{+}6$ units from B
3. The point C is $^{-}6$ units from E
4. The point O is $^{-}2$ units from A
5. The point E is 0 units from E

Exercise 3 (SB page 58)

1. $^{+}9$ **2.** $^{-}1$ **3.** $^{-}3$ **4.** $^{+}5$

Exercise 4 (SB page 58)

1. **a)** $^{+}40$ **b)** $^{-}51$ **c)** $^{-}100$ **d)** 0

2. **a)** $^{+}15$ **b)** $^{+}77$ **c)** $^{+}9$ **d)** $^{-}10$
e) $^{+}62$ **f)** $^{+}2$ **g)** $^{-}92$ **h)** $^{-}37$
i) 0 **j)** 0 **k)** 0 **l)** 0

3. **a)** $^{+}3 + {}^{+}1 = {}^{+}4$ **b)** $^{+}2 + {}^{-}3 = {}^{-}1$
c) $^{-}3 + {}^{+}6 = {}^{+}3$ **d)** $^{-}2 + {}^{+}13 = {}^{+}11$

Exercise 5 (SB page 60)

1. **a)** $^{+}3$ **b)** $^{+}13$ **c)** $^{-}3$ **d)** $^{-}8$ **e)** $^{-}4$ **f)** $^{-}4$
2. **a)** $^{+}1$ **b)** 0 **c)** $^{-}29$ **d)** $^{+}49$ **e)** $^{-}55$

Exercise 6 (SB page 61)

1. $^{+}24$ **2.** $^{-}12$ **3.** $^{-}72$ **4.** $^{+}48$ **5.** $^{+}30$
6. $^{+}42$ **7.** $^{-}90$ **8.** $^{-}88$ **9.** $^{+}75$ **10.** $^{+}606$

Exercise 7 (SB page 62)

1. $^{-}35$ **2.** $^{-}72$ **3.** $^{+}600$ **4.** $^{+}1\,344$

Exercise 8 (SB page 62)

1. $^{+}8$ **2.** $^{-}7$ **3.** $^{-}7$ **4.** $^{-}5$ **5.** $^{-}9$
6. $^{+}4$ **7.** $^{+}25$ **8.** $^{+}4$ **9.** $^{+}25$ **10.** $^{+}1$

Topic 6: Algebraic expressions

Introduction

In this topic important principles of algebraic operations are covered. It begins with expanding algebraic expressions and reminding students of the variables, expressions and basic multiplication. The distributive law that is used to expand brackets is discussed next. The examples start with simple expansions. It then moves on to more advanced examples where BODMAS have to be applied to perform the expansion. Lastly, binomial expansions are covered and two methods are shown: FOIL and a quadratic box.

In Unit 3 factorisation of simple algebraic expressions is covered. This is the first time that students are exposed to factorisation and the unit starts off with revision of the concept of the HCF. The examples first demonstrate the use of a table to factorise expressions before encouraging students to perform factorising without.

Algebraic fractions are the final part of this topic. To prepare students for this, arithmetic operations with fractions are revised. In the next unit, students are taken through how to add fractions using the LCM. It starts with simple examples with single variable numerators before going on to more complicated examples where the numerator is a binomial.

Common difficulties

When multiplications become more complicated, such as where signs, numbers and variables are involved, students will have to work more carefully. Guide them to remember to first multiply signs, then numbers and then variables in alphabetical order. Sometimes students make mistakes with the expansion of more complicated brackets, for example: in the equation $15a - 4a(5 - 2a)$, they may first try to subtract $4a$ from $15a$. Remind them of BODMAS and the order of operations. The

binomial expansion should be simple for students as long as they are familiar with the FOIL process.

Factorising can be difficult for students to perform the first time as reversing multiplication is sometimes a difficult operation to grasp. Work slowly through the examples using a table to ensure students become confident. Provide scaffolded examples, such as the ones in Exercise 6, to establish the foundational concepts.

In order to work comfortably with algebraic fractions, students need to know how to find the LCM of algebraic terms. Spend enough time practising this.

Preparation

Make charts and visual aids illustrating the guidelines to multiplication, FOIL, factorising and algebraic fractions.

Explain to students that they will be expanding their current algebraic knowledge by learning more about multiplication, factorising and algebraic fractions. Start by putting some simple multiplication examples on the board in order to revise previous knowledge. Explain the distributive law and how it holds with numbers and in algebra. Introduce factorising by showing students first numbers and then algebraic terms for which they can find the HCF. Explain that by reversing expanding brackets, one can find the factors of an expression. Algebraic fractions can be introduced by explaining that operations with fractions can be applied to algebraic terms.

Answers to exercises

Exercise 1

(SB page 64)

1. a) $6xy$ **b)** 0 **c)** $-120p^2$

d) $120xy^2$ **e)** $-\frac{8}{3}m^3n$

2. a)

$3a^2$	
$3a$	a

b)

$8x^2$	
$-4x$	$-2x$

c)

$14fg$	
$7f$	$2g$

d)

$-10a^2b$	
$-5a$	$2ab$

e)

$-24x^2y^2z$	
$8xy$	$-3xyz$

3. a) True **b)** True

c) False **d)** True

e) True

4. a)

×	c	$2b$	$5a$	b
ab	abc	$2ab^2$	$5a^2b$	ab^2
$3c$	$3c^2$	$6bc$	$15ac$	$3bc$
$4a$	$4ac$	$8ab$	$20a^2$	$4ab$
b	bc	$2b^2$	$5ab$	b^2

b)

×	$2c$	$6a$	$3b$	a
$4a$	$8ac$	$24a^2$	$12ab$	$4a^2$
$5b$	$10bc$	$30ab$	$15b^2$	$5ab$
$3c$	$6c^2$	$18ac$	$9bc$	$3ac$
c	$2c^2$	$6ac$	$3bc$	ac

Exercise 2

(SB page 65)

1. $6f + 12$
2. $6a + 8$
3. $8e + 20$
4. $12t + 6$
5. $8y + 14$
6. $12r - 20$
7. $14a + 21$
8. $12j - 24$
9. $10q - 45$
10. $42y - 56$
11. $6e + 15t$
12. $30y + 10w$
13. $6s - 12t$
14. $42k - 14v$
15. $18w - 9e$
16. $8a + 6a^2$
17. $9c + 6c^2$
18. $-2a^2 - 4a$
19. $-8e + 6e^2$
20. $-6k^2 - 21k$

Exercise 3

(SB page 66)

1. a) $x - 1 - (x - 1)$
$= x - 1 - x + 1$
$= 0$

b) $x - 1(x - 1)$
$= x - x + 1$
$= 1$

c) $10p - 4(2p - 5) + 4$
$= 10p - 8p + 20 + 4$
$= 2p + 24$

d) $14b - 3(4b - 3) - 5$
$= 14b - 12b + 3 - 5$
$= 2b - 2$

e) $16 - 2(3f + 5) - f$
$= 16 - 6f - 10 - f$
$= 6 - 7f$

f) $3x(x + 2) - (x - 4)$
$= 3x^2 + 6x - x + 4$
$= 3x^2 + 5x + 4$

g) $2(y + 3) - (y - 4)$
$= 2y^2 + 6y - y^2 + 4$
$= y^2 + 6y + 4$

h) $a(a + 2) - 3a(2a - 1)$
$= a^2 + 2a - 6a^2 + 3a$
$= 5a^2 + 5a$

i) $5(x-3)+4(2x+1)$
$=5x-15+8x+4$
$=13x-11$

j) $6(7-x)+5(3+2x)$
$=42-6x+15+10x$
$=57+4x$

k) $7(x+6)-3(x+4)$
$=7x+42-3x-12$
$=4x+30$

l) $5(x-4)-2(2x+7)$
$=5x-20-4x-14$
$=x-34$

m) $p(p-1)-2p^2-2p$
$=p^2-p-2p^2-2p$
$=-p^2-3p$

n) $6(3x-2)+2(x+3)$
$=18x-12+2x+6$
$=20x-6$

2.

A	B
$4(x+3)$	$4x+12$
$4(2x-3)$	$8x-12$
$6x-3$	$3(2x-1)$
$2(4x-2)$	$8x-4$
$3(2x-2)$	$6x-6$

3. **a)** $6a+12$ **b)** $35-10f$
c) $12ab+8b^2$ **d)** $12tu-16t^2$

Exercise 4

(SB page 68)

1. x^2+5x+6 **2.** $a^2+10a+24$
3. $c^2+7c+12$ **4.** $r^2+9r+14$
5. $y^2+8y+15$ **6.** $t^2+11t+24$
7. $k^2+8k+12$ **8.** $d^2+10d+16$
9. $6d^2+25d+14$ **10.** $14b^2+19b-3$
11. $6h^2-15h-54$ **12.** $15f^2-10f-10$
13. $8b^2-6b-14$ **14.** $x^2-2x-24$
15. x^2+2x+1

Exercise 5

(SB page 69)

1. x^2 **2.** t
3. $2x$ **4.** $18x^2$
5. u^2v **6.** xy

Exercise 6

(SB page 72)

1. **a)** a **b)** $2b$
c) a **d)** 1
e) $3a$ **f)** $3a(1+2b)$

2. **a)** $12k + 6 = 6(2k + 1)$ **b)** $4k + 4 = 4(k + 1)$

c) $5m + 15 = 5(m + 3)$ **d)** $12p - 4 = 4(3p - 1)$

e) $8k + 14 = 2(4k + 7)$ **f)** $2n - 10 = 2(n - 5)$

3. **a)** $30q + 20$
$= 10(3q + 2)$

b) $21p - 7$
$= 7(3p - 1)$

c) $6f^2 + 4$
$= 2(3f + 2)$

d) $8pq - 4q^2$
$= 4q(2p - q)$

4. **a)** $2(x + 3)$ **b)** $4(x + 3)$

c) $3(t + 3)$ **d)** $5(a - 4)$

e) $3(2y + 3)$ **f)** $2(2f - 5)$

g) $3(3g + 5)$ **h)** $4(2x + 3)$

i) $7(2r - 3)$ **j)** $3(4e - 5)$

k) $x(y + 3)$ **l)** $2a(b + d)$

m) $t(5 + r)$ **n)** $r(5y - f)$

o) $g(3h - 2)$ **p)** $x(x - 2)$

q) $d(2d - 3)$ **r)** $p(4p + 5)$

s) $r(6 - 5r)$ **t)** $p(9p + 1)$

Exercise 7

(SB page 76)

1. **a)** $2y$ **b)** $6cd$ **c)** $4a^2b$

d) $25a^2b^2c$ **e)** $10x^2y$

2. **a)** $\frac{2x}{3}$ **b)** $\frac{2a}{2b^2}$ **c)** $\frac{2}{5}$

d) $-2x$ **e)** $-2b$

3. **a)** $\frac{a}{7} + \frac{2a}{7}$
$= \frac{a + 2a}{7}$
$= \frac{3a}{7}$

b) $\frac{4a}{5} + \frac{2a}{5}$
$= \frac{6a}{5}$

c) $\frac{3x}{8} - \frac{x}{4}$
$= \frac{3(3x) - 6(x)}{24}$
$= \frac{9x - 6x}{24}$
$= \frac{3x}{24}$
$= \frac{x}{8}$

d) $\frac{7x}{10} - \frac{2x}{7}$
$= \frac{7(7x) - 10(x)}{70}$
$= \frac{49x - 20x}{70}$
$= \frac{29x}{70}$

e) $\frac{11x}{4} - \frac{x}{11}$

$= \frac{11(11x) - 4(x)}{44}$

$= \frac{121x - 4x}{44}$

$= \frac{117x}{44}$

f) $\frac{2}{b} - \frac{3}{c}$

$= \frac{2c - 3b}{bc}$

g) $\frac{7}{x} - \frac{2}{3y}$

$= \frac{3y(7) - (2)}{3xy}$

$= \frac{21y - 2x}{3xy}$

h) $\frac{2}{y} + \frac{3}{z}$

$= \frac{2(2) + y(3)}{y^z}$

$= 2z + \frac{3y}{y^z}$

i) $\frac{1}{3y} - \frac{2}{5y}$

$= \frac{5(1) - 3(2)}{15y}$

$= \frac{-1}{15y}$

j) $\frac{5}{2a} - \frac{2}{5}$

$= \frac{5(5) - 2a(2)}{10a}$

$= \frac{25 - 4a}{10a}$

k) $\frac{-y}{x} + \frac{x}{y}$

$= \frac{y(-y) + x(x)}{xy}$

$= \frac{-y^2 + x^2}{xy}$

l) $1 + \frac{2}{x} + \frac{3}{2x}$

$= \frac{2x(1) + 2(2) + 3}{2x}$

$= \frac{2x + 4 + 3}{2x}$

$= \frac{2x + 7}{2x}$

m) $1 + \frac{1}{x} + \frac{1}{x^2}$

$= \frac{x^2(1) + x(1) + 1}{x^2}$

$= \frac{x^2 + x + 1}{x^2}$

n) $\frac{3}{4y} + \frac{5}{y} - \frac{1}{2y}$

$= \frac{2(3) + 8(5) - 8(1)}{8y}$

$= \frac{6 + 40 - 8}{8y}$

$= \frac{38}{8y}$

$= \frac{19}{4y}$

o) $\frac{p}{q} + \frac{q}{r} + \frac{r}{p}$

$= \frac{p(pr) + q(pq) + r(qr)}{pqr}$

$= \frac{p^2r + q^2p + qr^2}{pqr}$

Exercise 8

(SB page 77)

1. $\frac{(a+b)}{2} - \frac{2a}{5}$

$= \frac{5(a+b) - 2(2a)}{10}$

$= \frac{a+5b}{10}$

2. $\frac{m+1}{3} - \frac{m-2}{4}$

$= \frac{4(m+1) - 3(m-2)}{12}$

$= \frac{4m+4-3m+6}{12}$

$= \frac{m+10}{12}$

3. $\frac{2x-1}{3} - \frac{x-1}{6}$

$= \frac{6(2x-1) - 3(x-1)}{18}$

$= \frac{12x-6-3x+3}{18}$

$= \frac{9x-3}{18}$

4. $\frac{3m+4}{7} + \frac{m-1}{2}$

$= \frac{2(3m+4) + 7(m-1)}{14}$

$= \frac{6m+8+7m-7}{14}$

$= \frac{13m+1}{14}$

5. $\frac{4(x+1)}{3} - \frac{5(x-2)}{2}$

$= \frac{4x+4}{3} - \frac{5x-10}{2}$

$= \frac{2(4x+4) - 3(5x-10)}{6}$

$= \frac{-7x+30}{6}$

6. $\frac{6x+2}{4} + \frac{3x-2}{3}$

$= \frac{3(6x+2) + 2(3x-2a)}{12}$

$= \frac{24x+2}{12}$

7. $\frac{4+y}{9} + \frac{3+2y}{2}$

$= \frac{2(4+2y) + 9(3+2y)}{18}$

$= \frac{8+2y+27+18y}{18}$

$= \frac{20y+35}{18}$

8. $\frac{2b+c}{3} - \frac{5b+3c}{4}$

$= \frac{4(2b+c) - 3(5b+3c)}{12}$

$= \frac{8b+4c-15b-9c}{12}$

$= \frac{-7b-5c}{12}$

9. $\frac{y-2x}{2} + \frac{4x+5}{4}$

$= \frac{2(y-2x) + 4x + 5}{4}$

$= \frac{2y-4x+4x+5}{4}$

$= \frac{2y+5}{4}$

10. $\frac{x-4}{2} + \frac{2(x-1)}{3} - \frac{x-1}{4}$

$= \frac{3(x-4) + 8(x-1) - 3(x-1)}{12}$

$= \frac{3x-12+8x-8-3x+3}{12}$

$= \frac{8x-17}{12}$

Topic 7: Simple equations

Introduction

Topic 7 starts by revising simple equations and the use of additive and multiplicative inverses to solve equations. The section moves from simple to more advanced equations – first starting with one step equations, then two step equations followed by multistep equations. Finally equations with brackets and with fractions are covered.

Common difficulties

Students should now be reasonably familiar with the process of solving an equation, but as equations get more challenging, mistakes can start to creep in. Ensure that students understand the concept of solving equations by using inverse operations. Sometimes the multiplicative inverse is harder to grasp for students. Ensure that the foundational concepts had been practised enough as it will impact on learning fractional equations going forward. Keeping an equation balanced is a concept that needs to be constantly reinforced.

Preparation

Prepare scales as visual aids to show how equations work. Charts and visual aids of fractional equations will also be helpful.

Define an equation as a statement of equality of two expressions. Explain that an equation is solved by using inverse operations and that it needs to remain "balanced". Write a few examples on the board to revise previous knowledge before moving on to more complicated equations.

Answers to exercises

Exercise 1

(SB page 79)

1. $v = 18$
2. $p = 5$
3. $b = 8$
4. $n = 6$
5. $m = 16$
6. $x = 20$
7. $m = -4$
8. $p = 1$
9. $v = 12$
10. $n = -7$

Exercise 2

(SB page 80)

1. $9x - 8 = -6$
$9x = 2$
$x = \frac{2}{9}$

2. $9x - 7 = x - 7$
$9x = 0$
$x = 0$

3. $-5 = -5 + 2z$
$0 = 2z$
$z = 0$

4. $8n + 7 = 31$
$8n = 24$
$n = 3$

5. $-4 = 4 + \frac{x}{2}$
$-8 = \frac{x}{2}$
$-x = -16$

6. $9 + 9n = 9$
$9n = 0$
$n = 0$

7. $\frac{x}{-2} + 6 = -1$
$\frac{x}{-2} = -7$
$x = 14$

8. $\frac{m}{9} - 1 = -2$
$\frac{m}{9} = -1$
$m = -9$

9. $-9x + 1 = -80$
$-9x = -81$
$x = 9$

10. $-10 = -2f + 5$
$-15 = -2f$
$f = 7.5$

Exercise 3

(SB page 81)

1. $9x - 13 = 10x$
$-x = 13$
$x = -13$

2. $5x - 3 = 2x + 6$
$3x = 9$
$x = 3$

3. $x + 2 = 2x - 1$
$3x = -3$
$x = -1$

4. $-3x + 18 = 6 - x$
$-2x = -12$
$x = 6$

5. $16x = x$
$15x = 0$
$x = 0$

6. $3x + 2 + 5x = x + 44$
$8x + 2 = x + 44$
$7x = 42$
$x = 6$

7. $4x + 3 = 2x + 11$
$2x = 8$
$x = 4$

8. $7x + 5 = 5 - 2x$
$9x = 0$
$x = 0$

9. $\frac{1}{2} + x = 2x - 3\frac{1}{2}$
$-x = -4$
$x = 4$

10. $6x + 5x = 4x$
$11x = 4x$
$7x = 0$
$x = 0$

Exercise 4

(SB page 82)

1. $3(x + 2) = 27$
$3x + 6 = 27$
$3x = 21$
$x = 7$

2. $-(2x + 9) = -10$
$-2x - 9 = -10$
$-2x = -1$
$x = \frac{1}{2}$

3. $3(2b - 1) = 2b + 5$
$6b - 3 = 2b + 5$
$4b = 8$
$b = 2$

4. $3 - 2(a - 1) = 4a - 13$
$3 - 2a + 2 = 4a - 13$
$-2a + 5 = 4a - 13$
$-6a = -8$
$a = \frac{4}{3}$

5. $4(x - 2) = 3(x + 2)$
$4x - 8 = 3x + 6$
$x = 14$

6. $3(x + 2) = 5(x - 2)$
$3x + 6 = 5x - 10$
$-2x = -16$
$x = 8$

7. $3(x - 2) + x = 3x$
$3x - 6 + x = 3x$
$4x - 6 = 3x$
$x = 6$

8. $\frac{x}{2} + 1 = 3(6x - 5)$
$\frac{x}{2} + 1 = 18x - 15$
$x + 2 = 36x - 30$
$-35x = -32$
$x = \frac{32}{35}$

9. $2(-4 - 3x) - 3x = 2(2x + 3) - 1$
$-8 - 6x - 3x = 4x + 6 - 1$
$-8 - 9x = 4x + 5$
$-13x = 13$
$x = 1$

10. $12 - (5 - 7x) = -3(x + 7) - 12$
$12 - 5 + 7x = -3x - 21 - 12$
$7 + 7x = -3x - 33$
$10x = -40$
$x = -4$

Exercise 5

(SB page 83)

1. a) $x = 120$

b) $b = 77$

c) $\frac{s + 10}{16} = 4$
$s + 10 = 64$
$s = 54$

d) $\frac{y + 5}{10} = 1$
$y + 5 = 10$
$y = 5$

e) $\frac{a-2}{4} = 5$

$a - 2 = 20$

$a = 22$

f) $\frac{18b+8}{10} = 2$

$18b + 8 = 20$

$18b = 12$

$b = \frac{2}{3}$

g) $\frac{3(2x-7)}{4} = 4$

$3(2c - 7) = 28$

$6c - 21 = 28$

$6c = 49$

$c = \frac{49}{6}$

h) $\frac{2(4l-10)}{13} = 3$

$2(4l - 10) = 39$

$8l - 20 = 39$

$8l = 59$

$l = \frac{59}{8}$

i) $\frac{x}{15} + 3 = 4$

$x + 45 = 60$

$x = 15$

j) $\frac{a}{11} + 3 = 9$

$a + 33 = 99$

$a = 66$

2. a) $\frac{2x}{3} = 12$

$2x = 36$

$x = 18$

b) $\frac{x-1}{4} = \frac{x}{7}$

$7(x - 1) = 4x$

$7x - 7 = 4x$

$-7 = -3x$

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

c) $\frac{4}{5} + v = \frac{41}{20}$

$4(4) + 20v = 41$

$20v = 25$

$v = \frac{5}{4}$

d) $\frac{-11}{5} = -2 + n$

$-11 = -10 + 5n$

$-1 = 5n$

$n = \frac{-1}{5}$

e) $\frac{a}{15} + 5 = 8 + \frac{9}{30}$

$2a + 30(5) = 30(8) + 9$

$2a + 150 = 240 + 9$

$2a = 99$

$a = \frac{99}{2}$

f) $\frac{y}{16} - 5 = 7 - \frac{7}{16}$

$y - 5(16) = 16(7) - 7$

$y - 80 = 105$

$y = 185$

g) $\frac{v}{15} + 8 = 13 - \frac{v}{9}$

$3(v) + 8(45) = 13(45) - 5(v)$

$3v + 360 = 585 - 5v$

$v = 225$

$v = \frac{225}{8}$

TERM 1

Revision

Revision exercises

(SB page 85)

Whole numbers

1. **a)** 3.6×10^{1} **b)** 4.26×10^{2} **c)** 8.3×10^{3}
d) 9.4×10^{4} **e)** 5.62×10^{5} **f)** 1.5×10^{-1}
g) 3.14×10^{-2} **h)** 5.4×10^{-3} **i)** 2.3×10^{-5}

2. **a)** 1 300 **b)** 34 000 **c)** 1 480 000
d) 218 000 **e)** 0.00936 **f)** 0.0000421

3. 1.123×10^{5} is smaller

4. **a)** 2^{7} **b)** 3^{9} **c)** x^{11} **d)** 1
e) y^{8} **f)** $3a$ **g)** $108a^{7}$

5. **a)** 1, 2, 4, 5, 10, 20 **b)** 1, 2, 3, 4, 6, 8, 12, 24
c) 1, 2, 5, 10, 25, 50
d) 1, 2, 4, 5, 10, 20, 25, 50, 100

6. **a)** 6, 12, 18, 24, 30, 36 **b)** 9, 18, 27, 36, 45, 54
c) LCM is 18

7. **a)** 3, 5, 13 **b)** 9 **c)** 4, 20

8. 3, 11, 17, 23, 37, 47

9. **a)** $300 = 2^{2} \times 3 \times 5^{2}$ **b)** HCF $= 2 \times 3 \times 5$
$90 = 2 \times 3^{2} \times 5$

10. **a)** $126 = 2 \times 3^{2} \times 7$ **b)** HCF $= 2 \times 3$
$60 = 2^{2} \times 3 \times 5$ $= 6$

11. **a)** $210 = 2 \times 3 \times 5 \times 7$ **b)** $54 = 2 \times 3^{3}$
$300 = 2^{2} \times 3 \times 5^{2}$ $90 = 2 \times 3^{2} \times 5$
LCM $= 2^{2} \times 3 \times 5^{2} \times 7$ $100 = 2^{2} \times 5^{2}$
$= 2\,100$ LCM $= 2^{2} \times 3^{2} \times 5^{2}$
$= 900$

12. Find the LCM:
12: $2^{2} \times 3$
5: 3×5
LCM $= 2^{2} \times 3 \times 5$
$\therefore$ the 60th caller

13. Find the LCM:

$20 = 2^2 \times 5$

$10 = 2 \times 5$

$8 = 2^3$

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

$\therefore$ two bags of balloons, four bags of party horns and five bags of chocolate bars.

14. Find the LCM: $2 \times 3 \times 5 = 30$

15. a) 2^3 **b)** 3^9

c) $2^3 \times 3^6$ **d)** $3^3 \times 4^6 \times 5^{12}$

16. $784 = 2^4 \times 7^2$

$\sqrt{784} = \sqrt{2^4} \times 7^2$

$= 2^2 \times 7$

$= 28$

17. a) $\frac{2}{4}$ **b)** $\frac{3}{10}$ **c)** $\frac{1}{11}$ **d)** $\frac{a^2}{b}$

Fractions

1.

Decimal	Fraction	Percentage
0.75	$\frac{3}{4}$	75%
2.375	$2\frac{3}{8}$	237.5%
2.333…	$2\frac{1}{3}$	233.33...%
0.48	$\frac{6}{25}$	48%
0.625	$\frac{5}{8}$	62.5%

2. a) B **b)** C **c)** B **d)** B **e)** D

3. $\frac{4}{5} = \frac{28}{25}$ and $\frac{6}{7} = \frac{30}{35}$

$\therefore \frac{29}{35}$

4. $6\frac{2}{7} = \frac{44}{7}$

5. a) 0.375 **b)** 0.07

6. a) $\frac{2}{25}$ **b)** $10\frac{1}{25}$

7. a) 26% **b)** 34% **c)** 72% **d)** 87%

8. a) 750 ml : 1.5 litre
750 ml : 1 500 ml
1 : 2

b) 2 hours : 30 min
120 min : 30 min
4 : 1

c) 1 500 g : 2 kg
1.5 kg : 2 kg
3 : 4

9. 9 : 10
$\frac{9}{10}$ = 90%

10. 4 500 × $\frac{2}{15}$ = ₦600
4 500 × $\frac{5}{15}$ = ₦1 500
4 500 × $\frac{8}{15}$ = ₦2 400

11. 27 000 × $\frac{1}{9}$ = 3 000
27 000 × $\frac{3}{9}$ = 9 000
27 000 × $\frac{5}{9}$ = 15 000

12. 98 × $\frac{2}{7}$ = 28 white tiles
98 × $\frac{5}{7}$ = 70 black tiles

13. 8 : 12
= 2 : 3

14. a) 6 : 5 : 4
b) Won: $\frac{6}{15}$ = 40% Lost: $\frac{5}{15}$ = 33% Drew: $\frac{4}{15}$ = 27%
c) 6 : 5

15. She scored 56%

Household and commercial arithmetic

1.

Oyakhirome's monthly budget			
		₦	kobo
Net salary		152 000	
Amount sent home	A	53 200	
Amount for living expenses	B	98 800	
LIVING EXPENSES			
Food and rental		50 100	
Transport		5 355	
Cellphone		1 900	
Clothing		3 575	
Entertainment		15 200	
TOTAL LIVING EXPENSES:	C	74 430	
AMOUNT REMAINING:	D	24 370	

2. Cost/Unit = 7 939 × 55 = ₦436 645
Standing charge = 92 × 10 = ₦920
Total = 436 645 + 920
= ₦437 565

3. $SI = \frac{PRT}{100}$

$= \frac{5\,000 \times 8.5 \times 4}{100}$

$= ₦1\,700$

Total = 5 000 + 1 700 = ₦6 700

4. $SI = \frac{PRT}{100}$

$= \frac{7\,250 \times 6 \times 3}{100}$

$= ₦1\,305$

Total = 7 250 + 1 305 = ₦8 555

5. Deposit: 35 000 × 7.5% = ₦2 625

Amount owed = 35 000 – 2 625

= ₦32 375

$SI = \frac{32\,375 \times 20 \times 2}{100}$

$= ₦12\,950$

Monthly instalment = $\frac{32\,375 + 12\,959}{24}$

= ₦1 888.54

6. **a)** Deposit = 73 000 × 10%

= ₦7 300

b) Repayments = 4 200 × 36

= ₦151 200

c) Total = 7 300 + 151 200

= ₦158 500

7. % Profit = $\frac{56\,400 - 35\,000}{35\,000} \times 100$

= 61.14%

8. **a)** Profit = 4 635 – 3 600 = ₦1 035

b) % Profit = $\frac{1\,035}{3\,600} = 28.75\%$

9. SP = 30 250 × 132% = ₦39 930

10. SP = 245 × $\frac{85}{100}$ = ₦208.25

11. SP = 1 645 000 × $\frac{108}{100}$ = ₦1 776 600

12. SP = 25 000 × $\frac{94}{100}$ = ₦23 500

13. % increase = $\frac{4\,550 - 3\,040}{3\,040} \times 100 = 49.67\%$

14. % decrease = $\frac{10\,600 - 8\,500}{10\,600} \times 100 = 19.81\%$

15. % increase = $\frac{300 - 250}{250} \times 100 = 20\%$

Approximation and estimation

1. **a)** **i)** 9 **ii)** 9.26 **iii)** 9.26
b) **i)** 30 **ii)** 29.5 **iii)** 29.51
c) **i)** 10 **ii)** 10.0 **iii)** 10.03
d) **i)** 1 **ii)** 0.725 **iii)** 0.72
e) **i)** 0 **ii)** 0.275 **iii)** 0.28
f) **i)** 422 **ii)** 422 **iii)** 422.24
g) **i)** 0 **ii)** 0.00646 **iii)** 0.01
h) **i)** 18 **ii)** 17.60 **iii)** 17.62
i) **i)** 900 **ii)** 900 **iii)** 900.23
j) **i)** 2 **ii)** 2.07 **iii)** 2.07
k) **i)** 4 **ii)** 3.56 **iii)** 3.56
l) **i)** 5 **ii)** 5.45 **iii)** 5.45
m) **i)** 21 **ii)** 21.0 **iii)** 20.95
n) **i)** 0 **ii)** 0.0651 **iii)** 0.07
o) **i)** 1 **ii)** 0.515 **iii)** 0.52

2. **a)** 8.9 **b)** 1 199.11 **c)** 24.2

3. **a)** B **b)** C **c)** A
d) D **e)** A **f)** A
g) D

Multiplication and division of directed and non-directed numbers

1. **a)** –1 365 653 < –1 177 443
b) –455 667 < –54 766

2. –34 999, –34 898, –31 315, –30 512, 30 215, 32 333

3. 7 800, –7 889, –7 989, –8 900, –9 800

4. **a)** 17 **b)** –59
c) 11 **d)** 67
e) –150 **f)** 400
g) –121 **h)** –1 440
i) 48 **j)** –2
k) 10 **l)** –10

5. +5 **6.** +3

7. –6 and 10

8. –12 and 12

9.

