

ESSENTIAL Mathematics Primary 6

Teacher's Guide



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Adwoa Nkrumah • Vida Takyi
Consultant: Juliet Comfort Donkor



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UNIVERSITY PRESS & ASSESSMENT



NNF Esquire Limited
P.O. Box AN 8644, Accra - North, Ghana.



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Shaftesbury Road, Cambridge CB2 8EA, United Kingdom
One Liberty Plaza, 20th Floor, New York, NY 10006, USA
477 Williamstown Road, Port Melbourne, VIC 3207, Australia
314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi – 110025, India
103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467
Old Warehouse Building, Black River Park, 2 Fir Street Observatory, Cape Town, 7925, South Africa

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First published 2020

Updated 2025

20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

Printed in South Africa by Academic Press

ISBN 978-9988-8965-9-1 Paperback

Editor: Izelle Theunissen

Designer: Mzwakhe Sibeko

Typesetter/illustrator: Firelight Studio

Cover artwork: jayk7/GettyImages

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Contents

Introduction	v
TOPIC 1: Number	1
Unit 1: Counting, representation, cardinality and ordinality	1
B6.1.1.1 Quantities and place value up to 1,000,000.	1
B6.1.1.2 Roman numerals up to C.	11
B6.1.1.3 Factors, multiples and prime numbers from 1 to 100	13
Unit 2: Number operations.	16
B6.1.2.1 Apply mental mathematics strategies and number properties for multiplication and division	16
B6.1.2.2 Multiply multi-digit numbers	18
B6.1.2.3 Manipulate numbers using division facts.	22
B6.1.2.4 Divide 2- or 3-digit numbers by 1- or 2-digit numbers	24
B6.1.2.5 Translate word problems into mathematical sentences and solve	26
B6.1.2.6 Understand integers	28
Unit 3: Fractions	35
B6.1.3.1 Compare, add, subtract, multiply and divide fractions.	35
Unit 4: Ratios and proportion.	41
B6.1.4.1 Ratio and its relationship to fractions, multiplication and division	41
B6.1.4.2 Proportion and its relationship to ratios and rates.	45
TOPIC 2: Algebra	48
Unit 1: Pattern and relationships	48
B6.2.1.1 Determine the pattern rule to make predictions	48
Unit 2: Algebraic expressions	53
B6.2.2.1 Understand algebraic expressions	53
Unit 3: Variables and equations	57
B6.2.3.1 Solve problems with a single variable and a whole number coefficient.	57
TOPIC 3: Geometry and measurement	60
Unit 1: 2D shapes and 3D shapes	60
B6.3.1.1 Understand prisms.	60

Unit 2: Measurements	64
B6.3.2.1 Construct rectangular and triangular prisms from their nets. .64	
Unit 3: Geometric reasoning	67
B6.3.3.1 Describe the position and motion of objects in space using the cardinal points.	67
B6.3.3.5 Perform a single transformation on a 2D shape	70
TOPIC 4: Data	80
Unit 1: Collect, organise, present, interpret and analyse data	80
B6.4.1.1 Create, label and interpret line graphs	80
B6.4.1.2 Select, justify and use appropriate methods to collect data.	85
Unit 2: Chance or probability	88
B6.4.2.2 Understand probability	88
Revision answers	91
Workbook answers	101

Introduction

Ghana's Ministry of Education wants to ensure that every learner receives quality education. This type of education should be accessible to all learners as it will help them enjoy learning and develop their full potential. Our country needs to help our citizens become mathematically literate and good problem-solvers. They should develop the ability to think critically and creatively and have the confidence and competence to participate fully in society as responsible citizens both of Ghana and of the world.

This teacher's guide includes the subject aims for Mathematics as set out in the new curriculum, and information about how to teach and assess content. It includes the core competencies and standards that learners should achieve and be able to demonstrate as they progress through each year's work.

Mathematics is included in most parts of our everyday lives. Improving their understanding of and skills in working with numbers and other mathematical concepts can help learners develop as responsible citizens.

The role of the teacher is vital in every classroom.

Teachers who teach Mathematics effectively help learners develop the foundations for further learning and improve their understanding of the world. The aim of this teacher's guide is to help equip teachers with the knowledge and skills they need to provide support and guidance for all learners in their classes. Using this series will help teachers ensure that learners are involved in the learning process and that they are not mere spectators who watch teachers and other learners solve problems.

Essential Mathematics aims to ensure that teaching in the Mathematics classroom will be enquiry-based and give learners opportunities to apply new insights to the way in which they understand and view the world. Teaching must be learner-centred and ensure that learners are actively engaged.

Learners must be given opportunities to build on previous knowledge and, where necessary, to correct misconceptions and become critical thinkers and problem-solvers.

When teaching Mathematics, teachers should help learners:

- realise that Mathematics is part of all aspects of everyday life
- understand the language, symbols and notation of Mathematics and apply this information correctly
- develop mathematical curiosity and use appropriate reasoning when solving problems, and develop confidence in their ability to use Mathematics to analyse and solve problems both in the classroom and of real-life situations

- appreciate the usefulness, power and beauty of Mathematics
- enjoy Mathematics and develop patience and the ability to keep their focus when solving problems even if their first attempts are not successful
- develop the knowledge, skills and attitudes necessary to pursue further studies in Mathematics
- develop abstract, logical and critical thinking, and the ability to reflect critically on their work and the work of others.

Teachers can rely on this teacher's guide to help them:

- select Mathematics content, adapt and plan lessons to meet the interests, knowledge, understanding, abilities and experiences of all learners in their classes
- guide and facilitate learning by encouraging class and small group discussions and challenging learners to accept and share responsibility for their own learning
- work with other teachers of Mathematics and teachers of other subjects to help learners develop, not only the skills they need to be successful young mathematicians, but also to develop as balanced young people
- use different methods to assess learners' understanding and identify problem areas
- give feedback to learners and their guardians about learners' progress
- design and manage a classroom that has the necessary resources so that learners can focus on learning content and be successful.

Core competencies

The core competencies are the set of skills learners can develop as their teachers help them engage with the subject matter.

The six core competencies:

- **Critical thinking and problem-solving (CP):** This skill is particularly important in the Mathematics classroom. Learners who develop this skill will be able to analyse a problem and continue to work until they find the way to solve it.
- **Creativity and innovation (CI):** Developing this skill will help learners use innovative ways to solve problems.
- **Communication and collaboration (CC):** Developing this skill will make it easy for learners to work in groups and to find good ways to solve problems. Communication skills are not only essential in the classroom, but also in later years when young people are employed.
- **Cultural identity and global citizenship (CG):** When learners understand the role of each person in a society and a country, they will be able to use their insights and skills when they take part in formulating solutions

to problems, which could include addressing issues such as floods, malnutrition, unemployment and illegal mining.

- **Personal development and leadership (PL):** People generally find it easier to work with leaders who have developed self-awareness and who have good self-esteem. Good leaders work to bring the best out in others and they take responsibility for their actions.
- **Digital literacy (DL):** Nowadays, people who have the necessary skills can use calculators, cellphones and computers and they can access information about most issues on the internet. Being digitally literate opens doors for people of all ages.

Learning behaviours

The curriculum stresses three integral learning domains that should be the basis for teaching, learning and assessment:

- **Knowledge, understanding and application:** Learners acquire knowledge through many learning experiences – both inside and outside the classroom. They can show their understanding of concepts by comparing, summarising, and rewriting concepts in their own words. Being able to apply knowledge to new situations shows that someone understands a concept well.
- **Skills and processes:** Mathematicians use accepted methods to solve problems and find more information. In the classroom, learners should be given the opportunity to tackle problems that require them to ask questions and use different strategies to solve problems.
- **Attitudes and values:** Effective, competent and reflective citizens are able to solve personal problems and problems in the society. Teachers should expose learners to problems where they have to ask questions and apply different strategies to find solutions. People who are positive and expect to be able to find solutions, are more likely to do so than those who doubt themselves and others.

Assessment

Assessment is a process of collecting and evaluating information about learners' skills and using this information to make decisions about how to help them improve their learning.

Teachers should use assessment to promote learning and find suitable methods that will help learners be successful. So, the purpose of assessment is to identify the strengths and weaknesses of learners and help teachers adapt their methods. A section with guidance about teacher, self/peer, group/peer, summative or diagnostic assessment is included in each section in this teacher's guide.

When developing assessment procedures, teachers should select indicators in such a way that they will be able to assess a representative sample in each section of work. Teachers should refer to the indicator in the curriculum as they point to criteria that learners should master. Most assessment questions and tasks aim to assess a few, but not all, indicators in a section of work. The assessment procedures teachers use for class assessments, homework, projects and so on, must complement each other to ensure that teachers include a representative sample of indicators.

Pedagogical approaches

The curriculum refers to pedagogical approaches, methods, strategies, and appropriate relevant teaching and learning resources that will help teachers ensure that every learner benefits from the teaching and learning process.

Teachers should:

- use creative approaches to create learning-centred classrooms
- ensure that all learners are included equally
- use differentiation and scaffolding as teaching and learning strategies
- use information and communication technology (ICT) as a pedagogical tool
- help learners realise that Mathematics is relevant in their lives
- integrate assessment strategies
- use questioning techniques that promote real learning.

This teacher's guide provides teaching methodologies for all sections of the curriculum to help teachers choose and use the most effective pedagogical approaches. However, teachers may need to change certain approaches based on the skills level of the learners in a class. Teachers must use their own experience and discretion to adapt methodologies as necessary.

Learning-centred pedagogy

In a learning-centred classroom, learners engage in meaningful hands-on activities that help them, where possible, relate what they are learning to the real world. The classroom should be a place where learners discuss ideas, become actively engaged in looking for answers and work in groups to solve problems. They should also do research on the internet and analyse and evaluate information. The aim of the learning-centred classroom is to enable learners to take ownership of their learning.

Inclusion

One of a teacher's greatest challenges is to ensure that all learners, particularly those who are disadvantaged, are included in the learning process. In this

teacher's guide, suggestions are given about how to teach a particular concept to classes that include learners with special needs.

Adapt teaching approaches to learners

Teachers must take differences between learners into account when they prepare and teach lessons. These differences include learning styles, readiness to learn and interests. A teacher's aim must be to ensure that all the learners in a class have the best possible chance of learning and being successful.

Examples of adapted approaches include:

- Set different tasks for learners with different abilities. For example, when drawing symmetrical shapes, some learners can draw freehand sketches while other learners should draw shapes on a grid.
- Some learners will need more support than others. For example, when solving an algebra problem, learners who have mastered the work will be able to skip certain steps, while other learners should write down each step as they solve a problem.
- Some learners will be able to complete a task much faster than others. Rather than telling learners who need more time to hurry up and finish the work, teachers can give learners who have completed tasks quickly and accurately a few challenging questions to solve.
- Teachers can divide most complicated tasks into parts and concentrate on one part until learners have mastered it.

Information and communication technology (ICT)

ICT as a teaching and learning tool can provide learners with access to large quantities of information online and offline. It can also provide a framework for analysing data, which learners can use to investigate patterns and relationships. Once learners have found information, they can use ICT to help them organise, edit and print the information in many different ways.

Examples of ways learners can use ICT for Mathematics:

- Learners can use calculators and also calculator apps on cellphones for calculations and to check their mental calculations.
- They can use cameras on cellphones to record results and steps when solving a problem or making a drawing.
- Teachers can show classes videos they find online that explain certain concepts.
- Teachers can search for grade-appropriate online mathematics games that learners can play and they can encourage learners to play such games online in groups, pairs or on their own.

- Learners can research data online. For example, they can do research to find population statistics for a few countries and compare the populations for these countries over a few decades.
- Teachers can ask learners who have completed a section of work faster than the rest of the class to find information and formulate a few questions for the class to discuss. Examples of topics learners can research include distances between towns in Ghana and neighbouring countries, main export and imports of countries in Western Africa, vaccination statistics for measles or other diseases (such as Covid-19) for a few countries and information about flooding and/or drought in certain regions.
- Teachers can encourage learners to start working with MS Office and learn to use basic word-processing skills, spreadsheets and PowerPoint presentations. They can also encourage learners to use online programmes that will teach them to touch-type on a computer keyboard.

The exposure that learners are given at the primary school level to use ICT can help build their confidence and increase their level of motivation to apply ICT in later years, both inside and outside the classroom. Using ICT in teaching and learning can greatly enhance the quality and competence level of learners.

Organisation and structure of Mathematics

The Essential Mathematics teacher's guides include the indicators and content standards that are given in the curriculum. The same structure is used in the learner's books, but strands are called topics and sub-strands are called units.

The four strands or topics are:

1. Number
2. Algebra
3. Geometry and measurement
4. Data

The suggested time allocation for Mathematics is two periods of 30 minutes per day.

Curriculum coverage table – Primary 6

Topic 1: Number			
Unit 1: Counting, representation, cardinality and ordinality			
Content standard	Indicator	Page references	
		LB	TG
B6.1.1.1 Demonstrate an understanding of quantities and place value for multi-digit numerals up to 1,000,000,000 or 1 billion Refer to Workbook pages 1–11 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.1.1.1 Model number quantities up to 1,000,000 using graph sheets and multi-base blocks	1–3	1–10
	B6.1.1.1.2 Read and write numbers in figures and in words up to 1,000,000	4–8	
	B6.1.1.1.3 Identify numbers in different positions around a given number in a number chart	11	
	B6.1.1.1.4 Compare and order whole numbers up to 100,000 and represent the comparison using $>$, $<$, or $=$	9–13	
	B6.1.1.1.6 Skip count forwards and backwards in 5,000s, 10,000s etc. up to and from 1,000,000	14–18	
B6.1.1.2 Demonstrate an understanding of Roman numerals up to C (i.e. 100) Refer to Workbook pages 12–14 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.1.2.1 Recognise Roman numerals system up to C (i.e. 100)	19	11–13
	B6.1.1.2.2 Count and convert Hindu Arabic numbers to Roman numerals up to 100 (C) and vice versa	20–24	
B6.1.1.3 Demonstrate an understanding of factors, multiples and prime numbers from 1 to 100 Refer to Workbook pages 15–18 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.1.3.1 Determine the HCF and the LCM of two or three numbers using prime factors	24–32	13–15

Unit 2: Number operations

Content standard	Indicator	Page references	
		LB	TG
B6.1.2.1 Describe and apply mental mathematics strategies and number properties to determine answers for basic multiplication facts to 144 and related division facts Refer to Workbook pages 19–20 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.2.1.1 Apply mental mathematics strategies and number properties, such as skip counting from a known fact, using doubling or halving, using patterns in the 9s and 11s facts, using repeated doubling or halving, to determine answers for basic multiplication facts to 81 and related division facts	33–38	16–18
	B6.1.2.1.2 Apply mental mathematics strategies for multiplication, such as annexing then adding zero, and halving and doubling using the distributive property		
B6.1.2.2 Demonstrate an understanding of multiplication of a 2- or 3-digit number by a 2- or 3-digit number Refer to Workbook pages 21–24 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.2.2.1 Multiply multi-digit numbers by 2- or 3-digit numbers efficiently	38–42	18–22
B6.1.2.3 Manipulate numbers, using basic division facts up to 144 Refer to Workbook pages 25–26 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.2.3.1 Determine basic division facts up to 81	43–45	22–24
B6.1.2.4 Demonstrate an understanding of division of a 2- or 3-digit number by a 1- or 2-digit number Refer to Workbook page 27 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.2.4.1 Divide 3-digit numbers by 1-digit or 2-digit numbers	45–46	24–26

B6.1.2.5 Translate word problems into mathematical sentences and solve Refer to Workbook page 28 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.2.5.1 Solve multi-step word problems involving the four basic operations	47–50	26–28
B6.1.2.6 Demonstrate an understanding of integers Refer to Workbook pages 29–43 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.2.6.1 Locate, compare and order sets of integers using the number line and symbols <, > or =	50–58	28–35
	B6.1.2.6.2 Solve simple addition and subtraction problems involving integers (excluding subtraction of negative numbers)	58–64	
	B61.2.6.3 Perform simple multiplication with integers	64–67	
Unit 3: Fractions			
Content standard	Indicator	Page references	
		LB	TG
B6.1.3.1 Demonstrate an understanding of strategies for comparing, adding, subtracting, multiplying and dividing common, decimal and percentage fractions Refer to Workbook pages 44–52 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.3.1.1 Compare and order a mixture of fractions: common, percentage and decimal fractions (up to thousandths)	68–79	35–41
	B6.1.3.1.2 Add and subtract unlike and mixed fractions	79–84	
	B6.1.3.1.3 Use models to explain the result of multiplying a fraction by a whole number, a whole number by a fraction and a fraction by a fraction	85–88	
Unit 4: Ratios and proportion			
Content standard	Indicator	Page references	
		LB	TG
B6.1.4.1 Demonstrate an understanding of the concept of ratio and its relationship to fractions and to the multiplication and division of whole numbers Refer to Workbook pages 53–62 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.4.1.1 Use concrete models and pictorial representations to explain a ratio as a concept that shows the number of times one quantity can be obtained in another and write this symbolically and in its simplest form	89–96	41–44
	B6.1.4.1.2 Express ratios in equivalent forms, compare and order ratios	96–101	

B6.1.4.2 Understand the concept of proportion and its relationship to ratios and rates. Use proportional reasoning and rates to solve real-world and mathematical problems Refer to Workbook pages 63–66 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.1.4.2.1 Use models to explain proportion as a comparison between quantities with equal ratios	102–105	45–47
	B6.1.4.2.3 Use various strategies to solve proportional reasoning problems involving rates and scales	106–108	

Topic 2: Algebra

Unit 1: Pattern and relationships

Content standard	Indicator	Page references	
		LB	TG
B6.2.1.1 Determine the pattern rule to make predictions about subsequent elements Refer to Workbook pages 67–71 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.2.1.1.4 Represent a given pattern visually to verify predictions	109–115	48–52
	B6.2.1.1.7 Write a rule in words and in algebra to represent a given pattern	116–121	
	B6.2.1.1.8 Describe the relationship in a given table or chart, using a mathematical expression	121–124	

Unit 2: Algebraic expressions

Content standard	Indicator	Page references	
		LB	TG
B6.2.2.1 Demonstrate an understanding of algebraic expressions Refer to Workbook pages 72–77 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.2.2.1.1 Demonstrate an understanding of algebraic expressions as mathematical phrases that can contain letters which represent ordinary numbers and operators (like add, subtract, multiply, and divide)	125–136	53–56

Unit 3: Variables and equations

Content standard	Indicator	Page references	
		LB	TG
B6.2.3.1 Solve problems involving single-variable, one-step equations with whole number coefficients Refer to Workbook pages 78–84 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.2.3.1.2 Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically	137–145	57–59
	B6.2.3.1.3 Create a problem for a given equation		

Topic 3: Geometry and measurement**Unit 1: 2D shapes and 3D shapes**

Content standard	Indicator	Page references	
		LB	TG
B6.3.1.1 Demonstrate an understanding of prisms Refer to Workbook pages 85–92 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.3.1.1.1 Identify examples of rectangular and triangular prisms in the classroom and the community	146–151	60–63

Unit 2: Measurements

Content standard	Indicator	Page references	
		LB	TG
B6.3.2.1 Demonstrate an understanding of prisms Refer to Workbook pages 93–96 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.3.2.1.2 Construct rectangular and triangular prisms from their nets	152–156	64–67

Unit 3: Geometric reasoning

Content standard	Indicator	Page references	
		LB	TG
B6.3.3.1 Describe the position of objects in space using the cardinal points	B6.3.3.1.1 Describe the position and motion of objects in space using the cardinal points north-east, north-west, south-east and south-west	157–165	67–70
B6.3.3.5 Perform a single transformation (i.e. reflection translation) on a 2D shape Refer to Workbook pages 97–108 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.3.3.5.1 Perform and identify images of a single transformation (i.e. reflection) on 2D shapes in a plane	166–175	70–79
	B6.3.3.5.2 Identify images of a single transformation (i.e. reflection and translation) of a 2D shape in a plane	176–188	

Topic 4: Data

Unit 1: Data collection, organisation, presentation, interpretation and analysis

Content standard	Indicator	Page references	
		LB	TG
B6.4.1.1 Create, label, and interpret line graphs to draw conclusions Refer to Workbook pages 109–116 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.4.1.1.1 Draw a line graph by determining the common attributes (title, axes and intervals) and draw the graph for a given table of values	189–193, 198–201	80–84
	B6.4.1.1.2 Determine whether a given set of data can be represented by a line graph (continuous data) or a series of points (discrete data) and explain why	194–197	
	B6.4.1.1.3 Apply an understanding of how to create a line graph by using a given table of values (or a set of data) to draw a line graph and answer questions based on them to interpret and draw conclusions	190–193 198–201	

B6.4.1.2 Select, justify, and use appropriate methods of collecting data, including questionnaires, interviews, observations, experiments, databases, electronic media, etc. Refer to Workbook pages 117–118 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.4.1.2.1 Select a method for collecting data to answer a given question and justify the choice	202–208	85–87
	B6.4.1.2.2 Design and administer a questionnaire for collecting data to answer a given question and record the results		
	B6.4.1.2.3 Design and administer a questionnaire for collecting data to answer given question(s), record the data, analyse and graph the results to solve problems		
Unit 2: Chance or probability			
Content standard	Indicator	Page references	
		LB	TG
B6.4.2.2 Demonstrate an understanding of probability by identifying all possible outcomes of a probability experiment, when determining the theoretical and experimental probability of outcomes in a probability experiment Refer to Workbook pages 119–123 for additional exercises. You can assign these for homework. Alternatively, you can assign the exercises as extension exercises.	B6.4.2.2.1 List the possible outcomes of a probability experiment, such as tossing a coin, rolling a dice with a given number of sides, spinning a spinner with a given number of sectors, and determine the theoretical probability of an outcome occurring for a given probability experiment	209–215	88–90
	B6.4.2.2.2 Predict the probability of a given outcome occurring for a given probability experiment by using theoretical probability		
	B6.4.2.2.3 Explain that the experimental probability approaches the theoretical probability of a particular outcome as the number of trials in an experiment increases		

Suggested internet sites for supplementary reading and research

<https://nrich.maths.org>

<https://mathseeds.com>

www.sciencedirect.com

www.researchguides.library.wisc.edu

Links to Youtube channels for primary mathematics teaching and learning

“The Video Math Tutor”

“Mathademics”

“Ten Marks”

“Math Mammoth”

“Math TV”

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Unit 1:

Counting, representation, cardinality and ordinality

Content standard

B6.1.1.1 Quantities and place value up to 1,000,000

1. Learning outcomes

Learners will be able to recognise, describe and represent numbers and their relationships, and estimate with competence and confidence in solving problems.

2. Essential for learning

Learners should have prior experience with counting forwards and backwards on number lines and number grids, place value, factors and multiples, ordering and comparing up to 6-digit numbers, rounding off to the nearest number, working on number lines, as well as number patterns or sequences.

Consider a baseline test, so that you can determine your learners' level of knowledge.

3. Key words

Place value, digits, expanded form, multiples, whole numbers, equivalence symbols ($<$, $>$ or $=$), ascending order, descending order, less than/smaller than, greater than/bigger than, equal to, rounding up/down, rounding off, less than/smaller than, greater than/bigger than, equal to

4. Resources

Learner's Book, Workbook, graph sheets, multi-base blocks, number cards, beads, plastic straws, number bonds, place

value charts, number wheel, number chart, abacus, pictures of animals, see-saw, number line, number cards

5. Large class teaching

Plan your activities for an inclusive class. Determine your learners' point of entry. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

6. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps.

Develop a balance between individual teaching, peer teaching, cooperative learning and whole class teaching. If you see learners who are struggling, allow them more time to complete the task.

When the learners attempt word problems, first help them to explore the vocabulary in word problems. Make sure the learners understand the language and vocabulary used.

The learners should be able to explain their comparisons in the examples that follow: 258,214,879 and 265,321,897; 658,122,140 and 658,122,411. Learners should also be able to explain their skills in determining the placing of whole numbers in relation to other whole numbers.

7. Additional content for the teacher

Review the different systems that were used to represent numbers, for example, the tally system used by olden-day traders, cocoa/cattle farmers and barter traders and the Hindu Arabic number system.

If you have access to the Internet, explore YouTube for video material on multiples and factors, ordering whole numbers and equivalence, rounding off, rounding up or down, as well as number patterns or sequences.

8. Teaching methodology

Ask learners to count in 1s, 2s, 3s and 4s, as far as possible, and revise multiplication up to 12×12 . Play games and have a class competition to encourage learner participation.

Prepare a place value chart, up to millions, and ask the learners to read off numbers from the chart. Use a concrete, semi-concrete and abstract sequence. Make use of peer-assisted learning.

Ask learners to count in multiples of 10,000. Prepare a number chart and ask learners, in pairs, to identify and read off numbers from the chart in different positions around a given number. Ask them to count forwards and backwards, in different sequences. The learners should be able to identify the rules in each sequence, for example, adding 25 each time to get the next number.

When the learners progress to ordering numbers in ascending or descending order, start with the first three digits, before moving to the next digits. Let them use a number line to say whether the number is nearer to a lower or higher value. Ask pairs of learners to use number cards as a starting point, then skipping forwards or backwards to reach the next whole number.

9. Assessment

Assessment should take many forms. Use a baseline test as a diagnostic assessment (numbers in words and numerals, odd, even, skipping numbers forwards and backwards, place value, and so on). Also assess the learners on mental mathematics. This can take the form of teacher assessment, class work, or self- or peer assessment.

10. Answers

Exercise 1

LB page 2

1.
 - a) 4 blocks, 2 flats, 3 rods, 7 cubes
 - b) 6 blocks, 3 flats, 4 rods, 5 cubes
 - c) 5 blocks, 1 flat, 2 rods, 8 cubes
 - d) 3 blocks, 2 flats, 3 rods, 0 cubes
 - e) 2 blocks, 0 flats, 5 rods, 2 cubes, 6 hundreds
 - f) 8 flats, 4 rods, 3 cubes, 5 hundreds
 - g) 7 flats, 4 rods, 6 cubes, 2 hundreds
 - h) 1 block, 5 flats, 2 rods, 3 cubes, 4 hundreds
- 2.

	Millions	Thousands			Hundreds	Tens	Ones
a)		3	5	3	0	0	0
b)	5	6	3	2	0	0	0
c)	6	4	0	2	0	0	0
d)	2	4	0	0	0	0	0
e)		3	7	6	0	0	0

Exercise 2

LB page 3

1.
 - a) 2 hundreds, 5 tens, 7 ones
 - b) 1 hundred, 4 tens, 5 ones
 - c) 5 hundreds, 0 tens, 5 ones
 - d) 2 hundreds, 2 tens, 4 ones
 - e) 1 thousand, 0 hundreds, 4 tens, 0 ones
 - f) 2 thousands, 1 hundred, 5 tens, 0 ones
 - g) 6 thousands, 5 hundreds, 2 tens, 0 ones
 - h) 8 thousands, 3 hundreds, 6 tens, 0 ones
 - i) 4 ten thousands, 5 thousands, 0 hundreds, 0 tens, 0 ones
 - j) 1 ten thousand, 2 thousands, 5 hundreds, 0 tens, 0 ones
 - k) 1 ten thousand, 4 thousands, 5 hundreds, 0 tens, 0 ones

- l)** 3 ten thousands, 1 thousand, 2 hundreds, 0 tens, 0 ones
- m)** 2 ten thousands, 6 thousands, 2 hundreds, 0 tens, 0 ones
- n)** 3 hundred thousands, 6 ten thousands, 5 thousands, 0 hundreds, 0 tens, 0 ones
- o)** 1 hundred thousand, 2 ten thousands, 3 thousands, 0 hundreds, 0 tens, 0 ones
- p)** 8 hundred thousands, 1 ten thousand, 2 thousands, 0 hundreds, 0 tens, 0 ones
- q)** 6 ten thousands, 5 thousands, 9 hundreds, 0 tens, 0 ones
- r)** 5 ten thousands, 2 thousands, 0 hundreds, 0 tens, 0 ones

2. Learners' own answers

Exercise 3

LB page 5

- 1.** **a)** 78,564 **b)** 128,953 **c)** 257,143
d) 5,890,648 **e)** 7,637,642 **f)** 3,586,201
g) 6,532,005 **h)** 8,590,012 **i)** 9,008,423
j) 4,025,069

2. Learners' own answers

- 3.** **a)** Two million, three hundred and fifty-six thousand, seven hundred and eighty
b) Ninety-nine million, one hundred and twenty-five thousand, two hundred and twenty-five
c) Forty-seven million, nine hundred and seventy-seven thousand, one hundred and eighty-one
d) Twenty-seven million, two hundred and seventy-two thousand three, hundred and sixty-nine
e) Three hundred, and seventy-eight thousand, two hundred and eighty-nine
f) One million two hundred and fifty-one thousand, six hundred and thirty-eight
g) One billion, four hundred and eighty-three million two hundred and four thousand, three hundred
h) Two hundred and thirty-five million, nine hundred, and forty-nine thousand, two hundred and ninety-two
- 4.** **a)** Three hundred thousand
b) Four million
c) Ninety million
d) Two billion
e) Five thousand

- f) Twenty million
 - g) Four hundred thousand
 - h) Zero
5. a) 197,353,319: One hundred and ninety-seven million, three hundred and fifty-three thousand, three hundred and nineteen
- b) 465,735,974: Four hundred and sixty-five million, seven hundred and thirty-five thousand, nine hundred and seventy-four
- c) 644,416: Six hundred forty-four thousand, four hundred and sixteen
- d) 6,886,761,426: Six billion, eight hundred and eighty-six million, seven hundred and sixty-one thousand, four hundred and twenty-six
- e) 742,952,392: Seven hundred and forty-two million, nine hundred and fifty-two thousand, three hundred and ninety-two
- f) 472,623,852: Four hundred and seventy-two million, six hundred and twenty-three thousand, eight hundred and fifty-two

Exercise 4

LB page 7

1. a) $4,000 + 500 + 20 + 1$
- b) $20,000 + 1,000 + 300 + 50 + 6$
- c) $90,000 + 2,000 + 700 + 40 + 1$
- d) $800,000 + 4,000 + 700 + 90 + 6$
- e) $2,000,000 + 800,000 + 70,000 + 4,000 + 600 + 40 + 4$
- f) $30,000,000 + 7,000,000 + 100,000 + 1,000 + 600 + 10 + 2$
- g) $8,000,000,000 + 400,000,000 + 50,000,000 + 7,000,000 + 800,000 + 20,000 + 2,000 + 300 + 50 + 4$
- h) $4,000,000,000 + 900,000,000 + 60,000,000 + 5,000,000 + 200,000 + 10,000 + 7,000 + 800 + 90 + 1$
- i) $4,000,000,000 + 200,000,000 + 10,000,000 + 5,000,000 + 800,000 + 70,000 + 6,000 + 300 + 90 + 2$
- j) $8,000,000,000 + 600,000,000 + 50,000,000 + 4,000,000 + 700,000 + 10,000 + 2,000 + 300 + 90$
- k) $300,000,000 + 60,000,000 + 5,000,000 + 200,000 + 50,000 + 4,000 + 200 + 30 + 1$
2. a) 86,421 b) 87,763 c) 9,877,421
- d) 986,533 e) 7,774,420 f) 7,766,650
- g) 9,887,321

3. a) 13,567 b) 11,388 c) 123,567
 d) 1,334,457 e) 2,355,668 f) 2,236,789
4. a) 123,683 b) 43,254
 c) 35,974,133 d) 7,823,152
 e) 954,617,235 f) 6,618,925,314

Exercise 5

LB page 11

1.

	Number	10 less than	10 more than	100 less than	100 more than	1,000 less than	1,000 more than	10,000 less than	10,000 more than
a)	135,789	135,779	135,799	135,689	135,889	134,789	136,789	125,789	145,789
b)	584,631	584,621	584,641	584,531	584,731	583,631	585,631	574,631	594,631
c)	257,843	257,833	257,853	257,743	257,943	256,843	258,843	247,843	267,843
d)	684,569	684,559	684,579	684,469	684,669	683,569	685,569	674,569	694,569
e)	247,754	247,744	247,764	247,654	247,854	246,754	248,754	237,754	257,754
f)	328,761	328,751	328,771	328,661	328,861	327,761	329,761	318,761	338,761
g)	148,690	148,680	148,700	148,590	148,790	147,690	149,690	138,690	158,690
h)	474,628	474,618	474,638	474,528	474,728	473,628	475,628	464,628	484,628

2. a) $178,916 > 89,056$ b) $80,732 = 80,732$
 c) $8,826 < 9,039$ d) $25,143 < 235,662$
 e) $65,041 < 65,082$ f) $66,378 > 59,784$
 g) $3,021 = 3,021$ h) $98,622 < 986,341$
 i) $46,941 < 986,341$ j) $905,631 > 904,932$
 k) $716,829 < 758,691$ l) $315,282 < 315,782$
3. a) $183,614 = 180,000 + 3,000 + 614$
 b) $932,406 > 900,000 + 32,000 + 174$
 c) $320,000 + 179 < 320,000 + 989$
 d) $106,000 + 341 < 100,000 + 7,000 + 329$
 e) $260,000 + 2,090 > 260,000 + 1,190$

Exercise 6

LB page 12

1. a) 13,512; 36,251; 80,725; 93,676
 b) 84,321; 228,476; 251,869; 432,761; 643,871
 c) 124,578; 232,416; 457,861; 567,390; 567,491
 d) 2,634,653; 2,637,890; 3,481,206; 4,378,212; 4,837,611
 e) 108,746; 108,931; 127,489; 143,352; 161,452

Tens (10s)	Hundreds (100s)	Thousands (1,000s)	Ten thousands (10,000s)
100	1,000	10,000	152,000
110	1,100	11,000	162,000
120	1,200	12,000	172,000

2. a) 180; 190; 200 b) 660; 670; 680
c) 1,020; 1,030; 1,040 d) 152,040; 152,050; 152,060
e) Ten
3. a) 13,700; 13,800; 13,900
b) 1,200; 1,300; 1,400
c) 754,300; 754,400; 754,500
d) 973,100; 973,200; 973,300
e) One hundred
4. a) 34,000; 35,000; 36,000
b) 61,000; 62,000; 63,000
c) 888,000; 889,000; 890,000
d) 997,000; 998,000; 999,000
e) One thousand
5. a) 200,000; 250,000; 300,000
b) 220,000; 270,000; 320,000
c) 400,000; 450,000; 500,000
d) 850,000; 900,000; 950,000
e) Fifty thousand
6. a) 700,000; 900,000; 1,100,000
b) 800,000; 1,000,000; 1,200,000
c) Two hundred thousand
7. a) 57; 47; 37. Ten
b) 205; 105; 5. Hundred
c) 73,000; 72,500; 72,000. Five hundred
d) 973,821; 973,721; 973,621. One hundred
e) 934,321; 924,321; 914,321. Ten thousand
8. a) 670; 370
b) 754; 784
c) 94,729; 91,729; 90,729
d) 110,000; 140,000; 150,000
e) 689,749; 689,719
f) 792,989; 492,989

Exercise 9

LB page 17

1. 4,000,000; 5,000,000. Counted forwards
2. 8,000,000; 9,000,000. Counted forwards
3. 5,500,000; 6,500,000. Counted forwards
4. 3,000,004; 4,000,004. Counted forwards
5. 3,099,999; 4,099,999. Counted forwards
6. 17,000,450; 16,000,450. Counted backwards
7. 271,269,271; 271,268,271. Counted backwards
8. 888,888,888; 858,888,888. Counted backwards

Exercise 10

LB page 18

1. 800,000,000; 900,000,000
2. 1,000,004,000; 1,000,005,000
3. 1,534,567,890; 1,634,567,890
4. 1,000,000; 100,000
5. 1,000,000,000; 1,010,000,000
6. 1,452,456,456; 1,453,456,456

Exercise 11

LB page 18

1. a) 201: two hundred and one
727: seven hundred and twenty-seven
4,000: four thousand
31,000: thirty-one thousand
b) 617: six hundred and seventeen
5,017: five thousand and seventeen
12,000: twelve thousand
17,000,000: seventeen million
21,000,000: twenty-one million
2. a) 612,000
b) 27,683,316

11. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 1 to 11 as extension exercises. You can also choose any exercises from pages 1 to 11 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

1. Learning outcomes

Learners will demonstrate an understanding of Roman numerals up to C. They will investigate the relationship between Roman numerals and Hindu Arabic numerals and develop problem-solving skills.

2. Essential for learning

Learners should have a good understanding of the binary number system. They should also have encountered Roman numerals in previous years.

3. Key words

Numerals, vertically, zigzag, diagonally

4. Resources

Learner's Book, Workbook, a wall chart with Roman numerals and symbols

5. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

6. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps.

7. Additional content for the teacher

Consult your learners' History curriculum for additional material on counting methods. If you have access to the Internet, explore YouTube for material on Hindu Arabic numbers and Roman numerals.

8. Teaching methodology

Use a wall chart to familiarise the learners with Roman numeration. Learners should use the chart to place numbers in a sequential order. Then, they should use the wall chart to convert Roman numerals to the Hindu Arabic numeral system and Hindu Arabic numerals to Roman numerals.

9. Assessment

Assessment can take many forms, for example teacher assessment (class work activity) and self- or peer assessment.

10. Answers

Exercise 12

LB page 20

- | | | |
|--------|--------|--------|
| 1. 11 | 2. 16 | 3. 23 |
| 4. 93 | 5. 39 | 6. 69 |
| 7. 40 | 8. 24 | 9. 72 |
| 10. 95 | 11. 34 | 12. 49 |
| 13. 70 | 14. 52 | 15. 59 |

Exercise 13

LB page 22

- | | | |
|-----------|------------|---------|
| 1. XVI | 2. VIII | 3. XLI |
| 4. LXXXVI | 5. XLIX | 6. LIII |
| 7. LXVIII | 8. LXXIII | 9. XXI |
| 10. XXXV | 11. XXIV | 12. VII |
| 13. XIX | 14. XCVIII | 15. XLV |

Exercise 14

LB page 22

- | | | |
|-----------|------------|------------|
| 1. VIII | 2. XII | 3. V |
| 4. XII | 5. VII | 6. II |
| 7. XIX | 8. XI | 9. XII |
| 10. III | 11. X | 12. XXV |
| 13. XXXIX | 14. XXXI | 15. XXXIV |
| 16. XII | 17. XXVIII | 18. XXXVII |

Exercise 15

LB page 24

- | | | |
|-----------|---------|---------|
| 1. V | 2. VIII | 3. VII |
| 4. VI | 5. XIX | 6. XXV |
| 7. V | 8. XV | 9. IV |
| 10. XX | 11. XIX | 12. XL |
| 13. XVIII | 14. XIX | 15. XXI |

11. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 12 to 14 as extension exercises. You can also choose any exercises from pages 12 to 14 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Content standard

B6.1.1.3 Factors, multiples and prime numbers from 1 to 100

1. Learning outcomes

The learners will be able to recognise, describe and represent numbers and their relationships, and estimate with competence and confidence when solving problems.

2. Essential for learning

Learners should have prior experience with prime numbers.

3. Key words

Highest common factor (HCF), lowest common multiples (LCM), prime factors

4. Resources

Learner's Book, Workbook, hundreds chart

5. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners

should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

6. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Make sure that learners understand the vocabulary in word problems.

7. Additional content for the teacher

Find YouTube videos on prime factors and the prime factorisation method

8. Teaching methodology

Revise the use of the factor tree method to determine prime factors. Learners use this method to express numbers as products of their prime factors. Use a concrete, semi-concrete and abstract sequence. Make use of peer-assisted learning.

9. Assessment

Teacher assessment, for example a class work activity, and self-and peer assessment.

10. Answers

Exercise 16

LB page 26

- | | |
|--|-----------------------------------|
| 1. a) $28 = 2 \times 2 \times 7$ | b) $18 = 2 \times 3 \times 3$ |
| c) $45 = 3 \times 3 \times 5$ | |
| 2. a) $2 \times 2 \times 2 \times 2$ | b) 2×17 |
| c) $2 \times 2 \times 3$ | d) $2 \times 2 \times 2 \times 3$ |
| e) $2 \times 2 \times 2 \times 2 \times 3$ | f) $2 \times 3 \times 3 \times 3$ |
| g) $2 \times 3 \times 7$ | h) $2 \times 3 \times 5$ |
| i) $2 \times 2 \times 2 \times 5$ | j) $2 \times 3 \times 11$ |
| k) $3 \times 3 \times 3$ | l) $3 \times 3 \times 3 \times 3$ |
| m) 5×7 | n) $2 \times 2 \times 19$ |
| o) 7×7 | |

Exercise 17

LB page 28

1. a) 6 b) 12 c) 4
 d) 7 e) 18 f) 12
2. 9
3. GH¢7
4. Boys: 2 groups of 7; Girls: 3 groups of 7
 Boys and girls together: 5 groups of 7
5. a) True
 b) True

Exercise 18

LB page 30

1. a) 180 b) 30 c) 42
2. a) 36 b) 456 c) 30
 d) 40 e) 20 f) 120

Exercise 19

LB page 31

1. HCF = 6, LCM = 126
2. HCF = 25, LCM = 75
3. HCF = 3, LCM = 30
4. HCF = 6, LCM = 120
5. HCF = 4, LCM = 40
6. HCF = 2, LCM = 528
7. HCF = 2, LCM = 600
8. HCF = 28, LCM = 84

Exercise 20

LB page 32

1. HCF = 8, LCM = 80
2. HCF = 6, LCM = 72
3. HCF = 3, LCM = 180
4. HCF = 6, LCM = 432
5. HCF = 5, LCM = 120

11. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 15 to 18 as extension exercises. You can also choose any exercises from pages 15 to 18 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Unit 2: Number operations

Content standard

B6.1.2.1 Apply mental mathematics strategies and number properties for multiplication and division

1. Learning outcomes

The learners will be able to use a range of strategies to perform written and mental calculations with whole numbers, with competence and confidence in solving problems.

2. Essential for learning

Learners should have prior experience with the different multiplication strategies.

3. Key words

Multiplier, multiplicand, product, doubling, halving, factors

4. Resources

Learner's Book, Workbook, multiplication tables, distributive and associative property charts

5. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

6. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary

in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the place value of whole numbers in relation to other whole numbers.

7. Additional content for the teacher

YouTube videos on multiplication bonds, and multiplication using the vertical column method

8. Teaching methodology

Use addition and subtraction to split numbers inside brackets (distributive property). Use factors to split up numbers, and use doubling and halving. Encourage peer-assisted learning using the vertical column method.

9. Assessment

Teacher assessment, for example a class work activity, and self- or peer assessment.

10. Answers

Exercise 1

LB page 34

- | | | |
|----------|-------|-------|
| 1. a) 24 | b) 32 | c) 25 |
| d) 20 | e) 30 | f) 30 |
| g) 35 | h) 40 | i) 42 |
| j) 56 | k) 10 | l) 40 |
| m) 72 | n) 30 | o) 49 |
| p) 64 | q) 81 | r) 36 |
2. Learners' own answers
3. a) $3 \times 4 = 12$; $6 \times 4 = 24$
b) $3 \times 5 = 15$; $6 \times 5 = 30$
c) $2 \times 7 = 14$; $4 \times 7 = 28$
d) $4 \times 8 = 32$; $8 \times 8 = 64$
e) $2 \times 8 = 16$; $4 \times 8 = 32$
f) $2 \times 5 = 10$; $4 \times 5 = 20$
g) $4 \times 6 = 24$; $8 \times 6 = 48$
h) $3 \times 9 = 27$; $6 \times 9 = 54$

4.	If $5 \times 10 = 50$	then $5 \times 9 = 45$	then $5 \times 11 = 55$
	If $4 \times 10 = 40$	then $4 \times 9 = 36$	then $4 \times 11 = 44$
	If $7 \times 10 = 70$	then $7 \times 9 = 63$	then $7 \times 11 = 77$
	If $8 \times 10 = 80$	then $8 \times 9 = 72$	then $8 \times 11 = 88$

11. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 19 to 20 as extension exercises. You can also choose any exercises from pages 19 to 20 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Content standard

B6.1.2.2 Multiply multi-digit numbers

1. Learning outcomes

The learners will be able to use a range of strategies to perform written and mental calculations with whole numbers, with competence and confidence in solving problems.

2. Essential for learning

Learners should have prior experience of the different multiplication strategies.

3. Key words

Expand and box method, vertical column method, distributive property, lattice method

4. Resources

Learner's Book, Workbook, expand box, lattice box

5. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

6. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the place value of whole numbers in relation to other whole numbers.

7. Additional content for the teacher

YouTube videos on the various methods used in this module

8. Teaching methodology

Split numbers inside brackets to make them smaller and easier to multiply. Use the distributive method to split the numbers. Use doubling and halving and make use of peer-assisted learning using the vertical column method.

9. Assessment

Teacher assessment, for example a class work activity, and self- or peer assessment.

10. Answers

Exercise 2

LB page 36

1. a) $46 \times 1,000 = 46,000$ b) $28 \times 10 = 280$
c) $100 \times 263 = 26,300$ d) $10 \times 22 = 220$

- e) $1,000 \times 343 = 343,000$ f) $304 \times 10 = 3,040$
 g) $69 \times 100 = 6,900$ h) $1,000 \times 79 = 79,000$
2. a) 4,260 b) 3,910 c) 1,900
 d) 250,000 e) 35,000 f) 2,800
 g) 1,200 h) 62,000 i) 89,000
 j) 520
3. $36 \times 10 = 360$. There are 360 boxes altogether.
4. $26 \times 100 = 2,600$. 2,600 planes will land at the airport in 100 hours.
5. $30 \times 100 = 3,000$. The length of all the rulers will be 3,000 cm.

Exercise 3

LB page 37

1. a) $7 \times (5 + 2) = (7 \times 5) + (7 \times 2) = 35 + 14 = 49$
 b) $(3 \times 8) - (3 \times 4) = 24 - 12 = 12$
 c) $4 \times 35 = (4 \times 30) + (4 \times 5) = 120 + 20 = 140$
 d) $14 \times 6 = 6 \times (10 + 4) = (6 \times 10) + (6 \times 4) = 60 + 24 = 84$
2. a) 128 b) 115 c) 96
 d) 96 e) 84 f) 85
 g) 168 h) 144 i) 144
 j) 120 k) 72 l) 207
 m) 105 n) 198

Exercise 4

LB page 38

1. Group of 8 items multiplied by 1 = 8
2. $5 \times 0 = 0$
 $0 + 0 + 0 + 0 + 0 = 0$

Exercise 5

LB page 42

1. a) $48 \times 6 = 288$

\times	40	8
6	240	48

- b) $583 \times 6 = 3,000 + 480 + 18 = 3,498$

\times	500	80	3
6	3,000	480	18

c) $489 \times 5 = 2,000 + 400 + 45 = 2,445$

×	400	80	9
5	2,000	400	45

d) $279 \times 4 = 800 + 280 + 36 = 1,116$

×	200	70	9
4	800	280	36

e) $634 \times 16 = 9,600 + 480 + 64 = 10,144$

×	600	30	4
10	6,000	300	40
6	3,600	180	24

f) $126 \times 17 = 1,700 + 340 + 102 = 2,142$

×	100	20	6
10	1,000	200	60
7	700	140	42

2. a) $24 \times 16 = 384$

	2	4	
×	1	6	
	1	4	4
+	2	4	0
	3	8	4

b) $37 \times 23 = 851$

	3	7	
×	2	3	
	1	1	1
+	7	4	0
	8	5	1

c) $562 \times 31 = 17,422$

	5	6	2	
×		3	1	
	5	6	2	
+	1	6	, 8	6 0
	1	7	, 4	2 2

d) $257 \times 21 = 5,397$

	2	5	7	
×		2	1	
	2	5	7	
+	5	, 1	4	0
	5	, 3	9	7

e) $879 \times 62 = 54,498$

	8	7	9	
×		6	2	
	1	, 7	5	8
+	5	2	, 7	4 0
	5	4	, 4	9 8

f) $236 \times 41 = 9,676$

	2	3	6	
×		4	1	
	2	3	6	
+	9	, 4	4	0
	9	, 6	7	6

3. a) 74

b) 76

c) 2,064

d) 2,142

e) 5,894

f) 7,452

11. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 21 to 24 as extension exercises. You can also choose any exercises from pages 21 to 24 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Content standard
B6.1.2.3 Manipulate numbers using division facts

1. Learning outcomes

The learners will be able to use a range of strategies to perform written and mental calculations with whole numbers, with competence and confidence in solving problems.

2. Essential for learning

Learners should have prior experience with the different division strategies.

3. Key words

Dividend, divisor, quotient

4. Resources

Learner's Book, Workbook, divisibility chart test, multiplication chart, dice, playing cards

5. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

6. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the place value of whole numbers in relation to other whole numbers.

7. Additional content for the teacher

YouTube videos on using the divisibility rule

8. Teaching methodology

Use the divisibility rule to determine the multiples of 6, 8, 9, 11. Draw a 6×6 multiplication chart and use it as a game to play the 3-in-line game. Include peer-assisted learning using the vertical column method.

9. Assessment

Teacher assessment, for example a class work activity

10. Answers

Exercise 6

LB page 44

1.
 - a) Yes. The last number is 8, and 8 is an even number.
 - b) No. The last number is 5. 5 is an odd number and not divisible by 2.
 - c) Yes. The last number is 6, and 6 is an even number.
 - d) No. The last number is 5. 5 is an odd number and not divisible by 2.
2.
 - a) Yes. The last two digits, 40, are divisible by 4.
 - b) Yes. The number formed by the last two digits is 48, divisible by 4.
 - c) No. The last two digits, 75, is not divisible by 4.
 - d) Yes. The number formed by the last two digits, 24, is divisible by 4.
 - e) No. $26 \div 4 = 6.5$. It has a remainder.
3.
 - a) No, it is not divisible by 3, 6 or 9. They have remainders.
 - b) No, it is not divisible by 3, 6 or 9. They have remainders.

- c) No, it is not divisible by 3, 6 or 9. They have remainders.
- d) Yes. $108 \div 3 = 36$. $108 \div 6 = 18$. $108 \div 9 = 12$
- 4. a) 42: 2; 3; 6
- b) 162: 2; 3; 6; 9
- c) 354: 2; 3; 6
- d) 245: 5
- e) 16,852: 2; 4
- f) 857: not divisible by any of the numbers
- g) 916: 2; 4
- h) 240: 2; 3; 4; 5; 6; 10
- i) 342: 2; 3; 6; 9;
- j) 2,286: 2; 3; 6; 9
- k) 4,992: 2; 3; 4; 6
- l) 62,370: 2; 3; 5; 6; 9; 10
- m) 432: 2; 3; 4; 6; 9
- n) 38,385: 3, 5, 9
- o) 723: 3
- 5. a) The number 1,536 is divisible by 6.
- b) The number 81 is divisible by 3.
- c) The number 72 is divisible by 4.
- d) The number 22 is divisible by 2.

11. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 25 to 26 as extension exercises. You can also choose any exercises from pages 25 to 26 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Content standard

B6.1.2.4 Divide 2- or 3-digit numbers by 1- or 2-digit numbers

1. Learning outcomes

The learners will be able to use a range of strategies to perform written and mental calculations with whole numbers, with competence and confidence in solving problems.

2. Essential for learning

Learners should have experience with using different strategies to perform the four basic operations.

3. Key words

Order of operations

4. Resources

Learner's Book, Workbook

5. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

6. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the place value of whole numbers in relation to other whole numbers.

7. Additional content for the teacher

YouTube videos on division techniques

8. Teaching methodology

Model mathematical statements from a given word problem, using the long division method. Role-play a given word problem involving division and subtraction and solve it by using an appropriate strategy.

9. Assessment

Teacher assessment, for example class work activities.

10. Answers

Exercise 7

LB page 46

1.

a) 66, remainder 6	b) 228, remainder 1
c) 109, remainder 1	d) 14, remainder 20
e) 73	f) 10
g) 915	h) 604
i) 692	j) 213
2.

a) $966 \div 69 = 14$. So, $14 \times 69 = 966$
b) $4,182 \div 41 = 102$. So, $102 \times 41 = 4,182$
c) $2,880 \div 24 = 120$. So, $120 \times 24 = 2,880$
d) $3,150 \div 15 = 210$. So, $210 \times 15 = 3,150$

11. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook page 27 as extension exercises. You can also choose any exercises from page 27 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Content standard

B6.1.2.5	Translate word problems into mathematical sentences and solve
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1. Essential for learning

Learners should have prior experience with using different strategies to perform the four basic operations.

2. Key words

Integers, whole numbers, ascending, descending

3. Resources

Learner's Book, Workbook, number lines

4. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

5. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the place value of whole numbers in relation to other whole numbers.

6. Additional content for the teacher

YouTube videos on rounding off, up or down

7. Teaching methodology

Use the number line to compare and order a set of integers. Ensure that learners are able to precisely locate integers on the number line.

8. Assessment

Teacher assessment

9. Answers

Exercise 8

LB page 49

1. $24 \times 12 = 288$
2. 7 days = 1 week and 2 weeks = 14 days. So, $260 \times 14 = 3,640$. Yao consumes 3,640 calories eating chocolate.
3. $84 \div 12 = 7$. The baker will need to prepare 7 boxes.
4. $30 \times 4 = 120$. $120 + 40 = 160$. $200 - 160 = 40$. Ebor will

- give her mom GH¢40.00 change.
5. $24 \times 3 = 72$. $72 + 24 = 96$. They picked 96 mangoes altogether.
 $96 \div 3 = 32$. They each get 32 mangoes.
 6. $12 \times 12 = 144$
 - a) $144 - 90 = 54$. She has GH¢54.00 remaining after purchasing jeans
 - b) $126 - 54 = 72$. $72 \div 12 = 6$. Anaika needs to save for 6 more weeks.

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook page 28 as extension exercises. You can also choose any exercises from page 28 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Content standard
B6.1.2.6 Understand integers

1. Learning outcomes

Learners will be able to use a range of strategies to perform written and mental calculations with whole numbers, with competence and confidence in solving problems.

2. Essential for learning

Learners should have prior experience of using different strategies to perform the four basic operations.

3. Key words

Integers, whole numbers, ascending, descending

4. Resources

Learner's Book, Workbook, number lines

5. Large class teaching

Plan your activities for an inclusive class. Determine your learners' point of entry. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

6. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the place value of whole numbers in relation to other whole numbers.

7. Additional content for the teacher

YouTube videos on rounding off, up or down

8. Teaching methodology

Use a number line to compare and order a set of integers. Also solve word problems involving integers using number lines. Ensure that the learners are able to locate numbers on the number line.

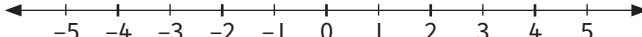
9. Assessment

Teacher assessment, for example class work activities, and self- or peer assessment.

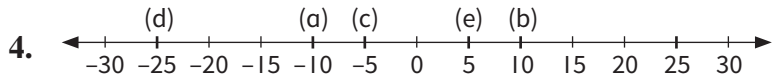
10. Answers

Exercise 9

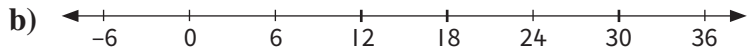
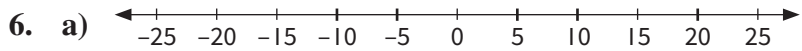
LB page 53

1. 
2. a) 6 b) -6 c) 8
d) Ones

3. a) 14 b) 4 c) -14



5. a) 5 units b) 5 units
c) Distance is the same.



7. a) $-1 > -2$ b) $5 < 6$ c) $-1 < 0$
d) $-4 < -3$ e) $-8 = -8$ f) $-5 < -4$
g) $-10 < -9$ h) $-8 > -9$ i) $-5 > -6$
8. a) $-3 > -10$ b) $3 < 5$ c) $-2 < 6$
d) $8 > -8$ e) $12 < 13$ f) $-7 < 6$
g) $-22 > -25$ h) $-26 < -19$ i) $-33 > -39$
9. a) -8 b) 5 c) -3
d) 0 e) 1 f) -1
g) -3 h) 1 i) 10

Exercise 10

LB page 56

1. a) -4; -2; 0; 3; 6; 8 b) -10; -8; -4; 4; 6
c) -9; -5; 2; 4 d) -10; -6; -2; 0; 4
e) -7; -4; 3; 4; 6
2. a) 6; 2; 0; -3; -7 b) 8; 7; 3; -4; -9
c) 8; 2; 0; -6; -10 d) 25; 10; -5; -10; -15
e) 12; 8; 0; -4; -8; -16 f) 4; 0; -2; -12
3. a) -9; -4; -1; 7; 8 b) -8; -4; 0; 2; 4
c) -10; -7; -5; 0; 2; 6 d) -25; -18; -6; 0; 3; 12
e) -46; -16; -5; 7; 33
4. a) 6; 4; 0; -2; -8 b) 9; 6; 6; 3; -3
c) 12; 8; 5; 3; -8; -10 d) 9; 8; 4; -1; -5; -10
e) 12; 3; -4; -6; -8 f) 3; 0; -2; -6; -8
g) 10; 9; 0; -14; -16 h) 11; 9; 7; 5; 0; -3; -5; -6
5. a) -50 b) -80 c) -18 d) -32
6. a) 50 b) 66 c) 57 d) 0

Exercise 11

LB page 57

1. a) -10 b) 15 c) -12 d) 10
e) -12 f) -15 g) -20 h) 35

2.

	Integer	One more	One less
a)	2	3	1
b)	0	1	-1
c)	-4	-3	-5
d)	-11	-10	-12
e)	5	6	4
f)	-6	-5	-7
g)	-8	-7	-9
h)	18	19	17
i)	12	13	11
j)	-12	-11	-13
k)	-4	-3	-5

Exercise 12

LB page 61

1. a) $-3 + 6 = 3$
 (c) $4 + (-7) = -3$
 e) $-5 + 9 = 4$
 g) $8 + (-6) = 2$
 i) $4 + 9 = 13$
 k) $0 + (-8) = -8$
2. a) $-15 + 20 = 5$
 c) $-9 + (12) = 3$
 e) $4 + (-10) = -6$
3. a) $-1 - 8 = -9$
 c) $5 - 7 = -2$
 e) $4 - 8 = -4$
 g) $5 - 8 = -3$
 i) $-10 - 5 = -15$
 k) $-7 - 3 = -10$
 m) $8 - 10 = -2$
 o) $16 - 20 = -4$
- b) $-5 + (-2) = -7$
 d) $-6 + 10 = 4$
 f) $-7 + 4 = -3$
 h) $-6 + 9 = 3$
 j) $-7 + 12 = 5$
 l) $-4 + 4 = 0$
 b) $-12 + 24 = 12$
 d) $12 + (-9) = 3$
 f) $-30 + 25 = -5$
 b) $-6 - 1 = -7$
 d) $-2 - 4 = -6$
 f) $-8 - 5 = -13$
 h) $-4 - 5 = -9$
 j) $6 - 8 = -2$
 l) $4 - 12 = -8$
 n) $7 - 12 = -5$

Exercise 13

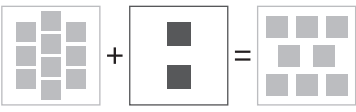
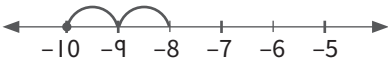
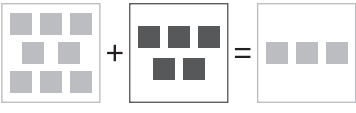
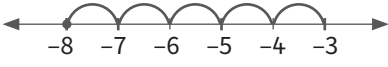
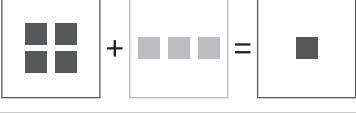
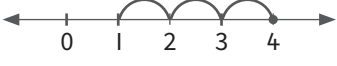

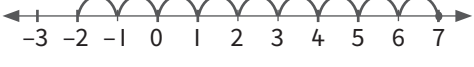
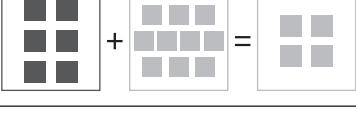
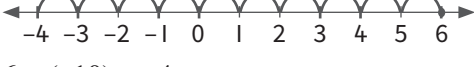
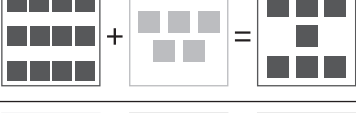
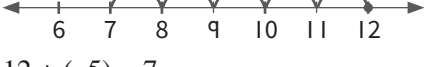


LB page 62

1. a) $-4 + 2 = -2$
 c) $1 + (-6) = -5$
 e) $-2 + 5 = 3$
 g) $4 + (-6) = -2$
 i) $12 + (14) = 26$
- b) $-9 + 4 = -5$
 d) $-1 + 7 = 6$
 f) $-6 + 4 = -2$
 h) $7 + (-9) = -2$
 j) $13 + (10) = 23$

- k)** $5 + (-3) = 2$
m) $-7 + 12 = 5$
o) $12 + (-16) = -4$
q) $8 + (-8) = 0$
2. a) $2 - 6 = -4$
c) $6 - 8 = -2$
e) $-1 - 3 = -4$
g) $-6 - 4 = -10$
i) $-4 - 4 = -8$
k) $12 - 15 = -3$
m) $6 - 12 = -6$
o) $7 - 9 = -2$

- l)** $-8 + 10 = 2$
n) $-10 + 6 = -4$
p) $5 + (-9) = -4$
r) $-6 + 7 = 1$
b) $7 - 9 = -2$
d) $5 - 7 = -2$
f) $-1 - 8 = -9$
h) $8 - 7 = 1$
j) $-8 - 6 = -14$
l) $9 - 14 = -5$
n) $3 - 6 = -3$
p) $12 - 18 = -6$

3.

Sum of ...	Model	Number line
a) $-10 + 2$		 $-10 + 2 = -8$
b) $-8 + 5$		 $-8 + 5 = -3$
c) $4 + (-3)$		 $4 + (-3) = 1$
d) $7 + (-9)$		 $7 + (-9) = -2$
e) $6 + (-10)$		 $6 + (-10) = -4$
f) $12 + (-5)$		 $12 + (-5) = 7$
g) $-4 + 7$		 $-4 + 7 = 3$

4.	Add	Subtract
	a) $3 + (-8) = -5$	h) $3 - (4) = -1$
	b) $-10 + (-3) = -13$	i) $6 - (5) = 1$
	c) $5 + (-7) = -2$	j) $-8 - (3) = -11$
	d) $(8) - 6 = 2$	k) $-20 - (-4) = -16$
	e) $(8) + (-6) = 2$	l) $-2 - (4) = -6$
	f) $-7 + (7) = 0$	m) $(4) - 1 = 3$
	g) $(-8) + 4 = -4$	n) $(-5) - 3 = -8$

Exercise 14

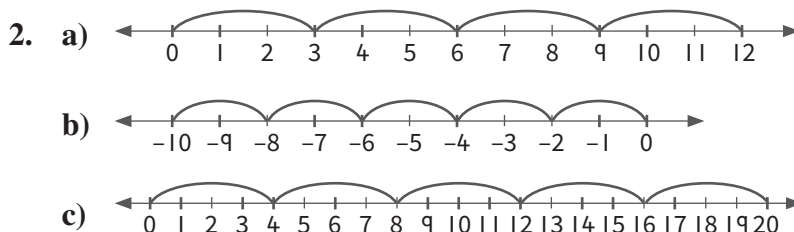
LB page 64

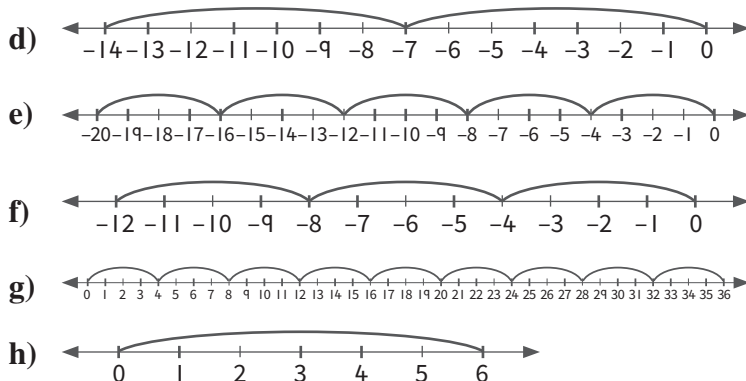
	Initial temperature	Changing temperature (dropped or increased?)	Calculation	Final temperature
1.	10 °C	Dropped by 6 = (-6 °C)	$10 - 6 = 4$	4 °C
2.	-3 °C	Dropped by 2 = (-2 °C)	$-3 + (-2) = -5$	-5 °C
3.	-4 °C	Increased by +4 = (4 °C)	$(-4) + (4) = (0)$	0 °C
4.	-5 °C	Increased by 8 = (+8 °C)	$-5 + 8 = 3$	3 °C
5.	-8 °C	Temperature remained the same	$-8 + 0 = -8$	-8 °C
6.	-9 °C	Dropped by 3 = (-3 °C)	$-9 + (-3) = -12$	-12 °C
7.	8 °C	Dropped by 22 = (-22 °C)	$8 - 22 = -14$	-14 °C
8.	-1 °C	Increased by 21 = (+21 °C)	$-1 + 21 = 20$	20 °C

Exercise 15

LB page 66

1. a) $4 \times 4 = 16$ b) $-2 \times 2 = -4$
 c) $7 \times 3 = 21$ d) $-3 \times 4 = -12$
 e) $-6 \times 3 = -18$ f) $-4 \times 6 = -24$





3. a) $3 \times (-2) = -6$ b) $-4 \times 3 = -12$
c) $8 \times 2 = 16$ d) $8 \times (-2) = -16$
e) $5 \times (-3) = -15$ f) $4 \times (-9) = -36$
4. a) $2 \times (-5) = -10$ b) $-3 \times 6 = -18$
c) $5 \times (-10) = -50$ d) $-8 \times 10 = -80$
e) $0 \times (-4) = 0$ f) $-2 \times 10 = -20$
g) $4 \times 6 = 24$ h) $5 \times (-4) = -20$
i) $6 \times 6 = 36$ j) $9 \times (-6) = -54$
k) $8 \times (-4) = -32$ l) $-3 \times 11 = -33$
5. a) -4
b) $-4 \times 5 = -20$. The bird's height changes by -20 m after 5 seconds.
c) $100 - 20 = 80$. The bird's height must change by -80 m before it reaches the ground.
d) $-80 \div (-4) = 20$. It will take 20 seconds for the bird to reach the ground.
6. a) -6
b) $-6 \times 6 = -36$
c) 6 laps = 36 litres of petrol. $54 - 36 = 18$. The car has 18 litres of petrol after 6 laps.
d) $18 \div 6 = 3$. It will be able to do 3 more laps.
7. a) $7 \times 8 = 56$. The change in depth is 56 m after 8 minutes.
b) A negative integer
c) The submarine submerges below sea level.

11. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly,

select questions from Workbook pages 29 to 43 as extension exercises. You can also choose any exercises from pages 29 to 43 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Unit 3: Fractions

Content standard

B6.1.3.1 Compare, add, subtract, multiply and divide fractions

1. Essential for learning

Learners should have experience with objects that are whole and objects which have missing parts. They should also have experience of using different strategies to perform the four basic operations on whole numbers.

2. Key words

Common fractions, decimals, percentages, part of a whole, numerator, denominator, improper fractions, mixed numbers, common denominator, equivalent

3. Resources

Learner's Book, Workbook, fraction charts, number cards, counters

4. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

5. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the place value of whole numbers in relation to other numbers.

6. Additional content for the teacher

YouTube videos on comparing fractions, addition and subtraction of fractions, and multiplication and division of fractions

7. Teaching methodology

Cut concrete objects (e.g. fruit and sheets of card/paper) into parts and state the part as a fraction of the whole. Ask the learners to draw whole items and then partition them according to your instruction. Ask learners to shade fractions of shapes that they have drawn. Also use concrete objects to add and subtract fractions of a whole. Use a fraction chart to make these operations easier.

When teaching multiplication of fractions, express the whole number as a fraction and multiply the numerators, then the denominators. Change all fractions into common fractions, then multiply them separately (numerators first then denominators). Stress that the learners should always simplify the products to their simplest form.

8. Assessment

Teacher assessment, for example a class work activity, or an end-of-unit test. Also create worksheets for extra practice.

9. Answers

Exercise 1

LB page 71

1. a) $\frac{2}{3} = \frac{6}{9}$
c) $\frac{4}{16} = \frac{1}{4}$
e) $\frac{5}{9} = \frac{15}{27}$

b) $\frac{2}{5} = \frac{6}{15}$
d) $\frac{9}{12} = \frac{3}{4}$
f) $\frac{4}{5} = \frac{16}{20}$

- g) $\frac{6}{11} = \frac{18}{33}$
2. a) $\frac{1}{4} < \frac{1}{3}$
- c) $\frac{7}{10} > \frac{5}{8}$
- e) $\frac{1}{6} < \frac{1}{3}$
3. a) $\frac{3}{4} > \frac{7}{12} > \frac{8}{16} > \frac{3}{8}$
- c) $\frac{7}{12}$
4. a) $\frac{1}{4}, \frac{3}{10}, \frac{1}{2}, \frac{3}{4}, \frac{4}{5}$
- c) $\frac{1}{2}, \frac{9}{16}, \frac{3}{4}, \frac{7}{8}$
5. a) $\frac{3}{4}, \frac{1}{2}, \frac{7}{16}, \frac{3}{8}$
- c) $\frac{3}{4}, \frac{15}{26}, \frac{5}{12}, \frac{1}{3}$
- h) $\frac{2}{9} = \frac{8}{36}$
- b) $\frac{2}{5} < \frac{1}{2}$
- d) $\frac{8}{15} < \frac{5}{9}$
- b) $\frac{3}{8}$
- d) $\frac{3}{8} < \frac{8}{16} < \frac{7}{12} < \frac{3}{4}$
- b) $\frac{1}{8}, \frac{2}{6}, \frac{6}{12}, \frac{2}{3}$
- b) $\frac{3}{4}, \frac{2}{3}, \frac{7}{12}, \frac{1}{3}, \frac{1}{6}$
- d) $\frac{3}{4}, \frac{5}{8}, \frac{1}{2}, \frac{7}{16}, \frac{2}{6}$

Exercise 2

LB page 74

1. a) $\frac{2}{5} = 0.4$
- b) $\frac{75}{100} = 0.75$
- c) $\frac{9}{25} = 0.36$
- d) $\frac{1}{20} = 0.05$
- e) $\frac{16}{20} = 0.8$
- f) $\frac{7}{50} = 0.14$
- g) $\frac{3}{250} = 0.012$
2. a) $0.78 = \frac{78}{100} = \frac{39}{50}$
- b) $0.345 = \frac{69}{200}$
- c) $0.12 = \frac{3}{25}$
- d) $0.56 = \frac{14}{25}$
- e) $0.39 = \frac{39}{100}$
- f) $0.15 = \frac{3}{20}$
- g) $0.24 = \frac{6}{25}$
- h) $0.8 = \frac{4}{5}$
- i) $0.6 = \frac{6}{10}$

Exercise 3

LB page 76

1.

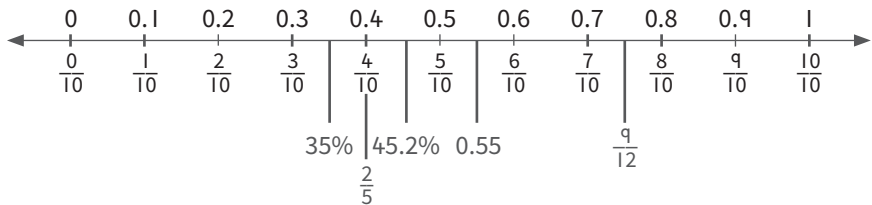
Common fraction	Percentage	Decimal number
$\frac{1}{20}$	5%	0.05
$\frac{1}{10}$	10%	0.1
$\frac{2}{5}$	40%	0.4
$\frac{7}{10}$	70%	0.7
$\frac{3}{4}$	75%	0.75

2. a) 45% b) 40% c) 94%
 d) 10% e) 80%
3. a) $\frac{58}{100} = \frac{29}{50}$ b) $\frac{74}{100} = \frac{37}{50}$ c) $\frac{77}{100}$
 d) $\frac{9}{100}$ e) $\frac{54}{100} = \frac{27}{50}$ f) $\frac{28}{100} = \frac{7}{25}$
 g) $\frac{36}{100} = \frac{9}{25}$ h) $\frac{92}{100} = \frac{23}{25}$
4. a) $\frac{86}{100} = \frac{43}{50}$ b) $\frac{21}{100}$
 c) $\frac{229}{1000}$ d) $\frac{33}{100}$
 e) $\frac{5}{10} = \frac{1}{2}$ f) $\frac{25}{100} = \frac{1}{4}$
 g) $\frac{230}{1000} = \frac{23}{100}$
5. a) 0.48 b) 0.159 c) 0.94
 d) 0.11 e) 0.30 f) 0.18
 g) 0.85 h) 0.65

Exercise 4

LB page 79

1.