×	–2	4	5	–8
–7	14	–28	–35	56
6	–12	24	30	-48
3	–6	12	25	–24
–2	4	–8	–10	16

Algebraic expressions

1. **a)** $12a^2b$ **b)** $15cd^2$

c) $32e^2f^5$ **d)** $18s^3t^3$

e) $36a^2$ **f)** $-36g^2$

g) $-30t^4$

2. **a)** $6ab$ **b)** $-8p^3$

c) $48y^3$

3.

×	$5w$	$2u$	$3u$
$4u$	$20uw$	$8u^2$	$12u^2$
v	$5vw$	$2uv$	$3uv$
$2uv$	$10uvw$	$4u^2v$	$6u^2v$
$3w$	$15w^2$	$6uw$	$9uw$

4. **a)** $4f + 10$ **b)** $6a + 4$

c) $e + 2\frac{1}{2}$ **d)** $24t + 12$

e) $12d + 6d^2$ **f)** $8e^2 - 20e$

g) $18 - 6g^2$ **h)** $10t^2 - 6t$

i) $14m^2 + 28m$ **j)** $-6a - 2$

k) $-16r - 8$ **l)** $-12a - 6$

m) $-18 + 24d$ **n)** $-24a + 18d$

o) $-8y + 32x$ **p)** $-18t - 24s$

5. **a)** $31t - 15$ **b)** $15u - 8$

c) $2y + 15$ **d)** $3x - 8$

e) $t - 12$ **f)** $3r - 12$

g) $p + 27$ **h)** $11b + 5$

i) $-13f - 2$ **j)** $5x + 14$

k) $16u - 12$ **l)** $6x + 48$

6. **a)** $f^2 + 3f - 10$ **b)** $g^2 - 2g - 8$
c) $e^2 - e - 2$ **d)** $b^2 + 3b - 4$
e) $h^2 + 5h - 10$ **f)** $p^2 + p - 20$
g) $m^2 - m - 12$ **h)** $h^2 - 2h - 63$
i) $8p^2 + 26p - 24$ **j)** $6x^2 + 10x - 4$
k) $r^2 - 9$ **l)** $4d^2 - 9$
m) $t^2 + 4t + 4$

7. **a)** $x^2 - 12x + 36$ **b)** $x^2 - x - 2$
c) $x^2 - 9x + 20$ **d)** $x^2 - x - 6$

8. **a)** $49x$ **b)** $4ab$
c) 8 **d)** $6a$
e) $7y$

9. **a)** $3(a + ab)$ **b)** $4(m - 5n)$
c) $5(3p + q)$ **d)** $6(4u - v)$
e) $5(2x + 3y)$ **f)** $4x(1 + 3y)$
g) $3x(5 - 3y)$ **h)** $2x(4y + 3)$
i) $4x(5x - 2)$ **j)** $3x(5x - 2)$

10. **1.** C **2.** D
3. E **4.** B
5. A **6.** F

11. **a)** $\frac{x}{4} + \frac{x}{7}$
$= \frac{7x + 4x}{28}$
$= \frac{11x}{28}$

b) $\frac{2x}{5} + \frac{x}{9}$
$= \frac{18x + 5x}{45}$
$= \frac{23x}{45}$

c) $\frac{2x}{3} - \frac{3x}{4}$
$= \frac{8x - 9x}{12}$
$= \frac{-x}{12}$

d) $\frac{3x}{4} - \left(\frac{x}{5} + \frac{x}{3}\right)$
$= \frac{3x}{4} - \left(\frac{3x + 5x}{15}\right)$
$= \frac{3x}{4} - \frac{8x}{15}$
$= \frac{15(3x) - 4(8x)}{60}$
$= \frac{45x - 32x}{60}$
$= \frac{13x}{60}$

e) $\frac{2}{x} - \frac{1}{y}$

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

f) $\frac{4}{x} - \frac{x}{4}$

$= \frac{16 - x^2}{4x}$

g) $\frac{2}{5} + \frac{3}{b}$

$= \frac{2b + 15}{15b}$

h) $\frac{-5x}{2} + \frac{3x}{7}$

$= \frac{-35x + 6x}{14}$

$= \frac{-29x}{14}$

i) $\frac{m + 1}{3} - \frac{3(m - 2)}{4}$

$= \frac{4(m + 1) - 3(m - 2)}{12}$

$= \frac{4m + 4 - 3m + 6}{12}$

$= \frac{m + 10}{12}$

j) $\frac{3x + 1}{2} - (6x + 5)$

$= \frac{3x + 1}{2} - 6x - 5$

$= \frac{3x + 1 - 12x - 10}{2}$

$= \frac{-9x - 9}{2}$

12. The error is in the second step.

$\frac{x}{2} - \frac{x - 2}{5}$

$= \frac{5x - 2(x - 20)}{10}$

$= \frac{5x + 2x + 4}{10}$

$= \frac{3x + 4}{10}$

13. a) $3x + 1 = 13$

$3x = 12$

$x = 4$

b) $5x - 3 = 27$

$5x = 30$

$x = 6$

c) $51 = 6c - 3$

$54 = 6c$

$c = 9$

d) $9 + \frac{u}{7} = 12$

$63 + u = 84$

$u = 21$

e) $\frac{h}{9} - 3 = 2$

$h - 27 = 18$

$h = 45$

f) $-2(4f + 6) = 28$

$-8f - 12 = 28$

$-8f = 40$

$f = -5$

g) $50 = 5(2p + 3)$

$50 = 10p + 15$

$35 = 10p$

$p = 3.5$

h) $7(2y - 3) = 28$

$14y - 21 = 28$

$14y = 49$

$y = \frac{7}{2}$

i) $-3x - 5 = x + 15$
$-4x = 20$
$x = -5$

j) $14x - 4 = 10x - 20$
$4x = -16$
$x = 4$

k) $5(x - 4) = 2(x - 7)$
$5x - 20 = 2x - 14$
$3x = 6$
$x = 2$

l) $3(4 - x) - 6(4 - 3x) = 3$
$12 - 3x - 24 + 18x = 3$
$-12 + 15x = 3$
$15x = 15$
$x = 5$

14. a) $\frac{x}{2} + \frac{x}{3} + 1$
$3x + 2x = 6$
$5x = 6$
$x = \frac{6}{5}$

b) $\frac{x - 3}{4} = \frac{2x + 1}{4}$
$x - 3 = 2x + 1$
$-x = 4$
$x = -4$

c) $\frac{x}{3} + \frac{(x + 5)}{2} = 0$
$2x + 3(x + 5) = 0$
$5x = -5$
$x = -1$

d) $\frac{3(x - 1)}{2} = \frac{3(3x + 1)}{4}$
$6(x - 1) = 3(3x + 1)$
$6x - 6 = 9x + 1$
$-3x = 7$
$x = -\frac{7}{3}$

15.1 a) B $= -x - 5$
C $= -x - 2$

b) B + C = 11
$-x - 5 + (-x - 2) = 11$
$-x - 5 - x - 2 = 11$
$-2x - 7 = 11$
$-2x = 18$
$x = 9$

c) B $= -(-9 - 5) = 4$
C $= -(-9) - 2 = 7$

15.2 a) B $= x + 4$
C $= 4 + 2 = 6$

b) $x - 1 = -4$
$x = 3$

c) B $= -3 + 4 = 1$

Topic 1: Solve word problems using algebraic fractions

Introduction

This topic covers word problems and the translation of word problems to mathematical expressions. It starts by providing guidelines on how to work with word problems and provides a list of words and their mathematical translation. Some examples are used to revise word problems before moving on to word problems with fractions.

Common difficulties

Often word problems can be challenging to students. Encourage them to underline key words in the word problem and to break it down into smaller parts. Translation of the parts of the problem often makes it easier for students to grasp. Reading the question out loud or making a drawing are useful techniques to solve word problems. Word problems with fractions add complexity, so provide students with adequate guidance on how to complete them.

Preparation

Make a chart with the English phrases translated into algebraic expressions. Prepare a chart with the different techniques and tips displayed on it to help students refer back to them.

Start with a simple word problem and ask students to identify the key words. Then ask them to tell the story of the word problem in their own words. Practise solving a few word problems in pairs before starting word problems with fractions.

Answers to exercises

Exercise 1

(SB page 96)

1. a) $6 + x = 15$

b) $x - 20 = 5$

c) $2x = 60$

d) $x - 30 = 20$

e) $\frac{x}{4} = 25$

f) $3x + 4 = 19$

g) $5x - 3 = 17$

h) $20a = 460$

i) $3x + 10 = 16$; $x = 2$

j) $x^2 = 16$; $x = 4$ cm

k) $4x = 72$; $x = 18$ cm

l) $2(x - 8) = 80$

2. a)
$5x = x + 8$
$4x = 8$
$x = 2$

b)
$2x - 54 = 12$
$2x = 66$
$x = 33$

c) $27 = (2x - 5) + 5 + x + (x + 3)$ and $24 = 4x$
$x = 6$
The value of each side is $2x - 5 = 7$ cm; 5 cm; $x = 6$ cm; and $x + 3 = 9$ cm respectively.

d)
$2(x + 5) + 2x = 26$
$4x = 16$
$x = 4$

e)
$50 = m + 2m + m + 7$
$m = \frac{43}{4}$
$2m = \frac{43}{2}$
$m = 21\frac{1}{2}$ minutes

f) Let a = apples and g = grapes.
$30a + 120g = 2\,800$
$a = 2g$
Simultaneous equation:
$30a + 120 \times \frac{a}{2} = 2\,800$
$90a = 2\,800$
$a = \frac{280}{9} = 31$ apples

g)
$276 = (x + 28) + x$
$2x = 248$
$x = 124$
Omoyemwen typed 152 pages and Nsedu typed 124 pages.

3. a) The sum of a certain number and 5 is 12.

b) The difference between 250 and 50 is the same as the sum of a certain number and 10.

c) A certain number multiplied by 4 and added to 8, is the same as 1 being subtracted from the certain number, multiplied by 3.

d) If 30 is subtracted from a certain number that is multiplied by 3, the result is equal to the difference between that certain number and 7.

e) The ratio of a number to 10 is 50.

f) A certain number divided by 3 is equal to 13.

Exercise 2

(SB page 98)

1. $\frac{1}{2}x + \frac{1}{5}(x-2) = x - 4$

$\frac{3}{10}x = \frac{18}{5}$

$15x = 180$

$x = 12$

2. $\frac{(x-6)}{5} = 4$

$x - 6 = 20$

$x = 26$

3. $\frac{1}{2}x + \frac{1}{3}x = x - 8$

$5x = 6x - 48$

$x = 48$

4. $x \times (x+1) = 210$

$x^2 + x - 210 = 0$

$x = 14$ or $x = -15$

5. $x \times (x+2) = 195$

$x^2 + 2x - 195 = 0$

$x = 13 (x \neq -15)$

Length = 15 cm and breadth = 13 cm

6. $x - 15 = \frac{1}{4}x$

$4x - 60 = x$

$x = 20$

7. $\frac{2}{3}x + \frac{1}{2}x = 35$

$4x + 3x = 210$

$7x = 210$

$x = 30$

8. $\frac{3}{4}x - \frac{1}{3}x = 15$

$9x - 4x = 180$

$5x = 180$

$x = 36$

9. $\frac{2}{5}x - \frac{1}{4}x = 3$

$8x - 5x = 60$

$3x = 60$

$x = 20$

10. $\frac{1}{3}x + \frac{1}{2}(x+1) = 13$

$\frac{5}{6}x = 13 - \frac{1}{2}$

$10x = 150$

$x = 15$

Note: Questions 4 and 5 are aimed at gifted students and are not part of the curriculum.

Topic 2: Linear inequalities

Introduction

Topic 2 starts by introducing the idea of an inequality and some simple examples of how phrases can be translated into inequalities. It then goes on to show how inequalities can be represented on a number line before solving linear inequalities and what the solutions look like on a number line. The topic concludes with word problems on inequalities.

Common difficulties

Sometimes students struggle to understand the basic principles of an inequality, so make sure enough time is spent on establishing the foundational concepts of "less than", "greater than" and so on. Reinforce the concept that an inequality is not just a single solution, but a range of solutions. When solving linear inequalities remind students to proceed as if they were solving a linear equation, except when multiplying or dividing by a negative number.

Preparation

Prepare number lines for the board to show students how to solve inequalities.

Draw a number line on the board and show an interval of numbers. Explain that an interval contains all points between two given numbers. Ask students to explain in their own words how they would describe the interval. Define an inequality as a statement that shows a relationship between two expressions with the signs $<$, $>$, $\geq$, $\leq$.

Answers to exercises

Exercise 1

(SB page 99)

1. **a)** $x < 4$ **b)** $y > 7$ **c)** $a \geq -5$
d) $2 < x \leq 8$ **e)** $t \geq 9$ **f)** $5 \leq x$
g) $x \geq 14$ **h)** $x \geq 1$ **i)** $2 > x$

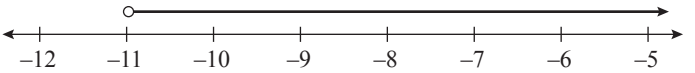
2. **a)** x is less than -3
b) x is greater than or equal to 4
c) x is more than -3 but less than 5

d) x is less than or equal to 0
e) x is less than –1
f) x is smaller than 13
g) 6 is bigger than x
h) x is less than or equal to –18
i) x is bigger than or equal to 12.

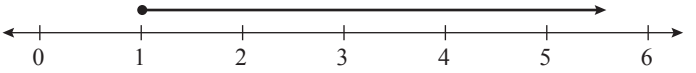
Exercise 2

(SB page 101)

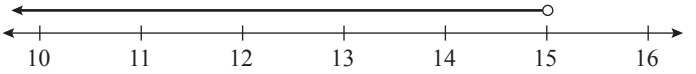
1. a)



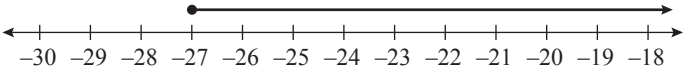
b)



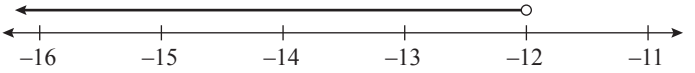
c)



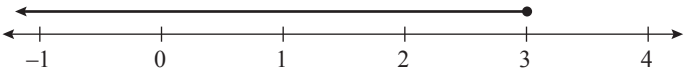
d)



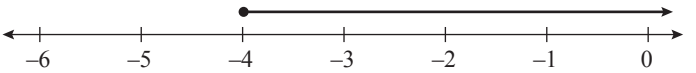
e)



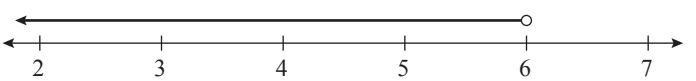
f)



g)



h)



2. a) $x > 7$ **b)** $x < 4$ **c)** $x > -4$
d) $x \geq 0$ **e)** $x \geq -7$ **f)** $x \leq 7$
g) $x > -8$ **h)** $x > -1$ **i)** $x \leq -5$

Exercise 3

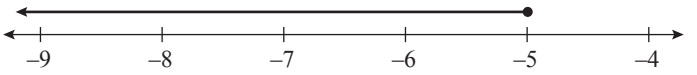
(SB page 103)

1. $9 < 9x$; $1 < x$
2. $3x \leq -12$; $x \leq -4$
3. $10 > \frac{x}{7}$; $70 > x$
4. $7x \geq -14$; $x \geq -2$
5. $14 < 2x$; $7 < x$
6. $-8 \geq 4x$; $-2 \geq x$
7. $x < 1$
8. $x < -5$
9. $-8 \leq -2x$; $4 \geq x$
10. $20 \geq -5x$; $-4 \leq x$

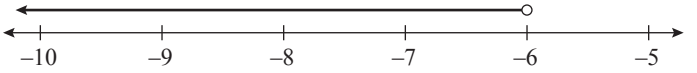
Exercise 4

(SB page 104)

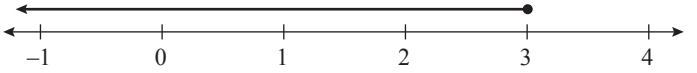
1. $x \leq -5$



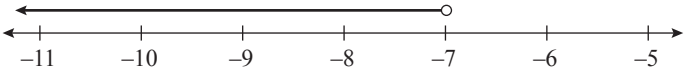
2. $2x < -12$; $x < -6$



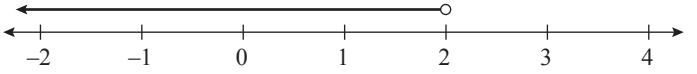
3. $11x \leq 33$; $x \leq 3$



4. $2x < -14$; $x < -7$

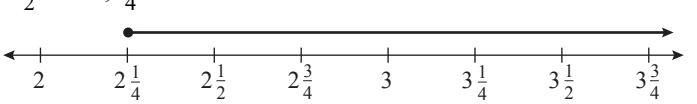


5. $-5x > -10$; $x < 2$

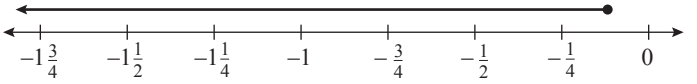


6. $-10 \geq 5x$; $-2 \geq x$

7. $4\frac{1}{2} \leq 2x$; $\frac{9}{4} \leq x$



8. $-4x \geq \frac{1}{2}$; $x \leq -\frac{1}{8}$



Exercise 5

(SB page 105)

1. $9x > 6 + 3x$; $6x > 6$; $x > 1$

2. $2x + 6 < x + 20$; $x < 14$

3. $x + (x + 2) > 98 - 2(x + 2)$; $2x + 2 > 94 - 2x$; $4x > 92$; $x > 23$

4. $120 > x + 27 + 55$; $x < 38$

5. $3\,500x + 800 \leq 15\,000$; $x \leq \frac{142}{35}$. Dele can buy a maximum of four books.

6. $4x < 160$; $x < 40$ cm

7. $1\,500 + 1\,000 + 600 + 500x \leq 8\,000$; $500x \leq 4\,900$; $x \leq 9.8$. You can go on nine rides.

8. Let Funmi = x and Funke = y.
$x + y < 72$ (Equation 1) and $x = 3y$ (Equation 2)
Simultaneous equation: $3y + y < 72$; $y < 18$ kg
$x = 3y = 3(18) = 54$; $x < 54$ kg

9. $60\,000 + 8x \geq 300\,000$; $8x \geq 240\,000$; $x \geq 30\,000$.
Mr Dada must save at least ₦30 000.

10. $25\,000x + 11\,000 \leq 120\,000$; $x \leq \frac{109}{25}$. The DJ will play a maximum of four hours.

Topic 3: Graphs

Introduction

In Topic 3, students are introduced to the Cartesian plane and the coordinate system for the first time. The topic starts by explaining how to plot points, write coordinates, leading students through various exercises to practise plotting points and constructing geometrical shapes on the Cartesian plane.

Once familiar with the coordinate system, the student is introduced to plotting linear graphs using a table of values. A table of values shows ordered pairs for linear equations that when connected form a straight line. The properties of linear graphs are further explored by looking at the gradient, the intercepts and vertical and horizontal lines.

Common difficulties

At first students will find it difficult to plot and find coordinates on the Cartesian plane, swapping x and y values or moving in the wrong direction. Lots of practise of plotting points and writing coordinates will help students to orientate themselves on the Cartesian plane.

The concept of a straight line as defined by an equation where each x-coordinate has a matching y-coordinate is an important one to establish. Students can often make the mistake that the equation is only for the points that they plot, without realising that a straight line represent all x and y values between the points.

Vertical and horizontal lines will also require careful explanation as the equations for these lines are not in standard form. Show students what these lines look like on the Cartesian plane and let them practise many examples.

Preparation

Have graph paper available for students to plot and draw on. Display an enlarged Cartesian plane on the board to make demonstrating to students easier. Make a chart that summarises all the information for linear graphs.

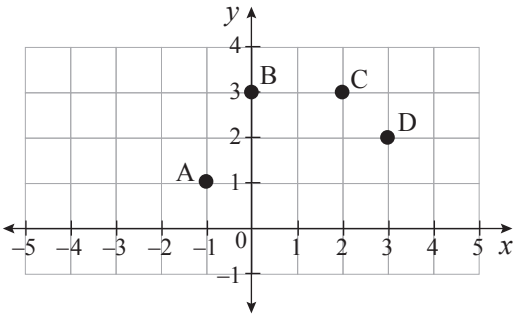
Discuss some real-life examples of coordinate systems such as grid references for maps. Explain that in Mathematics there is also a coordinate system that helps us to study algebra. Define the Cartesian plane and show students how to draw the axes using a suitable scale. Point out the origin, axes and quadrants. Start by showing students how to locate points.

Answers to exercises

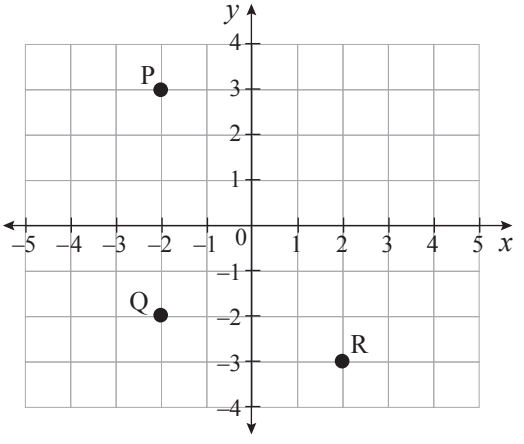
Exercise 1

(SB page 110)

1. a)



b)

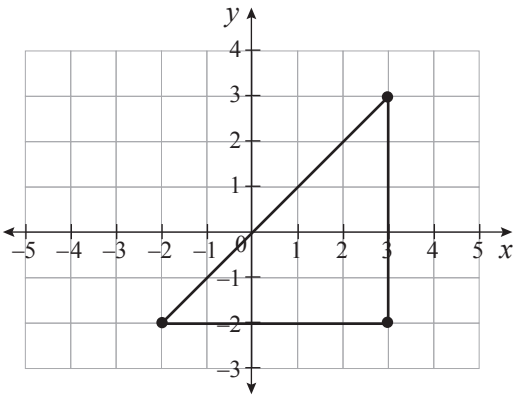


2. a) 2nd quadrant
b) 1st quadrant
c) *y*-axis
d) 3rd quadrant
e) 4th quadrant

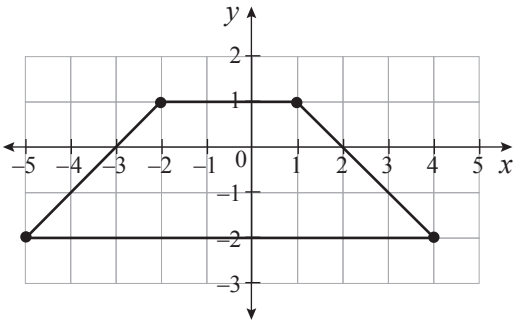
3. **a)** A **b)** U **c)** R **d)** J **e)** T
f) M **g)** H **h)** B **i)** Y **j)** L

4. D (1; –3), E (–2; –3), F (0; 5), I (4; 3), K (–3; 1), L (–4; 4), N (2; 1), P (5; 1), R (–1; 3), S (–5; –1), W (4; –4), Z (–4; –4)

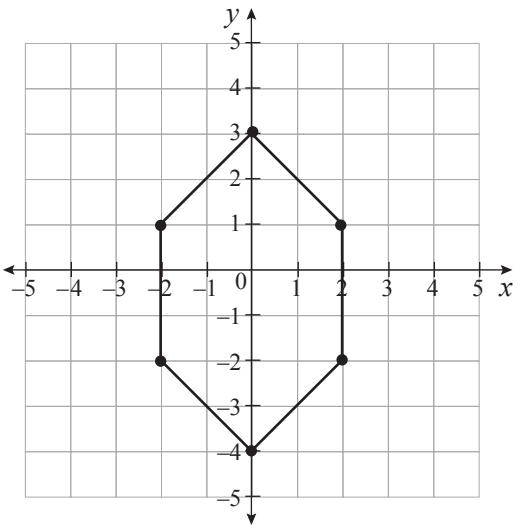
5. **a)** Right-angled triangle



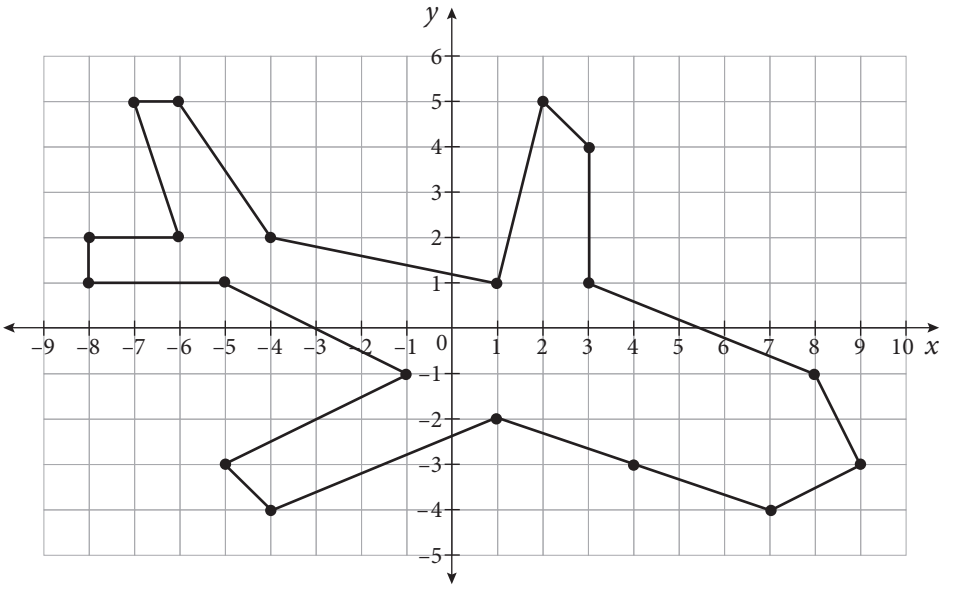
b) Trapezium



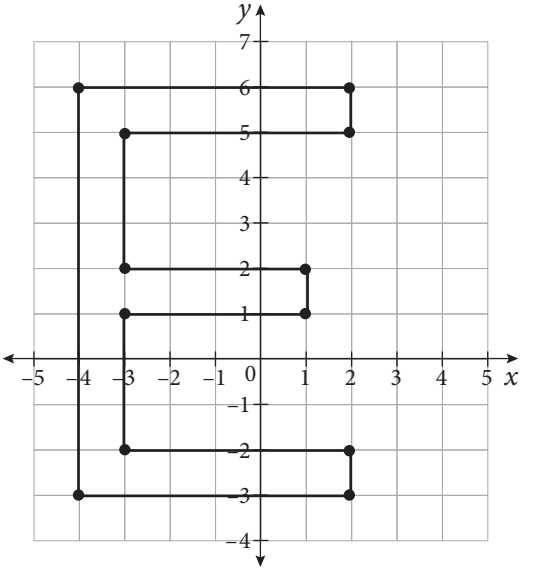
c) Hexagon



6. a) Aeroplane



b) The letter 'E'



Exercise 2

(SB page 113)

1. a) $y = 3x + 2$

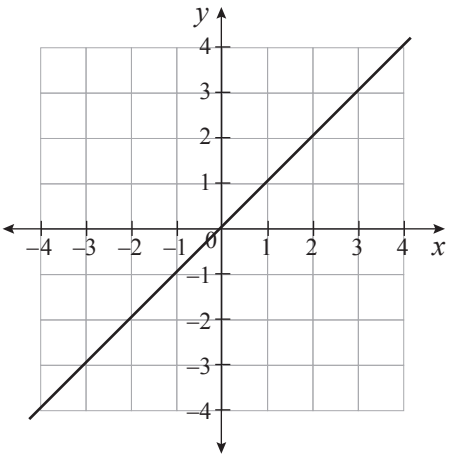
b) $y = \frac{1}{3}x + 1$

c) $y = 3x + 2$

2. a)

x	–3	–2	–1	0	1	2	3
y	–3	–2	–1	0	1	2	3

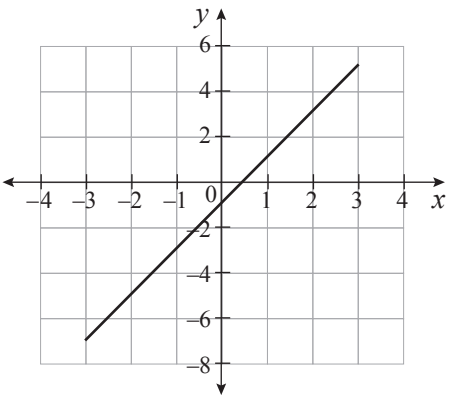
Graph of $y = x$



b)

x	–3	–2	–1	0	1	2	3
y	–7	–5	–3	–1	1	3	5

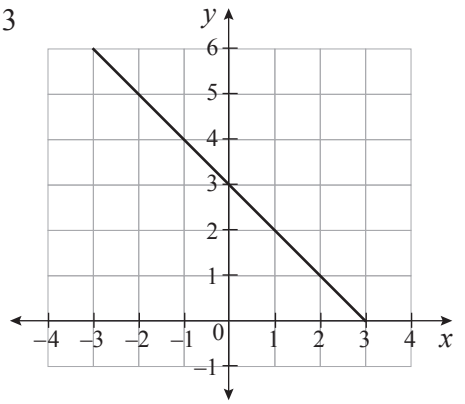
Graph of $y = 2x - 1$



c)

x	–3	–2	–1	0	1	2	3
y	6	5	4	3	2	1	0

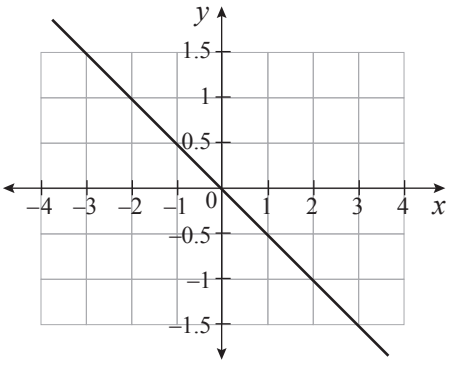
Graph of $y = -x + 3$



d)

x	–3	–2	–1	0	1	2	3
y	1.5	1	0.5	0	–0.5	–1	–1.50

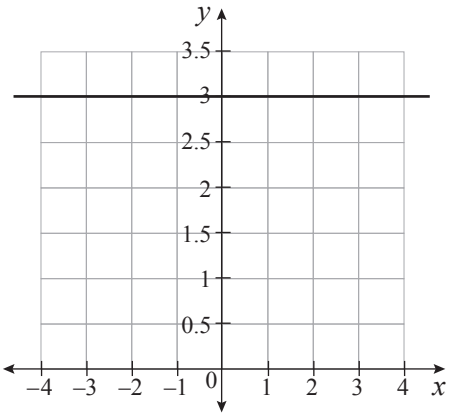
Graph of $y = -\frac{1}{2}x$



e)

x	–3	–2	–1	0	1	2	3
y	3	3	3	3	3	3	3

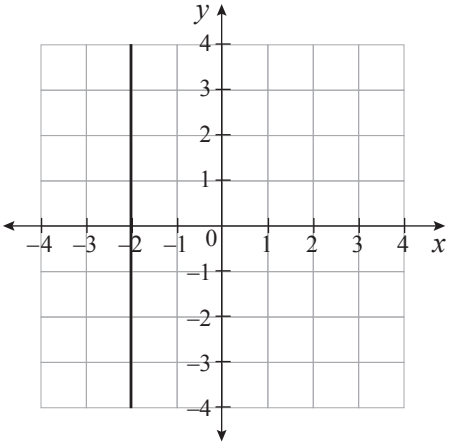
Graph of $y = 3$



f)

x	–3	–2	–1	0	1	2	3
y	undefined	y is all numbers	undefined	undefined	undefined	undefined	undefined

Graph of $x = -2$



3. $y = 3x - 1$

4. **a)** m represents the gradient

b) c represents the y-intercept

c) **i)** $m = 2$; $c = 2$

ii) $m = -1$; $c = 0$

iii) $m = -3$; $c = -9$

iv) $m = 0$; $c = 4$

v) m = undefined; c = does not exist

Exercise 3

(SB page 116)

1. **a)** $m = 3$; $c = -2$

b) $m = \frac{1}{2}$; $c = \frac{1}{2}$

c) $m = -2$; $c = 3$

2. **a)** Gradient is 2 and the graph slopes in positive direction.

b) Gradient is –1 and the graph slopes in negative direction.

c) Gradient is 3 and the graph slopes in positive direction.

d) Gradient is $\frac{1}{2}$ and the graph slopes in positive direction.

e) Gradient is 5 and the graph slopes in positive direction.

3. **a)** $m = 0$

b) m = undefined

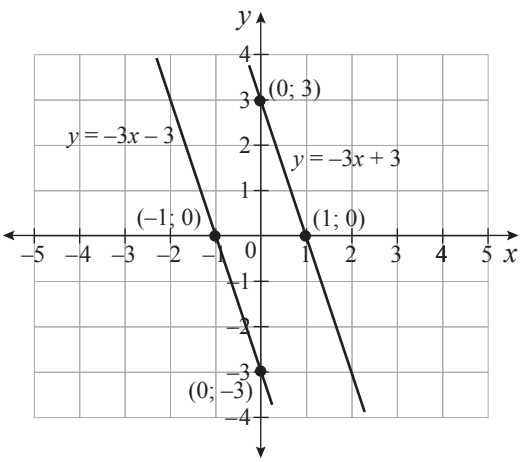
c) $m = 0$

d) m = undefined

e) $m = 0$

f) m = undefined

4. **a)**



b) Same: the slope of the graph; Different: x and y-intercepts

c) Both equations have an m-value of –3. Each equation has a different c-value.

5. a) $y - 2(0) = 4$, $y = 4$, y-intercept (0; 4)
$0 - 2x = 4$, $x = -2$, x-intercept (–2; 0)

b) $3(0) + y = 6$, $y = 6$, y-intercept (0; 6)
$3x + 0 = 6$, $x = 2$, x-intercept (2; 0)

c) $0 + 2y = 0$, $y = 0$, y-intercept (0; 0)
$x + 2(0) = 0$, $x = 0$, x-intercept (0; 0)

d) $2(0) + 3y = 12$, $y = 4$, y-intercept (0; 4)
$2x + 3(0) = 12$, $x = 6$, x-intercept (6; 0)

e) y-intercept is (0; 0)
x-intercept does not exist

f) y-intercept does not exist
x-intercept (2; 0)

g) $y = m(0) + c$, $y = c$, y-intercept $(0; c)$
$0 = mx + c$, $x = \frac{-c}{m}$, x-intercept $\left(\frac{-c}{m}; 0\right)$

Topic 4: Plane figures and shapes

Introduction

This topic falls under the Mensuration and Geometry theme. The first unit covers properties of quadrilaterals. It takes students through a practical exercise where the shapes are cut out and the properties explored and recorded using a table. After this each group of figures are looked at more in-depth, with exercises focussing on getting students to be very familiar with the properties of plane shapes.

In the next unit students are introduced to scale drawings and shown how to calculate the scale factor. Once familiar with these calculations, they go on to make scale drawings of buildings, floor plans, distances and other real life situations. The topic ends with a unit on reading maps and applying scale to calculations of distances.

Common difficulties

Plane shapes and figures can be challenging to students as they often get confused about the properties of shapes. Carefully work through the exercise where they have to explore the properties and practise identifying shapes and their properties. Short class tests or a quiz will be a good way to help students remember the properties.

Scale calculations will be less problematic if you remind students that a scale is a ratio. Brief revision of working with ratios will be beneficial. It is also important to encourage students to work accurately when taking measurements on maps and diagrams.

Preparation

Prepare copies of the shapes on pages 60–61 for students to complete Exercise 1.

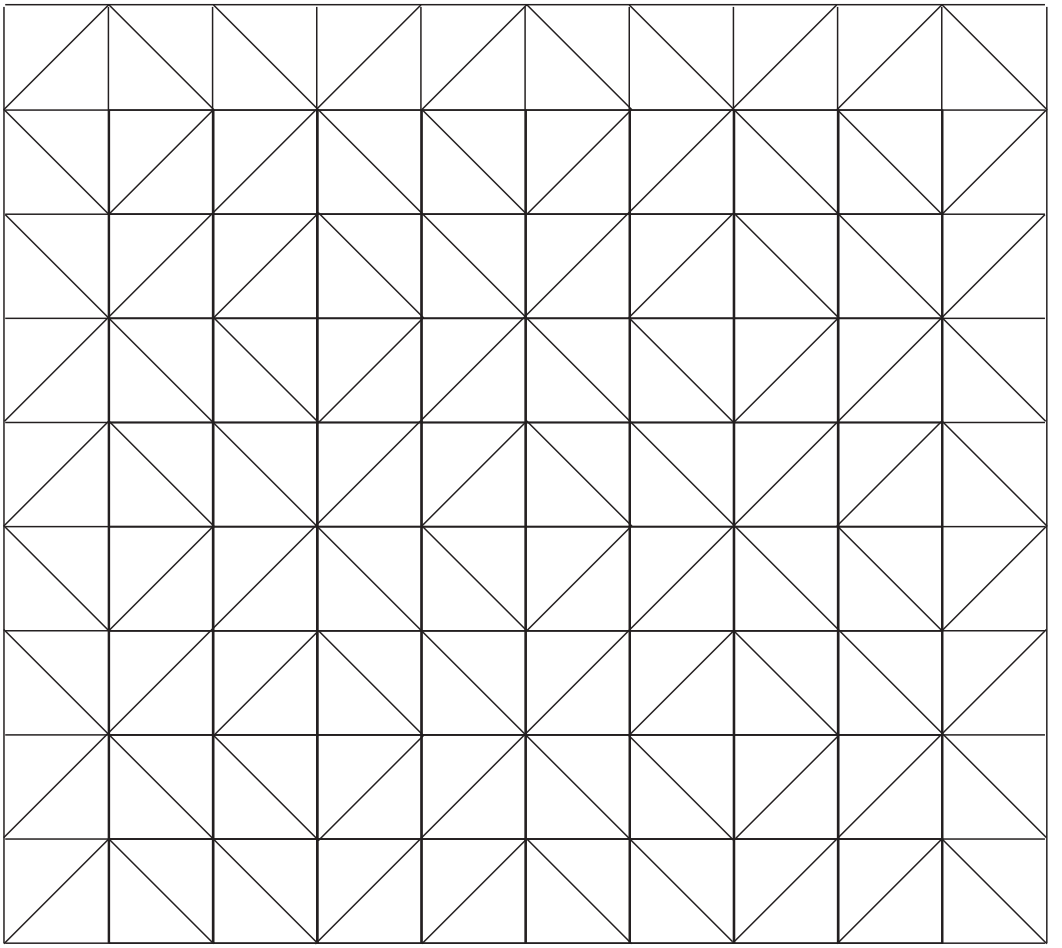
A summary of the properties of quadrilaterals and the Venn diagram on page 121 of the Student's Book can also be used as visual aids.

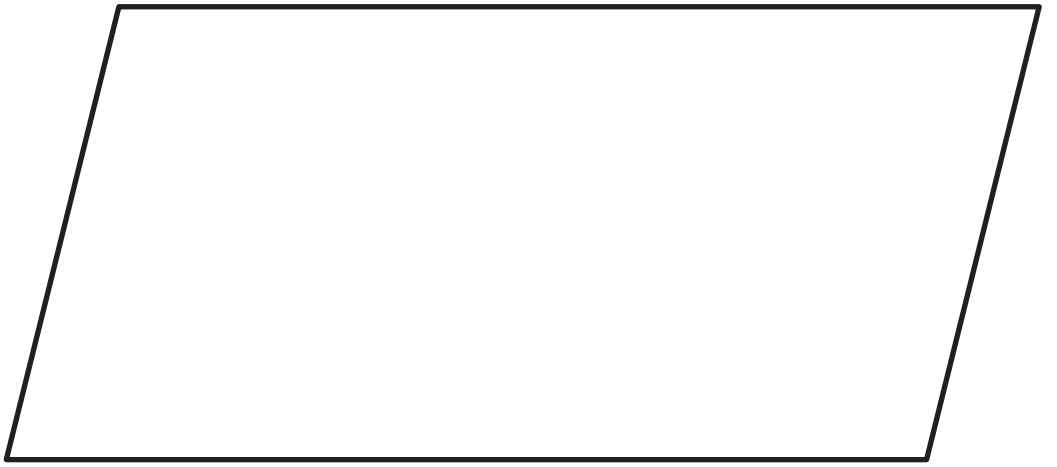
Students will also need dot paper, so make photocopies of the dot paper on the next page.

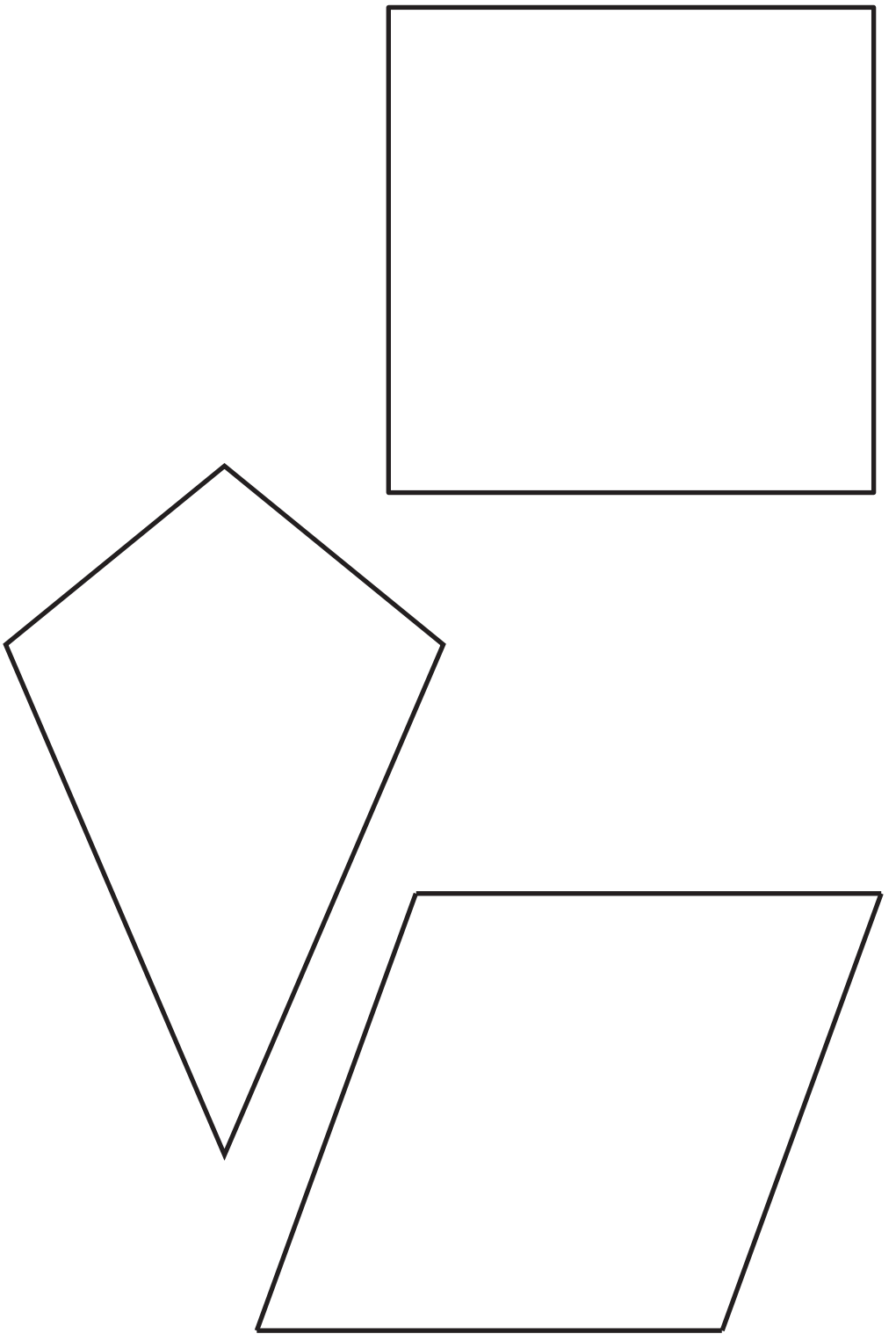
For Exercise 3 Question 3 you will need to provide students with the enlarged quilting template below.

Start by explaining to students that shapes are everywhere in the environment and that we will specifically be looking at the group of shapes called quadrilaterals. Define quadrilaterals and ask students if they can think of any quadrilaterals from real life. Explain that we will focus on only certain quadrilaterals namely, parallelograms, kites and trapeziums.

Scale drawings can be introduced by asking students of anything that they can think of that has been enlarged or reduced in size (for example, a globe that is a reduction of the Earth). If you have a model of a building available, show it as part of the discussion. Proceed by explaining what scale is and how it can be used to make drawings and representations of the real world.







Answers to exercises

Exercise 1

(SB page 118)

3.

Property	Parallelogram	Rhombus	Square	Rectangle	Kite	Trapezium
Interior angles add up to 306°	✓	✓	✓	✓	✓	✓
All angles are right angles			✓	✓		
All sides are equal		✓	✓			
At least two pairs of adjacent sides are equal		✓	✓		✓	
Both pairs of opposite sides are equal	✓	✓	✓	✓		
At least one pair of opposite sides is parallel	✓	✓	✓	✓		✓
Both pairs of opposite sides are parallel	✓	✓	✓	✓		
At least one pair of opposite angles are equal	✓	✓	✓	✓	✓	
Both pairs of opposite sides and angles are equal	✓	✓	✓	✓		
Diagonals bisect each other	✓	✓	✓	✓		
At least one diagonal is bisected at right angles		✓	✓		✓	
Both diagonals are bisected at right angles		✓	✓			
Diagonals are equal in length			✓	✓		
Diagonals bisect at least one pair of opposite interior angles	✓	✓	✓		✓	
Diagonals bisect both pairs of opposite interior angles		✓	✓			
All angles between diagonals and sides are 45°			✓			

4. Parallelogram: The interior angles add up to 360°. Both pairs of opposite sides are equal and parallel. Both pairs of opposite angles are equal. The diagonals bisect each other. The diagonals bisect one pair of interior angles.

Rhombus: The interior angles add up to 360°. All sides are equal and parallel. Adjacent sides are all equal. Both pairs of opposite angles are equal. The diagonals bisect each other. Both diagonals are bisected at right angles. The diagonals bisect both pairs of interior angles.

Square: The interior angles add up to 360°. All angles are right angles. All sides are equal and parallel. Adjacent sides are equal. Both pairs of opposite angles are equal. The diagonals bisect each other. Both diagonals bisect each other at right angles. The diagonals are equal in length. The diagonals bisect both pairs of opposite angles. All angles between sides and diagonals are 45°.

Rectangle: The interior angles add up to 360°. All angles are right angles. Both pairs of opposite sides are equal and parallel. Both pairs of opposite angles are equal. The diagonals bisect each other. The diagonals are equal in length.

Kite: The interior angles add up to 360°. Both pairs of adjacent sides are equal. One pair of opposite angles is equal. One diagonal is bisected at a right angle. The diagonals bisect one pair of opposite interior angles.

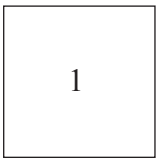
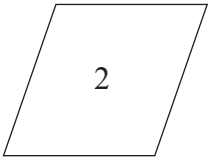
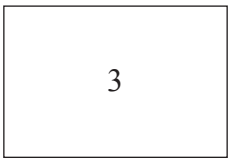
Trapezium: The interior angles add up to 360°. One pair of opposite sides is parallel.

Exercise 2

(SB page 123)

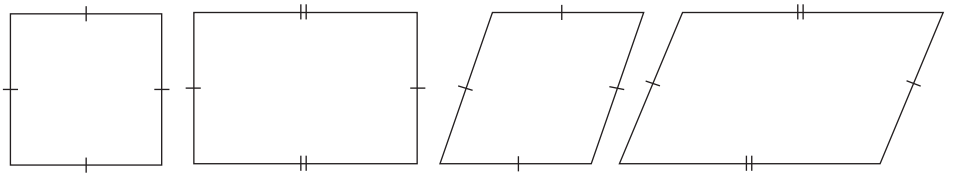
1. **a)** C **b)** A
c) E **d)** B

2.

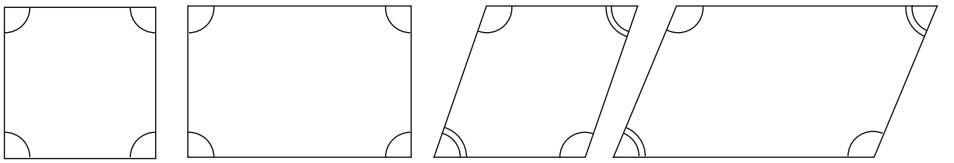
 1	 2	 3
Is a square, it has all four sides equal and all angles equal to 90°	Is a rhombus, it has all four sides equal and interior opposite angles equal	Is a rectangle, it has two pairs of opposite sides equal and all angles equal to 90°

 4	 5
Is a parallelogram, it has two pairs of opposite sides equal and interior opposite angles equal	Is also a parallelogram, it is different to 4 because it has different interior angles

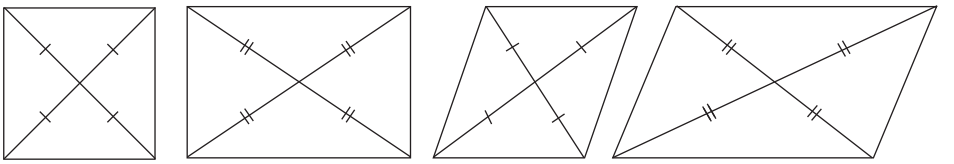
3. Two pairs of opposite sides equal



Two pairs of opposite angles equal



The diagonals bisect each other



4. **a)** Rectangle **b)** Square **c)** Rhombus
d) Trapezium **e)** Parallelogram **f)** Kite
g) Isosceles trapezium

5. **a)** Kite **b)** Square **c)** Square
d) Kite **e)** Rhombus **f)** Parallelogram
g) Rectangle **h)** Square

6. No, because a trapezium has one pair of parallel sides while a parallelogram has two pairs of parallel sides.

7. **a)** Rhombus

b) Both pairs of opposite sides are parallel
Both pairs of opposite angles are equal
The diagonals bisect each other
The diagonals bisect each other at right angles
The diagonals bisect both pairs of interior angles

c) Square

d) The diagonals bisect each other
The diagonals are all equal in length
The diagonals bisect each other at right angles
The diagonals bisect both pairs of opposite interior angles
All angles between the sides and the diagonals are equal to 45°

8. **a)** True **b)** False **c)** False
d) False **e)** False

9. **a)** Not all four sides are equal
b) All four sides are equal and the angles are not 90°
c) Not all four sides are equal, the opposite sides are not parallel and the opposite interior angles are not equal

10. **b)** 1. Right-angled isosceles triangle: two adjacent sides are equal, the angles opposite the equal sides are 45° and the angle between the two equal sides is 90°

2. Right-angled isosceles triangle: two adjacent sides are equal, the angles opposite the equal sides are 45° and the angle between the two equal sides is 90°

3. Right-angled isosceles triangle: two adjacent sides are equal, the angles opposite the equal sides are 45° and the angle between the two equal sides is 90°

4. Parallelogram: two pairs of opposite sides are parallel, two pairs of opposite sides are equal, the interior opposite angles are equal and the diagonals bisect each other

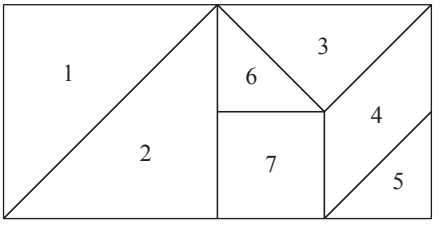
5. Right-angled isosceles triangle: two adjacent sides are equal, the angles opposite the equal sides are 45° and the angle between the two equal sides is 90°

6. Right-angled isosceles triangle: two adjacent sides are equal, the angles opposite the equal sides are 45° and the angle between the two equal sides is 90°

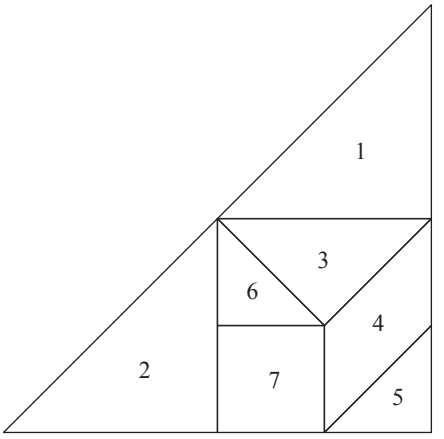
7. Square: all four sides are equal, two pairs of opposite sides are parallel, all interior angles are 90°, the diagonals are equal, the diagonals bisect each other, the diagonals bisect the opposite interior angles and all angles between the sides and the diagonals are 45°

c) 3, 5 and 6

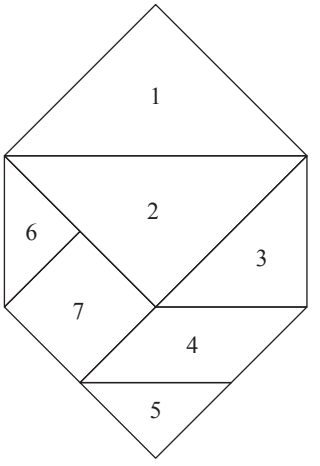
d) **i)**



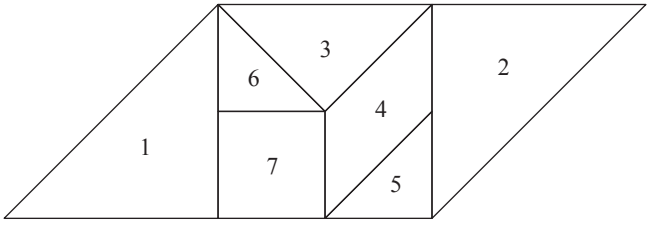
ii)



iii)



iv)



11. a) $x = 35°$

b) $x = 60°$

c) $x = 52°$

d) $x = 90°$

$y = 69°$

Exercise 3

(SB page 127)

1.

Shape	Everyday example
Trapezium	Popcorn box
Kite	Kite
Parallelogram	Folding security gate
Square	Floor tile
Rectangle	Television

2. Rectangle, isosceles triangle, right-angled trapezium, isosceles trapezium, square, rhombus, parallelogram, right-angled isosceles triangle

3. Student's own work.

4. **a)** A **b)** B **c)** F **d)** D **e)** E

Exercise 4

(SB page 132)

1. 5.38 cm

2. **a)** Scale factor is 1 : 300 and length is 12 cm
b) Scale factor is 1 : 100 and length is 25 cm

3. **a)** 180 cm **b)** 32 cm

4. 2.7 m

5. **a)** 45 000 000 cm **b)** 450 000 m **c)** 450 km

6. 640 000 m^2

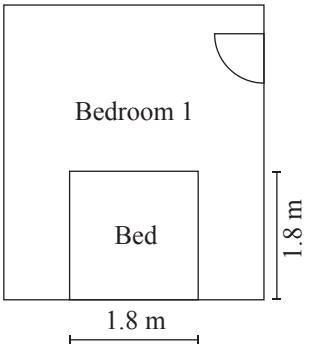
Exercise 5

(SB page 135)

1. **a)** 10 doors (including closet doors)

b) 2 m by 2 m

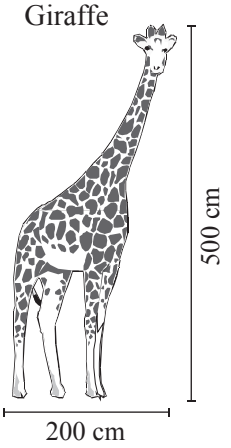
c)



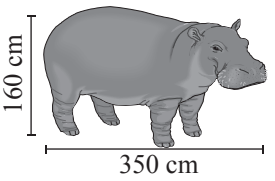
2. 3 cm by 3 cm
The scale is 1 : 15

3.

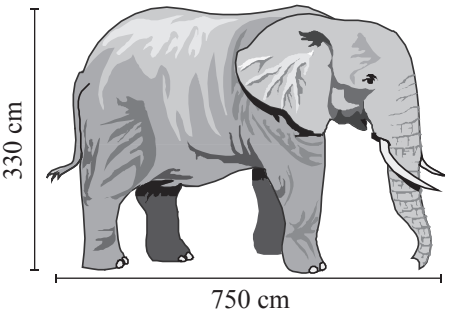
Giraffe



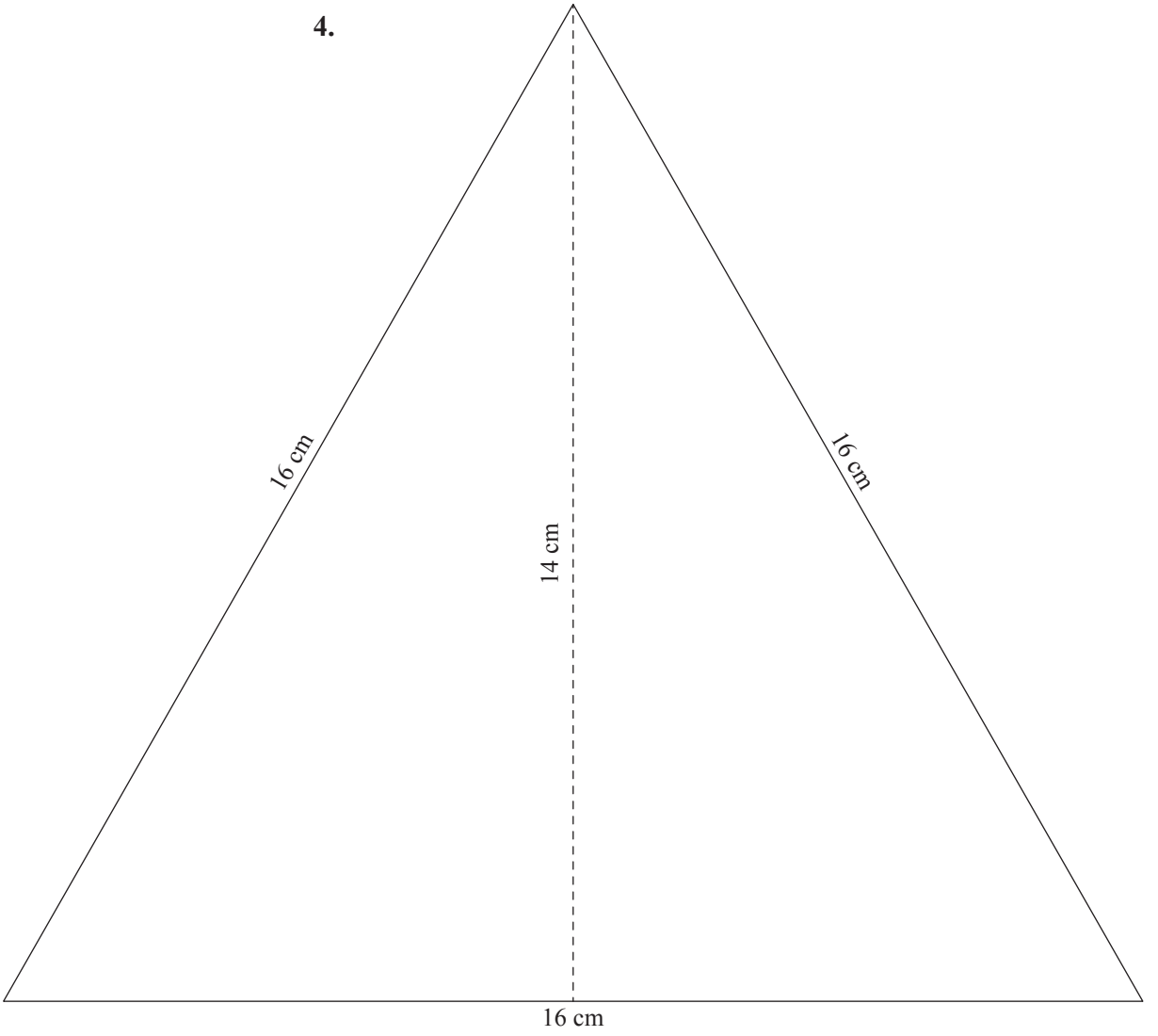
Hippopotamus



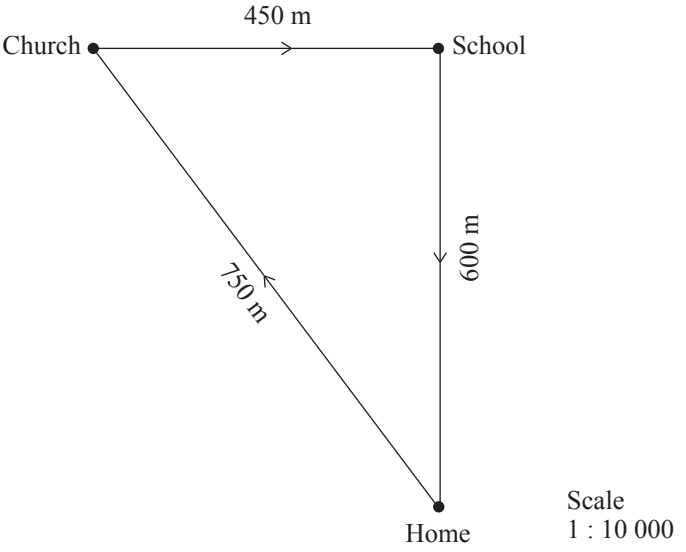
Elephant



4.