2. a) $\frac{1}{4}$; 30%; 0.45 b) 20%; $\frac{1}{5}$; 25%; 0.4
 c) $\frac{4}{20}$; 65%; $\frac{8}{10}$; 0.85 d) 20%; $\frac{5}{20}$; $\frac{4}{10}$; 0.65

Exercise 5

LB page 83

1. a) $2\frac{2}{3} - \frac{6}{5}$
 $= 2\frac{2}{3} - 1\frac{1}{5}$
 $= (2 - 1) + (\frac{2}{3} - \frac{1}{5})$
 $= (2 - 1) + (\frac{10}{15} - \frac{3}{15})$
 $= 1\frac{7}{15}$
- b) $3\frac{1}{4} - 2\frac{1}{5}$
 $= (3 - 2) + (\frac{1}{4} - \frac{1}{5})$
 $= (3 - 2) + (\frac{5}{20} - \frac{4}{20})$
 $= 1\frac{1}{20}$
- c) $4\frac{1}{2} + 2\frac{2}{3}$
 $= (4 + 2) + (\frac{1}{2} + \frac{2}{3})$
 $= (4 + 2) + (\frac{3}{6} + \frac{4}{6})$
 $= 6 + 1\frac{1}{6}$
 $= 7\frac{1}{6}$
- d) $\frac{1}{3} + \frac{1}{5}$
 $= \frac{5}{15} + \frac{3}{15}$
 $= \frac{8}{15}$

$$\begin{aligned}
 \text{e)} \quad & \frac{17}{5} - 2\frac{2}{3} \\
 &= 3\frac{2}{5} - 2\frac{2}{3} \\
 &= (3 - 2) + (\frac{2}{5} - \frac{2}{3}) \\
 &= (3 - 2) + (\frac{6}{15} - \frac{10}{15}) \\
 &= 1 - \frac{4}{15} \\
 &= \frac{15}{15} - \frac{4}{15} \\
 &= \frac{11}{15}
 \end{aligned}$$

$$\begin{aligned}
 \text{g)} \quad & 5\frac{1}{3} + 2\frac{3}{4} \\
 &= (5 + 2) + (\frac{1}{3} + \frac{3}{4}) \\
 &= (5 + 2) + (\frac{4}{12} + \frac{9}{12}) \\
 &= 7 + \frac{13}{12} \\
 &= 8\frac{1}{12}
 \end{aligned}$$

$$\begin{aligned}
 \text{i)} \quad & \frac{9}{4} - 1\frac{2}{3} \\
 &= 2\frac{1}{4} - 1\frac{2}{3} \\
 &= (2 - 1) + (\frac{1}{4} - \frac{2}{3}) \\
 &= (2 - 1) + (\frac{3}{12} - \frac{8}{12}) \\
 &= 1 - \frac{5}{12} \\
 &= \frac{7}{12}
 \end{aligned}$$

$$\begin{aligned}
 \text{k)} \quad & 4\frac{1}{5} - \frac{11}{3} \\
 &= 4\frac{1}{5} - 3\frac{2}{3} \\
 &= (4 - 3) + (\frac{1}{5} - \frac{2}{3}) \\
 &= (4 - 3) + (\frac{3}{15} - \frac{10}{15}) \\
 &= 1 - \frac{7}{15} \\
 &= \frac{8}{15}
 \end{aligned}$$

$$\begin{aligned}
 \text{f)} \quad & \frac{16}{3} + 4\frac{1}{2} \\
 &= 5\frac{1}{3} + 4\frac{1}{2} \\
 &= (5 + 4) + (\frac{1}{3} + \frac{1}{2}) \\
 &= (5 + 4) + (\frac{2}{6} + \frac{3}{6}) \\
 &= 9\frac{5}{6}
 \end{aligned}$$

$$\begin{aligned}
 \text{h)} \quad & 2 + \frac{2}{3} + \frac{8}{5} \\
 &= 2 + \frac{2}{3} + 1\frac{3}{5} \\
 &= (2 + 1) + (\frac{2}{3} + \frac{3}{5}) \\
 &= (2 + 1) + (\frac{10}{15} + \frac{9}{15}) \\
 &= 3 + \frac{19}{15} \\
 &= 4\frac{4}{15}
 \end{aligned}$$

$$\begin{aligned}
 \text{j)} \quad & \frac{5}{2} + \frac{5}{3} \\
 &= 2\frac{1}{2} + 1\frac{2}{3} \\
 &= (2 + 1) + (\frac{1}{2} + \frac{2}{3}) \\
 &= (2 + 1) + (\frac{3}{6} + \frac{4}{6}) \\
 &= 3 + \frac{7}{6} \\
 &= 4\frac{1}{6}
 \end{aligned}$$

$$\begin{aligned}
 \text{l)} \quad & \frac{9}{2} + 3\frac{3}{5} \\
 &= 4\frac{1}{2} + 3\frac{3}{5} \\
 &= (4 + 3) + (\frac{1}{2} + \frac{3}{5}) \\
 &= (4 + 3) + (\frac{5}{10} + \frac{6}{10}) \\
 &= 7 + \frac{11}{10} \\
 &= 8\frac{1}{10}
 \end{aligned}$$

$$\begin{aligned}
 2. \quad & 5\frac{2}{6} - 3\frac{1}{3} \\
 &= (5 - 3) + (\frac{2}{6} - \frac{1}{3}) \\
 &= (5 - 3) + (\frac{1}{3} - \frac{1}{3}) \\
 &= 2 \text{ litres of cooldrink left.}
 \end{aligned}$$

3. $3\frac{7}{10} + 3\frac{5}{10}$
 $= (3 + 3) + (\frac{7}{10} + \frac{5}{10})$
 $= 6 + \frac{12}{10}$
 $= 7\frac{1}{5}$ cans of oil were used over two days.
4. $5\frac{2}{3} + 3\frac{2}{3}$
 $= (5 + 3) + (\frac{2}{3} + \frac{2}{3})$
 $= 8 + \frac{4}{3}$
 $= 9\frac{1}{3}$ of the roses were sold.
5. $7\frac{2}{8} - 2\frac{3}{8}$
 $= (7 - 2) + (\frac{2}{8} - \frac{3}{8})$
 $= 5 - \frac{1}{8}$
 $= 4\frac{7}{8}$ tons.
6. $7\frac{1}{6} + 5\frac{6}{7}$
 $= (7 + 5) + (\frac{1}{6} + \frac{6}{7})$
 $= 12 + \frac{7}{7}$
 $= 13$ sacks were collected in total.
7. $2\frac{3}{7} + 1\frac{3}{5}$
 $= (2 + 3) + (\frac{3}{7} + \frac{3}{5})$
 $= (2 + 3) + (\frac{15}{35} + \frac{21}{35})$
 $= 5 + \frac{36}{35}$
 $= 6\frac{1}{35}$ hours were spent on the activities.

Exercise 6

LB page 87

1. $\frac{1}{7}$
4. $\frac{1}{3}$
7. $\frac{5}{9}$

2. $\frac{2}{3}$
5. $\frac{4}{15}$
8. $\frac{1}{2}$

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

Exercise 7

LB page 88

1. a) 14
d) $1\frac{1}{5}$
g) 3

- b) 21
e) $8\frac{1}{3}$
h) 25

- c) 28
f) 14

2. a) $\frac{3}{14}$ b) $\frac{1}{6}$ c) $\frac{10}{33}$
 d) $\frac{3}{10}$
 3. a) $3\frac{3}{5}$ b) $8\frac{1}{8}$ c) $\frac{49}{66}$
 d) $8\frac{4}{27}$

Exercise 8

LB page 88

1. The correct answer is 4.
2. 9 squares are red.
3. a) $6\frac{2}{5}$ hours b) 32 hours
4. $1\frac{19}{20}$ litre, so it is 1 litre 950 ml of paint
5. 1 book

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 44 to 52 as extension exercises. You can also choose any exercises from pages 44 to 52 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Unit 4: Ratios and proportion

Content standard

B6.1.4.1 Ratio and its relationship to fractions, multiplication and division

1. Essential for learning

Learners should have experience in making comparisons of similar units, for example ml to ml, as well as different units, for example kg and cedis. Learners should also have experience of common fractions, whole numbers and ratios.

2. Key words

Ratio, simplest form, comparisons

3. Resources

Learner's Book, Workbook, fraction charts, boxes

4. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

5. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the place value of whole numbers in relation to other numbers.

6. Additional content for the teacher

Newspaper advertisements showing the prices of articles, YouTube videos, for example, on the relationship between ratio and fractions, e.g. directions on how to mix concentrate with water

7. Teaching methodology

Use catalogues that state the price of goods to calculate the cost of a unit or more items. Investigate the ratios on concentrate bottles, to calculate the quantity of water to add to juice concentrate, or fabric softener, and so on. Plan a practical activity, where learners can mix various quantities of concentrate and water, and taste which one is stronger. Allow peer-assisted learning or group activities.

8. Assessment

Teacher assessment, for example class work activity and a short test at the end of the unit.

9. Answers

Exercise 1

LB page 91

1. a) i) 3 ii) $\frac{1}{3}$ iii) 1 : 3
b) i) 4 ii) $\frac{1}{4}$ iii) 1 : 4
c) i) No ii) Group in 3s. 3 : 4
2. a) 1 : 4. There are four sets of set 1 in set 2.
b) 7 c) 1 : 7 d) 4 : 7
3. a) 2 : 7 b) 1 : 1 c) 5 : 9
d) 1 : 2 e) 4 : 3
4. Learners' own answers
5. Learners' own answers
6. a) For every 1 broiler, there are 2 layers.
b) Part-to-part comparison
7. a) $12 - 4 = 8$ chocolates b) $4 : 12 = 1 : 3$
c) Part to whole comparison

Exercise 2

LB page 94

1. a) 1 : 3 b) 1 : 3 c) 1 : 5
d) 3 : 4 e) 1 : 4
2. a) 1 apple to 3 apples b) 3 eggs to 5 eggs
c) 1 bird to 2 wings d) 1 chicken to 2 legs
3. a) 2 : 3 b) 2 : 1 c) 1 : 6
d) 4 : 5 e) 4 : 7 f) 7 : 9
g) 6 : 1 h) 9 : 8 i) 3 : 8
j) 1 : 4 k) 1 : 3 l) 1 : 8

Exercise 3

LB page 97

1. 5 : 3
2. a) 5 : 12 b) 7 : 5
3. a) $\frac{24}{50} = \frac{12}{25}$ b) $8 : 50 = 4 : 25$
c) 4 : 3
4. 3 : 4
5. 4 : 7
6. 9 : 4

7. Cebu : Ami = 2 : 5
 $126 \div 7 = 18$
 $18 \times 2 = 36$
 $18 \times 5 = 90$
 Cebu will get GH¢36.00.
 Ami will get GH¢90.00.

Exercise 4

LB page 100

1. a) $7 : 2 = 14 : 4$ b) $4 : 5 = 8 : 10$
 c) $6 : 4 = 3 : 2$ d) $9 : 7 = 18 : 14$
 e) $3 : 5 = 6 : 10$ f) $9 : 10 = 18 : 20$
2. a) $2 : 3 = 14 : 21$
 b) 9 : 4 is not equivalent to 11 : 9
 c) 4 : 5 is not equivalent to $\frac{2}{3}$
 d) $\frac{7}{4} = \frac{21}{12}$
 e) GH¢20 for four loaves of bread is not equal to
 GH¢24 for six loaves of bread
 f) Three T-shirts for GH¢45 is equal to five T-shirts for
 GH¢75
 g) $\frac{42}{7} = \frac{54}{9}$
3. 16 girls
4. 18 chicken pieces
5. 6 pairs of sandals
6. 8 problems uncompleted. 22 homework problems in total.
7. a) 7 b) 2 c) 10 d) 12
 e) 12 f) 32 g) 36 h) 42
 i) 10 j) 5
8. 1 : 100
9. a) 2 : 3 b) 4 : 3 c) 3 : 2
 d) 7 : 16 e) 2 : 1
10. GH¢3,428.57 to one daughter, GH¢4,571.43 to the other
11. The height of the building is 54 metres.

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 53 to 62 as extension exercises. You can also choose any exercises from pages 53 to 62 of the Workbook and assign these as homework. Once

back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Content standard

B6.1.4.2 Proportion and its relationship to ratios and rates
--

1. Essential for learning

Learners should have experience of comparing quantities and expressing them in ratio and rate.

2. Key words

Ratio, simplest form

3. Resources

Learner's Book, Workbook, fraction charts, pizza boxes

4. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

5. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the place value of whole numbers in relation to other whole numbers.

6. Additional content for the teacher

Modelling and mapping diagrams, especially house plans, as these help learners to understand the ratio between a drawing and the real object.

7. Teaching methodology

Use worksheets from previous lessons to ensure that all learners understand the concepts and difference between ratio and rate. Give examples of ratio from real-life situations. Use peer-assisted learning for learners who battle to express ratios in their simplest forms.

8. Assessment

Teacher assessment, for example class work activity and a short test at the end of the unit.

9. Answers

Exercise 5

LB page 105

1. a) $2 \times 10 = 20$ and $5 \times 4 = 20$
b) $3 \times 8 = 24$ and $4 \times 6 = 24$
2. a) Not in proportion b) In proportion
c) Not in proportion d) Not in proportion
e) In proportion f) Not in proportion

Exercise 6

LB page 106

1. a) 320 g b) 800 g
c) 960 g d) 1,600 g
2. a) 1 hour b) 1 hour 20 minutes
c) 3 hours 20 minutes

3.

Number of books	1	10	15	20	40	50	100
Price in GH¢	150	1,500	2,250	3,000	6,000	7,500	15,000

4. a) GH¢100 b) GH¢150 c) GH¢350
5. $\text{GH¢}375 \div 12 \text{ crates} = \text{GH¢}31.25 \text{ per crate}$
 $\text{GH¢}31.25 \times 6 = \text{GH¢}187.50$
6. GH¢150
7. GH¢96 this week. GH¢168 next week. GH¢264 in total.
8. $\text{GH¢}20 \times 13 = \text{GH¢}260$
9. $3 : 5 = 21 : 35$. They will win 21 games.

10.

Minutes	1	2	3	10	200
Cost per minute	2.20	4.40	6.60	22.00	440.00

So, Kwasi has 200 minutes for calls in one month.

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 63 to 66 as extension exercises. You can also choose any exercises from pages 63 to 66 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Unit 1: Pattern and relationships

Content standard

B6.2.1.1 Determine the pattern rule to make predictions

1. Essential for learning

Learners should know that geometric patterns are shapes arranged according to a rule. They need to understand that a numeric sequence is a pattern using numbers. The numbers 3, 5, 7, 9 are a pattern of uneven numbers. Each shape or number in a pattern is called a term. Each term has a value. So, we can assign numerical values to a geometric pattern.

2. Key words

Geometric patterns, sequence, numerical values, rule, predictions, subsequent element, pattern, relationship

3. Resources

Learner's Book, Workbook, objects for building patterns, for example beads, matches, sticks and straws, toothpicks, earbuds

4. Large class teaching

Divide the class into small groups. Allow the learners to work practically, for example, cutting their drinking straws into lengths, counting out specific numbers and building patterns.

5. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners

should be able to explain their strategies in determining the place value of whole numbers in relation to other whole numbers.

6. Additional content for the teacher

YouTube videos, patterns seen in the environment

7. Teaching methodology

Most learners will benefit from building patterns from objects and not merely looking at the drawings in the Learner's Book. Let them start by first building simple patterns, and gradually moving to more complex patterns.

8. Assessment

Self- and peer assessment

9. Answers

Exercise 1

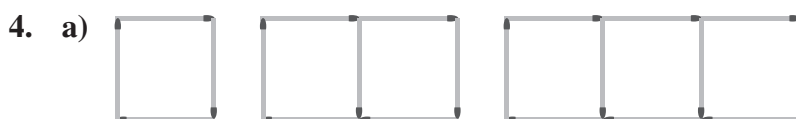
LB page 112

1. a) The pattern develops as follows: 1 square : 4 circles;
2 squares : 5 circles; 3 squares : 7 circles;
4 squares : 10 circles; 5 squares : 14 circles;
6 squares : 19 circles
b) The pattern develops as follows: 2 dashes : 2 hearts;
3 dashes : 3 hearts; 4 dashes : 4 hearts;
5 dashes : 5 hearts; 6 dashes : 6 hearts
c) The pattern develops as follows: 3 crosses : 2 lines;
5 crosses : 3 lines; 7 crosses : 4 lines;
9 crosses : 5 lines; 11 crosses : 6 lines
2. a) 2, 5, 8, 11, 14, 17, 20 b) 4, 7, 10, 13, 16, 19
c) 2, 8, 14, 20, 26, 32 d) 20, 17, 14, 11, 8, 5
e) 7, 11, 15, 19, 23, 27 f) 18, 13, 8, 3, -2, -7
g) -1, 4, 9, 14, 19, 24
3. a) Shape 1 Shape 2 Shape 3 Shape 4 Shape 5



Shape	1	2	3	4	5	6
Number of matches	3	6	9	12	15	18

We will use 15 matches to go up to pattern 5, and 18 matches to go up to pattern 6.



b) 3 squares in shape 3

c)

Pattern	1	2	3	4	5
Number of squares	1	2	3	4	5
Number of sides used	4	6	8	10	12

d) The number of squares (k) is equal to the pattern number (n); $k = n$.

e) The number of sides used in the perimeter (l) is equal to twice the pattern number (n) plus 2; $l = 2n + 2$



b) 17

c) 21

d) $m = 4n + 1$; m is the number of matches, n is the pattern number



6. a)

Pattern number	1	2	3	4	5
Number of toothpicks used	4	8	12	16	20

b) 24 matches in shape 6.

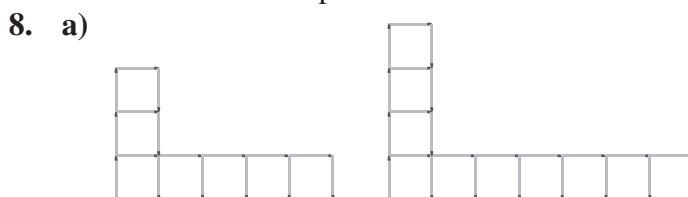
c) The number of matches used is 4 times the pattern number.



b) 7; 14; 21; 28

c) Learners' own answers

d) The number of triangles in each figure is equal to seven times the pattern number.



b)

Shape	1	2	3	4	5
Total squares	1	4	7	10	13
Number of squares going vertically	1	2	3	4	5
Number of squares going horizontally	1	3	5	7	9

- c) Learners' own answers
d) The number of horizontal squares is equal to twice the number of vertical squares minus one.
e) The pattern does have a constant rule.
f) The total number of squares is equal to three times the shape number minus two.

Exercise 2

LB page 120

- Non-linear, pattern changes between adding 2 and 3
 - Linear, pattern changes between adding 3, 5, and 7. (+2 to each previous addition)
 - Linear, pattern changes by adding 6 each time.
 - Linear, pattern changes by adding 3 each time.
 - Linear, pattern changes by adding 12 each time.
 - Linear, pattern changes by adding 8 each time.
- Constant difference is 3. No constant value is added. $3 \times n$
 - Constant difference is 3. Constant value of 4 is added. $3 \times n + 4$
 - Constant difference is 10. No constant value is added. $10 \times n$
 - Constant difference is -5. Constant value of 26 is added. $-5 \times n + 26$
- $7n - 3$. (n times $7 - 3$)
 - $4n + 5$. (n times $4 + 5$)
 - $4n + 2$. (n times $4 + 2$)
- $2n + 4$
 - $6n - 7$
 - $8(n + 1) - 2$
 - $6n + 5$
 - $3(n - 4) + 2$

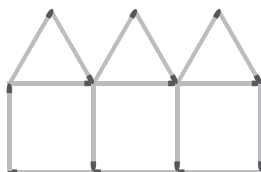
Exercise 3

LB page 122

- $5(2) - 2 = 8$
 - Yes. $5(3) - 2 = 13$. $5 \times 3 = 15$. $15 - 2 = 13$.

2. a) $2(5) + 4 = 14$ b) $2(12) + 4 = 28$
 c) $2(25) + 4 = 54$
 d) $128 - 4 = 124$. $124 \div 2 = 62$.

3. a)



b) $5(n) + 1$

Number of houses	1	2	3	4	12	28
Number of matches	6	11	16	21	61	141

- c) $5(18) + 1 = 91$
 d) 28 houses
 4. a) Fifteen is added each time. (No additional multiplication)
 b) $60 + 15 = 75$. (GH¢75 will be earned)
 c) $120 \div 15 = 8$. (8 tickets were bought)

5. a)

Rooms	1	2	3	4	5
Litres of paint	6ℓ	12ℓ	18ℓ	24ℓ	30ℓ

- b) $6n + 0$ c) $6(14) + 0 = 84$
 d) $6 : 1$
 6. a) $3 \times n - 1$ b) $3 \times n + 4$ c) $7 \times n - 1$

Exercise 4

LB page 124

1. No

n	1	2	3	4	5
Proportional	4	8	12	16	20
Linear	2	6	10	12	18

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 67 to 71 as extension exercises. You can also choose any exercises from pages 67 to 71 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Unit 2: Algebraic expressions

Content standard

B6.2.2.1 Understand algebraic expressions

1. Essential for learning

Learners should have been exposed to addition, subtraction, multiplication and division, as well as the concepts of input and output. By now, they should be able to establish a given rule from a given pattern and represent it algebraically, as well as interpreting data from the given tables and formulating the rule.

2. Key words

Algebra, predictions, subsequent element, pattern, relationship, expressions, phrases, operators

3. Resources

Learner's Book, Workbook, matches, straws

4. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

5. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Go from simple concepts to more complex ones. Explore the vocabulary

in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their skills in determining the place value of whole numbers in relation to other whole numbers.

6. Additional content for the teacher

More exercises on patterns, for example:

$$5 + 4z - 1 + 2z; 10s - 1 + 3 - 5s \text{ and } -9c + 7c + 8 - 3c.$$

7. Teaching methodology

Introduce the learners to functional relationships by means of diagrams. The input-output diagrams are sometimes called function diagrams. Do plenty of exercises on writing algebraic expressions for the word problems, for example “the sum of”, “take away”, and so on. Show the learners how to work step by step. Simplify the meanings of new words, such as “constant” and “unknown”.

8. Assessment

Teacher and peer assessment

9. Answers

Exercise 1

LB page 127

1. $8p$
2. $5x$
3. $\frac{1}{3}b$
4. $\frac{2}{5}(x + 6x + 6)$
5. $3 - y$
6. $4p + 3$
7. $n - 3$
8. $7 + x$
9. $m + 9$
10. $(z \times y) - 5 = zy - 5$
11. $\frac{x}{24}$
12. $(6 \times y) + 2 = 6y + 2$
13. $\frac{6}{(3y)}$
14. $(\frac{n}{8}) - 6$

Exercise 2

LB page 129

1. a) $(5 \times 3) + 9 = 15 + 9 = 24$
 b) $(\frac{15}{3}) + 2 = 5 + 2 = 7$
 c) $18 - (\frac{15}{3}) = 18 - 5 = 13$
 d) $(7 \times 3) + 4 - 5 = 21 + 4 - 5 = 20$
 e) $(\frac{16}{4}) \times 4 + 2 = 16 + 2 = 18$
 f) $(\frac{24}{6}) + (3 \times 12) = 4 + 36 = 40$
 g) $4 \times (8 - 5) = 4 \times 3 = 12$
 h) $182 - (24 \times 4) = 182 - 96 = 86$
 i) $23 + (\frac{636}{6}) \times 8 = 23 + (106 \times 8) = 23 + 848 = 871$
 j) $654 - (267 + 7) = 654 - 274 = 380$
 k) $(\frac{750}{15}) + (\frac{50}{2}) = 50 + 25 = 75$
 l) $\frac{2}{3}$ of $12 - 6 = \frac{2}{3} \times 12 - 6 = 8 - 6 = 2$
2. a) $3a$ b) $6d$ c) $5p$
 d) $6ab$ e) $16p$ f) $5x$
 g) $7p$ h) $5x$ i) $7x + 4$
 j) $2xy + 9x$ k) $11xy$ l) $10a + 4b + 4$
 m) $10y + 8$ n) $7a + 4b$

Exercise 3

LB page 133

1. a) $14x + 2$ b) $2x + 14$ c) $9y - 1$
 d) $18y$ e) $6x$
2. Shape A perimeter: $26x + 12$
 Shape B perimeter: $20x + 14$
 Shape C perimeter: $16x + 12$
 Shape D perimeter: $8x + 7$

Exercise 4

LB page 135

1.

Expression	Simplify	Number of terms	Coefficient of x	Evaluate if $x = 3$ and $y = 2$
$6\frac{x}{x}$	6	1	6	6
$3x - 4 + 2y$	$3x - 4 + 2y$	3	3	9
$2y - 7x + y - 4y + 6$	$-y - 7x + 6$	3	-7	-17
$4x - 3y + 8x + 6$	$12x - 3y + 6$	3	12	36

2. a) $(2 \times 3) + 5 = 6 + 5 = 11$
b) $2(2 \times 3 \times 5) = 2(30) = 60$
c) $3(2) - 2(3) + 2(5) = 6 - 6 + 10 = 10$
d) $\frac{3(3) + 5}{2} = \frac{14}{2} = 7$
e) $(2 + 3)(2 + 3) = 5 \times 5 = 25$
f) $3(2 + 3 + 5) = 3(10) = 30$
3. a) $3 + 6 + 2 = 11$
b) $3(3) + 5(2) = 9 + 10 = 19$
c) $2(6) + 4(3 \times 2) = 12 + 4(6) = 12 + 24 = 36$
d) $\frac{2(3) + 6}{2(2)} = \frac{12}{4} = 3$

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 72 to 77 as extension exercises. You can also choose any exercises from pages 72 to 77 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Unit 3: Variables and equations

Content standard

B6.2.3.1 Solve problems with a single variable and a whole number coefficient

1. Essential for learning

Learners should be able to establish a given rule from a given pattern and represent it algebraically.

2. Key words

Expressions, phrases, operators

3. Resources

Learner's Book, Workbook, matches, straws

4. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

5. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Go from simple concepts to more complex ones. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the place value of whole numbers in relation to other whole numbers.

6. Additional content for the teacher

More exercises on patterns, for example:

$$3 - 3b + 2 + 4b; 12p + 5 - 25 - 2p \text{ and } 5a + 4a - 30 + 3.$$

7. Teaching methodology

Introduce the learners to functional relationships by means of diagrams. The input-output diagrams are sometimes called function diagrams. Do plenty of exercises on writing algebraic expressions for the word problems, for example “the sum of”, “take away”, and so on. Show the learners how to work step by step. Simplify the meanings of new words, such as “constant” and “unknown”.