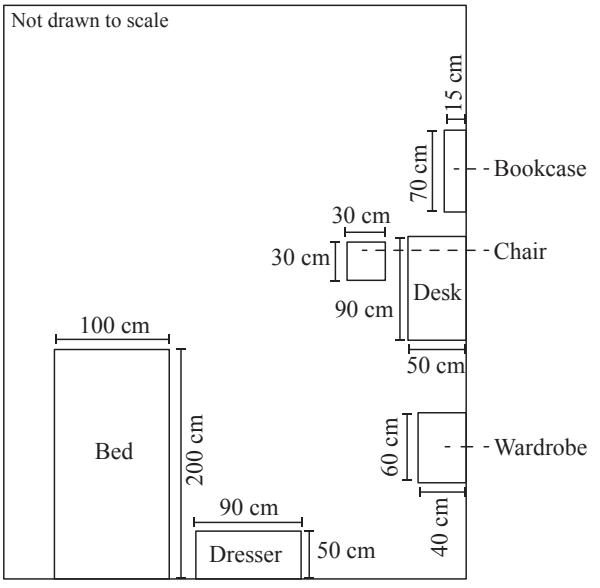


5.

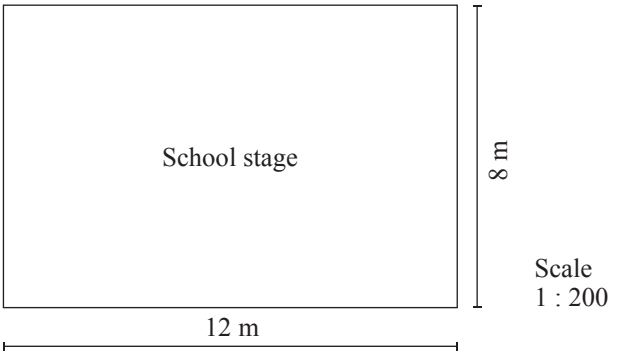


6. Student's own work.

7.



8.



Exercise 6

(SB page 137)

1.

	Scale	Measurement on map	Actual distance
a)	1 : 50	10 cm	5 m
b)	1 : 10	80 cm	8 m
c)	1 : 800	73 mm	58.4 m
d)	1 : 20 000	122.5 mm	24.5 km
e)	1 : 2 000	100 cm	2 km

2. 1.2375 km

3. 1 : 500 000

4. **a)** 416 km
b) 3.78 hours (3 hours and 47 minutes)
c) 45.76 litres

5. **a)** Cameroon
b) 12.52 cm

6. **a)** Hospital Street, Burger Street, Rissik Street and Dorp Street

b) Turn left out of Polokwane Hospital and travel east along Hospital Street and then turn right into Burger Street and travel south. The entrance to the Pietersburg Medi-Clinic will be on your right.

c) 2.025 km

TERM 2

Revision

Term 2: Revision exercises

(SB page 142)

Word problems

1. $15 = x - 5$
$x = 20$ years old

2. $3x = 9\,000$
$x = 3\,000$ kilowatt-hours

3. $x + y = 90$
$58 + y = 90$
$y = 32°$

4. $x + x + 1 + x - 1 = 20$
$3x = 20$
$x = 6\frac{2}{3}$ cm

5. $5(4x + 3) = 665$
$20x = 650$
$x = 32\frac{1}{2}$ cm

6. $50x = 1\,000$
$x = 20$ minutes

7. $\frac{5}{6}x + \frac{1}{5}x = 31$
$31x = 930$
$x = 30$

8. $\frac{2}{3}x + 20 = 2x$
$2x + 40 = 6x$
$x = 20$ years old

9. $x - \frac{1}{2}x - \frac{1}{3}x - \frac{1}{10}x = 200$
$\frac{1}{15}x = 200$
$x = ₦3\,000$

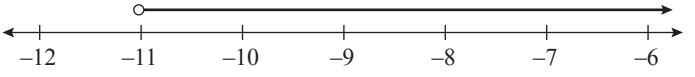
10. $\frac{2}{3}x - 35 = \frac{1}{6}x$
$\frac{1}{2}x = 35$
$x = 70$ litres

Inequalities

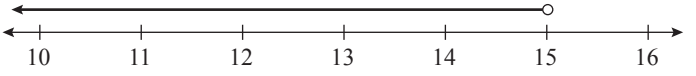
1. **a)** $5 \leq x$ **b)** $x \geq 14$ **c)** $x \leq 6$
d) $x > 15$ **e)** $9 \leq x$ **f)** $x \geq 1$
g) $x \leq 8$ **h)** $x - 7 \leq 13$ **i)** $x + 6 > 1$
j) $x + 14 \geq 28$ **k)** $x - 5 < 32$ **l)** $x - 4 > 20$

2. $x < -2$ with graph 3
$x > 15$ with graph 1
$x \geq -8$ with graph 5
$x \geq -25$ with graph 2
$x \leq 18$ with graph 4

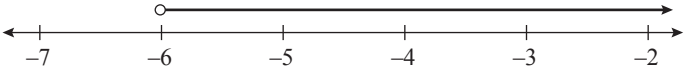
3. **a)**



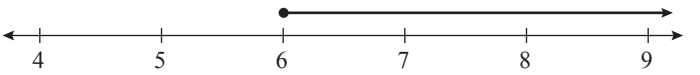
b)



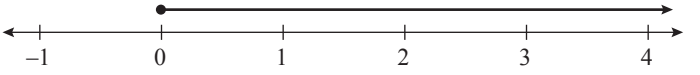
c)



d)

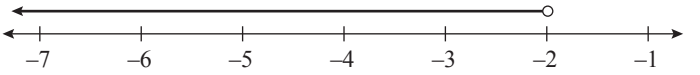


e)

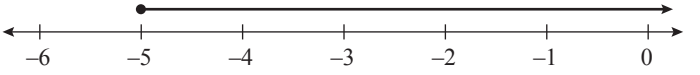


4. **a)** $1 \leq x < 6$ **b)** $2 < x < 5$ **c)** $3 < x \leq 7$
d) $-2 \leq x \leq 1$ **e)** $-9 < x \leq -5$ **f)** $x \leq -2; x > 1$

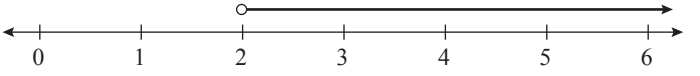
5. **a)** $-2x > 4; x < -2;$



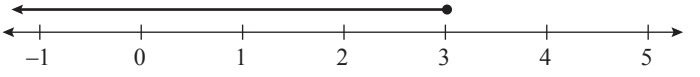
b) $-3x \leq 15; x \geq -5; -2x > 4; x < -2;$



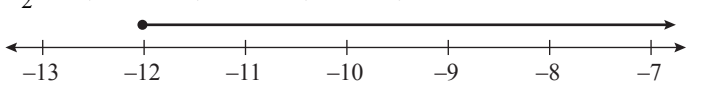
c) $-9x < -18; x > 2; -2x > 4; x < -2;$



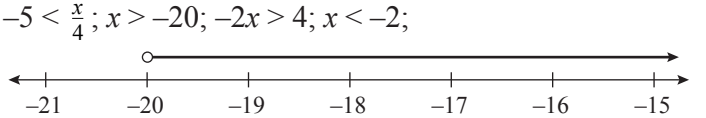
d) $6 \geq 2x; 3 \geq x; -2x > 4; x < -2;$



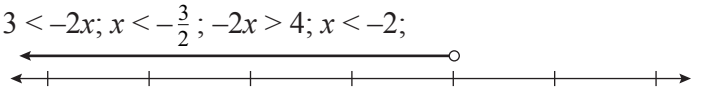
e) $-\frac{x}{2} \leq 6; x \geq -12; -2x > 4; x < -2;$



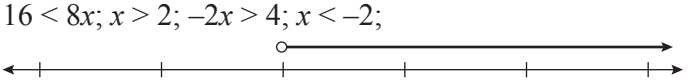
f) $-5 < \frac{x}{4}; x > -20; -2x > 4; x < -2;$



g) $3 < -2x; x < -\frac{3}{2}; -2x > 4; x < -2;$



h) $16 < 8x; x > 2; -2x > 4; x < -2;$

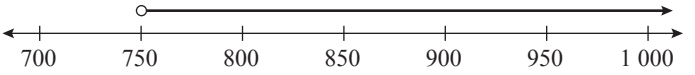


6. $5 < \frac{60}{x}$
$5x < 60$
$x < 12$ hours

7. $x < \frac{1}{4}(3x + 4)$
$4x < 3x + 4$
$x < 4$

8. **a)** $x + 250 > 1\,000$

b) $x > 750$ hours



9. a) Area = $18q$ **b)** $261 > 18q$

$q < 14\frac{1}{2}$ metres

10. a) Boy's age = $x + 4$ **b)** $13 > x + 4$

c) $x < 9$ years old

Graphs of linear equations

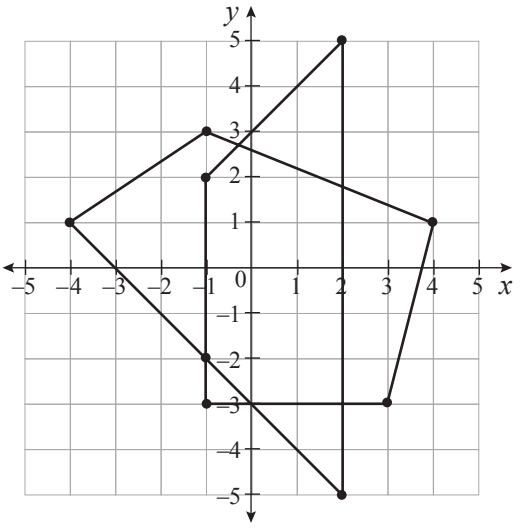
1.

Ordered pair	Quadrant 1	Quadrant 2	Quadrant 3	Quadrant 4	On x-axis	On y-axis
(–2; 5)		✓				
(0; –5)						✓
(9; 1)	✓					
(5; –5)				✓		
(8; 0)					✓	
(–1; 7)		✓				

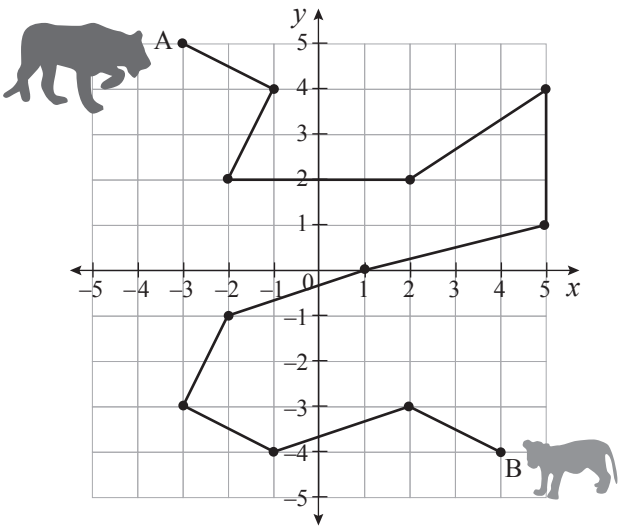
2.

A (–7; 3)	B (0; –1)	C (0; 5)
D (–5; 0)	E (–5; –2)	F (–6; –4)
G (8; –3)	H (2; 8)	I (–2; –2)
J (–3; 5)	K (–2; 2)	L (–1; 0)
M (2; 2)	N (6; –5)	O (–3; –7)
P (8; 8)	Q (5; 2)	R (–1; –5)
S (2; –8)	V (–6; 7)	W (0; –8)
X (4; 0)	Y (6; 5)	Z (4; –4)

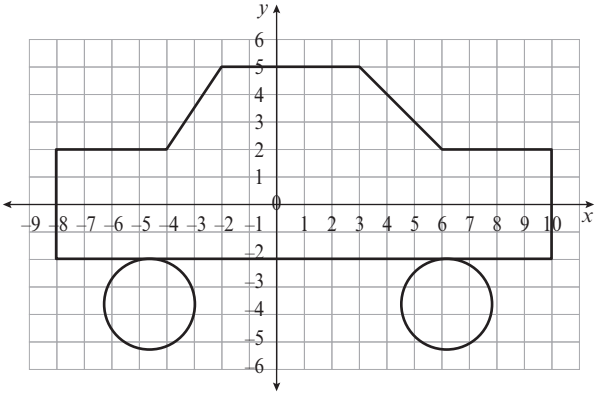
3.



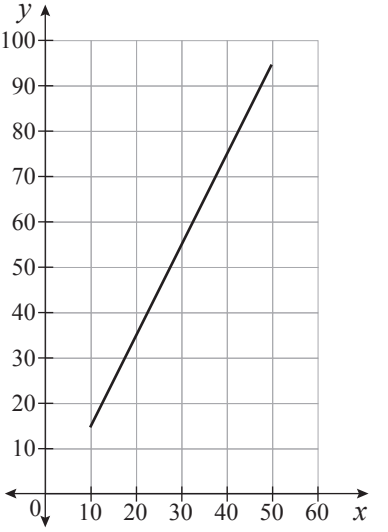
4.



5. Picture of a car



6. a)



b) $c = -6$; $m = 2$

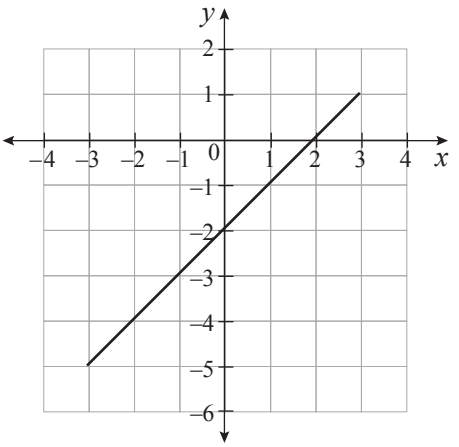
c) $y = 2(65) - 6$
$y = 124$

d) $234 = 2x - 6$
$x = 120$

7.

x	–3	–2	–1	0	1	2	3
y	–5	–4	–3	–2	–1	0	1

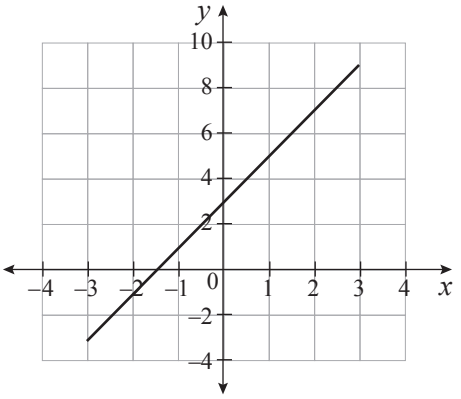
Graph of $y = x - 2$



8.

x	–3	–2	–1	0	1	2	3
y	–5	–1	1	3	5	7	9

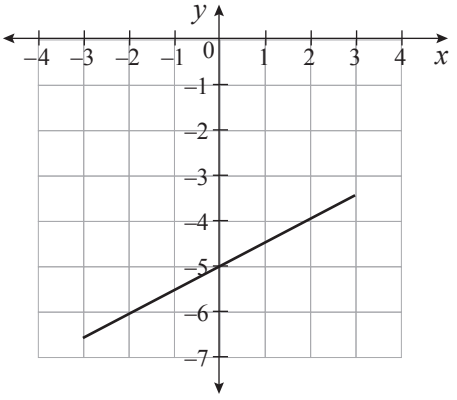
Graph of $y = 2x + 3$



9.

x	–3	–2	–1	0	1	2	3
y	$-6\frac{1}{2}$	–6	$-5\frac{1}{2}$	–5	$-4\frac{1}{2}$	–4	$-3\frac{1}{2}$

Graph of $y = \frac{1}{2}x - 5$



10. a) $m = 1$, y-intercept $= 2$, x-intercept $= -2$

b) $m = 3$, y-intercept $= 3$, x-intercept $= -1$

c) $m = -5$, y-intercept $= -2$, x-intercept $= \frac{2}{-5}$

d) $m = -4$, y-intercept $= 3$, x-intercept $= \frac{3}{4}$

e) $m = 2$, y-intercept $= \frac{-5}{3}$, x-intercept $= \frac{5}{6}$

f) $m = 2$, y-intercept $= -3$, x-intercept $= \frac{3}{2}$

g) $m = \frac{4}{3}$, y-intercept $= \frac{-4}{3}$, x-intercept $= 1$

11. A: positive

B: negative

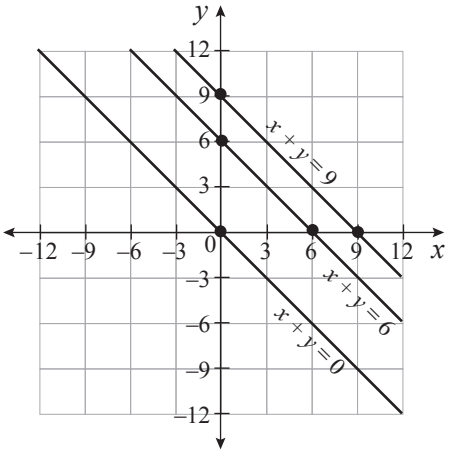
C: positive

D: negative

E: negative

F: positive

12.



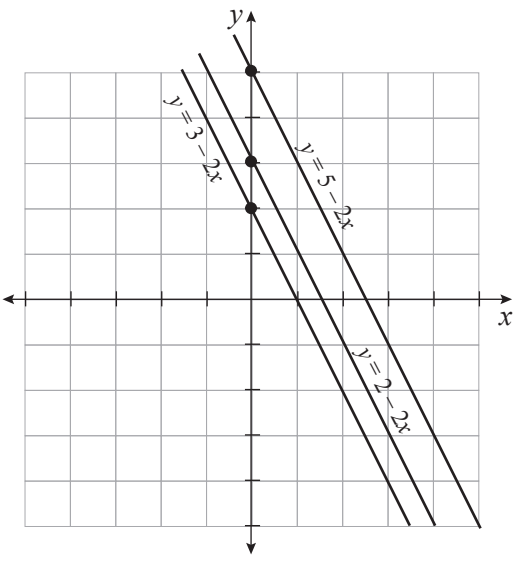
a) The gradients are all the same and in the negative direction.

b) The value for m is -1 for all three graphs.

13. a) The value of m is the same in both equations, therefore the lines are parallel.

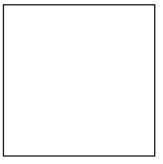
b) $y = 3 - 2x$

c)



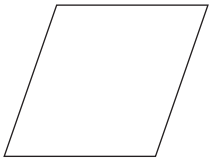
Plane shapes and figures

1. A quadrilateral is a family of shapes that have four sides and four vertices (corners). The internal angles of quadrilaterals always add up to 360°.

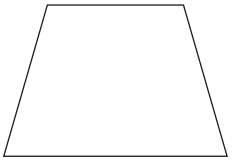


Square

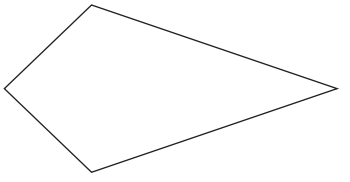
Rectangle



Rhombus

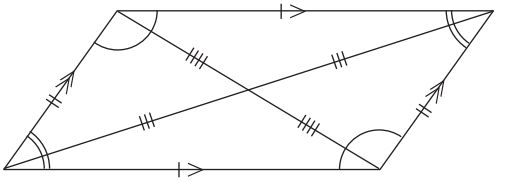


Trapezium



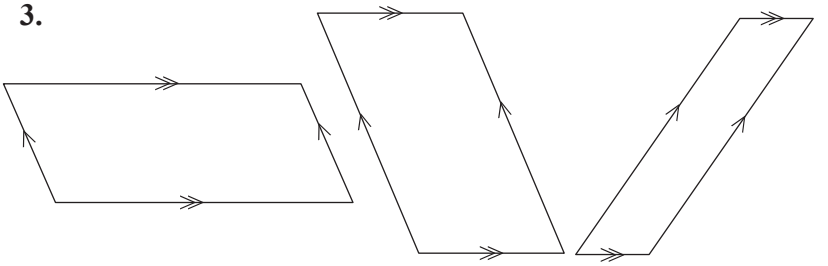
Kite

2.



Both pairs of opposite sides are parallel.
Both pairs of opposite sides are equal.
Both pairs of interior opposite angles are equal.
The diagonals bisect each other.
The diagonals bisect the interior opposite angles.

3.



4. A parallelogram is a type of quadrilateral. There are other types of quadrilateral that do not share the same properties as a parallelogram, for example, other quadrilaterals might have opposite sides parallel or opposite sides equal. Some quadrilaterals might have 90° internal angles, whereas parallelograms do not.

5. **a)** Square, rectangle
b) Trapezium
c) Rectangle, parallelogram
d) Square, rhombus
e) Square, rhombus, rectangle, parallelogram
f) Trapezium
g) Kite
h) Square, rhombus
i) Square, rhombus, rectangle, parallelogram
j) Square, rhombus, rectangles, parallelogram
k) Square, rectangle
l) Square

6. **a)** Parallelogram: 2 pairs of opposite sides are parallel
b) Trapezium: 1 pair of opposite sides is parallel
c) Rectangle: All angles are equal

7. $360° – (98° + 75° + 108°) = 79°$

8. 34°

9. Angle DAO = angle ADO = $\frac{1}{2} \times (180° – 82°)$
$= 49°$ (Interior angles of a triangle)
Angle BAO = $90° – 49° = 41°$ (Complementary angles)
$x = 41°$ (Alternate angles, AB // DC)

10. $x = 110°$ (The interior opposite angles of a parallelogram are equal)

11. $x = 90° – 50° = 40°$ (The diagonals of a kite intersect at 90°)

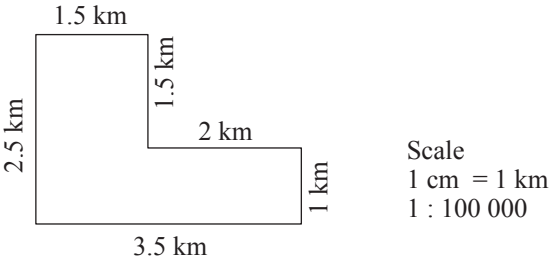
Scale and scale drawings

1.

	Drawing size	Real-life size
Slide	1.7 cm	3.4 m
Bench	0.6 cm	1.2 m
Flower bed	1.1 cm	2.2 m
Soft play area	4.2 cm	8.4 m
Running track	6 cm	12 m
Swings	1.4 cm	2.8 m
Roundabout	2.3 cm	4.6 m

2. 1 : 50 000

3. **a)**



b) 12 km

c) 5.42 times a week (6 times a week)

4. **a)** 1 : 300

b) 18 m × 18 m – (9 m × 6 m + 5 m × 10 m)
= 220 m^2

5. **a)** 21 mm = 200 km

b) 1 mm = 9.52 km

c) Distance on map is 30 mm
Real-life distance is 285.6 km

d) Distance on map is 87 mm
Real-life distance is 828.2 km

e) Time = $\frac{828.2}{100}$ = 8.3 hours = 8 hours and 18 minutes

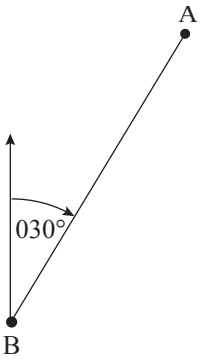
6. It would be better to use 1 : 1 000 000, because this would translate to 11.5 cm on a map. A scale of 1 : 8 000 000 would translate to 1.44 cm on a map. It is a relatively short journey so you can use a larger scale map, show more detail, and fit everything into 11.5 cm.

7. **a)** 3 130 km

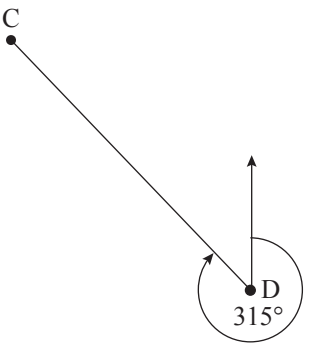
b) Speed = $\frac{3\,130}{9.5}$ = 329.47 km/h

Bearing

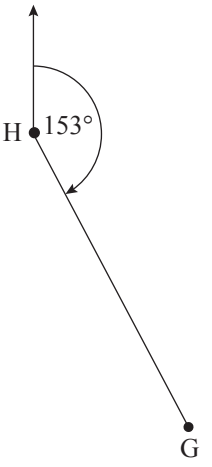
1. a)



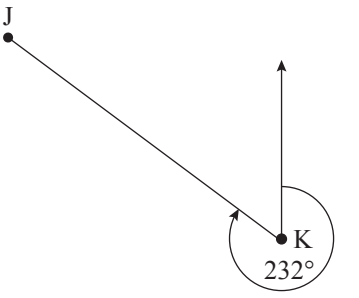
b)



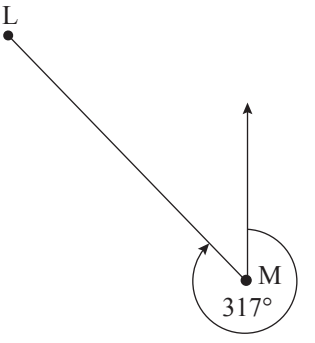
c)



d)



e)



2. 036°

3. 126°

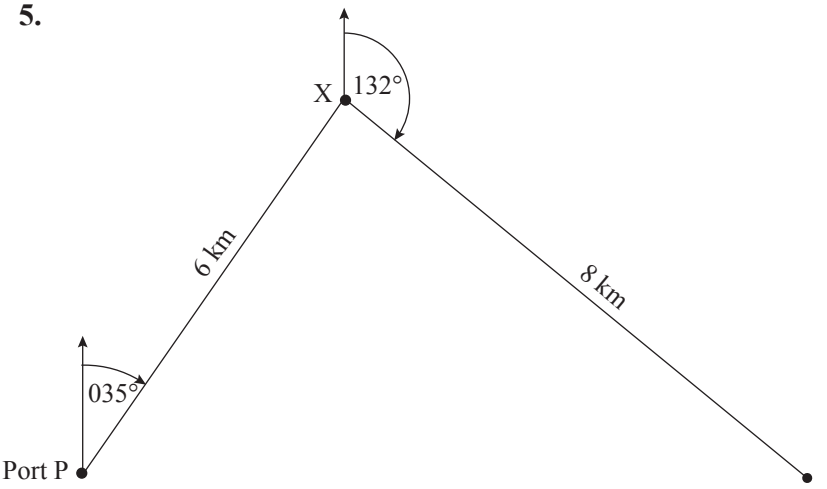
4. a) The ship must sail a distance of 5.4 km at a bearing of 060°.

b) The ship must sail a distance of 6.5 km at a bearing of 120°.

c) 10.3 km

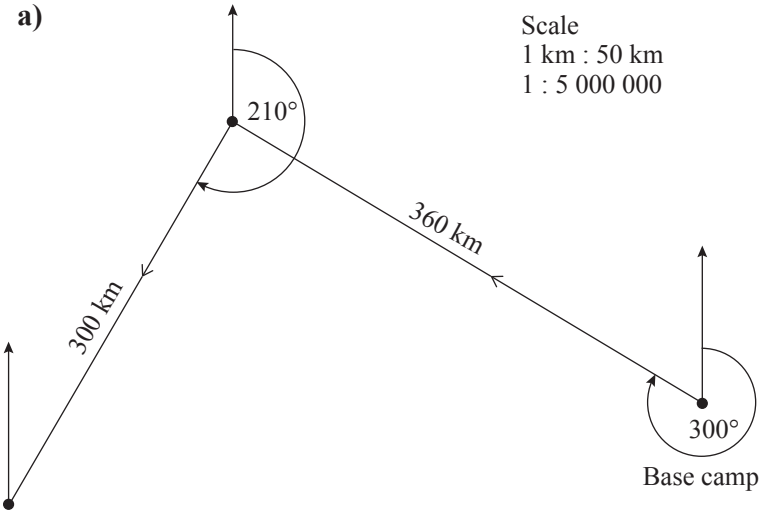
d) 273°

5.



Point Y is a distance of 9.6 km at a bearing of 092° from port P.

6. a)



b) i) 080°

ii) 465 km

Topic 1: Real-life applications of graphs

Introduction

This section takes a look at the application of linear graphs to real-life situations. It starts with conversion graphs, where the examples deal with percentage, temperature and distance conversions. Distance-time graphs are covered next in a typical situation, where people are walking or travelling and how their journey can be described by the graph. The topic concludes with velocity-time graphs.

Common difficulties

Some students may find it challenging to link one quantity to another in these linear graphs. Return to the basic principles of straight line graphs to help students understand the concepts.

Preparation

Have graph paper available for students to draw on. Make a summary chart of travel graphs and how they are used.

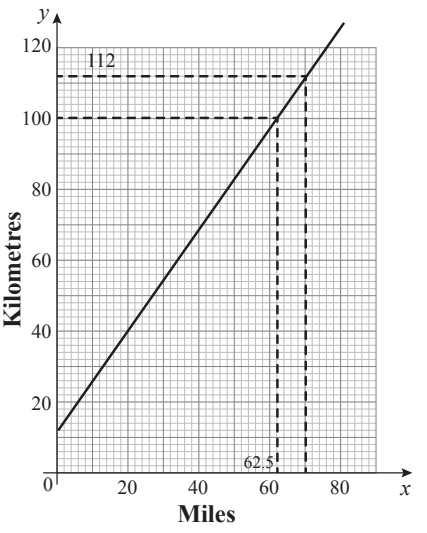
Briefly revise straight line graphs from the previous term. Explain to students that linear graphs can be applied to real-life situations where one quantity relates to another. Such graphs include conversion graphs and travel graphs.

Answers to exercises

Exercise 1

(SB page 154)

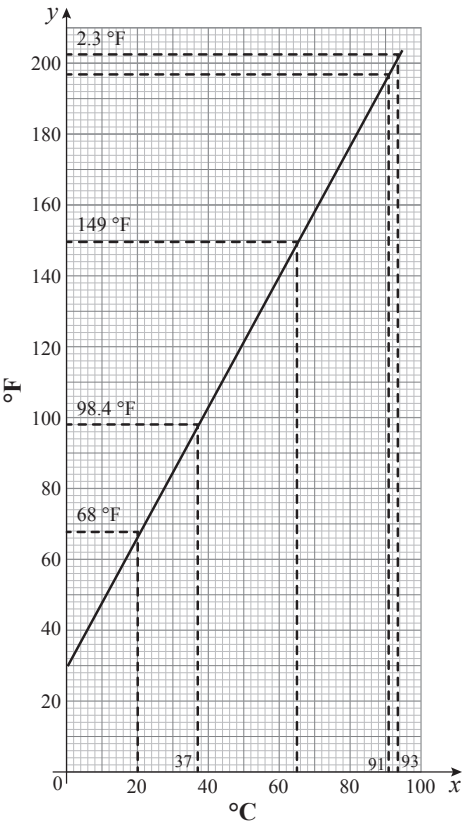
1.



a) 112 km

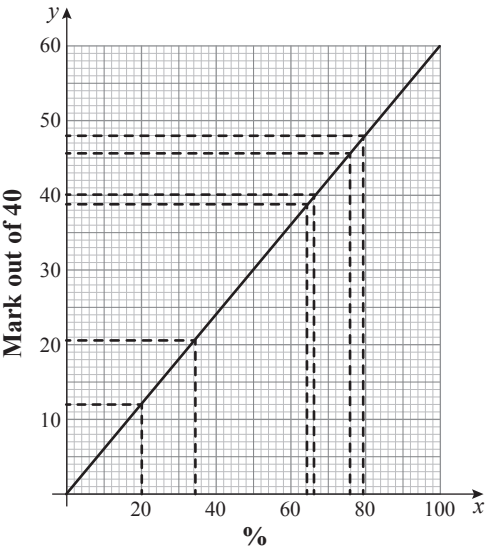
b) 62.5 miles

2.



a) 68 °F; 149 °F; 203 °F **b)** 93 °C; 91 °C; 37 °C

3.

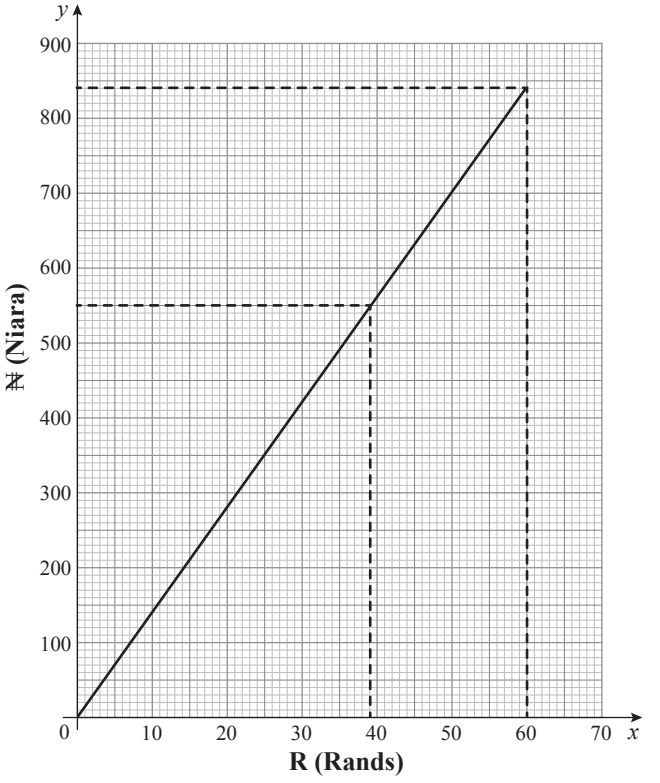


a) 75%; 67%; 33% **b)** 38; 48; 12

4. a)

R	1	3	10
₦	14	32	140

b)



c) ₦840 **d)** R39

Exercise 2

(SB page 158)

1. a) 4 km/h

b) 11 – 3 = 8 km

c) Her walking speed is constant.

d) $d = mt + c$; $d = 4t + 3$

e) m represents the walking speed. The distance she travels (Δy) in a given period of time (Δx).

2. a) Graph (i) is impossible, as this graph shows an infinite distance travelled in an instantaneous period of time.

b) Graph (ii) shows no change in distance over time. This can be understood as a person staying in the same place over a period of time.

3. a) Chimezie left home at 10:00 and Tayo left home at 11:00.

b) 30 minutes

i) 2 km

ii) 4 km/h

c) At 10:30

i) 15 minutes

ii) 0 km/h

d) 4 km

i) 45 minutes

ii) 5.3 km/h

e) i) Chimezie was 2 km from Tayo

ii) Tayo was at home

f) i) 11:30

ii) 12 km/h

g) 4.7 km – 3.1 km = 1.6 km

Exercise 3

(SB page 162)

1. a) 5 minutes

b) 10 minutes

c) decreasing

d) 20 × 5 = 100 km

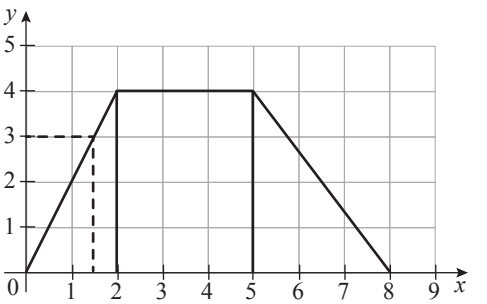
e) Acceleration: 2 km/min
Deceleration: 4 km/min

f) $\left(20 \times 10 \times \frac{1}{2}\right) + 100 + \left(20 \times 5 \times \frac{1}{2}\right)$
$= 100 + 100 + 50 = 350$ km

g) 350 km in 20 minutes = 17.5 km/min

2. The velocity increases from rest and reaches a maximum velocity of 5 m/s in 4 seconds. The velocity is then constant from 4 to 7 seconds and the object moves forward at a constant rate. The velocity then takes 3 seconds to decrease from 5 m/s to 0 m/s and come to a rest.

3.



a) $1\frac{1}{2}$ minutes

b) $(4 \times 3) = 12$ km

c) $\left(4 \times 3 \times \frac{1}{2}\right) = 6$ km

d) $4 + 6 + 12 = 22$ km

Topic 2: Angles and polygons

Introduction

The focus of this topic is angles, which includes angles in polygons and angles of elevation and depression. Students have learnt about angles before, so the topic starts with a basic revision of angles. Adjacent angles, angles in a revolution and the angles that are formed when a transversal cut through parallel lines, are all covered.

The topic continues by investigating the interior angles of polygons, including that of triangles and of quadrilaterals. It guides the student through a practical exercise to discover that the interior angles of a triangle add up to 180°. The examples then show how an unknown angle in a triangle can be determined given this fact. The examples include complex problems where an equation needs to be made to solve for a variable.

The section is followed by looking at the interior angles of quadrilaterals. The students are again guided to perform a practical activity to find out that the interior angles of a quadrilateral add up to 360°. The examples and exercises provide problem solving activities for students to practise the concept.

Regular polygons are introduced next and students are shown the formula for calculating the sum of the interior angles of various polygons. The examples and exercises take students through a number of problem solving activities regarding the interior angles of a polygon.

In the final unit, angles of elevation and depression are discussed. Scale drawings are used to solve problems with angles of elevation and depression. Finally, students are shown how to determine angles of elevation and depression using a clinometer.

Common difficulties

This topic presents a number of potential problems for students. From the very start, make sure that the foundational concepts covered in the revision are well understood. When students struggle to perform calculations with angles in a triangle or a quadrilateral, always refer them back to their initial investigation where they determined the sum of the angles. Assist them when they have to solve equations in geometrical figures, by revising the basic principles of equations.

Problems with angles of elevation and depression can be challenging to students, as they often do not know where to start with the problem. Provide them with guidelines and problem-solving strategies in this case. Encourage them to first draw rough diagrams of the problems they need to solve.

Preparation

Make a summary chart of the different polygons and the sum of their interior angles. You will also need to have a clinometer.

Explain to students that they have previously learnt about angles. Draw a few polygons on the board and explain what a polygon is and that angles form at the vertices of the polygons. Explain the interior angles of a polygon and state that students will focus on triangles, quadrilaterals and regular polygons.

A good way to introduce angles of elevation and depression is through a practical example where students go outside to look at a tree or a tall building. Explain that one looks up at an angle and the same for looking down. Give students a chance to work with the clinometer to measure these angles.

Answers to exercises

Exercise 1

(SB page 165)

1. $m = 131°$
2. $x = 50°$
3. $x = 115°$
4. $a = 130°$
5. $a = 47°$; $b = 133°$
6. $d = 15°$; $e = 65°$
7. $x = 13.4°$
8. $x + 10 = 4x - 80$; $x = 30°$

Exercise 2

(SB page 170)

1. a) XWY = 50°
b) BCD = 25°
c) JLK = 70°

2. a) $x = 40°$

b) $3a - 15 + a + a + 45 = 180$

$a = 30°$

c) $x = 44°$; $y = 150°$; $z = 106°$

d) $180 = 90 + x + 67 + x + 37$

$x = -7°$

e) $80 + 60 + x + 51 = 180$

$x = -11°$

f) $x = 80°$; $y = 100°$; $z = 100°$

Exercise 3

(SB page 173)

1. $x = 60°$

2. $x = 110°$

3. $x = 75°$

4. $4x = 0°$; $x = 0°$

5. $18x = 162°$; $x = 9°$

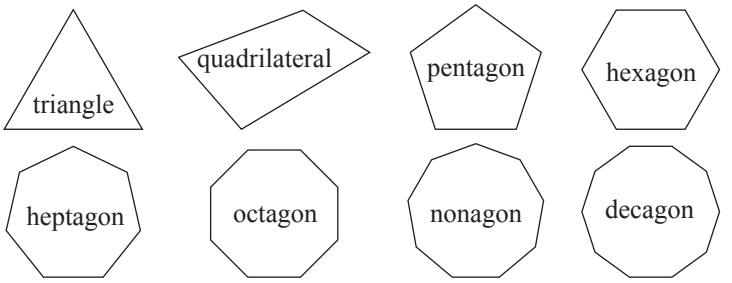
Exercise 4

(SB page 176)

1.

Number of sides in polygon	Name
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon

2.



3. a) $900 = 111 + 132 + 109 + 157 + 120 + 149 + x$

$x = 122°$

b) $540 = 47 + 127 + 280 + 62 + y$

$y = 24°$

c) $900 = 152 + 162 + 136 + 143 + 119 + 107 + r$

$r = 81°$

d) $720 = 90 + 118 + 132 + 88 + 255 + c$
$c = 37°$

4. a) $105 + x + 75 + x - 6 + x + 12 = 540$
$3x = 354$
$x = 118°$

b) $900 = x + 18 + x + 138 + x + 10 + 130 + 130 + 132$
$3x = 342$
$x = 114°$

c) $720 = 90 + x - 27 + x + 15 + 125 + 112 + x + 30$
$3x = 375$
$x = 125°$

5. $(2n - 4) \times 90 = 160n$
$180n - 360 = 160n$
$20n = 360$
$n = 18$ sides

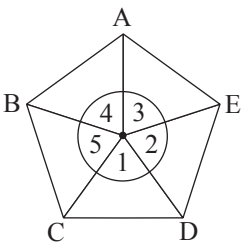
6. $5 \times 180° = 900°$;
$\frac{900}{7} = 128.6°$

7. a) $7 + 2 = 9$ sides

b) $7 \times 180° = 1\,260°$
$\frac{1\,260}{9} = 140°$

8. $720 = 115 + 85 + 130 + 3x$
$3x = 390$
$x = 130°$

9. a)



Pentagon has five central angles.

b) $\frac{360}{5} = 72°$

c) $3 \times 180 = 540°$

10. a) Increases **b)** Decreases **c)** Increases

11. Each angle in the pentagon is equal to 108°. The sum of angles in shape BCDF is 360°.
$360 = x + 3(108)$
$x = 36°$

12. The internal angles of a regular hexagon are 120° and the internal angles of a regular octagon are 135°.
$360 = x + 120 + 135$
$x = 105°$

Exercise 5

(SB page 181)

1. a) $13^2 = 5^2 + x^2$

$x = 12$ cm

b) $15^2 = 9^2 + x^2$

$x = 12$ m

$y^2 = 5^2 + 12^2$

$y = 13$ m

c) $17^2 = 8^2 + y^2$

$y = 15$ m

$x^2 = 9^2 + 15^2$

$x = \sqrt{306}$

$x = 17.5$ m

d) $y^2 = 1^2 + 1^2$

$y = \sqrt{2}$ m

$z^2 = 1^2 + (\sqrt{2})^2$

$z = \sqrt{3}$ m

$x^2 = 1^2 + (\sqrt{3})^2$

$x = 2$ m

Exercise 6

(SB page 182)

1. $30^2 = 24^2 + b^2$

$b = 18$ m

2. $2.5^2 + 1.3^2 = l^2$

$l = 1.3$ m

3. $6^2 + 3.5^2 = x^2$

$x = 6.9$ m

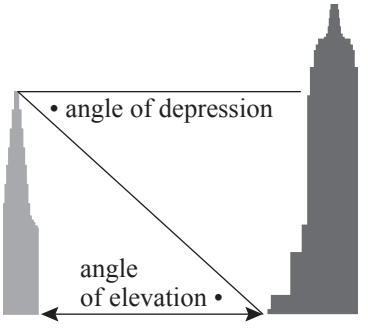
Exercise 7

(SB page 184)

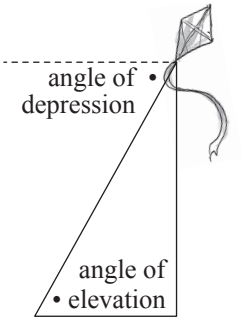
1. Tables, doors, classrooms, books, shelves.

2. A: angle of depression; B: neither; C: Angle of elevation

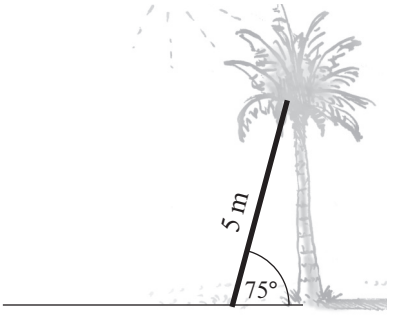
3. a)



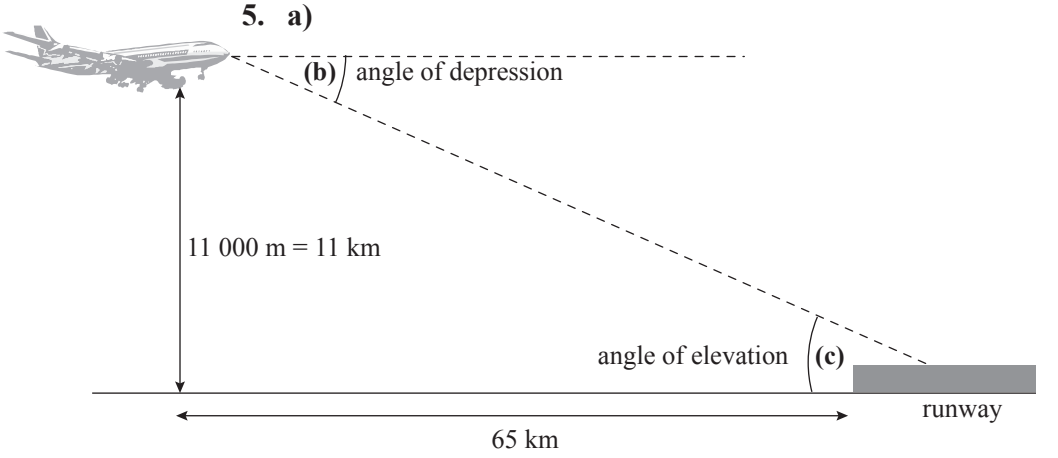
b)



4.



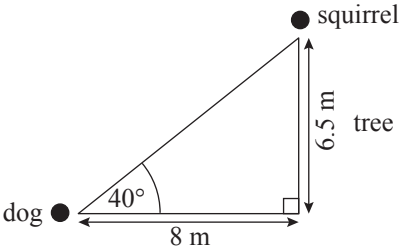
5. a)



Exercise 8

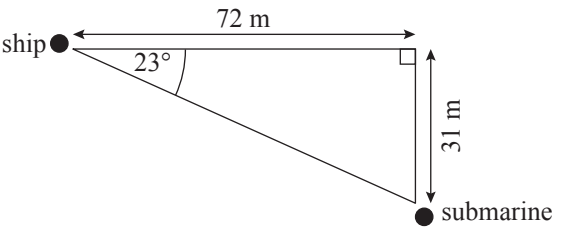
(SB page 188)

1.



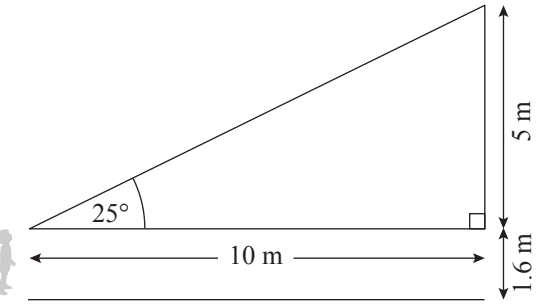
The tree measures 6.5 cm, which is 6.5 m in real life.

2.



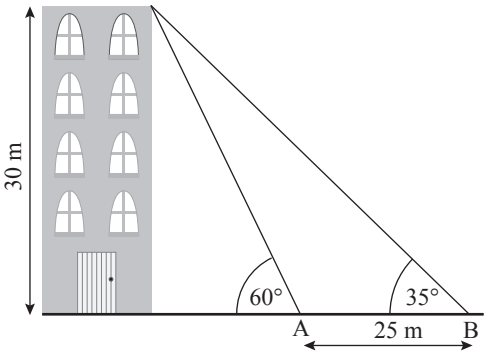
Submarine is 31 m below water surface.

3.



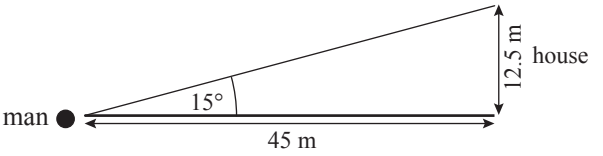
Height of the flagpole is 1.6 + 5 = 6.6 m.

4.



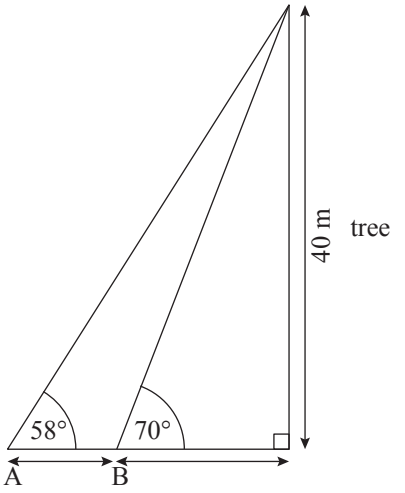
Height of building is 30 m.

5.



Height of the house is 12.5 m.

6.



a) The tree is 40 m tall.

b) 70°

Exercise 9

(SB page 190)

Student's own work.

Topic 3: Bearing

Introduction

Topic 3 begins by introducing the four cardinal directions and explains how to write three-figure bearings. This is followed by calculations with bearing. The exercises provide the context of map work and direction to explore the concepts. In the final unit, scale drawings to find bearing are covered.

Common difficulties

Some students may have difficulty with knowing how to measure the bearing angle. Remind students that angles are always measured in a clockwise direction from north.

Preparation

Make an enlargement of a compass to show students the cardinal points. Have pencils and protractors available for students to make scale drawings.

Explain that bearing is the direction of one place to another and that it is usually given through compass direction. Explain that it can also be given by an angle measured from the north in a clockwise direction. Explain that ships, aircraft and anyone using a map will depend on accurate bearing measurements.

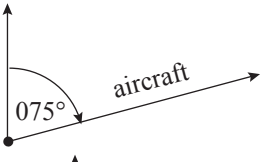
Answers to exercises

Exercise 1

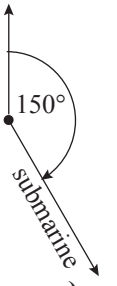
(SB page 192)

1. **a)** 180° **b)** 180° **c)** 45° **d)** 225° **e)** 45°

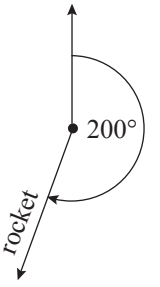
2. **a)**



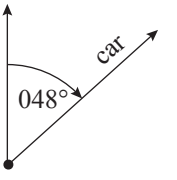
b)



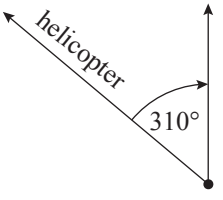
c)



d)



e)



3. **a)** 145° **b)** 270° **c)** 070°

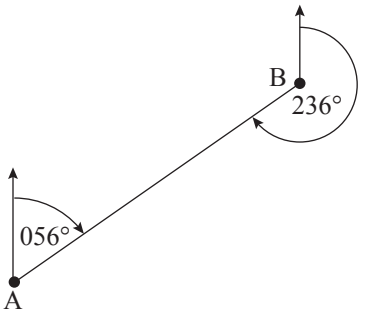
4. **a)** Train station
b) South East (SE), 135°
c) Travel west to the National Theatre and then travel north to the National Stadium.

Exercise 2

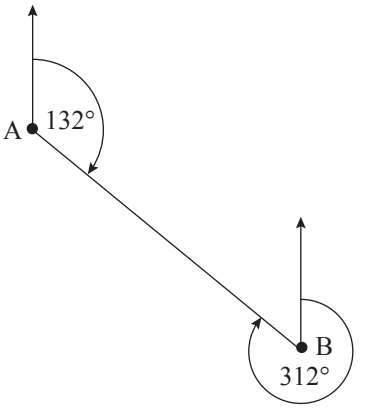
(SB page 195)

1. **a)** 225°
b) 300°
c) 040°

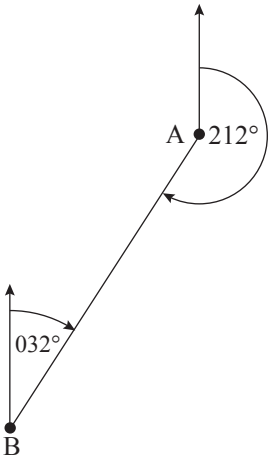
2. **a)** 236°



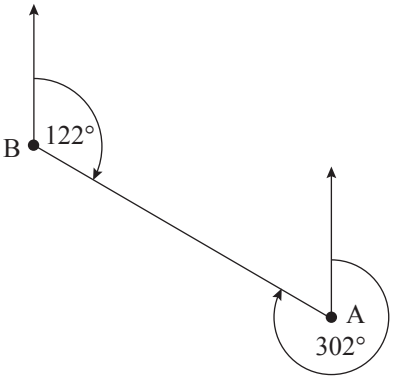
b) 312°



c) 032°



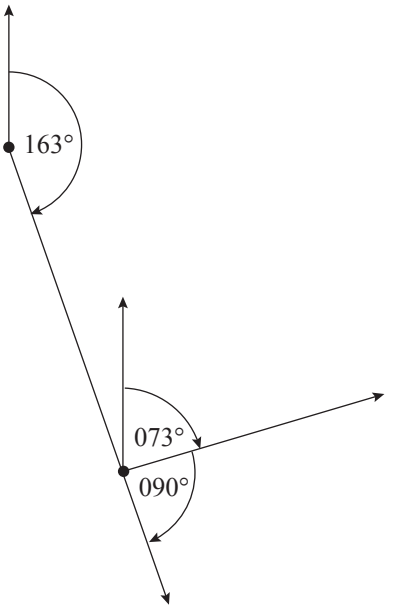
d) 122°



3. **a)** 298° **b)** 090°
c) 243° **d)** 063°

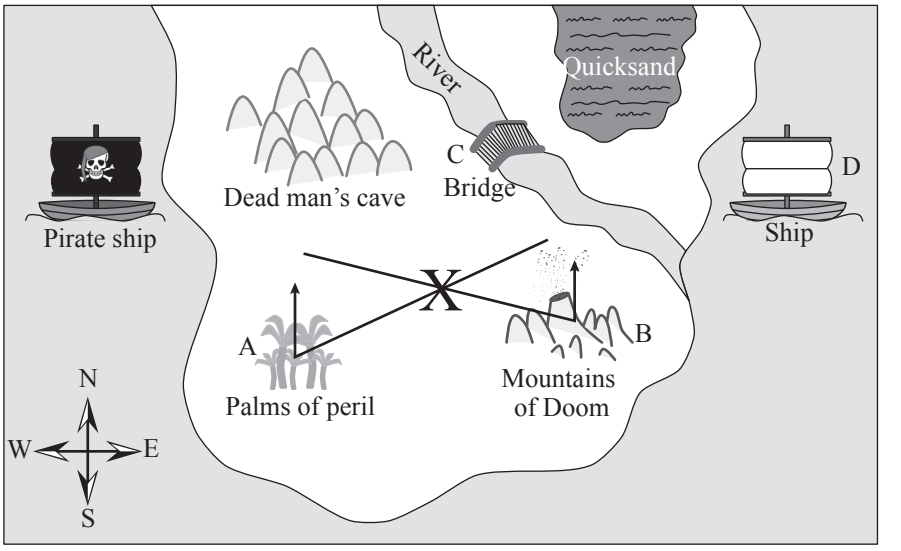
4. **a)** East
b) 225°

5.



6. **a)** 045°
b) 075°
c) 310°

7. **a)**



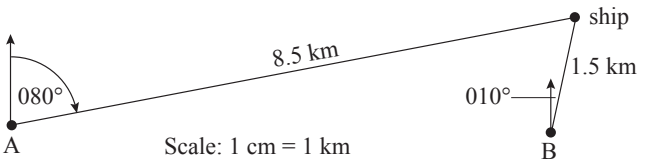
b) No, it is not a good idea, because the treasure hunter's ship is in the opposite direction.

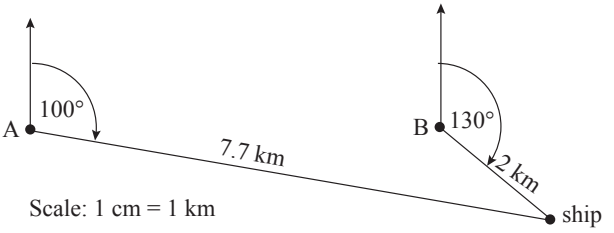
c) Travel at a bearing of 020° until you reach the bridge, cross the bridge and then travel at a bearing of 105° until you reach your ship.

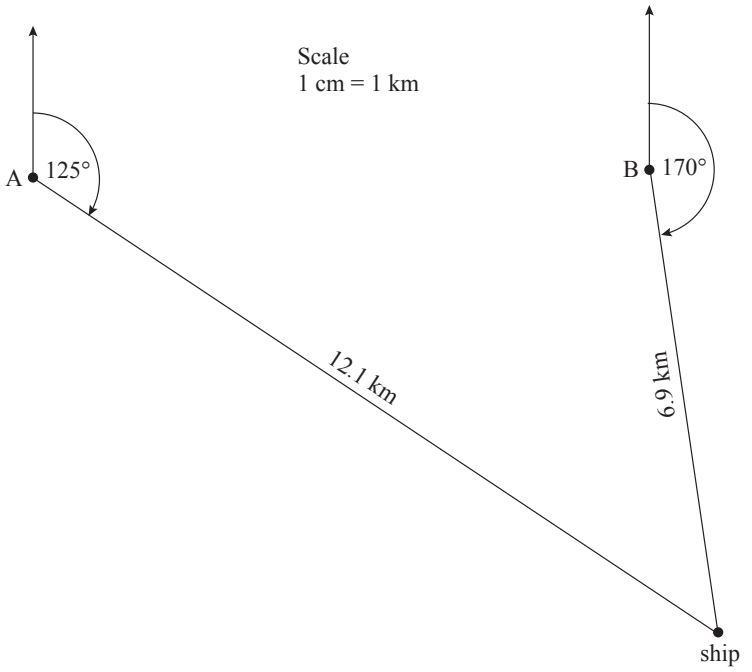
Exercise 3

(SB page 198)

1.



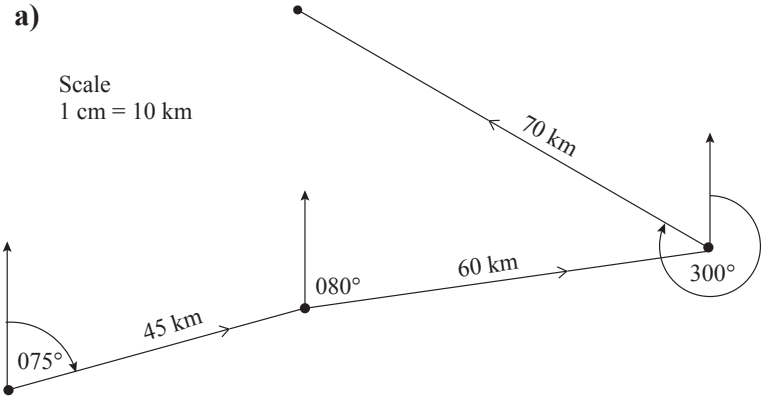




Scale used on scale drawing	Distance between coastguard stations	Bearing to ship from A	Bearing to ship from B	Distance to ship from A	Distance to ship from B
1 cm : 1 km	8 km	080°	010°	8.5 km	1.5 km
1 cm : 1 km	6 km	100°	130°	7.7 km	2 km
1 cm : 1 km	9 km	125°	170°	12.1 km	6.9 km

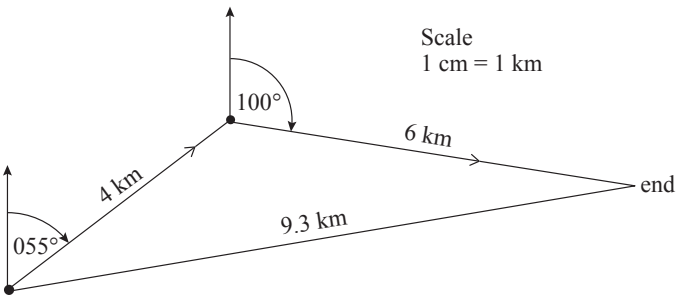
2. 6.3 km

3. a)



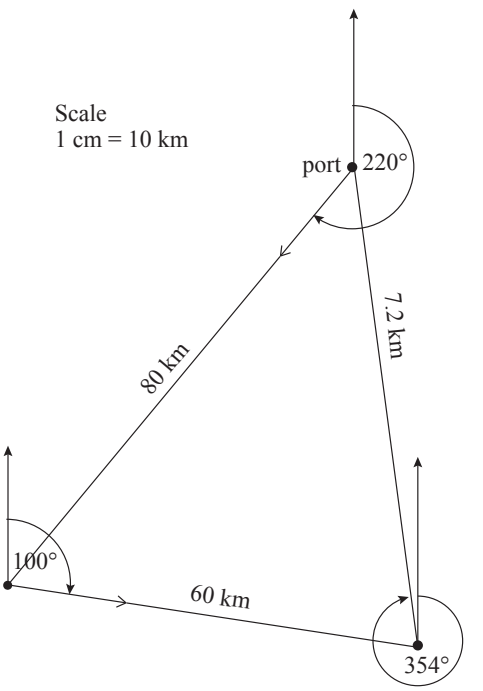
b) 175 km **c)** 70 km

4.