8. Assessment

Teacher and peer assessment

9. Answers

Exercise 1

LB page 141

- | | | |
|-----------------------|--------------|-----------------------|
| 1. a) $x = 11$ | b) $x = 8$ | c) $x = -12$ |
| d) $x = 11$ | e) $x = 5$ | f) $x = 20$ |
| g) $x = 3$ | h) $x = 8$ | |
| 2. a) $x = 8$ | b) $x = 6$ | c) $x = -6$ |
| d) $f = 10$ | e) $x = -5$ | f) $b = 5$ |
| g) $x = 12$ | h) $t = 7$ | i) $x = 6$ |
| j) $y = -8$ | k) $x = 16$ | l) $m = 4\frac{2}{3}$ |
| m) $m = -7$ | n) $y = -10$ | o) $d = 14$ |
| p) $x = 2\frac{2}{3}$ | q) $p = 4$ | r) $x = 10$ |
| s) $y = 4\frac{1}{2}$ | t) $x = 6$ | |

Exercise 2

LB page 143

- | | | |
|----------------------|---------------------------|-----------------------|
| 1. a) $7n - 1 = 13$ | b) $n + 16 = 34$ | c) $6n = 48$ |
| d) $\frac{n}{7} = 7$ | e) $12 + n = 38$ | f) $\frac{n}{15} = 3$ |
| g) $n - 3 = 4$ | h) $2n + 3 = 7$ | i) $4n - 6 = 10$ |
| j) $5(n + 4) = 16$ | k) $4 + \frac{n}{3} = 12$ | l) $4(n - 6) = 20$ |
| 2. a) $n = 2$ | b) $n = 18$ | c) $n = 49$ |
| d) $n = 26$ | e) $n = 7$ | f) $n = 2$ |

Exercise 3

LB page 144

1. $\text{GH}\text{¢}45 - \text{GH}\text{¢}19 = \text{GH}\text{¢}26$
2. $\text{GH}\text{¢}14 \times 3 = \text{GH}\text{¢}42$. The pizza costs $\text{GH}\text{¢}42$.
3. $42 \div 6 = 7$. Each chocolate costs $\text{GH}\text{¢}7$.
4. a) $226 - 56 = 170$. He needs $\text{GH}\text{¢}170$ more.
b) $170 \div 12 = 14.16$. He would have to save for 15 weeks.
5. $9 + 2 = 11$. Mawusi practises for 11 hours.
6. $96 \div 32 = 3$. Granny is able to buy 3 bags of rice.
7. $148 \div 4 = 37$. Each waiter earns $\text{GH}\text{¢}37$.
8. Learners' own answers

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 78 to 84 as extension exercises. You can also choose any exercises from pages 78 to 84 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Unit 1: 2D shapes and 3D shapes

Content standard

B6.3.1.1 Understand prisms

1. Essential for learning

Learners should be able to recognise and name 3D shapes so that they can move on to describing and comparing various shapes. Learners should be able to distinguish pyramids from prisms. Learners should also be able to measure objects of different shapes.

2. Key words

Construct, prisms, angles, equilateral, net, examine

3. Resources

Learner's Book, Workbook, cardboard, glue, clay, scissors, rulers, crayons, paper, graph sheets, multi-base blocks, number cards, plastic straws

4. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

5. Support for learners with special needs

As a teacher, you should facilitate and teach holistically through the use of visual aids, such as televisions and projectors.

6. Additional content for the teacher

YouTube videos on 3D shapes

7. Teaching methodology

Ask learners to bring 3D shapes to school. Divide the class into small groups, and then ask them to sort their 3D shapes. Ask the learners to record the number of shapes in their books. Allow learners to play games, for example opening and closing boxes, counting edges, vertices and faces and identifying shapes.

8. Assessment

Peer or self-assessment; also include puzzles and games such as “Mastermind”

9. Answers

Exercise 1

LB page 147

- | | |
|------------------------------|----------|
| 1. a) Square | b) Five |
| c) Eight | d) Five |
| 2. a) Square | b) Edges |
| c) Vertices | d) Cube |
| 3. a) Rectangle | |
| b) Five | |
| c) Edges | |
| d) Six | |
| 4. a) Flat | |
| b) One | |
| 5. a) Curved | |
| b) Three faces and two edges | |

Exercise 2

LB page 149

1. Learners' own answers

2.

3D shape	2D shape formed when cutting horizontally	2D shape formed when cutting vertically
Cuboid	Square	Square
Rectangular prism	Rectangle	Square
Cylinder	Circle	Rectangle
Triangular prism	Rectangle	Triangle
Square pyramid	Square	Triangle
Triangular pyramid	Triangle	Triangle

3.

Shape	Yes/no	2D shape formed
Cuboid	Yes	Rectangle
Cylinder	Yes	Circle
Square pyramid	No	
Rectangular prism	Yes	Triangle and rectangle, depending on the cutting angle

4. Learners prepare posters. Assess them according to originality and creativity.

Shape	Base shape	Cross section formed by a vertical cut	Cross section formed by a horizontal cut
Rectangular prism	Rectangle	Square	Rectangle
Cylinder	Circle	Rectangle	Circle
Triangular prism	Rectangle	Triangle	Rectangle
Square pyramid	Square	Triangle	Square
Triangular pyramid	Rectangle	Triangle	Rectangle
Hexagonal prism	Rectangle	Hexagon	Rectangle
Pentagonal prism	Rectangle	Pentagon	Rectangle
Cone	Circle	Triangle	Circle
Sphere	None	Circle	Circle

5.

Column A	Column B
3D shape	Cross section
Triangular prism standing on its base, cut parallel to its base	Rectangle
A rectangular prism, cut perpendicular to its base	Square
A cuboid, cut perpendicular to its base	Square
A hexagonal prism, cut perpendicular to its base	Hexagon
Triangular prism standing on its base, cut perpendicular	Triangle
A cylinder, cut perpendicular to its base	Rectangle
A triangular prism, cut perpendicular to its base	Triangle
A cone, cut perpendicular to its base	Triangle
A cylinder, cut parallel to its base	Circle
A hexagonal prism, cut parallel to its base	Rectangle

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 85 to 92 as extension exercises. You can also choose any exercises from pages 85 to 92 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Unit 2: Measurements

Content standard

B6.3.2.1 Construct rectangular and triangular prisms from their nets

1. Essential for learning

Learners should have been exposed to properties of a rectangular prism (6 faces, 8 vertices, and 12 edges) and a triangular prism (5 faces, with a triangular base). Learners should be able to recognise and name 3D shapes.

2. Key words

Construct, prisms, angles, equilateral, net, examine

3. Resources

Learner's Book, Workbook, cardboard, glue, clay, scissors, ruler, crayons, sheets of paper, graph paper

4. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

5. Support for learners with special needs

Allow learners who are comfortable with the visualisation of the nets to explain this to their peers.

6. Additional content for the teacher

YouTube videos on nets of 3D shapes

7. Teaching methodology

This part of the curriculum is best done “hands on”. It is very difficult to visualise a net if it is only a drawing on a page. Learners have to cut out the shapes and assemble their own nets.

8. Assessment

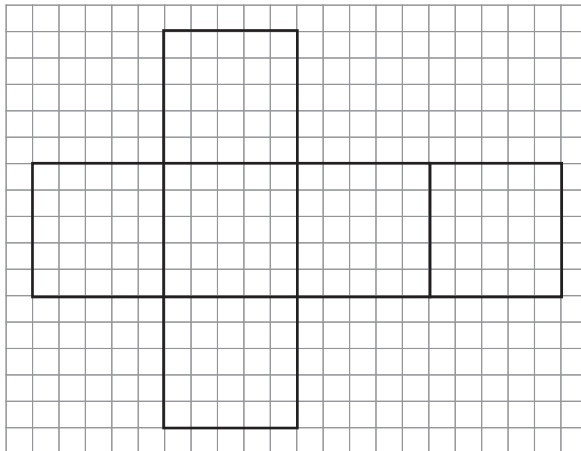
Worksheets and tests, homework, assignments, projects and end-of-term/year examinations

9. Answers

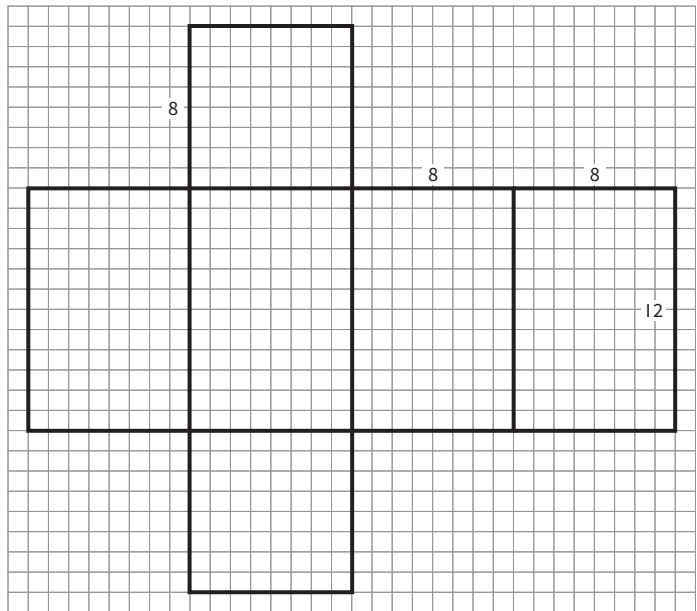
Exercise 3

LB page 155

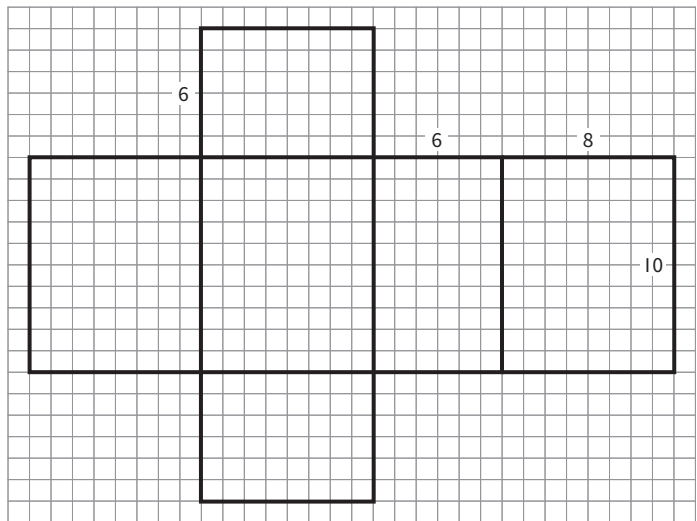
1. Learners’ own answers
2.
 - a) Rectangular prism
 - b) Hexagonal prism
 - c) Square-based pyramid
 - d) Rectangular pyramid
 - e) Cylinder
3. a)



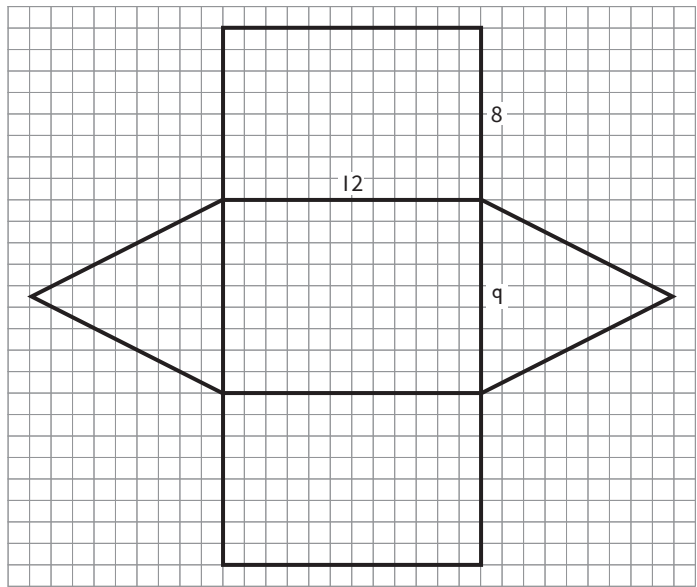
b)



c)



d)



4. Learners' own answers

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 93 to 96 as extension exercises. You can also choose any exercises from pages 93 to 96 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Unit 3: Geometric reasoning

Content standard

B6.3.3.1 Describe the position and motion of objects in space using the cardinal points

1. Essential for learning

Learners should know the four basic cardinal points (north, east, west, and south) and describe positions using these points.

2. Key words

Compass, cardinal points, origin

3. Resources

Learner's Book, Workbook, compass, grid paper, pencils, rulers

4. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

5. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the positioning of whole numbers in relation to other whole numbers.

6. Additional content for the teacher

YouTube videos on plotting points

7. Teaching methodology

Give the learners graph paper and give them instructions to move in various directions from a central point on the paper. The learners can also play games encouraging them to move in response to instructions.

8. Assessment

Teacher assessments as the learners do the activities

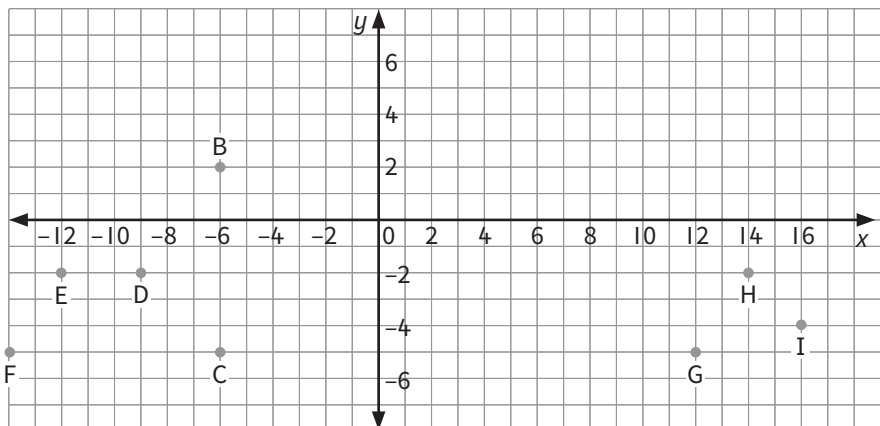
9. Answers

Exercise 4

LB page 160

1. a) i) A is north-east of C, but C is south of D
ii) D is north-west of X, but X is south-east of H
- b) i) A is north-west of M
ii) B is south-east of G
iii) G is north of E
iv) E is south of G
v) M is south-east of H
vi) E is south-west of A
vii) A is east of D
viii) G is south-west of H

2. Possible answers



3. a) Mampong is north-west of Accra.
b) Salaga is north-east of Mampong.
c) Bole is north-west of Salaga.
d) Salaga is south-east of Bole.
e) Learners' own answers
4. a) From swim area, go north-east to camping area
b) From welcome centre, go north-east to forest
c) From welcome centre, go north to camping area
d) From camping area, go south-east to boats

Exercise 5

LB page 164

1.
 - a) Petrol station
 - b) McDonald's
 - c) Ice cream parlour
 - d) Lake
 - e) Library
 - f) Ice cream parlour
 - g) Move 7 squares south and 4 squares east
 - h) Move 6 squares east and 3 squares south
2.
 - a) North-west
 - b) South-west
 - c) 3 squares south, 4 squares east
 - d) 2 squares south, 4 squares west
 - e) 3 squares south, 2 squares east
 - f) No, the police station is to the north-east.

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 93 to 96 as extension exercises. You can also choose any exercises from pages 93 to 96 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Content standard

B6.3.3.5 Perform a single transformation on a 2D shape

1. Essential for learning

Learners should have prior experience of plotting x and y on a coordinate plane.

2. Key words

Line of symmetry, reflection, properties, vector, translation, compass, origin

3. Resources

Learner's Book, Workbook, graph sheets, pencils, rulers, hand mirrors

4. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies. Also integrate your work in the Mathematics class with other subjects.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

5. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. Explore the vocabulary in word problems first in order to ensure that the learners understand the language and vocabulary used. The learners should be able to explain their strategies in determining the place value of whole numbers in relation to other whole numbers.

6. Additional content for the teacher

YouTube videos on reflection, translation, and lines of reflection

7. Teaching methodology

Some learners struggle to imagine shapes being translated or reflected. Allow them to cut out shapes, and then physically move them across graph paper. Learners who struggle to grasp the concept of reflection, may benefit from using mirrors to see how shapes are reflected. Once again, it may help them to cut out shapes and physically flip them over on graph paper.

8. Assessment

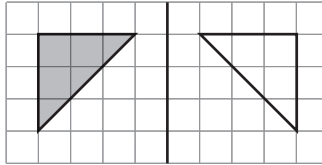
Teacher assessment as the learners do the activities, and self- or peer assessment of homework

9. Answers

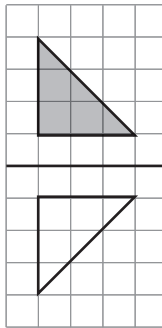
Exercise 6

LB page 170

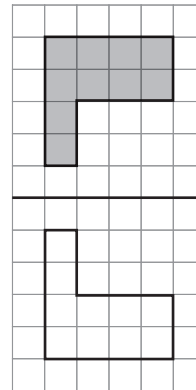
1. a)



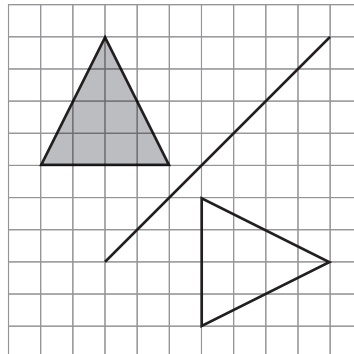
b)



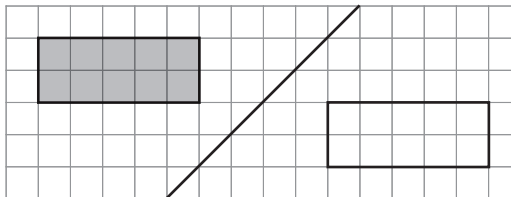
c)



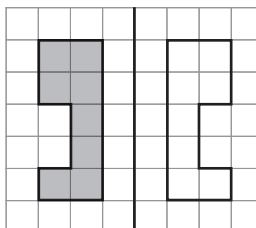
d)



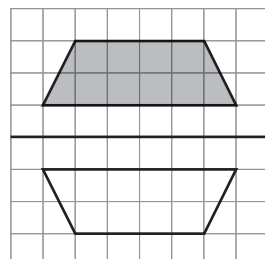
e)



f)



g)

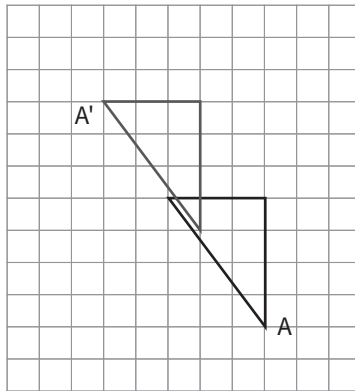


2.
 - a) Vertical
 - b) Horizontal
 - c) Diagonal
 - d) Vertical
3. Learners' own answers

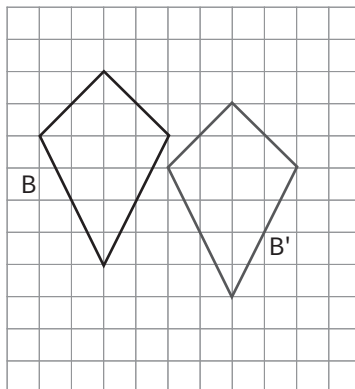
Exercise 7

LB page 174

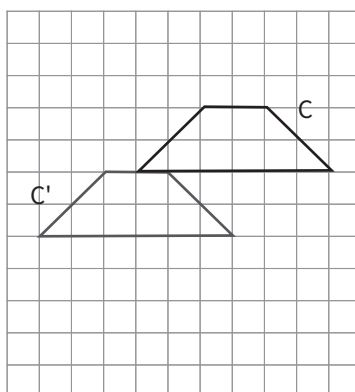
1. a)

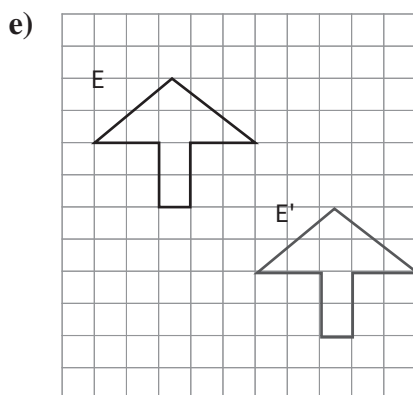
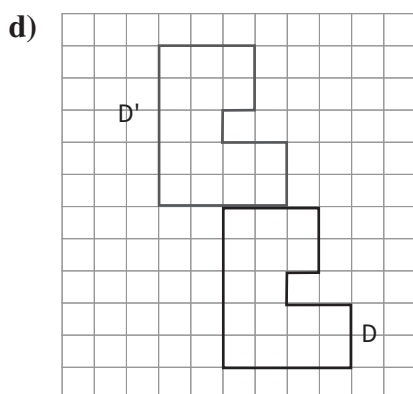


- b)



- c)





2. a) $\begin{pmatrix} 5 \\ -8 \end{pmatrix}$ b) $\begin{pmatrix} 0 \\ 9 \end{pmatrix}$
 c) $\begin{pmatrix} -6 \\ 9 \end{pmatrix}$ d) $\begin{pmatrix} 0 \\ -10 \end{pmatrix}$
 e) $\begin{pmatrix} -4 \\ -10 \end{pmatrix}$ f) $\begin{pmatrix} -4 \\ -9 \end{pmatrix}$

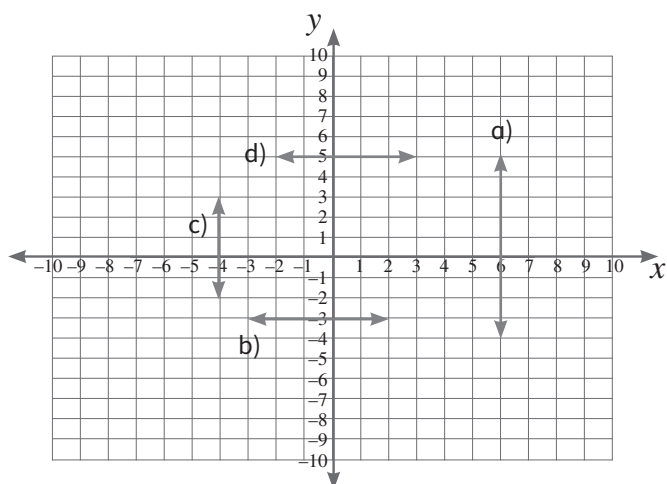
Exercise 8

LB page 183

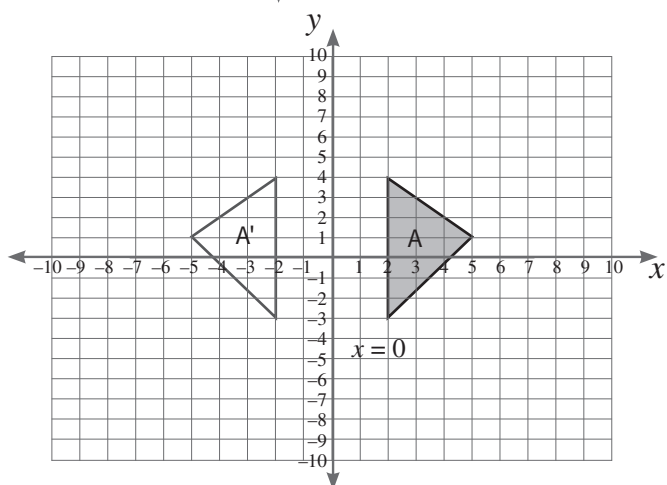
1.

Line	Direction of the line of reflection	Equation
F	Horizontal	$y = 9$
A	Vertical	$x = 4$
B	Vertical	$x = -3$
C	Horizontal	$y = 6$
D	Horizontal	$y = -7$
E	Vertical	$x = -8$

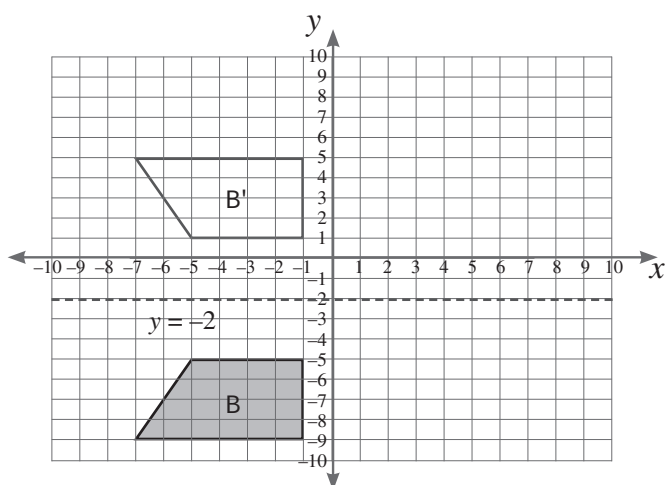
2.



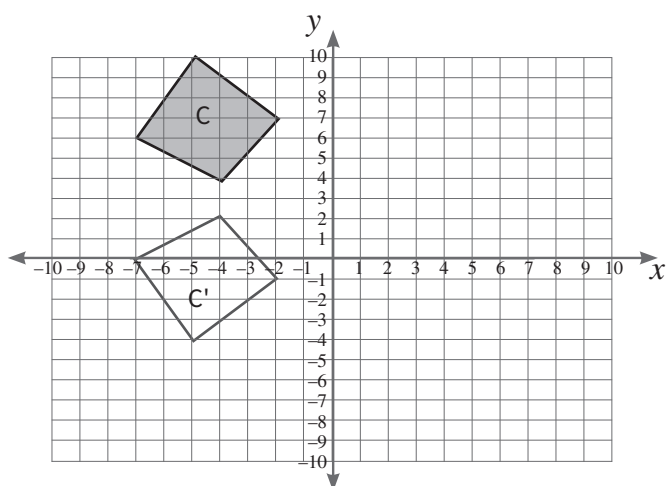
3. a)



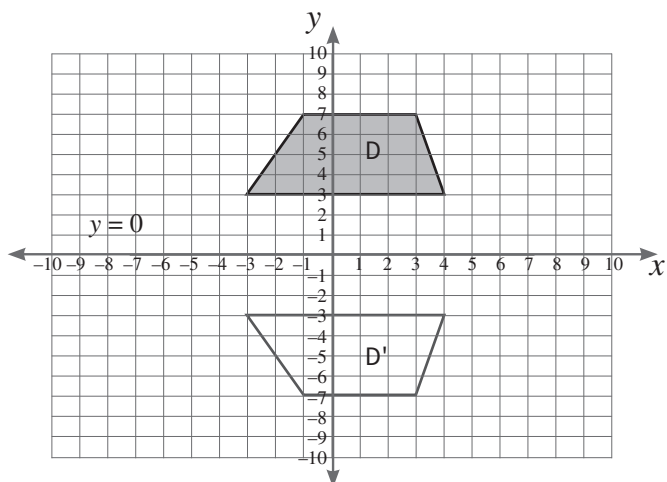
b)



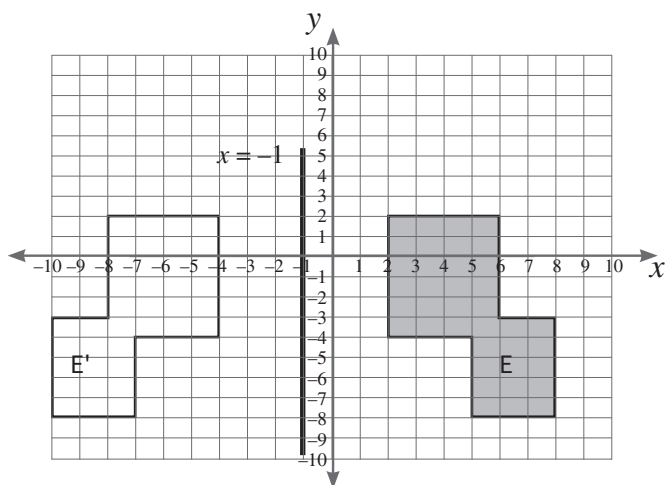
c)



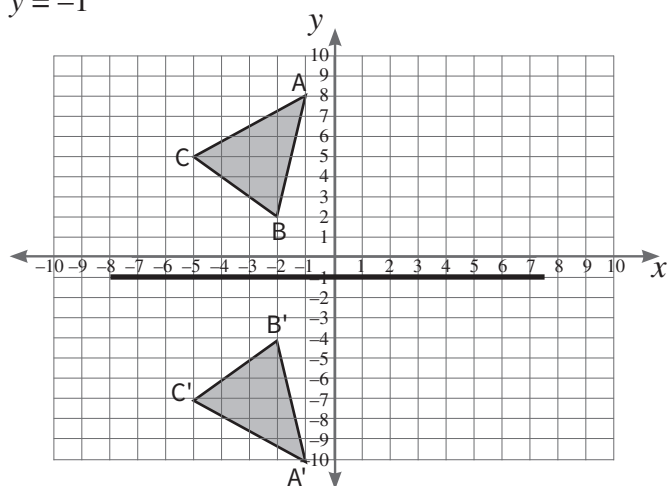
d)



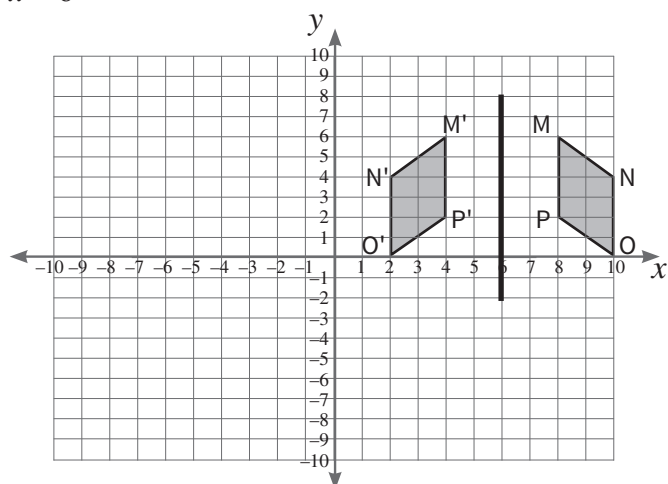
e)



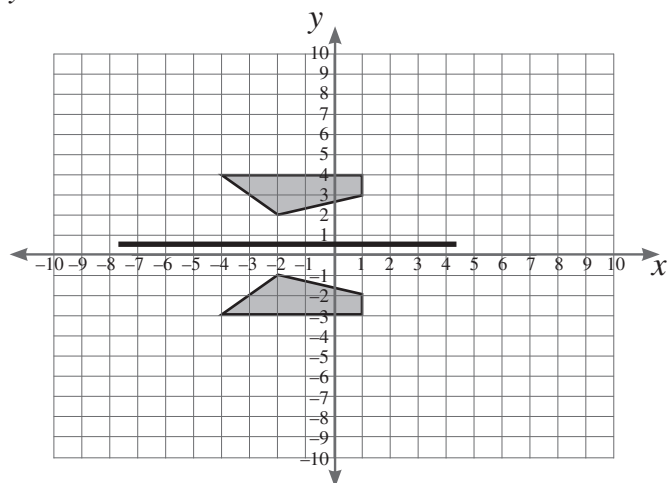
4. a) $y = -1$



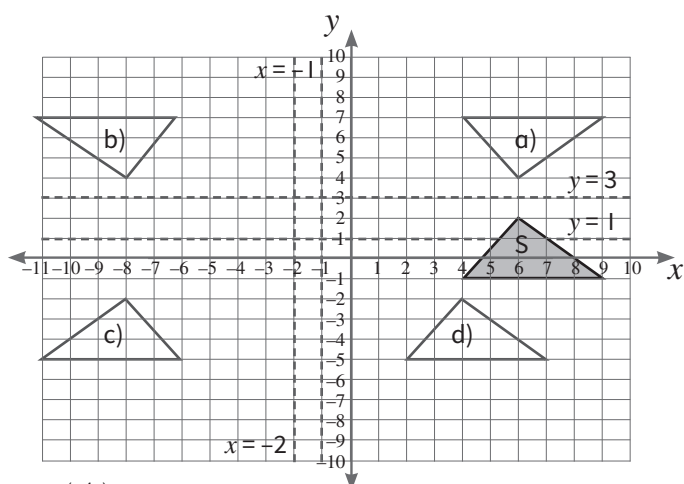
b) $x = 6$



c) $y = 0.5$

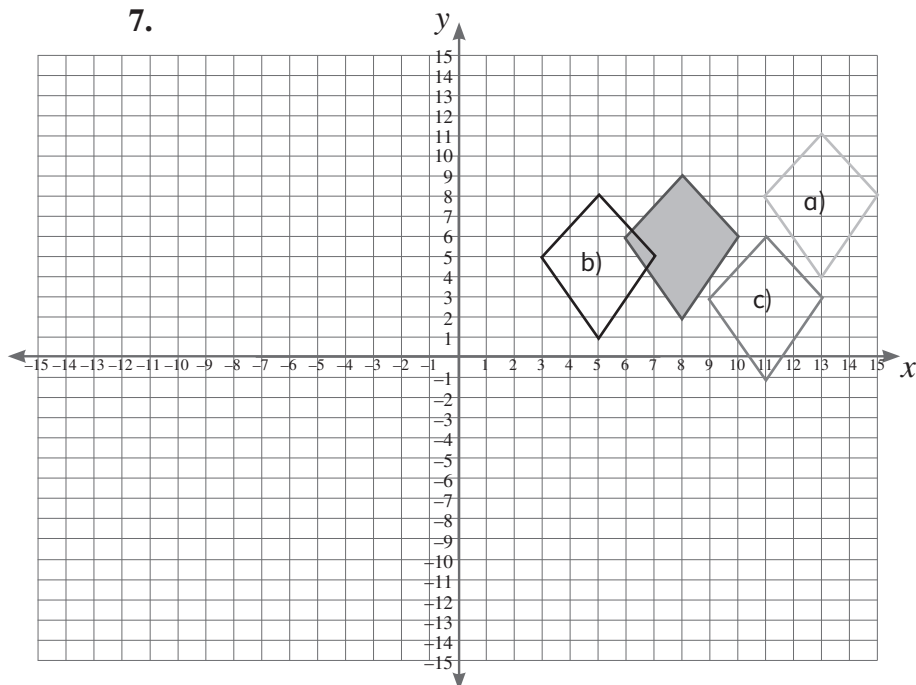


5.

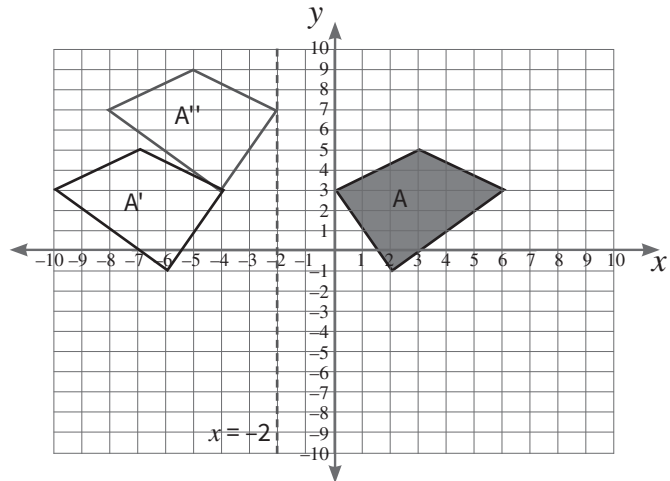


6. a) $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$
 b) $\begin{pmatrix} -6 \\ 0 \end{pmatrix}$
 c) $\begin{pmatrix} 5 \\ -11 \end{pmatrix}$
 d) $\begin{pmatrix} -11 \\ -10 \end{pmatrix}$
 e) $\begin{pmatrix} 15 \\ 5 \end{pmatrix}$

7.



8. a) and b)



10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 97 to 108 as extension exercises. You can also choose any exercises from pages 97 to 108 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Unit 1:**Collect, organise, present, interpret and analyse data****Content standard****B6.4.1.1 Create, label and interpret line graphs****1. Essential for learning**

Learners should have prior knowledge of data being a collection of information. They need to understand that there are many reasons for collecting data. Learners should be aware that the methods of data collection can vary. Therefore, they have to find suitable ways to represent the collected information, so they can make conclusions or predictions. They will learn how to use simple questionnaires and draw different types of graphs.

2. Key words

Collection, organise, predict, presentation, interpretation, analyse, discrete data, continuous data, increase

3. Resources

Learner's Book, Workbook, scale, measuring tape, a chart, calendar, tables, graph paper, line graph, series of separate points, frequency distribution table

4. Large class teaching

Plan your activities for an inclusive class. Determine your learners' skills level. Activities should also be learner-centred, so that learners are in control of their learning. Learners should be able to try a variety of strategies.

Divide the class into smaller groups of learners with different abilities. Provide them with clear instructions, so they know what to do.

When assessing, give learners recognition for logical reasoning. Credit them for the strategies they use, even if there is a mechanical error that might give rise to a wrong answer.

5. Support for learners with special needs

As a teacher, your role is to facilitate learning and to keep content relevant to all learners. Break down content into small, manageable and logical steps. The activities should be practical and hands-on. Limit distractions.

6. Additional content for the teacher

You can represent the data of a given situation in multiple ways, for example a line graph or a series of separate points. Ask learners to look for graphs in newspapers, and explain them to the class.

7. Teaching methodology

Start from known concepts, then move on to unknown concepts. Give them problems that relate to their immediate environment. Let them complete tables from flow diagrams, and draw graphs.

8. Assessment

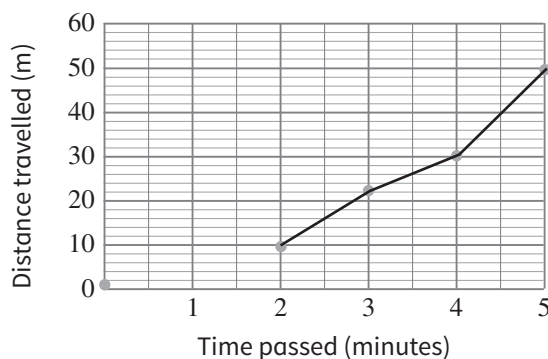
Worksheets and tests, homework, assignments, projects and end-of-term/year examinations

9. Answers

Exercise 1

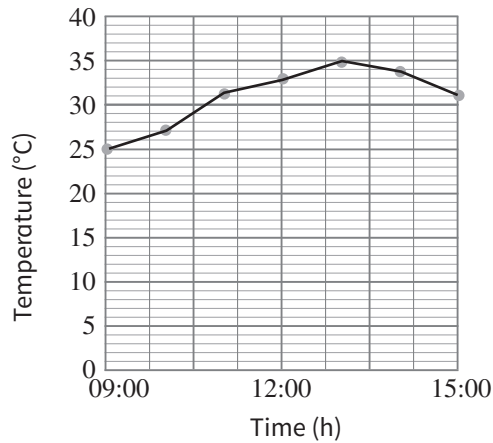
LB page 192

1. a)



b) Between 4 and 5 minutes (20 m difference).

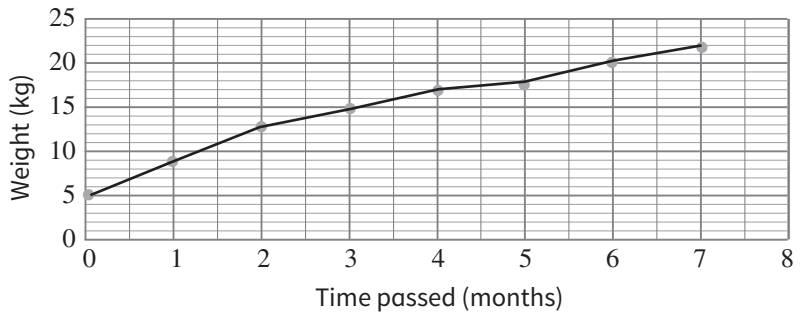
2. a)



b) 35 °C

c) 13:00 (1 p.m.)

3. a)

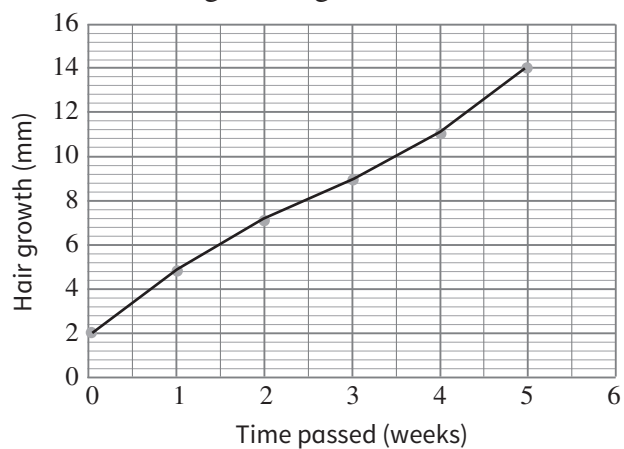


b) The puppy reached 20 kg at 6 months.

c) After the age of 0 months (4 kg difference)

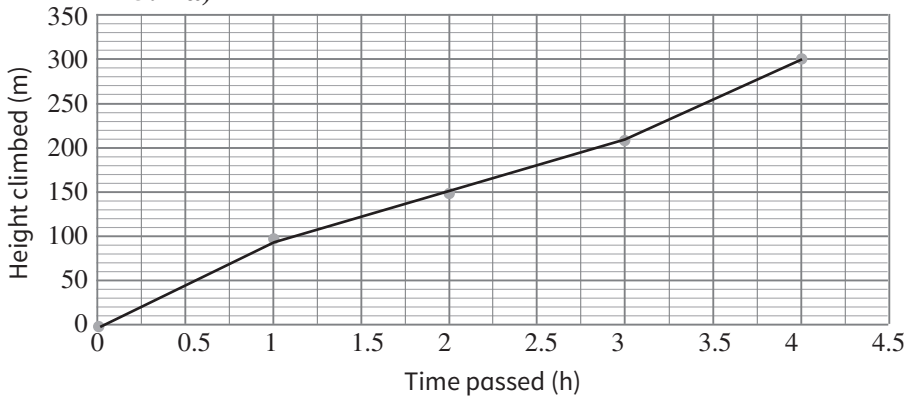
d) At birth he weighed 5 kg.

4. a)



b) During the fifth week (3 mm growth)

5. a)



b) During the first hour (100 m)

c) It is the point where he began his climb.

Exercise 2

LB page 196

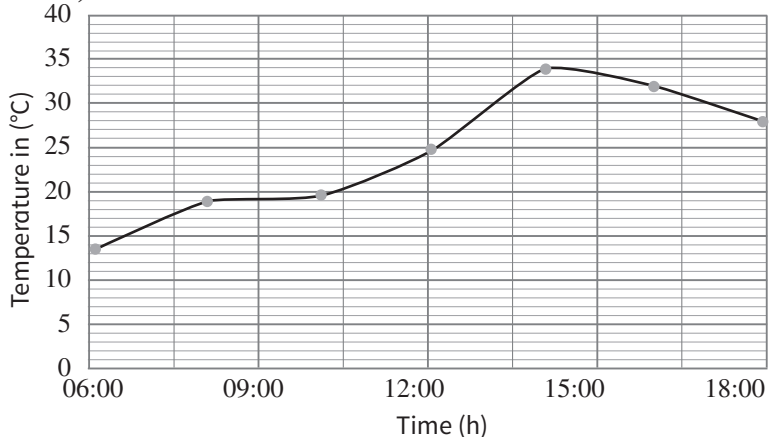
1. a) Discrete. Points on a graph. Year on y -axis and profit earned on x -axis
- b) Discrete. Points on a graph. Weight on y -axis and age on x -axis
- c) Discrete. Points on a graph. Year on x -axis and number of games won on y -axis
2. Learners' own answers

Exercise 3

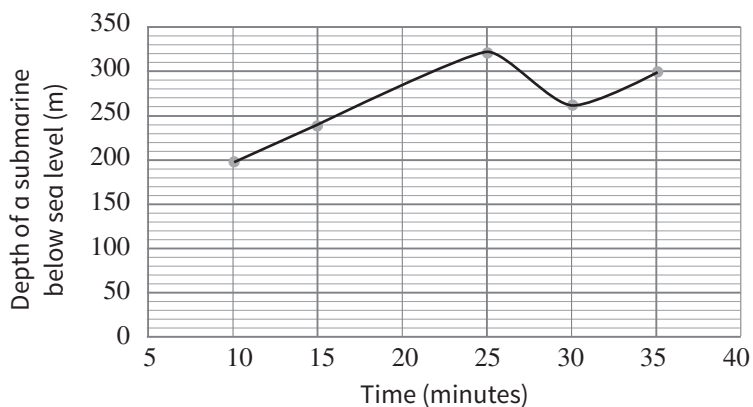
LB page 199

1. a) 0; 70
- b) 1 bar is 2 kg
- c) The third month
- d) 35 kg
- e) The tiger's weight shows an exponential increase.

2. a)



- b) 34 °C
 - c) 14 °C
 - d) 29.5 °C
 - e) 1 p.m.; 5 p.m.
3. a) Vertical axis: 1 bar is 4 pages. Horizontal axis: 1 bar is 15 minutes.
- b) A: 30 pages; B: 25 pages
 - c) 60 pages
 - d) Learner A
 - e) Linear
 - f) A: $2\frac{1}{2}$ minutes per page. B: 3 minutes per page.
4. a)



- b) Approximately 280 m
- c) The submarine depth decreased to 260 m, then increased to 300 m.
- d) The submarine will be 320 m below sea level.

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 109 to 116 as extension exercises. You can also choose any exercises from pages 109 to 116 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

1. Essential for learning

Learners should be familiar with question-and-answer scenarios, whether formally or informally, for example interviews. They should have been exposed to recording observations, for example, in Natural Science classes.

2. Key words

Data, database, justify, questionnaires, interview, observation, experiments, electronic media

3. Resources

Learner's Book, Workbook, surveys, interviews, observations, tally sheets and questionnaires

4. Large class teaching

Divide the class into groups, each group not being more than 10% of the class size. Include learners of different abilities. Each member in the group must be assigned a specific task that they should complete for the group assignment.

Also delegate some “teacher tasks” to your learners, such as distributing handouts, collecting homework and arranging groups.

5. Support for learners with special needs

Ensure that the learners understand the vocabulary of data collection. Also ensure that they understand the drawing of graphs (how axes should be labelled), and so on.

6. Additional content for the teacher

Integrate with other subjects and educate learners on what graphs are best for what data. Give more information on how graphs help us to interpret data. Expose the learners to more hands-on activities and more exercises. You may also integrate the subject into other learning areas, such as English, using the data collection vocabulary as a spelling activity.

7. Teaching methodology

Use examples from the learners' immediate environment. Allow them to design questionnaires for their peers. Let the learners report back to the class and explain how they reached their conclusions.

8. Assessment

Give the learners an assignment, so that you can see whether they are able to apply the concepts they have learnt.

9. Answers

Exercise 4

LB page 204

Learners' own answers

Exercise 5

LB page 207

1. a)

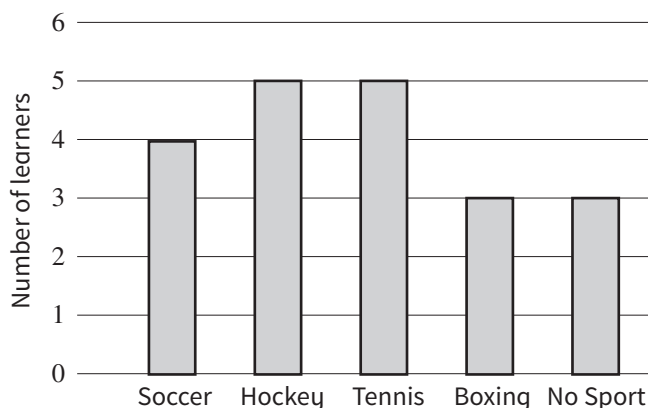
Favourite sport	Tally	Frequency
Soccer		4
Tennis		5
Hockey		5
Boxing		3
No sport		3
Total		20

b) Both hockey and tennis (5)

c) $\frac{3}{20} = 0.15 = 15\%$

d) $\frac{5}{20} = 0.25 = 25\%$

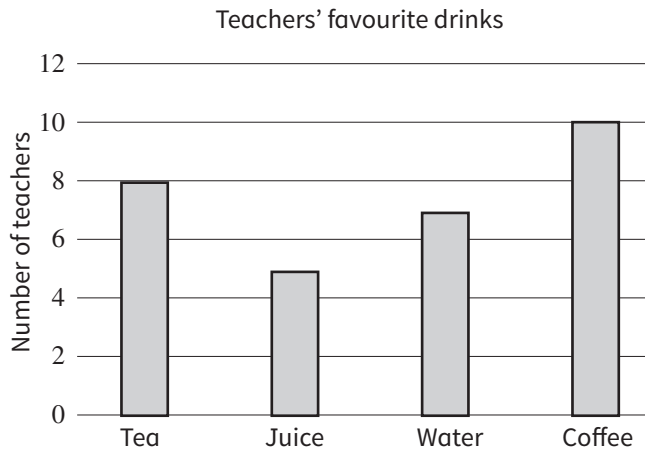
e) Learners' winter sports participation



2. a)

Favourite drink	Tally	Frequency
Tea		8
Juice		5
Water		7
Coffee		10
Total		30

b)



c) Coffee is the favourite drink amongst the teachers: $\frac{10}{30}$.

d) $\frac{7}{30}$; 7 teachers drank water.

e) $\frac{8}{30} = 0.26666 = 26.67\%$

f) 10 coffees : 8 teas
Ratio: 5 : 4

g) $\frac{5}{30} = 1 : 6$

3. Learners' own answers

10. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 117 to 118 as extension exercises. You can also choose any exercises from pages 117 to 118 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Unit 2: Chance or probability

Content standard

B6.4.2.2 Understand probability

1. Essential for learning

Learners should have been exposed to the concept of probability in games, for example “tossing of a coin”, “you win or draw or lose”, or cards. They should be able to perform simple repeated actions and list possible outcomes for events, such as tossing a coin and rolling dice. They should be able to count and compare the frequency of actual outcomes for a series of trials.

2. Key words

Predict, probability, approach, outcome, results, chance

3. Resources

Learner’s Book, Workbook, dice, coins, deck of playing cards

4. Large class teaching

Divide the class into groups, each group not being more than 10% of the class size. Each member in the group must be assigned a specific task that they should complete for the group assignment.

5. Support for learners with special needs

Ask two learners to play, while one learner records the outcome. Then, allow them to swap.

6. Teaching methodology

Allow the learners to play games, such as cards, which will help them understand the concept of probability. Give them a problem that relates to their immediate environment. Encourage peer-assisted learning, or the concept of a “flipped” classroom.

7. Assessment

Formative assessment (when they have been exposed to the topic), for example tests and exams

8. Answers

Exercise 6

LB page 211

1.
 - a) Very probable
 - b) Probable (depending on weather)
 - c) Probable
 - d) Probable to very probable
 - e) Very probable
 - f) Highly unlikely
 - g) Very probable
2.
 - a) $0.13 = 13\%$
 - b) $0.12 = 12\%$
 - c) $0.1 = 10\%$
 - d) $0 = 0\%$
3.
 - a) 0.19
 - b) 0.15
 - c) Theoretical: $\frac{1}{6}$. Experimental: $\frac{1}{10}$
 - d) 0.48
 - e) 0.5
 - f) The dice slightly favoured the odd sides in the experiment.
4. Learners' own answers. Theoretical probability = 50%
5. Learners' own answers. Theoretical probability = 50%
6. Learners' own answers
7.
 - (a) to (c) Learners' own answers
 - d) 0.5
 - e) The experimental probability will approach the theoretical probability.
 - f) Learners' own answers

Exercise 7

LB page 214

1. Learners' own answers
2.
 - a) 50%
 - b) 66.6% chance of getting tails
 - c) The coin was only tossed six times. If the experiment is repeated, the experimental value will approach the theoretical value.