9.3 km

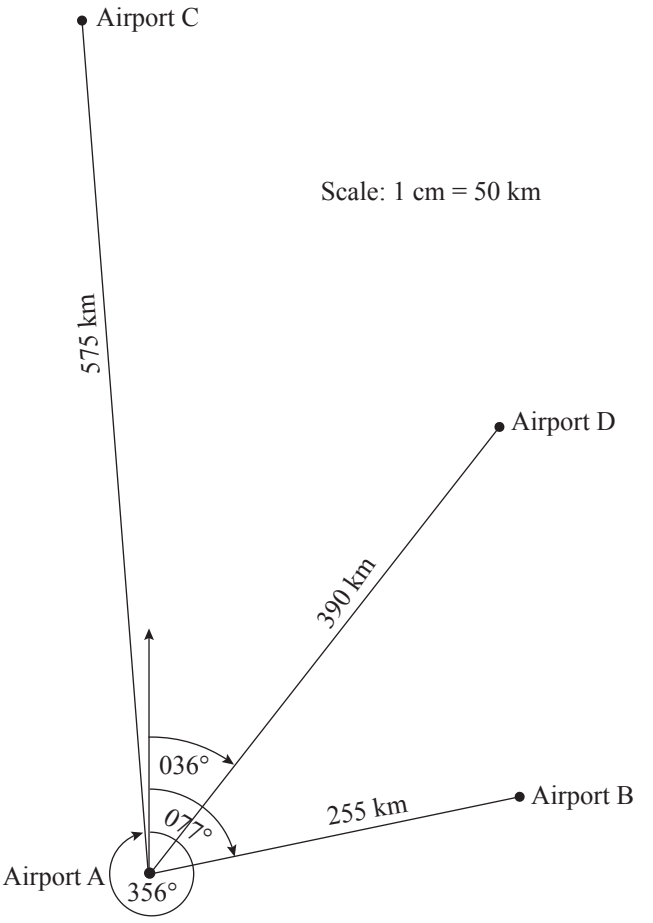
5.



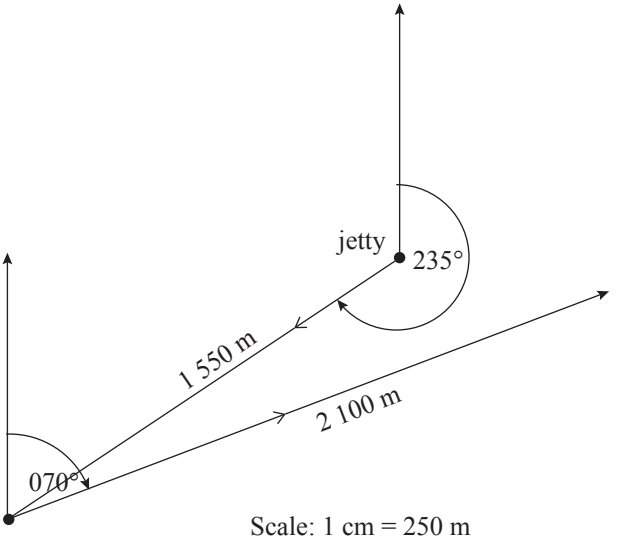
The submarine should travel on a bearing of 354° for 7.2 km.

6. 11 km

7.



8. a)



b) i) 280° **ii)** 700 m

Topic 4: Constructions

Introduction

This section first deals with the construction of triangles and an angle bisector.

Common difficulties

Students frequently find it challenging to follow steps provided in the question. Always encourage them to make a rough drawing first. Accuracy is another pitfall and students have to work carefully with sharp pencils and compasses that work properly. Remind them not to make the construction lines too dark, so that it is easier to delete it should they make a mistake.

Preparation

The most important preparation is ensuring that students have a pencil, eraser and compass available. It is useful to have available a computer package or pictures that show the construction steps.

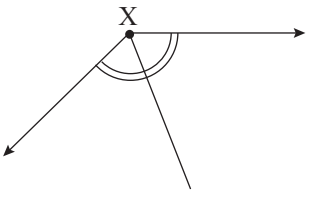
Explain that constructions are accurate drawings of geometric shapes. Remind the students on the use of the protractor and compasses. Remind students of the construction techniques studied in the previous years.

Answers to exercises

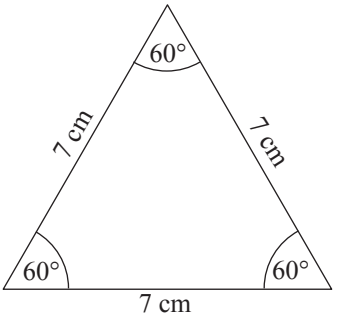
Exercise 1

(SB page 204)

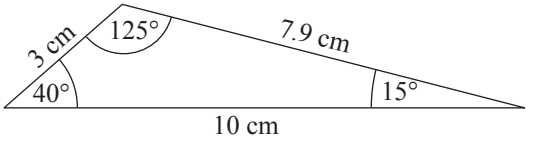
1.



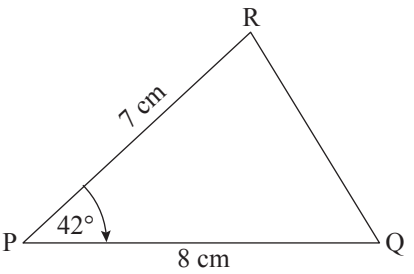
2.



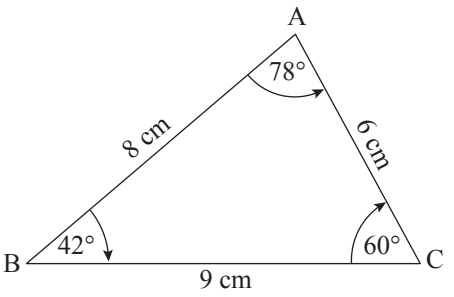
3.



4.



5. a)

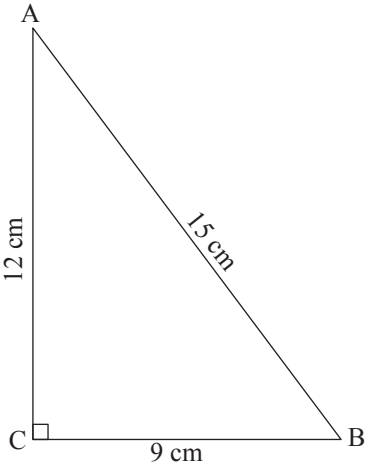


Angle ABC is 42°
Angle BAC is 78°
Angle ACB is 60°

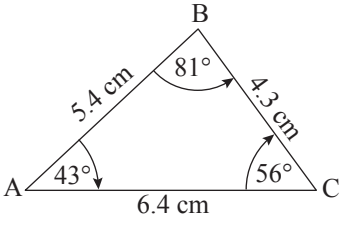
b) The sum of the internal angles is 180°.

c) 23 cm

6.

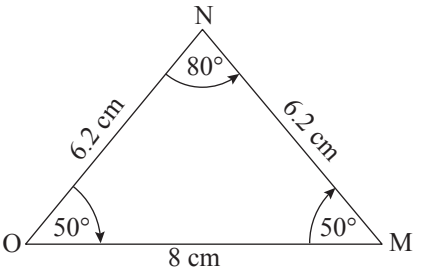


7.



Scalene triangle

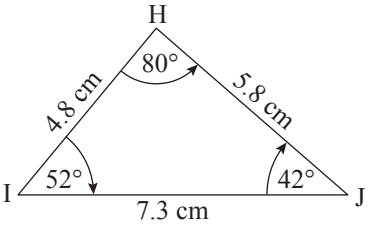
8.



a) Isosceles triangle

b) The two sides that are opposite the equal angles are equal in length.

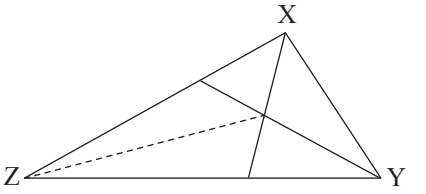
9.



a) Angle IHJ is 86°
Angle HJI is 42°

b) Student's own work.

10.



That the bisector for angle Z intersects the same point where bisectors X and Y meet.

Everyday statistics

Topic 5: Data representation

Introduction

Students have worked with data representations in previous years and this section aims to build on that knowledge. First, Topic 5 deals with the ordering of data in ascending or descending order and then representing it in frequency tables. Next, the topic deals with data representation in bar graphs, pictograms and pie charts. Detailed guidelines are provided for the drawing of bar graphs and pie charts with the exercises aiming to provide different contexts for practice. Tables, charts and schedules are the final part of this topic.

Common difficulties

Some students will find difficulty with drawing pie charts and doing the calculations to divide the circle into the correct proportions. Remind students that the proportions represent a number of degrees in the circle that determine the size of the sectors. Remind students to use the correct scale when drawing bar graphs. Accurately plotting the graphs is important.

Preparation

Find examples of charts, tables and schedules in the newspaper or from the Internet. A summary chart showing the different ways of representing data can also be useful.

Introduce the topic to students by first showing them data represented as numbers only. Ask them in what ways they think the data can be presented graphically. Show them a graphical representation of the same data and explain how showing it like this makes it easier to read.

Answers to exercises

Exercise 1

(SB page 208)

1. a) 109, 279, 287, 368, 429, 450, 450, 479, 593, 692, 730, 730, 791, 820, 975

b) 975, 820, 791, 730, 730, 692, 593, 479, 450, 450, 429, 368, 287, 279, 109

2. a) 29°, 28°, 25°, 24°, 22°, 21°, 19°, 18°, 16°, 16°, 14°, 11°

b) 11° **c)** February

3. a) 3, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 5, 5, 5, 5, 6, 6, 6, 7, 7

b)

Number of members in family	Tally	Frequency
3	𝍸	4
4	𝍸	4
5	𝍸 ‖	7
6	‖‖	3
7	‖	2

4. a) Drawing **b)** Embroidery work

c) 9 **d)** 14 **e)** 40

5. a) 9 **b)** 5 **c)** 25 **d)** 5

6. a)

Favourite pet	Tally	Frequency
Dog	𝍸 𝍸 |	11
Cat	𝍸 𝍸 ‖‖	14
Fish	‖‖	3
Rabbit	𝍸	4
Frog	|	1
Hamster	‖	2

b) 14 **c)** Cats **d)** 35

Exercise 2

(SB page 211)

1.

Type of book	Frequency	
Mystery	10	📖 📖 📖 📖 📖
Science fiction	7	📖 📖 📖 🕮
Sport	13	📖 📖 📖 📖 📖 📖 🕮
Romance	8	📖 📖 📖 📖

Key: 📖 = 2 people; 🕮 = 1 person

2. **a)** Crisps **b)** Fruit **c)** 4 **d)** 5
e) 2 **f)** 4 **g)** 24

3.

Colour of car	Frequency	
Red	20	
Blue	12	
Black	18	
White	23	
Green	13	

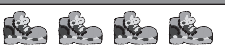
Key:  = 4 cars

4.

Category	Frequency	
Children	50 000	
Women	40 000	
Men	30 000	

Key:  = 10 000

5.

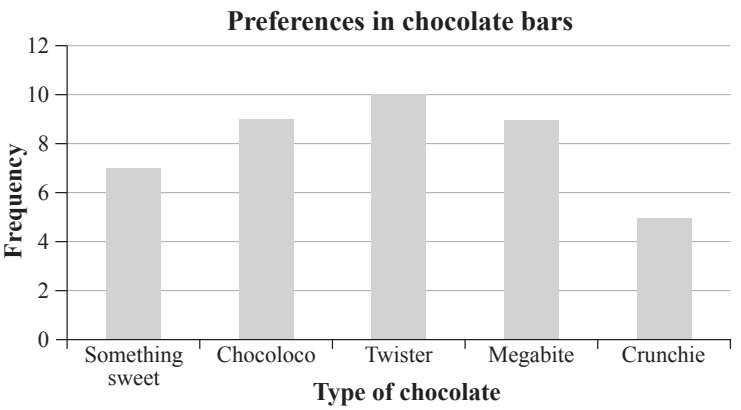
Favourite sport	Number of people	Pictogram
Football	8	
Running	5	
Swimming	9	
Netball	2	

Key:  = 2 people

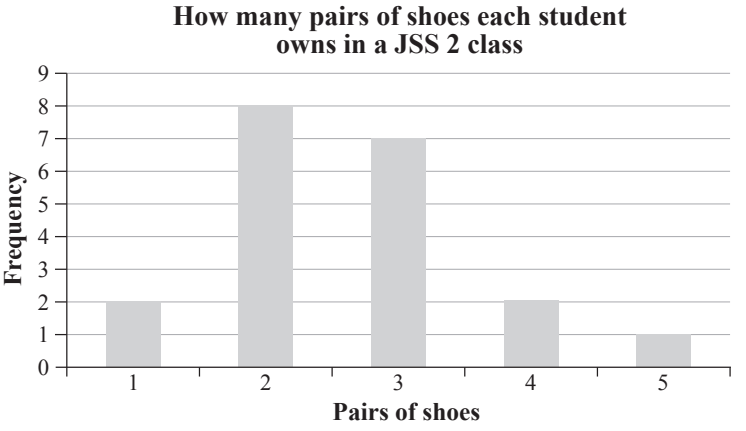
Exercise 3

(SB page 214)

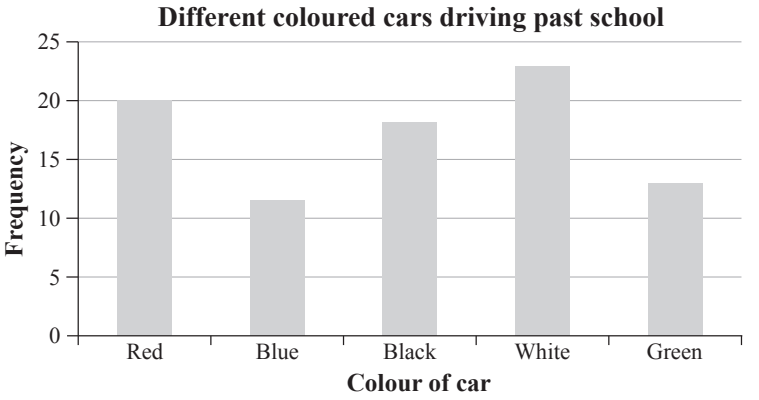
1.



2.



3.

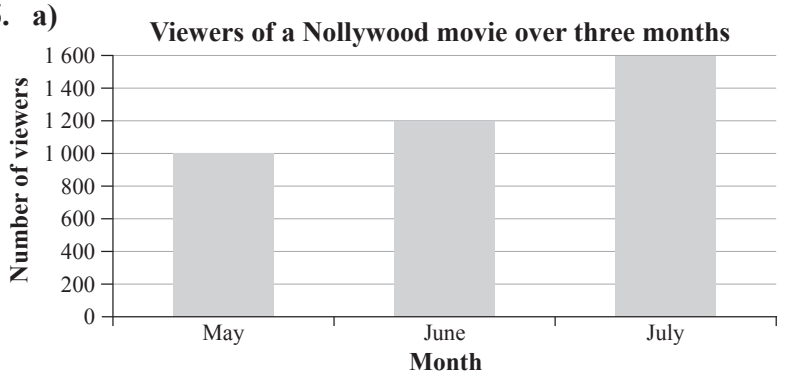


4. a) The horizontal axis shows the different categories (college levels in this case) and the vertical axis shows the frequency of that category (the number of students in this case). The resultant graph is a series of bars, with each different bar representing a different category and with the taller bars having a higher frequency than the shorter bars.

b) 950 **c)** JSS3

d) 725 in the Junior levels and 225 in the Senior levels

5. a)

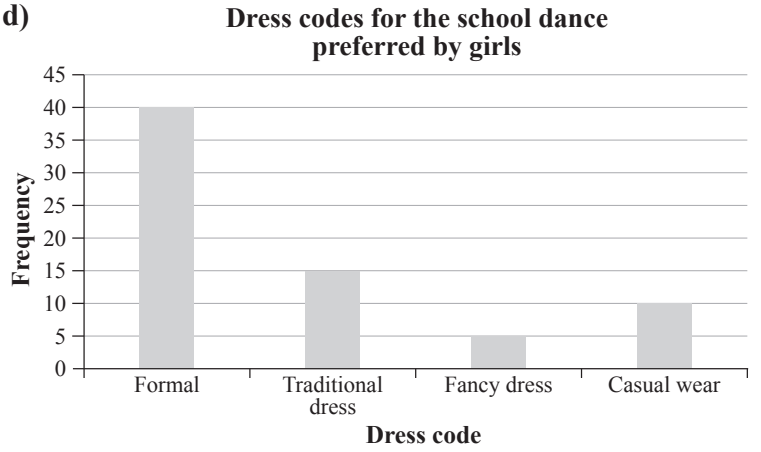


b) July **c)** 31.58%

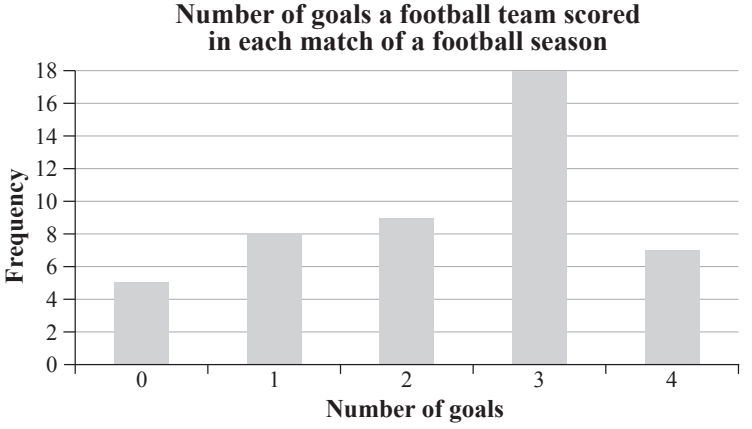
d) Yes, because it has been increasing so far and it does not seem to have peaked, it will most likely increase for a few more months and then remain stable before decreasing.

6. a) 130 **b)** 30.8% **c)** Fancy dress

d)



7.

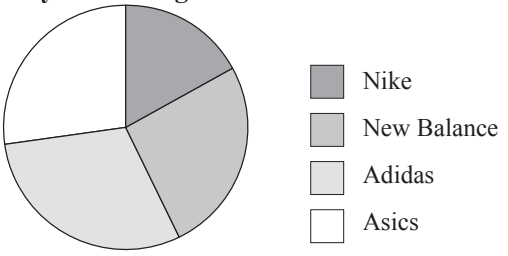


8. a) Tuesday **b)** 18 **c)** 78

Exercise 4

(SB page 219)

1. Popularity of training shoe brands



Total number of shoes = 17 + 26 + 30 + 27 = 100

Percentages of total: Nike = $\frac{17}{100} \times 100\% = 17\%$

New balance = $\frac{26}{100} \times 100\% = 26\%$

Adidas = $\frac{30}{100} \times 100\% = 30\%$

Asics = $\frac{27}{100} \times 100\% = 27\%$

Degrees on chart: Nike = 17% of 360° = 0.17 × 360 = 61.2°

New balance = 26% of 360° = 0.26 × 360 = 93.6°

Adidas = 30% of 360° = 0.3 × 360 = 108°

Asics = 27% of 360° = 0.27 × 360 = 97.2°

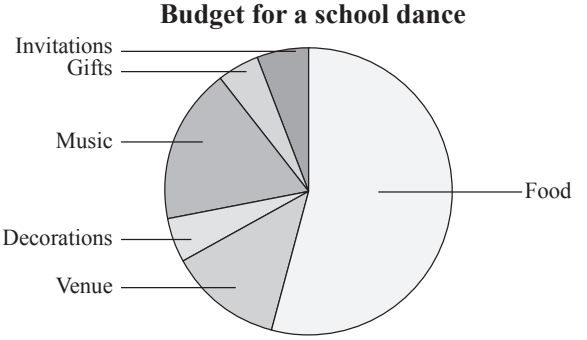
2. a) i) $\frac{1}{5}$ **ii)** $\frac{3}{10}$ **iii)** $\frac{1}{10}$

b) i) 19% **ii)** 30% **iii)** 10%

c) i) 14 **ii)** 21 **iii)** 13 **iv)** 7

3. a) 17.6% **b)** ₦3 205

c)



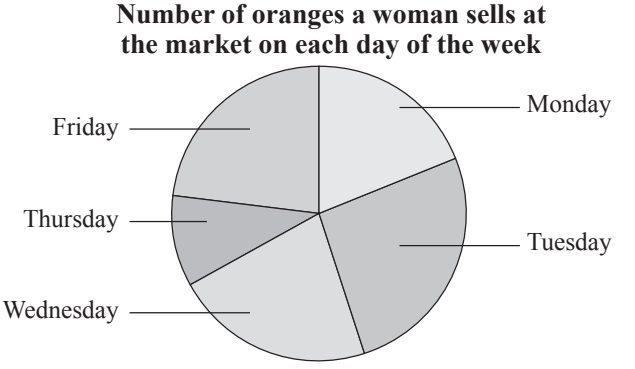
4. a) 5.2 %

b) Science 172.8°; Arts 130.68°; Medicine 37.8°; Engineering 18.72°

5. 120.6°

6. 18°

7.



8. a) 60% of 350 = 210 **b)** 144°

c) 10% of 350 = 35

Exercise 5

(SB page 223)

1. **a)** 2 **b)** 3 : 52 : 06 **c)** Bradley McGee

2. **a)** A = 127; B = 12 **b)** $\frac{127}{200} \times 100 = 63.5\%$

c) Yes, because people stopped to watch the demonstrations.

3. **a)** Abuja **b)** Lagos and Kaduna; Kano and Benin

c) $\frac{10}{70} \times 100 = 14.3\%$

4. A = $\frac{360}{30}$ = 12 hours

B = $\frac{360}{6}$ = 60 km/h

5. **a)** 8.48% **b)** 1.07%

c) ₦360 × 8.48% = ₦30.53
The milk will increase by ₦30.53, therefore it will cost ₦390.53 in 2014.

6. **a)** 164 km **b)** 880 km

c) 499 km + 774 km = 1 273 km

7. **a)** 7:00 p.m. and 06:30 a.m.

b) ₦4 000

c) No you cannot leave at 7 p.m. because the bus only leaves at 8 p.m.

d) Shuttle bus

e) ₦3 000 + ₦3 000 = ₦6 000

8. **a)** Route 2 **b)** Train

c) Odiaxere **d)** By bus on route 4

e) A footbridge

f) The service to Montes Juntos is very infrequent. Not many buses take that route, so you will have to wait a long time for a bus.

9. **a)** No, they did not, because by 01:00 Dayo had already travelled 100 km while Dotun had travelled 0 km, meaning that Dotun had not left yet.

b) At 04:00 and at 08:00

c) Dayo: speed = $\frac{400}{4}$ = 100 km/h

Dotun: speed = $\frac{360}{3}$ = 120 km/h

10. **a)** 10 m **b)** 10 m – 1.8 m = 8.2 m

c) 10 m – 8 m = 2 m **d)** 3 m – 1.8 m = 1.2 m

Topic 6: Probability

Introduction

Students are introduced to probability in this section by first looking at the probability scale, experimental probability and then calculating probability. Spinners, cards and coins are used to illustrate probability.

Common difficulties

Probability is often a difficult concept for students to grasp. Use as many examples from real life as possible for students to understand the concept of chance. Provide enough opportunity for learners to practically explore probability by working with cards and coins.

Preparation

Have a pack of cards available to work through some of the examples and think of some of your own. Collect other examples from newspapers or the internet, such as weather reports or lottery games.

Explain the concept of "chance" when it comes to card games, slot machines and the lottery. Ask students to name examples of chance events from their everyday lives. Explain to students that the probability of drawing a card or tossing a coin can be presented mathematically.

Answers to exercises

Exercise 1 (SB page 230)

Student's own work. Results depend on experimental outcome.

Exercise 2 (SB page 233)

1. a) P(odd) $= \frac{10}{16} = \frac{5}{8}$ **b)** P(even) $= \frac{6}{16} = \frac{3}{8}$

c) P(prime number) $= \frac{9}{16}$ **d)** P(1 or 5) $= \frac{8}{16} = \frac{1}{2}$

e) P(3 or 4) $= \frac{5}{16}$

2. a) P(red) $= \frac{8}{24} = \frac{1}{3} = 0.3333 = 33.33\%$

b) P(green) $= \frac{4}{24} = \frac{1}{6} = 0.1667 = 16.67\%$

c) P(red or white) $= \frac{13}{24} = 0.5417 = 54.17\%$

d) P(red or yellow) = $\frac{15}{24} = \frac{5}{8} = 0.625 = 62.5\%$

e) P(red or white or green) = $\frac{17}{24} = 0.7083 = 70.83\%$

f) P(black) = $\frac{0}{24} = 0 = 0\%$

3. **a)** less likely **b)** equally likely
c) equally likely **d)** sure
e) impossible **f)** more likely

4. **a)** P(31 day month) = $\frac{7}{12} = 0.5833 = 58.33\%$

b) P(end in y) = $\frac{4}{12} = \frac{1}{3} = 0.3333 = 33.33\%$

c) P(end in r) = $\frac{4}{12} = \frac{1}{3} = 0.3333 = 33.33\%$

d) P(starting with j or ending in y) = $\frac{5}{12} = 0.4167 = 41.67\%$

e) P(starting with j and ending with y)
$= \frac{2}{12} = \frac{1}{6} = 0.1667 = 16.67\%$

5. P(5) = $\frac{1}{6} = 0.1667 = 16.67\%$

6. P(white shirt) = $\frac{4}{7} = 0.5714 = 57.14\%$

7. P(chocolate) = $\frac{0}{6} = 0 = 0\%$

8. **a)** $\frac{1}{4}$ **b)** $\frac{1}{8}$
c) $\frac{5}{7}$ **d)** $\frac{27}{31}$
e) $\frac{2}{19}$

9. **a)** P(green) = $\frac{11}{25}$

b) P(yellow) = $\frac{14}{25}$

10. P(apple) = $\frac{7}{17} = 0.4118 = 41.18\%$

11. **a)** P(odd) = $\frac{5}{10} = \frac{1}{2} = 0.5 = 50\%$

b) P(even) = $\frac{5}{10} = \frac{1}{2} = 0.5 = 50\%$

12. **a)** P(odd) = $\frac{10}{20} = \frac{1}{2} = 0.5 = 50\%$

b) P(even) = $\frac{10}{20} = \frac{1}{2} = 0.5 = 50\%$

13. **a)** P(vowel) = $\frac{5}{26} = 0.1923 = 19.23\%$

b) P(consonant) = $\frac{21}{26} = 0.8077 = 80.77\%$

TERM 3

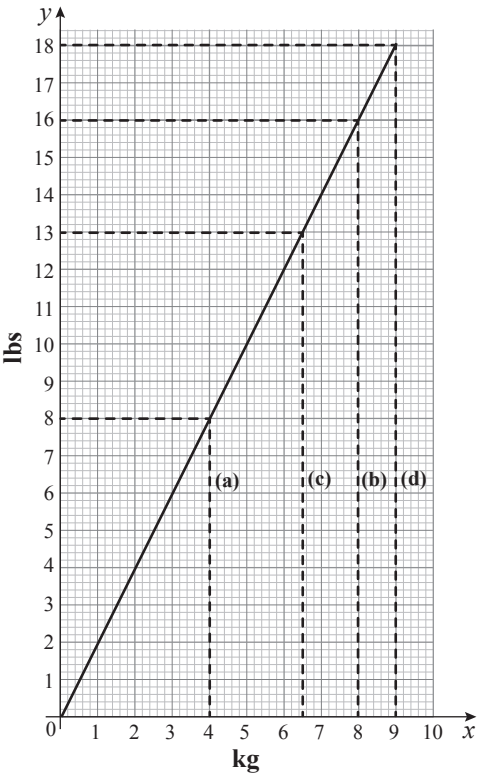
Revision

Revision exercises

(SB page 236)

Graphs of real-life situations

1.



a) 8 lbs

b) 16 lbs

c) 6.5 kg

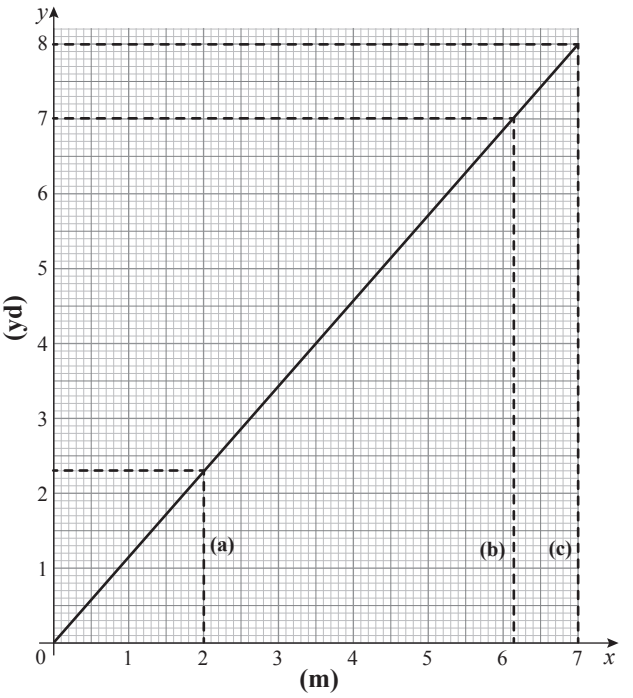
d) 9 kg

2. Graph appears on next page.

a) 2.2 yds

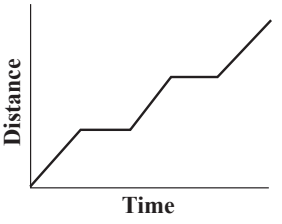
b) 6.3 m

c) 7.2 m

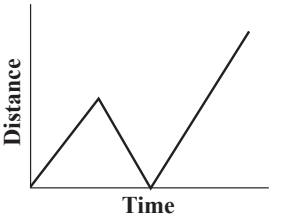


3. **a)** D **b)** B **c)** C **d)** A

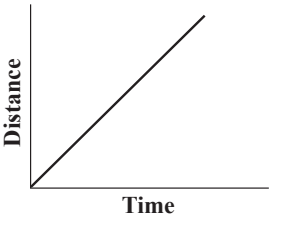
4. **a)**



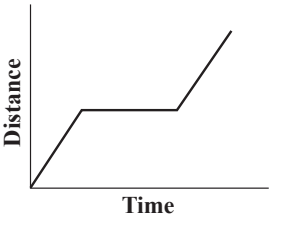
b)



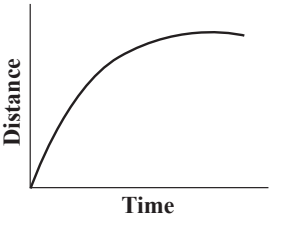
c)



d)



e)



5. **a)** Distance in km a family travelled from home versus time taken

b) 5 hours **c)** 400 km

d) i) The family drove at a steady rate for 2 hours

ii) The family stopped for lunch for an hour

e) 100 km/h

f) Yes, it was the same. This can be determined because the gradients of both lines are the same (and hence the distance travelled over time).