- d) Three heads (false)
Almost two tails (false)
Exactly two heads (true)
An even number of tails (true)
- 3. a) Red ball; white ball; blue ball and green ball, 12 balls in total.
b) $\frac{1}{3}$; 33.33%
c) Learners' own answers
d) $\frac{1}{4}$; 25%
e) White and green balls
- 4. a) $\frac{4}{52} = \frac{1}{13}$
b) $\frac{1}{4}$
c) $\frac{1}{13}$
d) 0

9. Homework

Ask learners to complete any exercises that they could not complete during class time as homework. If there are learners in your class who complete the assigned work quickly, select questions from Workbook pages 119 to 123 as extension exercises. You can also choose any exercises from pages 119 to 123 of the Workbook and assign these as homework. Once back in class, allow time for learners to provide feedback and allow them to correct any mistakes they may have made.

Topic 1: Number

1. Check that learners have used different colours to show the following:
 - a) $8 \times 1,000$ blocks; 1×100 blocks; 4×10 blocks, $5 \times$ blocks
 - b) $3 \times 10,000$; $4 \times 1,000$; 8 blocks
 - c) $1 \times 100,000$; $3 \times 1,000$; 4×100 ; 5×10 ; 6 blocks
 - d) $1 \times 10,000$; 9×10 ; 9 blocks
2.
 - a) thirty-nine million, four hundred and five thousand, one hundred and nineteen
 - b) nine million, four hundred and forty-five thousand, and one
 - c) four billion, nine hundred and eighty million, one hundred and fifteen thousand, and ninety-eight
3.
 - a) 20,000 b) 10,000,000 c) 1,000,000,000
 - d) 900,000,000 e) 8,000,000 f) 20,000,000
4.
 - a) $190,809,888 = 100,000,000 + 90,000,000 + 800,000 + 9,000 + 800 + 80 + 8$
 - b) $45,610,098 = 40,000,000 + 5,000,000 + 600,000 + 10,000 + 90 + 8$
 - c) $780,770,880 = 700,000,000 + 80,000,000 + 700,000 + 70,000 + 800 + 80$
5.
 - a) 23,198,731,645 b) 47,310,747,419
6.
 - a) 456,088 b) 456,198 c) 457,098 d) 446,098
7.
 - a) $212,098 < 212,908$ b) $76,119 > 67,119$
 - c) $456,899 > 456,889$ d) $101,001 < 101,011$
 - e) $345,098 = 345,098$ f) $780,245 < 789,245$
8.
 - a) 144,094; 144,499; 144,904; 145,198; 145,990
 - b) 789,809; 789,908; 798,880; 809,789; 890,780
9.
 - a) 619,198; 618,116; 617,981; 617,189; 616,998
 - b) 233,413; 233,313; 232,312; 231,321; 223,331
10.
 - a) 700,000
 - b) 874,321
 - i) eight hundred and seventy-four thousand, three hundred and twenty-one
 - ii) 884,321

c) 123,478

i) $100,000 + 20,000 + 3,000 + 400 + 70 + 8$

ii) 113,478

11. a) 1,056; 1,206; 1,356 Rule: +150

b) 2,064; 2,175; 2,286 Rule: +111

c) 11,648; 11,315; 10,982 Rule: -333

d) 151,860; 151,810; 151,760 Rule: -50

12. a) 23 b) 39 c) 70 d) 43

13. a) XLVII b) LXXXII c) LXXVIII

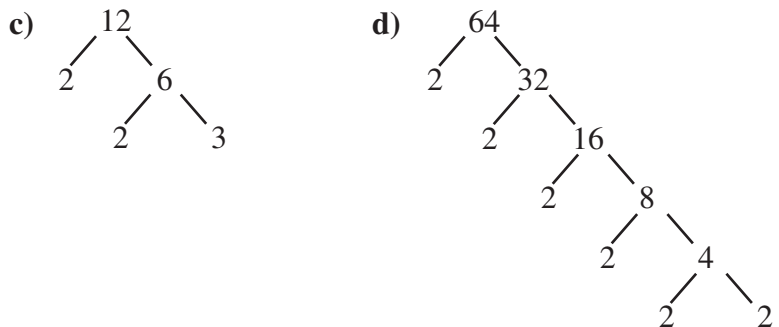
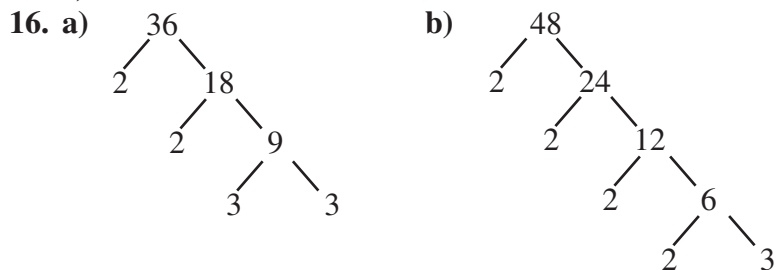
d) XCIII e) LXIX

14. a) $6 + 2 = 8$ b) $10 + 3 = 13$

c) $13 - 4 = 9$ d) $14 - 9 = 5$

15. a) $XI + IV = XV$ b) $XIX - IX = X$

c) $XVIII + III = XXI$



17. a) $2 \times 2 \times 2 \times 3$ b) $2 \times 3 \times 3 \times 3$

c) $2 \times 3 \times 7$ d) $2 \times 2 \times 2 \times 5$

e) $3 \times 3 \times 3 \times 3$

18. a) 12 b) 5 c) 9

19. 5 groups of 3 boys and 5 girls each

20. a) 36 b) 40 c) 48

21. a)

$18 \rightarrow 2 \times 9 \rightarrow 2 \times 3 \times 3$
 $15 \rightarrow 3 \times 5$

$\text{HCF} = 3$
 $\text{LCM} = 2 \times 3 \times 3 \times 5 = 90$

b)

$16 \rightarrow 2 \times 8 \rightarrow 2 \times 2 \times 4 \rightarrow 2 \times 2 \times 2 \times 2$
 $32 \rightarrow 2 \times 16 \rightarrow 2 \times 2 \times 8 \rightarrow 2 \times 2 \times 2 \times 4 \rightarrow 2 \times 2 \times 2 \times 2 \times 2$

$\text{HCF} = 2 \times 2 \times 2 \times 2 = 16$
 $\text{LCM} = 2 \times 2 \times 2 \times 2 \times 2 = 32$

c)

$64 \rightarrow 2 \times 32 \rightarrow 2 \times 2 \times 16 \rightarrow 2 \times 2 \times 2 \times 8 \rightarrow 2 \times 2 \times 2 \times 2 \times 4 \rightarrow 2 \times 2 \times 2 \times 2 \times 2 \times 2$
 $96 \rightarrow 2 \times 48 \rightarrow 2 \times 2 \times 24 \rightarrow 2 \times 2 \times 2 \times 12 \rightarrow 2 \times 2 \times 2 \times 2 \times 6 \rightarrow 2 \times 2 \times 2 \times 2 \times 2 \times 3$

$\text{HCF} = 2 \times 2 \times 2 \times 2 \times 2 = 32$
 $\text{LCM} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 192$

22. a)

2	7	14	49
7	7	7	49
7	1	1	7
	1	1	1

$\text{LCM} = 2 \times 7 \times 7 = 98$
 $\text{HCF} = 7$

b)

2	10	20	35
2	5	10	35
5	5	5	35
7	1	1	7
	1	1	1

$\text{LCM} = 2 \times 2 \times 5 \times 7 = 140$
 $\text{HCF} = 5$

c)

2	16	32	64
2	8	16	32
2	4	8	16
2	2	4	8
2	1	2	4
2	1	1	2
	1	1	1

$LCM = 2 \times 2 \times 2 \times 2 \times 2 \times 2$
 $= 64$
 $HCF = 16$

23. a) 20 b) 72 c) 30 d) 40
 e) 27 f) 49 g) 44 h) 63
 i) 42 j) 24 k) 60 l) 48
 24. a) 1,000 b) 328 c) 440 d) 1,000
 25. a) 7,740 b) 23,900 c) 530,000 d) 77,000
 e) 71,000 f) 52,200
 26. There are 2,200 books.
 27. a) 110 b) 184 c) 112 d) 198
 28. a) 2,886

×	400	80	1
6	2,400	480	6

b) 1,440

×	200	80	8
5	1,000	400	40

c) 1,484

×	300	70	1
4	1,200	280	4

d) 3,842

×	200	20	6
10	2,000	200	60
7	1,400	140	42
	3,400	340	102

29. a)
$$\begin{array}{r} 44 \\ \times 16 \\ \hline 264 \\ + 440 \\ \hline 704 \end{array}$$
- b)
$$\begin{array}{r} 27 \\ \times 33 \\ \hline 81 \\ + 810 \\ \hline 891 \end{array}$$
- c)
$$\begin{array}{r} 460 \\ \times 23 \\ \hline 1380 \\ + 9200 \\ \hline 10,580 \end{array}$$
- d)
$$\begin{array}{r} 222 \\ \times 16 \\ \hline 1332 \\ + 2220 \\ \hline 3,552 \end{array}$$

30. a)

	2	8
0	4	1
5	6	2

$28 \times 2 = 56$

b)

	3	6
0	3	0
1	2	6

$36 \times 14 = 504$

c)

	5	5	4
1	1	1	0
2	1	5	2

$554 \times 23 = 12,742$

d)

	4	0	2
0	8	0	0
0	4	0	0

$402 \times 212 = 85,224$

31. a) 1,320 or 1,326

c) 52 or 56

e) 2,440 or 2,448

b) 21, 24 or 27

d) 30, 32, 34, 36 or 38

f) 550

32. a)

	2	4	2
6	1	4	5
	1	2	
	2	5	
	2	4	
	1	2	
	1	2	
	0		

b)

	1	2	3	4
4	4	9	3	6
	4			
	9			
	8			
	1	3		
	1	2		
	1	6		
	1	6		
	0			

c)

	1	0	0
22	2	2	0
	2	2	
	0	0	

d)

	6	2	9
5	3	1	4
	3	0	
	1	4	
	1	0	
	4	5	
	4	5	
	0		

33. $32 \times 11 = 352$ bottles were collected by Lariba.

34. 3 butterflies per day for 3 weeks = 3×21 days = 63 more butterflies

$120 + 63 = 183$ butterflies after 3 weeks

35. -18; -12; -9

36. a) $-4 > -12$

b) $13 > -11$

c) $-2 < 16$

37. a) $-12; -9; -5; 6; 12$ b) $-11; -6; 0; 1; 12$
 38. a) $12; 7; 6; -7; -11$ b) $12; 9; -7; -11; -13$
 39. a) -6 b) 8 c) 8 d) 16
 e) -8 f) -14
 40. a) 6 b) 8 c) -20 d) 25
 e) -18 f) -6
 41. a) -12 b) -20 c) -60 d) -180
 e) 0 f) 32
 42. a) $\frac{4}{8}$ b) $\frac{3}{6}$ c) $\frac{7}{20}$
 43. a) $\frac{3}{4} < \frac{4}{5}$ b) $\frac{1}{5} = \frac{2}{10}$ c) $\frac{4}{9} < \frac{7}{15}$
 44. $\frac{1}{6}, \frac{3}{15}, \frac{1}{4}, \frac{2}{5}, \frac{8}{16}$
 45. $\frac{5}{8}, \frac{7}{12}, \frac{1}{2}, \frac{6}{14}, \frac{1}{3}$
 46. a) 0.16 b) 0.42 c) 0.18 d) 0.7
 47. a) $\frac{58}{100}$ or $\frac{29}{50}$ b) $\frac{165}{1000}$ or $\frac{33}{200}$
 c) $\frac{3}{10}$ d) $\frac{56}{100}$ or $\frac{28}{50}$ or $\frac{14}{25}$
 e) $\frac{24}{100}$ or $\frac{12}{50}$ or $\frac{6}{25}$

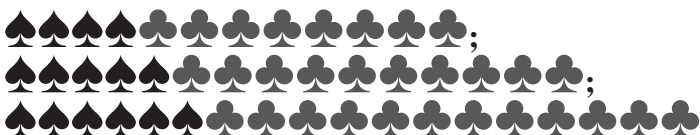
48.

Common fraction	Percentage	Decimal number
$\frac{4}{5}$	80%	0.8
$\frac{1}{4}$	25%	0.25
$\frac{13}{20}$	65%	0.65
$\frac{28}{50}$	56%	0.56
$\frac{1}{8}$	12.5%	0.125

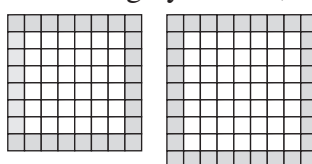
49. a) $0.45; \frac{3}{4}; 80\%$
 b) $25\%; \frac{2}{5}; 50\%; 0.7$
 50. a) $3\frac{1}{4}$ b) $7\frac{1}{9}$ c) $3\frac{4}{5}$
 51. There are 8 boys altogether. $6 \text{ litres} \div 8 \text{ boys} = \frac{3}{4} \text{ litre per boy}$
 52. $4\frac{5}{8} + 3\frac{3}{4} = 8\frac{3}{8}$ cans of oil were used over the weekend.
 53. a) 12 b) 25 c) 4 d) 40

54. a) $\frac{3}{14}$ b) $\frac{5}{18}$ c) $\frac{12}{55}$ d) $\frac{7}{30}$
 55. a) $4\frac{1}{2}$ b) $17\frac{1}{4}$ c) $21\frac{7}{40}$
 56. a) 9 b) $3 : 12 = 1 : 4$ c) $3 : 9$ or $1 : 3$
 57. a) $1 : 2$ b) $1 : 4$ c) $1 : 4$
 d) $1 : 2$ e) $2 : 3$
 58. $35 : 50$ or $7 : 10$
 59. $32 : 64$ or $1 : 2$
 60. Examples as follows (accept all correct answers):
 a) $1 : 2$ b) $1 : 3$
 c) $4 : 1$ d) $18 : 20$
 e) $10 : 4$
 61. 8 burgers
 62. She is running at 4 km/h.
 a) 1 h 15 min b) $2\frac{1}{2}$ h or 2 h 30 min
 c) $3\frac{3}{4}$ h or 3 h 45 min
 63. Week 1 = GH¢15 \times 6 = GH¢90
 Week 2 = GH¢15 \times 11 = GH¢165
 GH¢255 in total

Topic 2: Algebra

1. 

2. a) increasing by 5 : 34, 39, 44
 b) decreasing by 11 : 33, 22, 11

3. a) 

- b) 20 orange tiles and 16 white tiles
 c) 24 orange tiles and 25 white tiles

d)

Pattern	1	2	3	4	5
Orange tiles	8	12	16	20	24
White tiles	1	4	9	16	25

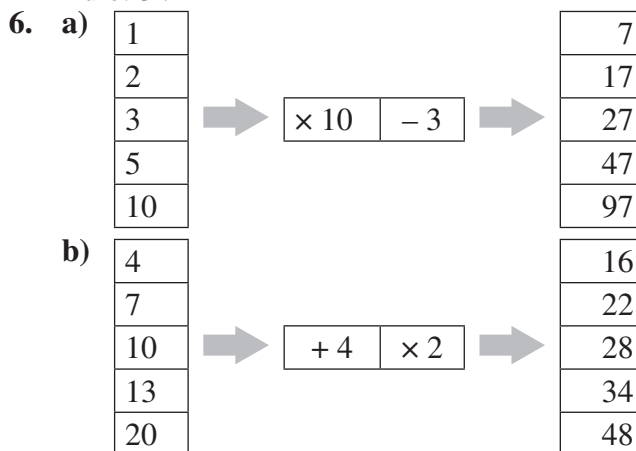
- e) The orange tiles increase by 4 each time. The white tiles is the pattern number multiplied by itself e.g. pattern 2 is $2 \times 2 = 4$.

- f) 44 orange tiles and 100 white tiles
4. a) The input $\times 4$ is the output or $4n$.
b) The input $\times 5 - 2$ is the output or $5n - 2$.

5.

Input	1	2	3	4	10	25	40
Output	7	10	13	16	34	79	124

Rule: $3n + 4$



7. a) $3z$ b) $25x$ c) $\frac{c}{8}$ d) $\frac{5}{8}y + 4y + 2$
e) $11 - x$ f) $ab - 6$
g) $\frac{m}{8} + 5$
8. a) $10x$ b) $-y - 3$
c) $5a - 3a + 4c - 4c + c + 2 + 4 = 2a + c + 6$
9. a) $3(3) + 3(4) = 9 + 12 = 21$
b) $2(2) - 2(4) = 4 - 8 = -4$
c) $\frac{6}{12} = \frac{1}{2}$
d) $3a + 5a - 4b + 2b - c + 2c$
 $= 8a - 2b + c$
 $= 8(3) - 2(2) + 4$
 $= 24 - 4 + 4 = 24$
10. a) $a = 2$, because $2 + 14 = 16$
b) $b = -4$, because $-4 + 14 = 10$
c) $x = 17$, because $17 - 2 = 15$
11. a) $p = 3$, because $8 \times 3 = 24$
b) $16 - 10 = 6$ so $2b = 16$
 $2b \div 2 = b$ $16 \div 2 = 8$
So $b = 8$

$$\text{c) } 3 + 2 = 5 \text{ so } \frac{1}{4}b = 3$$

$$\frac{1}{4}b \times 4 = b$$

$$3 \times 4 = 12$$

$$\text{So } b = 12.$$

$$\text{d) } 3g - 1 = 8$$

$$9 - 1 = 8 \text{ so } 3g = 9$$

$$3g \div 3 = g \quad 9 \div 3 = 3$$

$$\text{So } g = 3$$

12. 11 hours

13. 4 bottles

14. a) $312 - 72 = \text{GH}\text{¢}240$

b) $240 \div 15 = 16$ weeks

15. GH¢76

Topic 3: Geometry and measurement

1. a) 5 faces and 9 edges b) cone
c) 6 faces in a square shape d) rectangle
e) triangle f) triangle
g) rectangle
2. a) triangle-based pyramid b) hexagon-based prism
c) rectangular prism d) cube
3. a) north-west b) south
c) Bolgatana d) Accra
4. a) black arrow b) orange star c) yellow star
d) There are several possible answers. One suggestion is: Move 4 squares east. Move 6 squares north. Move 1 square east.
5. a) reflection b) rotation c) translation
6. Check learners' drawings
7. a) $\begin{pmatrix} 11 \\ -3 \end{pmatrix}$ b) $\begin{pmatrix} 0 \\ -10 \end{pmatrix}$ c) $\begin{pmatrix} -5 \\ 11 \end{pmatrix}$ d) $\begin{pmatrix} -4 \\ -8 \end{pmatrix}$

Topic 4: Data

1. Discrete data can be counted and takes on an integer value, for example the number of people who bought cars in a year. It is drawn as points on a graph.
Continuous data is not restricted to a whole number (defined value) and can take on any value in a range of

values, for example temperature over a given time period.
It is drawn as a line joining points on a graph.

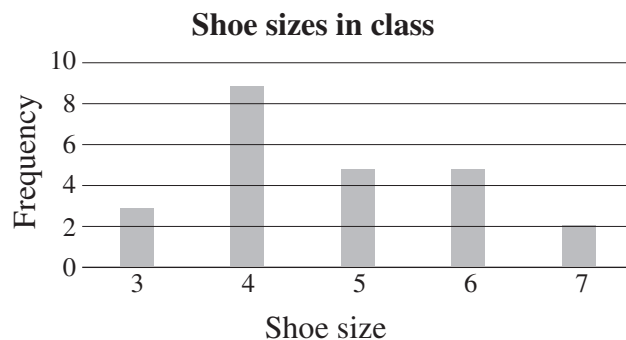
2. a) Day 4 b) 150 pages
c) 5 more pages d) Days 2, 3 and 4
e) Day 5 f) 10 pages
g) Yao h) Yes, on Day 4
i) 5 pages
j)

	Pages read				
	Day 1	Day 2	Day 3	Day 4	Day 5
Yao	25	30	35	40	20
Efua	5	50	25	40	30

3. a)

Shoe size	Tally	Frequency
3	III	3
4	HHH IIII	9
5	HHH	5
6	HHH	5
7	II	2
Total		24

- b) size 4
c) $\frac{3}{24}$ or $\frac{1}{8}$
d) sizes 5 and 6
e) 37.5%
f)



4. a) 1
b) Learners' own answers, depends on weather
c) 0.5
d) 0
5. Learners' own answers. In theory, the outcome for an even number should be 0.5.

Workbook answers

Topic 1: Number

Quantities and place value up to 1,000,000

Exercise 1

WB page 1

1. a) and b)

Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
2	3	4	8	5	9	4
1	5	6	9	2	3	7
7	8	2	3	4	5	9

2. a) 9 thousands
b) 9 ones
3. a) 2 hundreds
b) 2 ten thousands
4. a) 3 tens
b) 3 thousands
5. 6 ten thousands
6. 4 hundreds
7. a) 1,569,237
b) 7,823,459

Exercise 2

WB page 2

1. a) 2,543,00
b) 7,264,000
c) 9,452,000
2. a) 357
b) 278
3. a) 2,030
b) 2,360
4. a) 31,200
b) 42,600
5. a) 2,450,000
b) 5,320,000
6. Learners' own work

Exercise 3

WB page 7

1. a) Two **million**, four hundred and sixty-**eight** thousand, three **hundred** and **fifty-nine**
 b) **Four** million, **one hundred and** thirty-**six thousand**, eight hundred and **ninety-one**
2. a) Three hundred and forty-five thousand, six hundred and seventy-eight
 b) Two hundred and forty-five thousand, eight hundred and thirty-nine
 c) Two million, four hundred and sixty-seven thousand, eight hundred and forty-three
 d) One million, four hundred and sixty-eight thousand, nine hundred and four
3. a) 456,738
 Digits: 700
 Word form: seven hundred
 b) 367,894
 Digits: 60,000
 Word form: sixty thousand
 c) 2,456,739
 Digits: 450,000
 Word form: four hundred and fifty thousand
 d) 7,456,264
 Digits: 7,450,000
 Word form: seven million, four hundred and fifty thousand
4. a) $800,000 + 90,000 + 4,000 + 100 + 30 + 4$
 b) $50,000 + 6,000 + 400 + 50 + 7$
 c) $1,000,000 + 200,000 + 30\ 000 + 4,000 + 500 + 60 + 3$

Exercise 4

WB page 9

Whole number	Expanded form	Word form
3,966,124	$3,000,000 + 900,000 + 60,000 + 6,000 + 100 + 20 + 4$	Three million, nine hundred and sixty-six thousand one hundred and twenty-four
1,128,175	$1,000,000 + 100,000 + 20,000 + 8,000 + 100 + 70 + 5$	One million, one hundred and twenty-eight thousand one hundred and seventy-five

Whole number	Expanded form	Word form
9,134,215	9,000,000 + 100,000 + 30,000 + 4,000 + 200 + 10 + 5	Nine million, one hundred and thirty-four thousand, two hundred and fifteen
6,751,313	6,000,000 + 700,000 + 50,000 + 1,000 + 300 + 10 + 3	Six million, seven hundred and fifty-one thousand, three hundred and thirteen
203,767	200,000 + 3,000 + 700 + 60 + 7	Two hundred and three thousand and sixty-seven
8,401,186	8,000,000 + 400,000 + 1,000 + 100 + 80 + 6	Eight million, four hundred and one thousand, one hundred and eighty-six

Exercise 5

WB page 9

1. a)

Number	10 less	10 more
23,465	23,455	23,475
	100 less	100 more
	23,365	23,565
	1,000 less	1,000 more
	22,465	24,465
	10,000 less	10,000 more
	13,465	33,465

b)

Number	10 less	10 more
34,567	34,557	34,577
	100 less	100 more
	34,467	34,667
	1,000 less	1,000 more
	33,567	35,567
	10,000 less	10,000 more
	24,567	44,567

c)

Number	10 less	10 more
435,780	435,770	435,790
	100 less	100 more
	435,680	435,880
	1,000 less	1,000 more
	434,780	436,780
	10,000 less	10,000 more
	425,780	445,780

d)

Number	10 less	10 more
2,367,892	2,367,882	2,367,902
	100 less	100 more
	2,367,792	2,367,992
	1,000 less	1,000 more
	2,366,892	2,368,892
	10,000 less	10,000 more
	2,357,892	2,377,892

2.
 - a) greater than
 - b) less than
 - c) less than
 - d) equal to
3.
 - a) <
 - b) <
 - c) <
 - d) >
4.
 - a) 53,691; 112,234; 124,567; 213,491; 241,600
 - b) 256,712; 354,269; 1,812,365; 2,389,412; 3,213,574
5.
 - a) 632,415; 459,742; 235,671; 38,285; 17,639
 - b) 3,369,134; 3,344,565; 3,229,812; 3,025,689; 326,813

Roman numerals up to C

Exercise 1

WB page 12

1.

Hindu Arabic number	Roman numeral
1	I
50	V
10	X
50	L
100	C

2.