6. a) 10 a.m.

b) 12:30 p.m to 1:30 p.m.

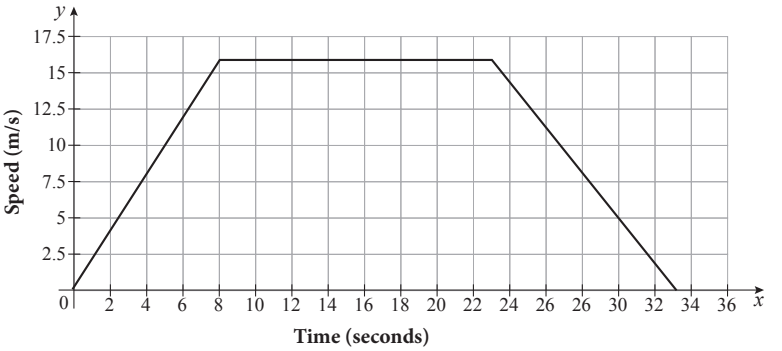
c) At 11 a.m. 25 km from home

d) 20 km/h

e) 80 km in total (40 km each way)

f) 80 km over 7 hours; 11.4 km/h

7. a)



b) acceleration: 2 m/s^2; deceleration: 1.6 m/s^2

c) $(16 \times 15) + \left(16 \times 8 \times \frac{1}{2}\right) + \left(16 \times 10 \times \frac{1}{2}\right)$

$= 240 + 64 + 80 = 384$ m

d) 384 m in 33 seconds = 11.6 m/s

8. a) $T = \frac{16}{2} = 8$ seconds

b) $\left(16 \times 8 \times \frac{1}{2}\right) + (16 \times 12) + \left(10 \times 16 \times \frac{1}{2}\right)$

$= 64 + 192 + 80 = 336$ m

Angles and polygons

1. a) 105° **b)** $\frac{4}{12} \times 360 = 120°$

c) Isosceles triangle **d)** Complement

e) Revolution **f)** Parallel

2. a) $6x = 180$

$x = 30°$

b) $180 = 90 + 50 + x$

$x = 40°$

c) $a = 105°$ **d)** $x = 33°$

e) $3x - 10 + x + 30 = 180$
$4x = 160$
$x = 40°$

f) $x = 180 - 34 - 90 = 56°$

g) $a = 68°$; $b = 68°$; $c = 44°$

h) $66 + x + 180 - 3x = 180$
$x = 33°$

i) $3x + 2x - 10 + 180 - 4x - 10 = 180$
$x = 20°$

j) $x = 43°$; $y = 94°$; $z = 137°$

3.

Shape	Name	Sum of interior angles	Each interior angle
	Pentagon	540	108
	Heptagon	900	129
	Octagon	1 080	135
	Decagon	1 440	144

4. $(n - 2)180 = 135n$; $n = 8$ sides (octagon)

5. $\frac{540}{5} = 108°$; Exterior angle $= 180 - 108 = 72°$

6. $x - 5 + 3x + 24 + 3x + 6 + 5x - 1 = 360$
$x = 28°$, so the four angles are 23°, 108°, 90°, 139°

7. **a)** $270 + x = 360$
$x = 90°$

b) $3x = 165$
$x = 55°$

c) $435 + k = 540$
$k = 105°$

d) $540 = 3x + 330$
$x = 70°$

e) $2x = 540 - 430$
$2x = 110$
$x = 55°$

f) $3x + 210 + 138 = 540$
$x = 64°$

g) $5x + 210 = 540$
$5x = 330$
$x = 66°$
$35 + 103 + 66 + y = 360$
$y = 156°$

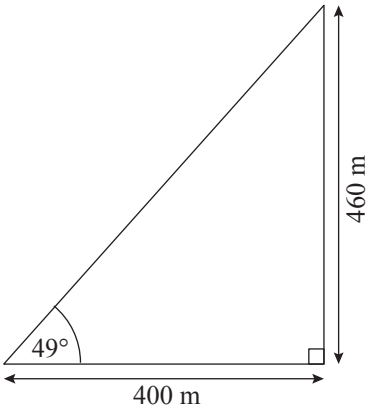
8. **a)** $x = 90°$

b) $y = 180 - 108 = 72°$
$z = \frac{108}{2} = 54°$

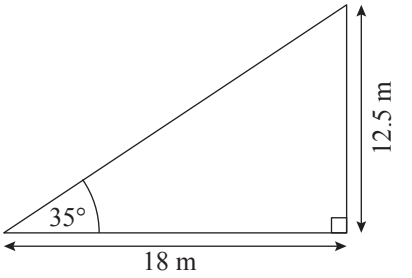
9. BCH = 60°
CHB = 60°
CBH = 180 – 60 – 60 = 60°
ABH = 180 – 60 = 120°

Angles of elevation and depression

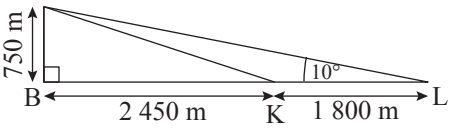
1. 460 m



2. 35°

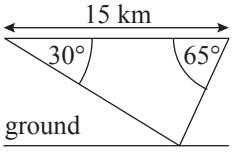


3.



a) 10°
b) 80°
c) 2 450°

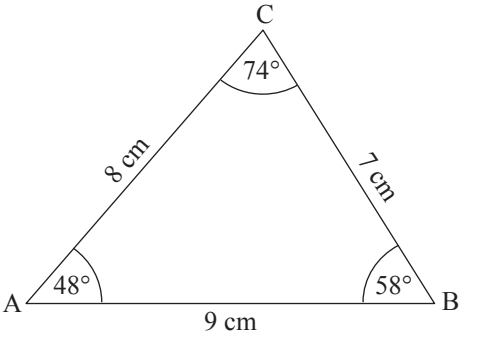
4. **a)**



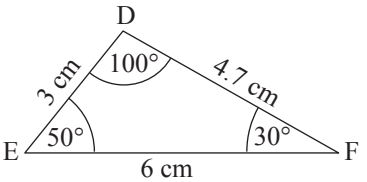
b) 6 km

Construction

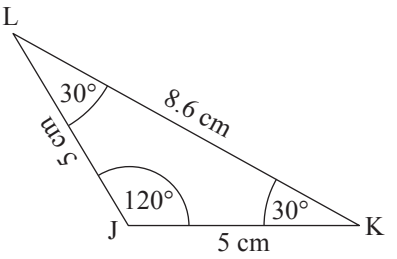
1.



2. a)



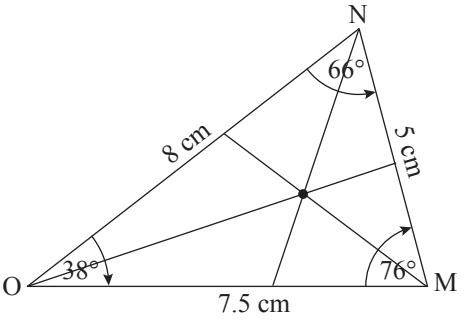
b)



c) Triangle DEF: DE = 3 cm; EF = 6 cm; DF = 4.7 cm
Angle D = 100°; Angle E = 50°; Angle F = 30°
Triangle JKL: JL = 5 cm; JK = 5 cm; KL = 8.6 cm
Angle J = 120°; Angle K = 30°; Angle L = 30°

d) Triangle DEF is a scalene triangle.
Triangle JKL is an isosceles triangle.

3. a)



b) Angle M is 76°
Angle N is 66°

c) Triangle MNO is a scalene triangle.

Statistics

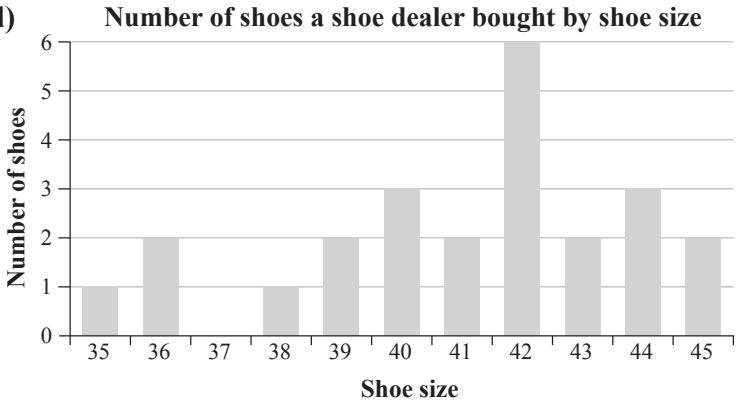
1. a)

Shoe size	Tallies	Frequency
35	|	1
36	||	2
37		0
38	|	1
39	||	2
40	|||	3
41	||	2
42	𝍸 |	6
43	||	2
44	|||	3
45	||	2

b) Number of shoes per shoe size

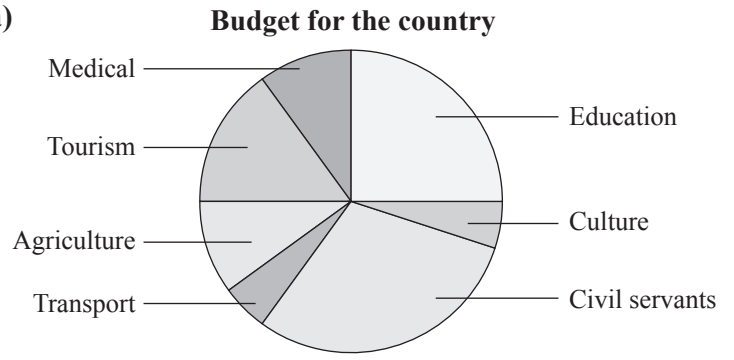
c) 35, 36, 36, 38, 39, 39, 40, 40, 40, 41, 41, 42, 42, 42, 42, 42, 42, 43, 43, 44, 44, 44, 45, 45

d)



2. **a)** D **b)** C **c)** D **d)** C

3. **a)**



b) $\frac{90}{360} \times 100 = 25\%$

$0.25 \times 150\,000\,000 = ₦37\,500\,000$

c) $\frac{36}{360} \times 100 = 10\%$

4. **a)** Walking

b) $\frac{1}{4}$

c) $9 \times 4 = 36$

5. **a)** $\frac{111.72}{360} \times 100 = 31\%$

31% of 29 goals $= 0.31 \times 29 = 9$ goals

b) $\frac{x}{360} \times 29 = 10$

$x = \frac{10}{29} \times 360$

$x = 124.14°$

6. a) Size 38

b) Size $5\frac{1}{2}$

c) $9\frac{3}{8}$ inches × 2.54 = 23.8125 cm
Therefore, the table is correct.

7. a) Fighting, bullying, swearing, vandalism, disrespecting staff members

b) 187 – 156 = 31
Percentage increase = $\frac{31}{156}$ × 100 % = 19.87%

c) The total number of transgressions decreases from JSS1 to JSS2. This is most likely, because the students become more mature and learn to behave themselves.

8. a) i) Senegal
ii) It is a tie between Burkina Faso, Guinea and Niger

b) 4

c) $\frac{661}{43\,279}$ × 100 = 1.53%

9. a) 302 miles

b) 164 miles

c) 302 miles + 164 miles + 202 miles = 668 miles

Probability

1. a) B

b) A

c) Rolling an even number

2. c, a, b, d

3. a) i) $\frac{23}{90}$

ii) $\frac{36}{90} = \frac{2}{5}$

iii) $\frac{16}{90}$

b) $\frac{16}{90}$ × 450 = 80 cars

4. a) $\frac{44}{144} = \frac{11}{36}$

b) $\frac{32}{144} = \frac{2}{9}$

5. a) $\frac{3}{10}$ = 0.3 = 30%

b) $\frac{0}{10}$ = 0 = 0%

c) 50 times

TERM 1

Workbook solutions

Theme 1 Numbers and numeration

Topic 1 Whole numbers and decimal numbers

Worksheet 1 Standard form

(WB page 1)

1. **a)** 3 534 **b)** 5 760 217
c) 93.02 **d)** 7.065

2. **a)** six hundred and fifty thousand, two hundred and thirty five
b) two million, three hundred and thirty thousand, four hundred and sixty-seven
c) sixty-five and two tenths and two hundredths and one thousandth / sixty-five, and two hundred and twenty-one thousandths

3. **a)** 2 000 000 000 + 500 000 000 + 60 000 000 + 7 000 000 + 300 000 + 40 000 + 1 000 + 900 + 2
b) 800 000 000 + 50 000 000 + 7 000 000 + 300 000 + 60 000 + 4 000 + 100
c) 700 + 40 + 5 + 0.02 + 0.003

4. **a)** 892 639 128 **b)** 4 722 461 999
c) 438.135 **d)** 987 654.321

5. **a)** 2.3×10^{-2} **b)** 5.6×10^{-4}
c) 3×10^{-6} **d)** 2×10^{-4}

6. **a)** 5 000 **b)** 730 000
c) 9 200 000 **d)** 21 000

7. **a)** p^9 **b)** $6w^6$
c) $3x^2$ **d)** $\frac{3 \times 10^6}{9 \times 10^7}$
$= \frac{3 \times 10^6}{3^2 \times 10^7}$
$= 3^{-1} \times 10^{-1}$
$= \frac{1}{3^1} \times 10^1$
$= \frac{1}{30}$

Worksheet 2 Factors, multiples and square numbers

(WB page 4)

1. 7, 11, 13, 17, 19, 23, 29, 31

2. 120

3. 1, 2, 3, 4, 6, 8, 12, 24

4. **a)** 120
b) 132

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

6. $2^3 \times 13$

7. **a)** $2^2 \times 3^2 = 36$
b) $2^3 \times 3 \times 5 = 120$

8. **a)** 18 = 1, 2, 3, 6, 9, 18
48 = 1, 2, 3, 4, 6, 8, 12, 16, 24, 48
$\therefore$ 6
b) 21 = 1, 3, 7, 21
84 = 1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84
$\therefore$ 21

9. **a)** 64 **b)** 121
c) $\frac{1}{4}$ **d)** 900

10. 4, 9, 16, 25, 49, 64, 100

11. **a)** 13 **b)** 20 **c)** 0.5
d) 30 **e)** $8 \times 12 = 96$

Theme 2 Basic operations

Topic 2 Fractions

Worksheet 3 Converting fractions

(WB page 7)

1. 3 : 4

2. $1\,000 \div 8 = 125 \times 3 = 375$
$= 1.375 \times 100$
$= 137.5\%$

3. $\frac{64}{100} = \frac{16}{25}$

4. 5 : 4

5. $\frac{16}{100} = \frac{4}{25}$

6. 2.86

7.

Fraction	Decimal	Percentage
$\frac{4}{10} = \frac{2}{5}$	0.4	40%
$\frac{255}{100} = \frac{51}{20}$	2.55	255%

Topic 3 Transactions in the home and office

Worksheet 4 Household and commercial arithmetic

(WB page 8)

1.

Monthly income			Monthly expenditure	
Sales	975 000	Salaries	534 000	
		Medical Aid	104 000	
		Insurance	46 000	
		Electricity	47 000	
		Water and refuse	29 000	
		Consumables	37 000	
		Stationery	98 000	
		Telephone	125 000	
Total	975 000	Total	1 020 000	

a) No, the business made a loss of ₦45 000 in the month.

b) $\frac{37\,000}{1\,020\,000} \times 100 = 3.63\%$

c) Fixed: Salaries, Medical Aid, Insurance
Variable: Electricity, Water and refuse, Consumables, Stationery, Telephone

2. a) SI = 100 000 × 0.09 × 5 = ₦45 000
b) SI = 50 000 × 0.125 × 3 = ₦18 750
c) SI = 75 000 × 0.04 × 7.5 = ₦22 500

3. a) $75\,990 \times \frac{15}{100} =$ ₦11 398.50
b) ₦64 591.50
c) A = 64 591.50(1 + 0.12 × 3) = ₦87 844.44
87 844.44 ÷ 12 = ₦7 320.37
d) No. Afiba will pay ₦23 252.94 more than the purchase price.

4. $25\,990 \times \frac{20}{19} =$ ₦27 357.89

5. 32 000 ÷ 1.6 = ₦20 000

6. $6\,700 \times \frac{100}{89} =$ ₦7 528.09

Topic 4 Approximation and estimation

Worksheet 5 Rounding up (WB page 11)

1. **a)** 2 **b)** 1 **c)** 32
2. **a)** 30 **b)** 460 **c)** 3 580
3. **a)** 300 **b)** 5 700 **c)** 45 000
4. **a)** 1 000 **b)** 35 000 **c)** 60 000

Worksheet 6 Approximation (WB page 13)

1. **a)** 600 **b)** 20.0 **c)** 0.005
2. **a)** 13 000 **b)** 670.000 **c)** 0.00033
3. **a)** 6 780 **b)** 343.000 **c)** 0.0123
4. **a)** 562.0 **b)** 1.0 **c)** 3.2
5. **a)** 13.77 **b)** 0.01 **c)** 452.90
6. **a)** 0.090 **b)** 15.677 **c)** 0.010

Worksheet 7 Estimation (WB page 15)

1. **a)** $\approx 30 \times 30$
≈ 900

b) $\approx 10 \times 20$
≈ 200

c) $\approx 2 \times 80$
≈ 160

d) $\approx \frac{60}{30}$
≈ 2

e) $\approx \frac{550}{50}$
≈ 11

f) $\approx \frac{5}{30}$
$\approx \frac{1}{6}$

g) $\approx (7 - 3) \times 60$
≈ 240

h) $\approx \frac{350 \times 20}{50 \times 200}$
$\approx \frac{7\,000}{10\,000}$
$\times \frac{7}{10}$

i) $\approx (8 + 2) \times \frac{70}{10}$
≈ 70

Topic 5 Multiplication and division of directed numbers

Worksheet 8 Addition and subtraction (WB page 16)

1. $^{+}9$ **2.** $^{+}2$ **3.** $^{-}2$ **4.** $^{-}15$ **5.** 0
6. $^{+}26$ **7.** $^{+}157$ **8.** $^{-}4$ **9.** $^{+}16$ **10.** $^{-}25$
11. $^{+}3$ **12.** $^{+}50$ **13.** $^{+}80$ **14.** $^{+}34$ **15.** $^{+}23$

Worksheet 9 Multiplication and division (WB page 18)

1. $^{+}18$ **2.** $^{-}20$ **3.** $^{-}70$ **4.** $^{+}24$ **5.** $^{-}150$
6. $^{-}120$ **7.** $^{-}2$ **8.** $^{+}5$ **9.** $^{+}9$ **10.** $^{-}3$

11. $(^{+}25 \div {}^{-}5) \div {}^{-}5$
$= ({}^{-}5) \div {}^{-}5$
$= 1$

12. $100 \div ({}^{-}25 \div {}^{+}5)$
$= {}^{-}100 \div ({}^{-}5)$
$= 20$

13. $({}^{-}32 \div {}^{+}8) \div {}^{+}8$
$= ({}^{-}4) \div 8$
$= {}^{-}\frac{1}{2}$

14. $^{+}44 \div {}^{+}11 \times {}^{-}9$
$= 4 \times {}^{-}9$
$= {}^{-}36$

15. $^{+}4 \times ({}^{-}3 \div {}^{-}6) \div {}^{+}3$
$= 4 \times \left(\frac{1}{2}\right) \div 3$
$= \frac{2}{3}$

Worksheet 10 BODMAS

(WB page 20)

1. $^{+}2 \times ({}^{-}3 + {}^{-}5) - {}^{-}10 \div {}^{+}5$
$= 2 \times ({}^{-}8) - ({}^{-}2)$
$= {}^{-}16 + 2$
$= {}^{-}14$

2. $-5({}^{-}10 - {}^{+}4) \div {}^{-}7$
$= {}^{-}5({}^{-}14) \div {}^{-}7$
$= 70 \div {}^{-}7$
$= {}^{-}10$

3. $^{-}120 \div ({}^{+}15 \times {}^{+}4) + {}^{+}23 - {}^{-}12$
$= {}^{-}120 \div (60) + 23 + 12$
$= {}^{-}2 + 23 + 12$
$= 33$

4. $^{+}5({}^{-}6 - {}^{-}2) - {}^{-}3({}^{+}7 + {}^{+}4)$
$= 5({}^{-}4) + 3(11)$
$= {}^{-}20 + {}^{+}33$
$= 13$

5. $^{-}15 \div {}^{+}5 \times {}^{-}7 \times ({}^{+}5 + {}^{-}13)$
$= {}^{-}3 \times {}^{-}7 \times ({}^{-}8)$
$= 21 \times ({}^{-}8)$
$= {}^{-}168$

Theme 3 Algebraic processes

Topic 6 Algebraic expressions

Worksheet 11 Expanding algebraic expressions

(WB page 21)

1. $8ab$

2. 0

3. $-24m$

4. $6abc$

5. $-\frac{3}{8}x^2y^2$

6. $6a - 8$

7. $-3x + 2y$

8. $2d^2 - 4d$

9. $(a - 2) - 3(a - 4)$
$= a - 2 - 3a + 12$
$= 10 - 2a$

10. $6x(x + 2) - 3x(x - 2)$
$= 6x^2 + 12x - 3x^2 + 6x$
$= 3x^2 + 18x$

11. $4 + 3(y - 1) - y$
$= 4 + 3y - 3 - y$
$= 1 + 2y$

12. $q(q - 3) - 4q^2 - q$
$= q^2 - 3q - 4q^2 - q$
$= -3q^2 - 4q$

13. $(m + 2)(3m + 3)$
$= 3m^2 + 3m + 6m + 6$
$= 3m^2 + 9m + 6$

14. $(3w - 1)(2w + 3)$
$= 6w^2 + 9w - 2w - 3$
$= 6w^2 + 7w - 3$

15. $(k + 3)(k + 3)$
$= k^2 + 3k + 3k + 9$
$= k^2 + 6k + 9$

16. $(2p + 4)(p - 3)$
$= 2p^2 - 6p + 4p - 12$
$= 2p^2 - 2p - 12$

17. $(5c - 3a)^2$
$= 25c^2 - 30ac + 9a^2$

18. $-(2a + b)^2$
$= -(4a^2 + 4ab + b^2)$
$= -4a^2 - 4ab - b^2$

19. $(6f - 5g)(5g - 6f)$
$= 30fg - 36f^2 - 25g^2 + 30fg$
$= 60fg - 36f^2 - 25g^2$

20. $3b - (4b - 1)(2b + 3)$
$= 3b - (8b^2 + 12b - 2b - 3)$
$= -7b - 8b^2 + 3$

Worksheet 12 Factorising simple algebraic expressions

(WB page 24)

1. **a)** 5 **b)** a^3 **c)** xyz
d) $2pq$ **e)** $3pq$

2. **a)** $2(a - 5)$ **b)** $2(x + 3)$
c) $2p(q + r)$ **d)** $3(3f - 4)$
e) $4b(4a + 3c)$ **f)** $x(5 - x)$
g) $xy(x + y)$ **h)** $abc(2a^2 + 3c)$
i) $5p(3p + 2q)$

Worksheet 13 Algebraic fractions

(WB page 26)

1. $\frac{1}{2x}$

2. $\frac{3q^2}{2p}$

3. $\frac{-b}{4a}$

4. $\frac{3m}{2n}$

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

6. $\frac{5y}{4}$

7. $\frac{4a}{10} - \frac{a}{5}$
$= \frac{4a}{10} - \frac{2a}{10}$
$= \frac{2a}{10} = \frac{a}{5}$

8. $\frac{5x}{7} - \frac{2x}{3}$
$= \frac{15x}{21} - \frac{14x}{21}$
$= \frac{x}{21}$

9. $\frac{4d}{6} - \frac{d}{5}$

$= \frac{20d}{30} - \frac{6d}{30}$

$= \frac{14d}{30} = \frac{7d}{15}$

10. $\frac{4y + 9x}{6xy}$

11. $\frac{-28a^2 - 15b^2}{35ab}$

12. $\frac{2}{3x} + \frac{4}{5x - 1}$

$= \frac{2(5x - 1) + 12x}{3x(5x - 1)}$

$= \frac{22x - 2}{3x(5x - 1)}$

13. $2 + \frac{4}{y^2} - \frac{3}{2y}$

$= \frac{4y^2 + 8 - 3y}{2y^2}$

14. $\frac{(x - y)}{3} + \frac{x}{5}$

$= \frac{5(x - y) + 3x}{15}$

$= \frac{5x - 5y + 3x}{15}$

$= \frac{8x - 5y}{15}$

15. $\frac{(a + 3)}{2} - \frac{(a - 1)}{3}$

$= \frac{3(a + 3) - 2(a - 1)}{6}$

$= \frac{3a + 9 - 2a + 2}{6}$

$= \frac{a + 11}{6}$

16. $\frac{(2p + q)}{5} - \frac{(q - 3)}{6}$

$= \frac{6(2p + q) - 5(q - 3)}{30}$

$= \frac{12p + 6q - 5q + 15}{30}$

$= \frac{12p + q + 15}{30}$

17. $\frac{2(m + 3)}{4} + \frac{4(2m - 1)}{3}$

$= \frac{6(m + 3) + 16(2m - 1)}{12}$

$= \frac{6m + 18 + 32m - 16}{12}$

$= \frac{38m + 2}{12}$

$= \frac{19m + 1}{6}$

18. $\frac{-(3x - y)}{2} - \frac{(x + 4y)}{5}$

$= \frac{-5(3x - y) - 2(x + 4y)}{10}$

$= \frac{-15x + 5y - 2x - 8y}{10}$

$= \frac{-17x - 3y}{10}$

19. $\frac{(4b - c)}{4} + \frac{(c - 3b)}{6}$

$= \frac{6(4b - 3c) + 4(c - 3b)}{24}$

$= \frac{24b - 18c + 4c - 12b}{24}$

$= \frac{12b - 14c}{24}$

$= \frac{6b - 7c}{12}$

20. $\frac{3(x - 2)}{4} + \frac{2}{(x + 2)} - \frac{(x - 1)}{3}$

$= \frac{9(x - 2)(x + 2) + 24 - 4(x - 1)(x + 2)}{12(x + 2)}$

$= \frac{9(x^2 - 4) + 24 - 4(x^2 + x - 2)}{12}$

$= \frac{9x^2 - 36 + 24 - 4x^2 - 4x + 8}{12(x + 2)}$

$= \frac{5x^2 - 4x - 4}{12(x + 2)}$

Topic 7 Simple equations

Worksheet 14 Simple equations

(WB page 30)

1. $a = 2$

2. $b = 5$

3. $c = -9$

4. $d = 3$

5. $2e = 4$
$e = 2$

6. $3f = 0$
$f = 0$

7. $3k = 9$
$k = 3$

8. $-n = -11$
$n = 11$

9. $8 - 4p + 2 = p$
$-5p = -10$
$p = 2$

10. $5q = q$
$4q = 0$
$q = 0$

11. $15r - 33 + 4r = -26 - 16r$
$19r + 16r = -26 + 33$
$35r = 7$
$r = \frac{1}{5}$

12. $x = 0$

13. $6y - 3 = 14y + 1 - 8y$
$6y - 6y = 1 + 3$
$0y = 4$
$y =$ undefined $\left(\frac{4}{0}\right)$

Worksheet 15 Equations with brackets (WB page 32)

1. $x = 1$

2. $x = 2$

3. $x = -21$

4. $4(x - 2) = 2(5 + 2x)$

$4x - 8 = 10 + 4x$

$0x = 18$

$x = \frac{18}{0}$ (undefined)

5. $x = 6$

6. $x = -1$

7. $x = \frac{1}{11}$

8. $x = 10$

Worksheet 16 Fractional equations (WB page 34)

1. $x = 15$

2. $x = \frac{2}{7}$

3. $g = 6$

4. $h = -4$

5. $x = 27$

6. $x = 28$

7. $\frac{-(x - 4)}{7} = 6$

$-x + 4 = 42$

$-x = 38$

$x = -38$

8. $\frac{3(x - 5)}{4} = -11$

$3x - 15 = -44$

$3x = -29$

$x = -\frac{29}{3}$

9. $x = \frac{42}{11}$

10. $x = \frac{8}{5}$

11. $\frac{3x}{4} - 5 + 2x = \frac{11x}{3}$

$9x - 60 + 24x = 44x$

$-11x = 60$

$x = -\frac{60}{11}$

Worksheet 17 Word problems (WB page 36)

1. **a)** $x + 4x = 35$

b) $x + (x + 1) + (x + 2) = 21$

c) $x + 3 = 12 - 9x$

d) $15 + \frac{1}{4}x = 30$

e) $7 - \frac{5x}{2} = 12$

2. a) $2x + 12 = 20$

$2x = 8$

$x = 4$

b) $4x + x + 2x = 77$

$7x = 77$

$x = 11$

$\therefore$ chips ₦11, juice ₦44, chocolate ₦22.

c)

	Man	Son
Now	$4x$	x
6 years' time	$2(x + 6) + 8$ $= 2x + 12$	$x + 6$

$2x + 20 = 4x + 6$

$2x + 14$

$\therefore x = 7$

d) $\frac{1}{2}x + \frac{3}{4}x = 12$

$2x + 3x = 48$

$5x = 48$

$x = \frac{48}{5}$

TERM 2

Workbook solutions

Theme 3 Algebraic processes

Topic 2 Linear inequalities

Worksheet 18 Understanding linear inequalities

(WB page 38)

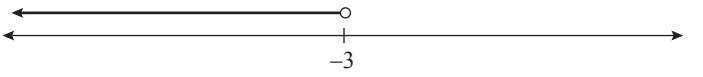
1. a) x is less than 2.
b) x is greater than and equal to 6.
c) x is greater than 0, but less than 4.
d) x is greater than and equal to –4, but less than –1.

2. a) $x > 2$ **b)** $x \leq 5$
c) $3 < x$ **d)** $1 < x \leq 4$

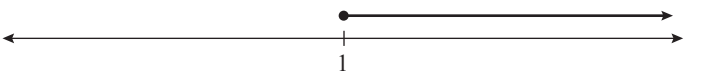
Worksheet 19 Graphical representations of inequalities on a number line

(WB page 39)

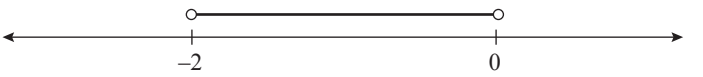
1. a)



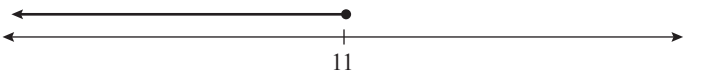
b)



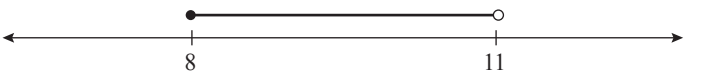
c)



d)



e)

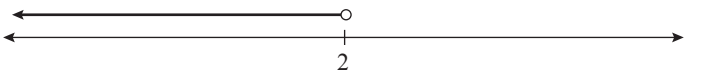


2. a) $x > 5$ **b)** $x \geq -2$
c) $7 \leq x < 12$ **d)** $x < -8$

Worksheet 20 Solving linear inequalities

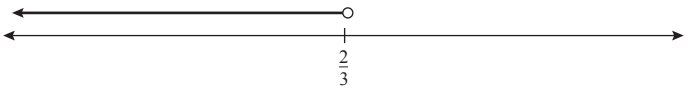
(WB page 41)

1. $2x < 4$
$x < 2$



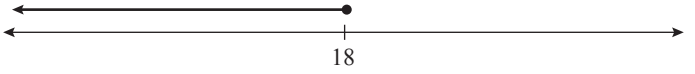
2. $2 > 3x$

$\frac{2}{3} > x$



3. $\frac{x}{3} \leq 6$

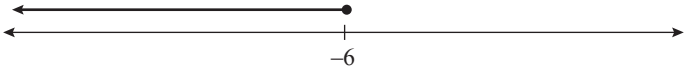
$x \leq 18$



4. $-\frac{2x}{3} \geq 4$

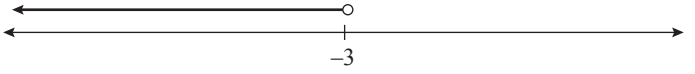
$-2x \geq 12$

$x \leq -6$



5. $18 < -6x$

$-3 > x$



Worksheet 21 Inequality word problems (WB page 43)

1. $x + 15 > 37$

$x > 22$

2. $7x < 4x + 3$

$3x < 3$

$x < 1$

3. shirt: x, shoes: $2x + 2\,000$

$x + 2x + 2\,000 \leq 20\,000$

$3x \leq 18\,000$

$x \leq 6\,000$

Shirt can cost no more than ₦6 000.

4. $2x + 2(3x) \leq 240$

$8x \leq 240$

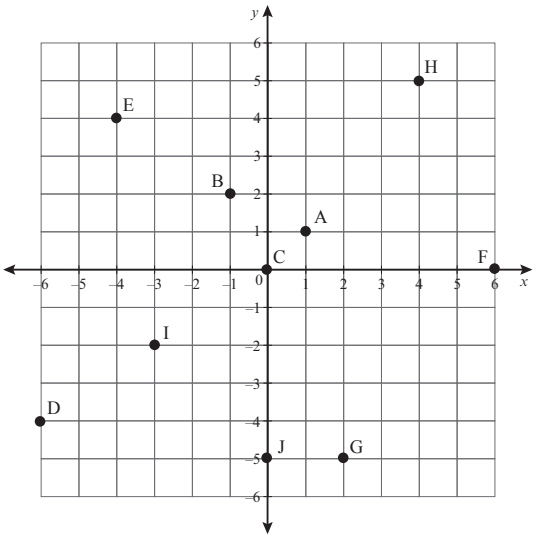
$x \leq 30$

The maximum length is 90 cm.

Worksheet 22 The Cartesian plane (WB page 44)

1. A: (–4; 3) B: (–3; 1) C: (–1; 3) D: (0; 2)
E: (1; 2) F: (2; 0) G: (0; –1) H: (–2; –1)
I: (–4; –2) J: (1; 1)

2.



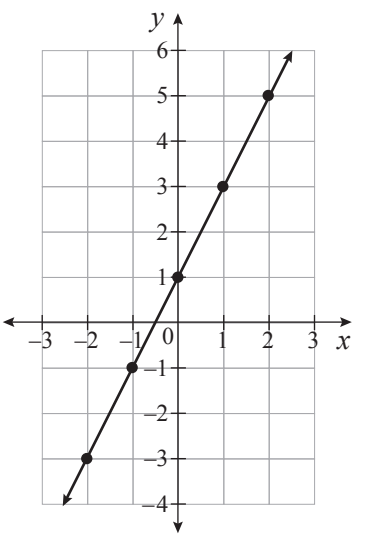
Worksheet 23 Graphs of linear equations (WB page 45)

1. **a)** $y = -\frac{1}{2}x - 1$ **b)** $y = \frac{1}{2}x - 3$ **c)** $y = 5x - 1$

2. **a)** $m = 3$; $c = -4$ **b)** $m = -2$; $c = 1$
c) $m = 3$; $c = 0$ **d)** $c = 5$

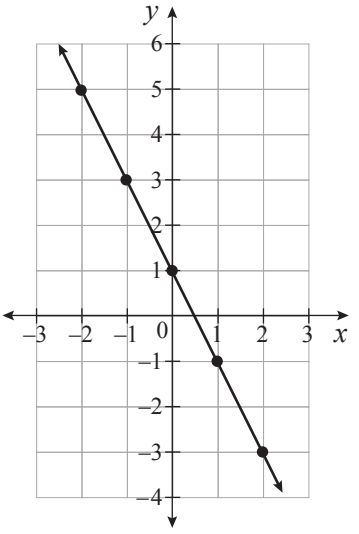
3. **a)**

x	–2	–1	0	1	2
y	–3	–1	1	3	5



b)

x	–2	–1	0	1	2
y	5	3	1	–1	–3



4. **a)** $y = -1; x = \frac{1}{5}$

b) $y = 1; x = 2$

c) $y = 0; x = 0$

5. **a)** Not parallel

b) Parallel

c) Not parallel

d) Parallel

e) Parallel

Worksheet 24 Real-life applications of graphs (travel graphs)

(WB page 48)

1. 3 km

2. 45 minutes $\left(\frac{3}{4}\text{ hour}\right)$

3. 15 minutes $\left(\frac{1}{4}\text{ hour}\right)$

4. They cycle slower between 10h15 and 10h45.

5. 5 km

6. 30 minutes $\left(\frac{1}{2}\text{ hour}\right)$

7. 11h15

8. 10h15 and ± 11h20

9. 10 km/h

10. 5 km/h

Theme 4 Mensuration and geometry

Topic 4 Plane figures and shapes

Worksheet 25 Properties of quadrilaterals

(WB page 50)

1. a) Rectangle. Two pairs of opposite sides are equal. Right angle.

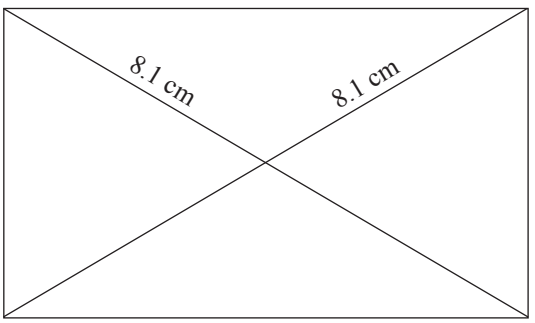
b) Rhombus. Two sets of opposite sides are parallel and one pair of adjacent sides are equal.

c) Parallelogram. One pair of opposite sides are equal and parallel.

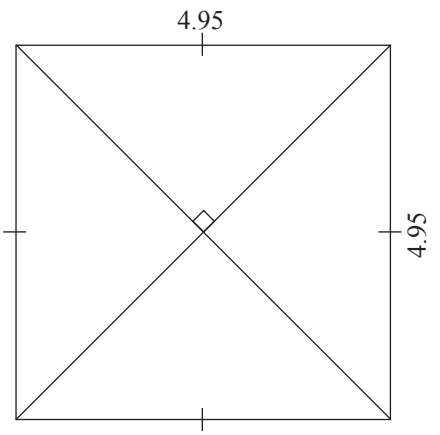
2.

1.	b)
2.	d)
3.	a)
4.	c)

3. a)



b)



c)–e) Student's own work.

4. a) True. Sketch a slanted rhombus and measure angles not to be 90 degrees.

b) False. All rhombuses are parallelograms but not all parallelograms are rhombuses. Sketch a rhombus showing the properties of a parallelogram. Sketch a parallelogram showing its properties which are not the same as a rhombus.

c) True. Sketch a square showing the properties of a kite. Sketch a kite showing that it does not have square properties.

d) False. Sketch a parallelogram showing its properties which are not the same as a rectangle. Sketch a rectangle showing that it has the properties of a parallelogram.

Worksheet 26 Calculations with quadrilaterals

(WB page 55)

1. a) Rhombus. Two pairs of sides parallel and one pair of adjacent sides equal.

b) $6a + 10 = 8a - 20$ (opposite angles of rhombus)

$30 = 2a$

$15 = a$

In $\triangle PSR$:

$PS = PR$ (properties of rhombus)

$\therefore S\hat{P}R = b$ (base angle of isosceles triangle)

$\therefore 100 + 2b = 180$ (angles in triangle)

$b = 40°$

$c = 2b$ (opposite angles of rhombus

$c = 80°$ are bisected)

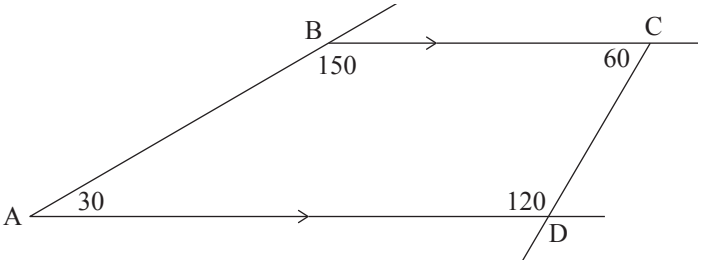
c) Yes. If you construct diagonal SQ, it will bisect FR at 90°. Also two pairs of adjacent sides are equal.

2. a) $x + 2x + 5x + 4x = 360$ (angles in quadrilateral = 360°)

$12x = 360$

$x = 30$

b)



c) Trapezium. One pair of opposite sides parallel.

Worksheet 27 Scale drawing (WB page 57)

1. **a)** 50 m × 25 m

b) 110 m × 73 m

c) 20 m × 45 m

d) 8 m × 15 m

2. **a)** 2.5 cm : 5 m

1 cm : 2 m

b) 1 mm : 1 m

3. Student's own work.

4. **a)** Abuja to Port-Novo = 1 cm

Port-Novo to Lome = 0.2 cm

Lome to Accra = 0.5 cm

Accra to Ouagadougou = 1.2 cm

Ouagadougou to Niamey = 0.7 cm

Niamey to Abuja = 1.2 cm

Total = 4.8 cm

Using the scale of 1 : 42 300 000, the distance is 2 030.4 km

b) 4.8 – 1.2 = 3.6

3.6 + 2.3 = 5.9

∴ 2 495.7 km

∴ 465.3 km further

c) 2 030.4 ÷ 21 = 96.69 km per day

d) 2 030.4 km ÷ 100 = 20.304

20.304 × 5 litre = 101.52 litre

101.52 litre × ₦93.68 per litre = ₦9 510.39

TERM 3

Workbook solutions

Theme 4 Mensuration and geometry

Topic 2 Angles and polygons

Worksheet 28 Angles (revision)

(WB page 61)

1. **a)** 1 **b)** obtuse
c) 72 **d)** opposite
e) hexagon

2. **a)** $57 + 60 + 3a + 180$ (angles on straight line = 180°)
$a = 21°$
$3a + 5b + 12 = 180$ (angles on straight line = 180°)
$b = 21°$

b) $c + 87 + 18 = 180$ (angles in triangle = 180°)
$c = 75°$
$d + 75 + 62 = 180°$ (angles in triangle = 180°)
$d = 43°$

c) $L\hat{N}O = 72°$ (alternate angles equal, KL // MO
$\therefore P\hat{N}O = 45°$
$e + 45 = 180$ (co-interior angles = 180; PQ // MO)
$e = 135°$

Worksheet 29 Sum of the interior angles of polygons

(WB page 63)

1. 108°

2. 6

3. 360°

4. 40° and 100° or 70° and 70°

5. 7

6. **a)** $111 + 61 + x + 89 = 360$ (angles in quadrilateral)
$x = 81°$

b) $2x + 22 + 63 + 81 + 3x = 180$ (angles in quadrilateral)
$x = \frac{14}{5}$

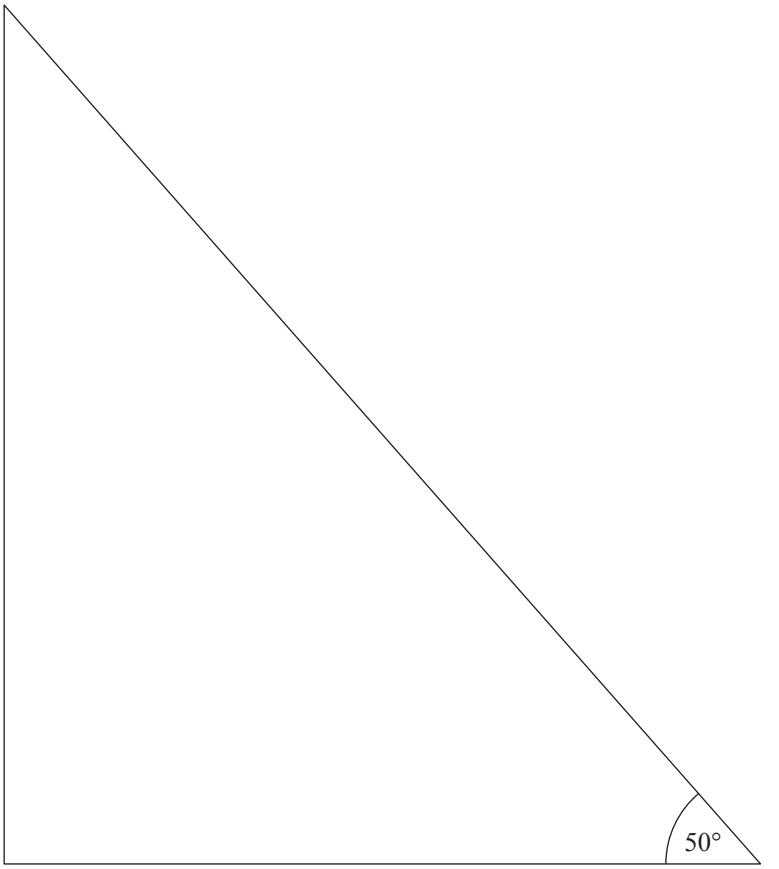
7.

$\hat{E} = 120°$	(angle in a hexagon)
$E\hat{F}D = x$	(base angles of isosceles triangle)
$120 + 20x = 180$	(angles in triangle = 180)
$x = 30°$	

Worksheet 30 Angles of elevation and depression

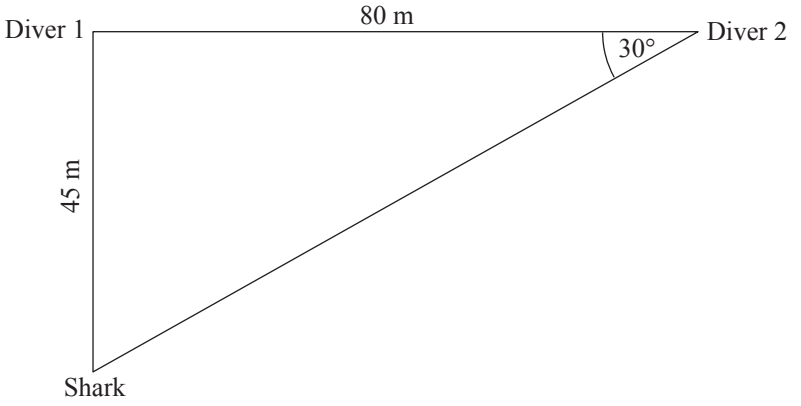
(WB page 65)

1. a)



b) 11.5 m

2. a)



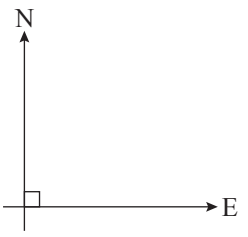
b) 91 m

Topic 3 Bearing

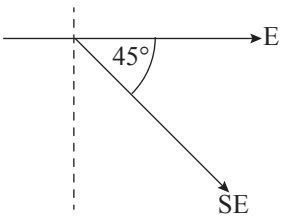
Worksheet 31 Bearing

(WB page 67)

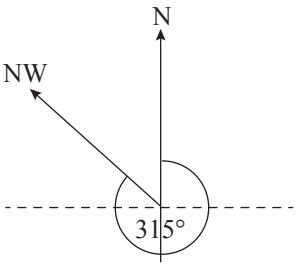
1. a)



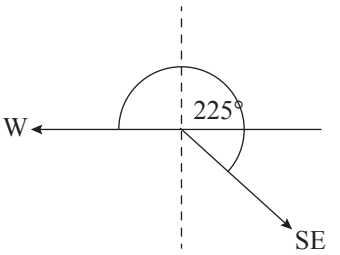
b)



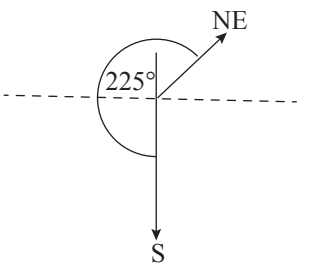
c)



d)



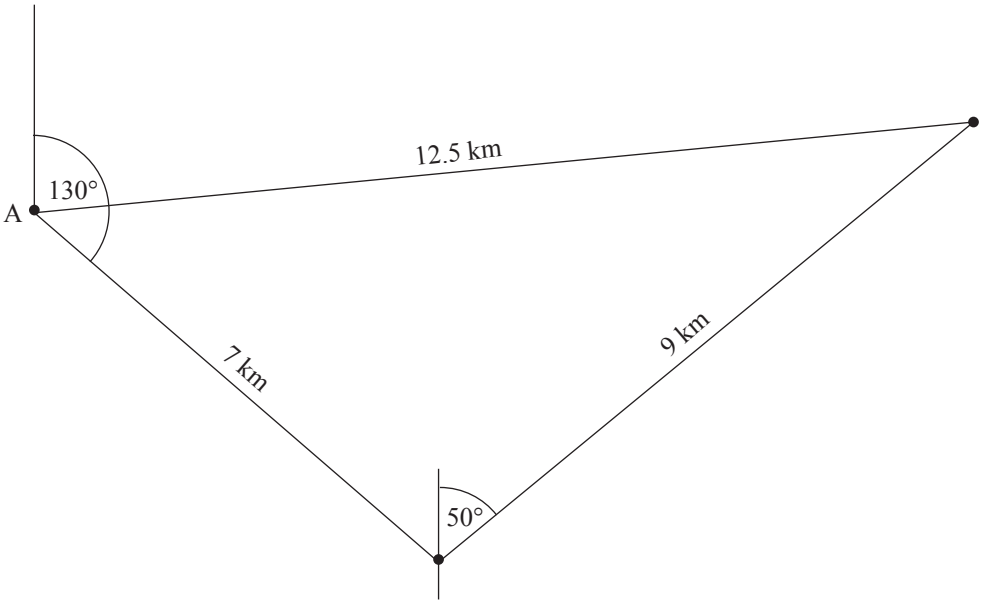
e)



2. a) NE **b)** SE
c) SW **d)** S
e) NW

3. a) E **b)** SW **c)** SW

4. a)

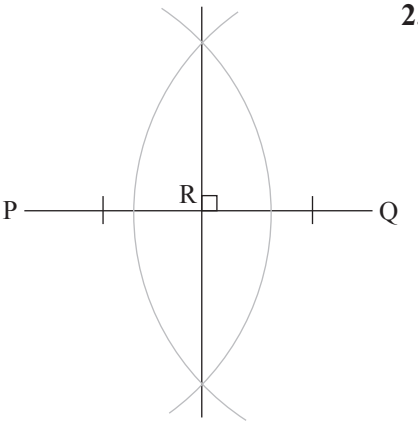


b) 12.5 km
c) 16 km

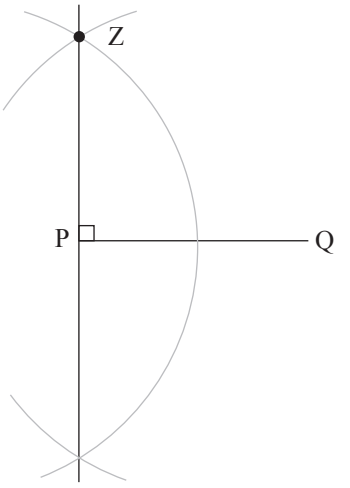
Worksheet 32 Lines and angles

(WB page 71)

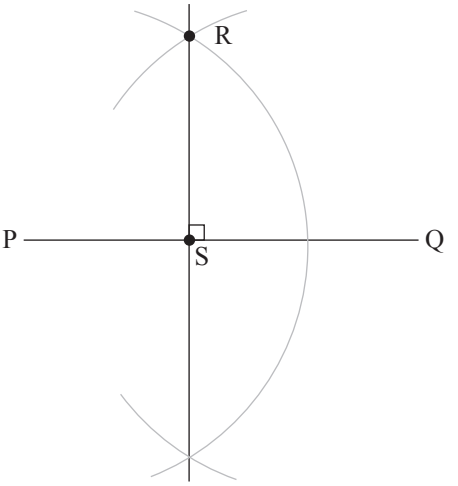
1.



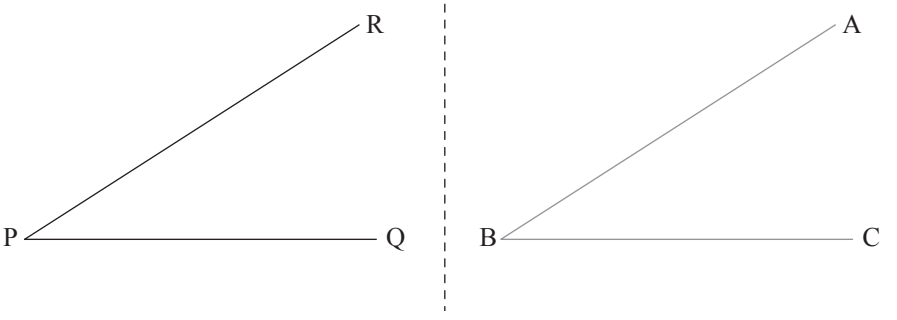
2.



3.

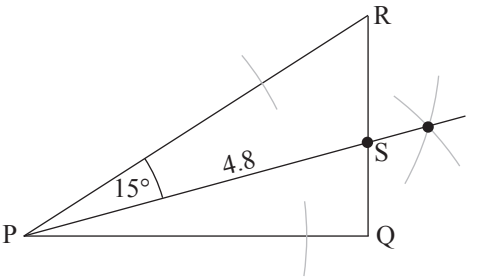


4.



5. Student's own work.

6.



Worksheet 33 Construct triangles

(WB page 75)

1–4. Student's own work.

Theme 5 Everyday statistics

Topic 5 Data presentation

Worksheet 34 Ordering data and frequency tables

(WB page 77)

1. a) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
b) 200, 221, 345, 390, 410, 423, 589, 657, 888, 934

2. a) 98, 78, 76, 64, 51, 50, 44, 34, 25, 23
b) 9, 8, 5, 3, 2, 1, 0, –2, –5, –7

3. a) 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 5, 6, 6, 6, 6, 7, 7, 8

b)

Number of servings per day	Tally
1	𝍸
2	𝍸 𝍸 |
3	𝍸 𝍸
4	𝍸 𝍸
5	𝍸 𝍸
6	𝍸 𝍸
7	||
8	|

c) 2
d) 15

4. a) 20
b) 5
c) 8

Worksheet 35 Bar graphs, pictograms and pie charts

(WB page 80)

1. **a)** 70 **b)** 175 **c)** Week 3: 245
d) Week 2 and 4: 105 **e)** 140 per week

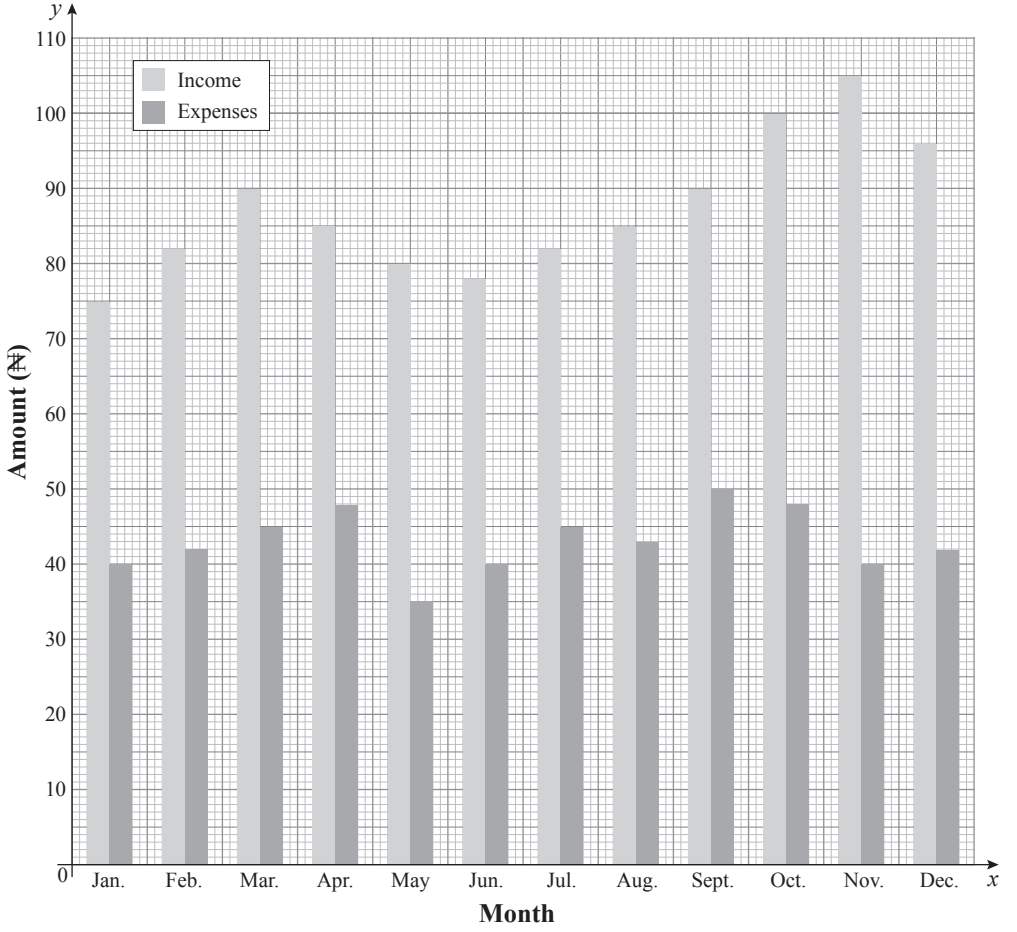
2.

Month	Number of deliveries
January	4
February	5
March	4½
April	4

Key: = 20 deliveries

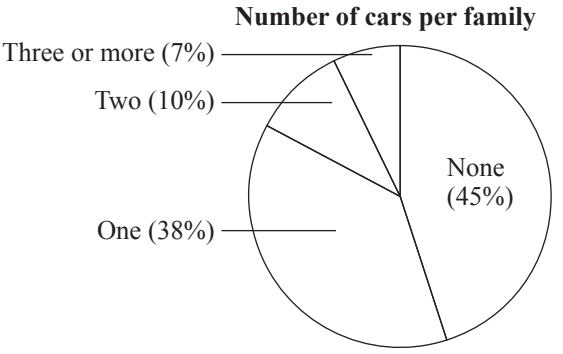
3. **a)** August ± 195 mm
b) March, April and December (0 mm)
c) 475 mm
d) Summer rainfall

4. **a)** Dual bar graph



b) November
c) September
d) November. ₦35 000

5. a)



b) $0.38 \times 178\,000\,000 = 67\,640\,000$

6. a) $0.3 \times 120 = 36$ students

b) $\frac{6}{120} \times 100 = 5\%$

Worksheet 36 Charts and schedules

(WB page 86)

1. a) A: 9 050 000; B: 600 000; C: 100 000

b) Corn

c) $\frac{5\,350\,000}{19\,000\,000} \times 100 = 28.16\%$

2. a) $10\frac{1}{2}$

b) No. Should be $28\frac{1}{2}$.

3. a) 1 hour 5 minutes

b) 11:00

c) Sunday

Topic 6 Probability

Worksheet 37 Probability scale

(WB page 89)

1. a) 1

b) 0

c) $\frac{1}{13}$

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

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

2. **a)** impossible
b) even chance
c) unlikely
d) certain
e) likely
f) even chance
g) unlikely
h) certain

Worksheet 38 Experimental probability (WB page 90)

1.

Possible outcomes	Experimental probability	Theoretical probability
1	$\frac{17}{60}$	$\frac{1}{6}$
2	$\frac{8}{60} = \frac{2}{15}$	$\frac{1}{6}$
3	$\frac{10}{60} = \frac{1}{6}$	$\frac{1}{6}$
44	$\frac{15}{60} = \frac{1}{4}$	$\frac{1}{6}$
5	$\frac{7}{60}$	$\frac{1}{6}$
6	$\frac{3}{60} = \frac{1}{20}$	$\frac{1}{6}$

2. 3 came up with a probability of $\frac{1}{6}$.

Worksheet 39 Calculating probabilities (WB page 91)

1. **a)** $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$

b) $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$

c) $3\left(\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\right) = \frac{3}{8}$

2. **a)** $\frac{26}{52} \times \frac{26}{52} = \frac{1}{4}$

b) $\frac{4}{52} \times \frac{4}{52} = \frac{1}{169}$

c) $\left(\frac{1}{52} \times \frac{1}{52}\right) \times 2 = \frac{1}{1\,352}$

d) $\left(\frac{13}{52} \times 1\right) + \left(\frac{13}{52} \times 1\right) = \frac{1}{2}$

e) $\left(\frac{1}{52} \times \frac{1}{2}\right) + \left(\frac{1}{2} \times \frac{1}{52}\right) = \frac{1}{52}$

3. a) $\frac{26}{52} \times \frac{25}{51} = \frac{25}{102}$

b) $\frac{4}{52} \times \frac{3}{51} \times \frac{1}{221}$

c) $\left(\frac{1}{52} \times \frac{1}{51}\right) \times 2 = \frac{1}{2\,652}$

d) $\left(\frac{13}{52} \times 1\right) + \left(\frac{13}{52} \times 1\right) = \frac{1}{2}$

e) $\left(\frac{1}{52} \times \frac{25}{51}\right) + \left(\frac{26}{52} \times \frac{1}{51}\right) = \frac{1}{52}$

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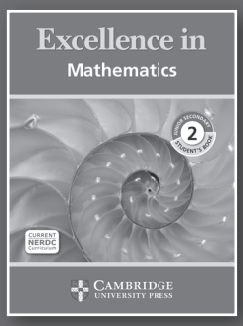

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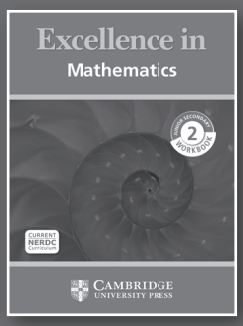

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