Roman numeral	Calculations	Hindu Arabic number
VIII	$V + I + I + I = 5 + 1 + 1 + 1 =$	8
XXI	$X + X + I = 10 + 10 + 1 =$	21
C	$C = 100$	100
XXVII	$X + X + V + I + I = 10 + 10 + 5 + 1 + 1 =$	27
LXXXI	$L + X + X + X + I = 50 + 10 + 10 + 10 + 1 =$	81
LXIV	$L + X + (V - I) = 50 + 10 + (5 - 1) =$	64
XCVI	$(C - X) + V + I = (100 - 10) + 5 + 1 =$	96
XLV	$(L - X) + V = (50 - 10) + 5 =$	45
LXXXIX	$L + X + X + X + (X - I) = 50 + 10 + 10 + 10 + (10 - 1) =$	89
XXXVI	$X + X + X + V + I = 10 + 10 + 10 + 5 + 1 =$	36
LVII	$L + V + I + I = 50 + 5 + 1 + 1 =$	57
LIX	$L + (X - I) = 50 + (10 - 1) =$	59
XII	$X + I + I = 10 + 1 + 1$	12
XIV	$X + (V - I) = 10 + (5 - 1) =$	14
XCIV	$(C - X) + (V - I) = (100 - 10) + (5 - 1) =$	94

3.

- | | | |
|----------|----------|------------|
| a) LIX | b) XXIV | c) LXXVIII |
| d) XXIII | e) XLVI | f) XXXIX |
| g) XIV | h) XVIII | i) XXV |
| j) LXV | k) LII | l) XXI |

Exercise 2

WB page 14

1.	+	I	III	IV	V	IX
	VIII	IX	XI	XII	VIII	XVII
	X	XI	XIII	XIV	XV	XIX
	XV	XVI	XVIII	XIX	XX	XXIV
	XXV	XXVI	XXVIII	XXIX	XXX	XXXIV

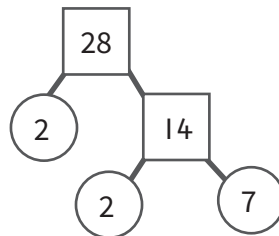
2.	–	III	VI	XIX	XV	IV
	LX	LVII	LIV	XLI	XLV	LVI
	C	C – III = XCVII	XCIV	LXXXI	LXXXV	XCVI
	XXV	XXII	XIX	VI	X	XXI
	XLIII	XL	XXXVII	XXIV	XXVIII	XXXIX

Factors, multiples and prime numbers from 1 to 100

Exercise 1

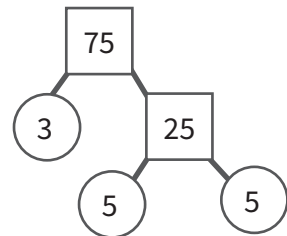
WB page 15

1. a)



$$28 = 2 \times 2 \times 7$$

b)



$$75 = 3 \times 5 \times 5$$

2. a) 2×17
 b) $2 \times 2 \times 2 \times 2 \times 2 \times 2$
 c) 2×23
 d) $2 \times 3 \times 39$

Exercise 2

1. a) $32 = 2 \times 2 \times 2 \times 2 \times 2$

$40 = 2 \times 2 \times 2 \times 5$

$\text{HCF} = 2 \times 2 \times 2 = 8$

b) $16 = 2 \times 2 \times 2 \times 2$

$64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$\text{HCF} = 2 \times 2 \times 2 \times 2 = 16$

2. a) $9 = 3 \times 3$

$12 = 2 \times 2 \times 3$

$\text{LCM} = 2 \times 2 \times 3 \times 3 = 36$

b) $8 = 2 \times 2 \times 2$

$14 = 2 \times 7$

$\text{LCM} = 2 \times 2 \times 2 \times 7 = 56$

c) $12 = 2 \times 2 \times 3$

$26 = 2 \times 13$

$\text{LCM} = 2 \times 2 \times 3 \times 13 = 156$

3. a) $9 = 3 \times 3$

$15 = 3 \times 5$

$\text{HCF} = 3; \text{LCM} = 3 \times 3 \times 5 = 45$

b) $15 = 3 \times 5$

$18 = 2 \times 3 \times 3$

$\text{HCF} = 3; \text{LCM} = 2 \times 3 \times 3 \times 5 = 120$

c) $30 = 2 \times 3 \times 5$

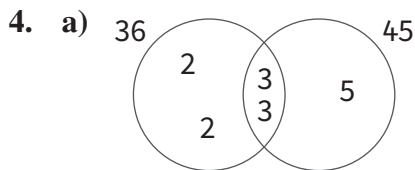
$24 = 2 \times 2 \times 2 \times 3$

$\text{HCF} = 2 \times 3 = 6; \text{LCM} = 2 \times 2 \times 2 \times 3 \times 5 = 120$

d) $9 = 3 \times 3$

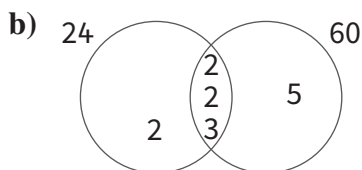
$27 = 3 \times 3 \times 3$

$\text{HCF} = 3 \times 3 = 9; \text{LCM} = 3 \times 3 \times 3 = 27$



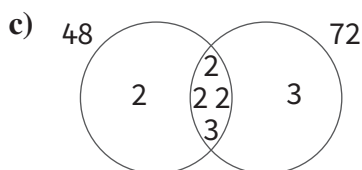
$\text{HCF of } 36 \text{ and } 45 = 3 \times 3 = 9$

$\text{LCM of } 36 \text{ and } 45 = 2 \times 2 \times 3 \times 3 \times 5 = 180$



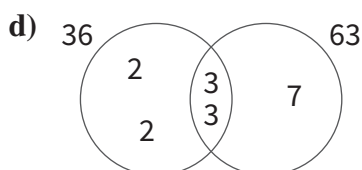
$\text{HCF of } 24 \text{ and } 60 = 2 \times 2 \times 3 = 12$

$$\text{LCM of 24 and 60} = 2 \times 2 \times 2 \times 3 \times 5 = 120$$



$$\text{HCF of 48 and 72} = 2 \times 2 \times 2 \times 3 = 24$$

$$\text{LCM of 48 and 72} = 2 \times 2 \times 2 \times 2 \times 3 \times 3 = 288$$



$$\text{HCF of 36 and 63} = 3 \times 3 = 9$$

$$\text{LCM of 36 and 63} = 2 \times 2 \times 3 \times 3 \times 7 = 252$$

Exercise 3

WB page 18

1. a) $15 = 3 \times 5$
 $35 = 5 \times 7$
 $40 = 2 \times 2 \times 2 \times 5$
 $\text{HCF} = 5; \text{LCM} = 2 \times 2 \times 2 \times 3 \times 5 \times 7 = 840$
- b) $16 = 2 \times 2 \times 2 \times 2$
 $24 = 2 \times 2 \times 2 \times 3$
 $48 = 2 \times 2 \times 2 \times 2 \times 3$
 $\text{HCF} = 2 \times 2 \times 2 = 8; \text{LCM} = 2 \times 2 \times 2 \times 2 \times 3 = 48$
- c) $12 = 2 \times 2 \times 3$
 $32 = 2 \times 2 \times 2 \times 2 \times 2$
 $40 = 2 \times 2 \times 2 \times 5$
 $\text{HCF} = 2 \times 2 = 4;$
 $\text{LCM} = 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 5 = 480$
- d) $12 = 2 \times 2 \times 3$
 $36 = 2 \times 2 \times 3 \times 3$
 $48 = 2 \times 2 \times 2 \times 2 \times 3$
 $\text{HCF} = 2 \times 2 \times 3 = 12;$
 $\text{LCM} = 2 \times 2 \times 2 \times 2 \times 3 \times 3 = 144$
- e) $42 = 2 \times 3 \times 7$
 $48 = 2 \times 2 \times 2 \times 2 \times 3$
 $54 = 2 \times 3 \times 3 \times 3$
 $\text{HCF} = 2 \times 3 = 6;$
 $\text{LCM} = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 7 = 3,024$

Apply mental mathematics strategies and number properties for multiplication and division

Exercise 1

WB page 19

1. a)

×	3	0	5	7	9
3	9	0	15	21	27
4	12	0	20	28	36
6	18	0	30	42	54
8	24	0	40	56	72

b)

×	2	1	6	9	11
2	4	2	12	18	22
4	8	4	24	26	44
5	10	5	30	45	55
7	14	7	42	63	77
9	18	9	54	81	99

2. a) $12 + 12 = 24$

b) $48 \div 2 = 24$

c) $30; 30 + 30 = 60$

d) $28; 28 + 28 = 56$

e) $30; 30 + 30 = 60$

3. a) $4 \times 9 = (40 - 4) = 36 \leftarrow 4 \times 10 = 40 \rightarrow 4 \times 11 = (40 + 4) = 44$

b) $8 \times 9 = (80 - 8) = 72 \leftarrow 8 \times 10 = 80 \rightarrow 8 \times 11 = (80 + 8) = 88$

c) $6 \times 9 = (60 - 9) = 54 \leftarrow 6 \times 10 = 60 \rightarrow 6 \times 11 = (60 + 6) = 66$

d) $7 \times 9 = (70 - 9) = 63 \leftarrow 7 \times 10 = 70 \rightarrow 7 \times 11 = (70 + 7) = 77$

e) $3 \times 9 = (30 - 3) = 27 \leftarrow 3 \times 10 = 30 \rightarrow 3 \times 11 = (30 + 3) = 33$

Exercise 2

WB page 20

1. a) $35 \times 10 = 350 \leftarrow 350 \times 100 = 35,000$
 $\rightarrow 35,000 \times 1,000 = 35,000,000$
- b) $15 \times 10 = 150 \leftarrow 150 \times 10 = 1,500 \rightarrow 1,500 \times 10$
 $= 15,000$
- c) $2 \times 100 = 200 \leftarrow 200 \times 10 = 2,000 \rightarrow 2,000 \times 100$
 $= 200,000$
- d) $36 \times 10 = 360 \leftarrow 360 \times 1,000 = 360,000$
 $\rightarrow 360,000 \times 10 = 3,600,000$
2. a) $4 \times (10 + 5) = (4 \times 10) + (4 \times 5) = 40 + 20 = 60$
- b) $5 \times (20 + 4) = (5 \times 20) + (5 \times 4) = 100 + 20 = 120$
- c) $6 \times (20 + 6) = (6 \times 20) + (6 \times 6) = 120 + 36 = 156$
- d) $7 \times (30 + 2) = (7 \times 30) + (7 \times 2) = 210 + 14 = 254$

Multiply multi-digit numbers

Exercise 1

WB page 21

1. a) $164 + 40 = 200$

\times	20	5
8	160	40

- b) $240 + 30 = 270$

\times	40	5
6	240	30

- c) $200 + 24 = 224$

\times	50	6
4	200	24

- d) $(600 + 120) + (50 + 10)$
 $= 720 + 60$
 $= 780$

\times	60	5
10	600	50
2	120	10

$$\begin{aligned} \text{e) } & (2,000 + 1,400) + (100 + 70) + (60 + 42) \\ & = 3,400 + 170 + 102 \\ & = 3,672 \end{aligned}$$

×	200	10	6
10	2,000	100	60
7	1,400	70	42

2. a) 2,788

$$\begin{array}{r} 82 \\ \times 34 \\ \hline 328 \\ + 2460 \\ \hline 2788 \end{array}$$

b) 1,088

$$\begin{array}{r} 68 \\ \times 16 \\ \hline 408 \\ + 680 \\ \hline 1088 \end{array}$$

c) 7,425

$$\begin{array}{r} 275 \\ \times 27 \\ \hline 1925 \\ + 5500 \\ \hline 7425 \end{array}$$

d) 4,672

$$\begin{array}{r} 146 \\ \times 32 \\ \hline 292 \\ + 4380 \\ \hline 4672 \end{array}$$

e) 3,082

$$\begin{array}{r} 134 \\ \times 23 \\ \hline 402 \\ + 2680 \\ \hline 3082 \end{array}$$

f) 3,690

$$\begin{array}{r} 205 \\ \times 18 \\ 1640 \\ + 2050 \\ \hline 3690 \end{array}$$

g) 21,148

$$\begin{array}{r} 622 \\ \times 34 \\ 2488 \\ + 18660 \\ \hline 21148 \end{array}$$

3. Learners' own answers

4. Learners' own answers

Exercise 2

WB page 24

1. a) 1,694

	1	2	1	
	0	0	0	1
		1	2	1
1	0	0	0	4
		4	8	4
	6	9	4	

b) 5,850

	3	2	5	
	0	0	0	1
		3	2	5
5	2	1	4	8
		4	6	0
	8	5	0	

c) 5,005

	1	4	3	
	0	1	0	3
		3	2	9
5	0	2	1	5
		5	0	5
	0	0	5	

d) 32,535

	7	2	3	
3	2	0	1	4
	8	8	2	
2	3	1	1	5
	5	0	5	
	5	3	5	

e) 30,885

	1	4	5	
	0	0	1	2
	2	8	0	
3	0	0	0	1
	1	4	5	
0	0	1	1	3
	3	2	5	
	8	8	5	

f) 61,857

	2	3	7	
	0	0	1	2
	4	6	4	
6	1	1	4	6
	2	8	2	
1	0	0	0	1
	2	3	7	
	8	5	7	

g) 71,504

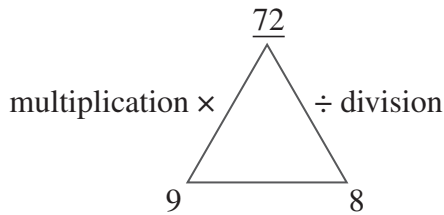
	3	2	8	
	0	0	1	2
	6	4	6	
7	0	0	0	1
	3	2	8	
1	2	1	6	8
	4	6	4	
	5	0	4	

Manipulate numbers using division facts

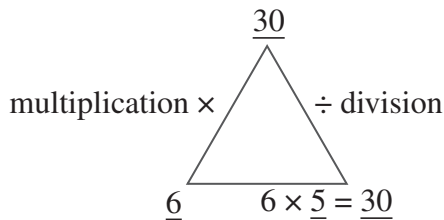
Exercise 1

WB page 25

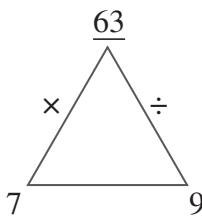
1. a)



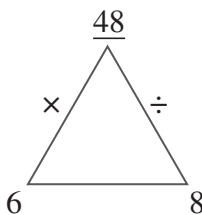
b)



2. a)



b)



3. a) The last digit is an even number or zero.
b) The sum of the digits is divisible by 3.
c) The last 2 digits are divisible by 4.
d) No, not always.
e) If the last digit is 5 or zero.

4.

Number	Divisible by	Divisible by	Divisible by	Divisible by
55	5	11		
255	3	5	17	
84	2	3	7	
230	2	5	10	23
74	2	37		
112	2	4	7	8
432	2	4	8	9
2,706	2	3	6	11
610	2	5	10	
384	2	3	4	6 and 8
4,992	2	3	4	6 and 8

Divide 2- or 3-digit numbers by 1- or 2-digit numbers

Exercise 1

WB page 27

1. a)

$$\begin{array}{r}
 117 \\
 5 \overline{) 586} \\
 \underline{- 5} \\
 8 \\
 \underline{- 5} \\
 36 \\
 \underline{- 35} \\
 1
 \end{array}$$

b)

$$\begin{array}{r}
 39 \\
 24 \overline{) 936} \\
 \underline{- 72} \\
 216 \\
 \underline{- 216} \\
 0
 \end{array}$$

$936 \div 24 = 39$

$586 \div 5 = 117 \text{ remainder } 1$

c)

$$\begin{array}{r}
 20 \\
 12 \overline{) 250} \\
 \underline{- 24} \\
 10
 \end{array}$$

$250 \div 12 = 20 \text{ remainder } 10$

d)

$$\begin{array}{r}
 75 \\
 14 \overline{) 1,050} \\
 \underline{- 98} \\
 70 \\
 \underline{- 70} \\
 0
 \end{array}$$

$1,050 \div 14 = 75$

$$\begin{array}{r} \text{e)} \quad \quad \quad 28 \\ 15 \overline{) 432} \\ \underline{- 30} \\ 132 \\ \underline{- 120} \\ 12 \end{array}$$

$$432 \div 15 = 28 \text{ remainder } 12$$

$$\begin{array}{r} \text{2. a)} \quad \quad 21 \\ 40 \overline{) 850} \\ \underline{- 80} \\ 50 \\ \underline{- 40} \\ 10 \end{array}$$

$$850 \div 40 = 21 \text{ remainder } 10$$

$$\begin{array}{r} \text{c)} \quad \quad \quad 29 \\ 18 \overline{) 535} \\ \underline{- 36} \\ 175 \\ \underline{- 162} \\ 13 \end{array}$$

$$535 \div 18 = 29 \text{ remainder } 13$$

$$\begin{array}{r} \text{e)} \quad \quad \quad 321 \\ 15 \overline{) 4815} \\ \underline{- 45} \\ 31 \\ \underline{- 30} \\ 15 \\ \underline{- 15} \\ 0 \end{array}$$

$$4,815 \div 15 = 321$$

$$\begin{array}{r} \text{b)} \quad \quad \quad 17 \\ 29 \overline{) 493} \\ \underline{- 29} \\ 203 \\ \underline{- 203} \\ 0 \end{array}$$

$$493 \div 29 = 17$$

$$\begin{array}{r} \text{d)} \quad \quad \quad 519 \\ 27 \overline{) 1,377} \\ \underline{- 135} \\ 27 \\ \underline{- 27} \\ 0 \end{array}$$

$$1,377 \div 27 = 51$$

$$\begin{array}{r} \text{f)} \quad \quad \quad 201 \\ 12 \overline{) 2,418} \\ \underline{- 24} \\ 18 \\ \underline{- 12} \\ 6 \end{array}$$

$$2,418 \div 12 = 201 \text{ remainder } 6$$

Translate word problems into mathematical sentences and solve

Exercise 1

WB page 28

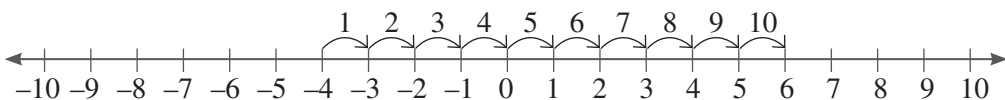
1. Total number of cakes = $4 \times 12 = 48$
 $48 \div 24 = 2$
So, each learner will receive 2 cakes.
2. $(12 + 12) \times 4 = 96$ kg of food needed for 24 animals.
 $4,896 \div 96 = 51$
So, the farmer will be able to feed the animals for 59 days.
3. $(15 \times 2) + (6 \times 2) + (3 \times 2) = 30 + 12 + 6 = 48$
Fifi's purchase will cost GH¢48. No, he will not have enough money.
4. a) $1,944 \div 12 = 162$. One payment = GH¢162.
 $162 \times 5 = \text{GH¢}810$
So, she has paid off GH¢810 after 5 months.
b) $1,944 - 810 = 1,134$
Her balance after 5 months is GH¢1,134.

Understand integers

Exercise 1

WB page 29

1. a) +2; -2
b) +5; -5
c) The sum of the same digit with opposite signs equals zero.
d) $-10 + 10 = 0$
- 2.



3. a) > b) < c) > d) >

Exercise 2

1.
 - a) $D = 0$
 - b) $G = 15$
 $G - D$
 $15 - 0 = 15$
 - c) -15
 - d) $F = 9$
 $G = 15$
 So, $F < G$
 - e) $F = 9$
 $9 > -9$
 So, $F > -9$
 - f) On the number line, the distance from B to 6 is 4 units.
 $1 \text{ unit} = 3 \text{ values}$
 So, $4 \text{ units} = 4 \times 3 = 12$
 - g) On the number line, the distance from D to A is 4 units.
 $1 \text{ unit} = 3 \text{ values}$
 So, $4 \text{ units} = 4 \times 3 = 12$
 - h) On the number line, the distance from -15 to G is 30 units.
 $1 \text{ unit} = 3 \text{ values}$
 So, $30 \text{ units} = 10 \times 3 = 30$
2.
 - a) $A = -25$
 $B = -20$
 $C = -10$
 $D = -5$
 $E = 5$
 $F = 15$
 $G = 20$
 $H = 25$
 - b) $B = -20$
 $D = -5$
 So, $D - B = -5 - (-20) = 15$
 - c) $D = -5$
 $G = 20$
 So, $G - D = 20 - (-5) = 25$
 - d) $E = 5$
 $B = -20$
 So, $B - E = -20 - 5 = -25$

- e) i) smaller than
 ii) greater than
 iii) equal to
3. a) -10 b) 1 c) -6 d) 7
 e) -7 f) -8 g) 0 h) -1
 i) -11 j) 11

Exercise 3

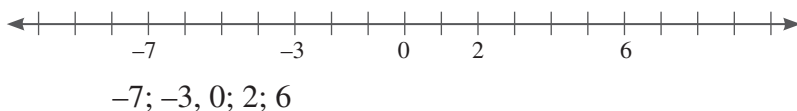
WB page 32

1. a) 1 b) 10 c) 9 d) -12
 e) -1 f) -9; -7 g) smaller; -7
 h) 0
2. a) < b) < c) > d) <
 e) < f) > g) > h) >
 i) < j) > k) >

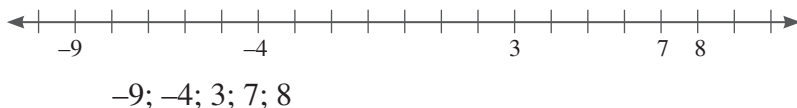
Exercise 4

WB page 33

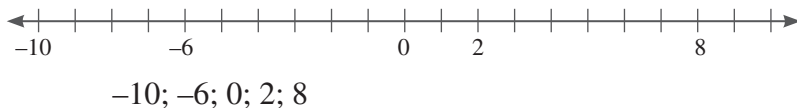
1. a)



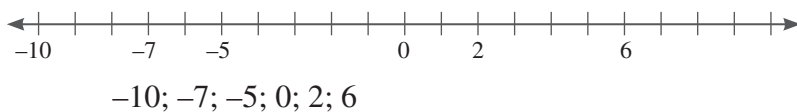
b)



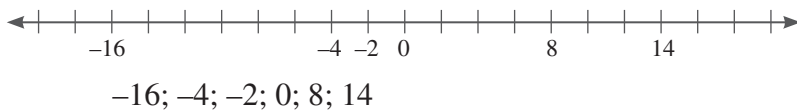
c)



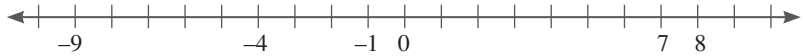
d)



e)

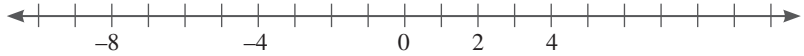


2. a)



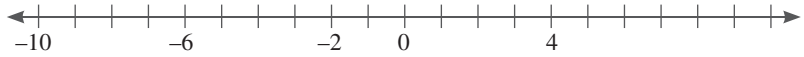
8; 7; 0; -1; -4; -9

b)



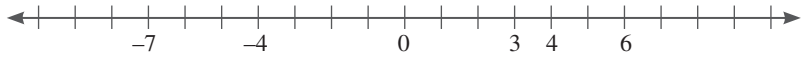
4; 2; 0; -4; -8

c)



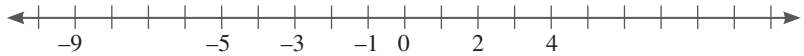
4; 0; -2; -6; -10

d)



6; 4; 3; 0; -4; -7

e)



4; 2; 0; -1; -3; -5; -9

Exercise 5

WB page 35

1. a) -8; -3; -2; 7; 4; 7
b) -5; -1; 0; 4; 8; 10
c) -9; -5; -3; -1; 2; 4; 5
d) -8; -7; -2; 0; 3; 6; 9
e) -12; -8; -5; -1; 3; 6; 12
2. a) 8; 3; 2; 1; -4; -5; -6; -8
b) 12; 9; 5; 4; 0; -6; -18
c) 20; 15; 4; -1; -8; -9; -13
d) 17; 10; 6; 3; -2; -3; -11; -12
e) 13; 6; 5; 2; -2; -5; -6; -13

Exercise 6

WB page 36

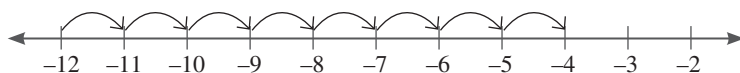
1. a) -5°
b) -10 m
c) -25 litre
d) -12 m
e) +7 cm
f) -GH¢100
g) -GH¢200
h) -10°
i) +20 km/h
j) -6%

2. a) $-2; -3; -1; 0; -2$
 b) $5; 4; 6; 7; 5$
 c) $-1; -2; 0; 1; -1$
 d) $16; 15; 17; 18; 16$
 e) $-8; -9; -7; -6; -8$
 f) $-11; -12; -10; -9; -11$

Exercise 7

WB page 37

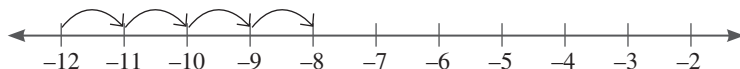
1. a) -4



- b) 2



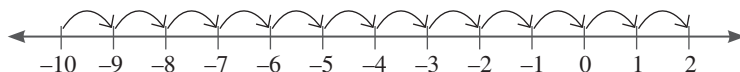
- c) -8



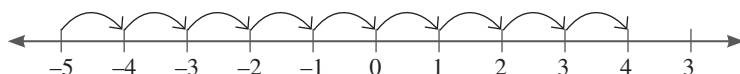
- d) 12



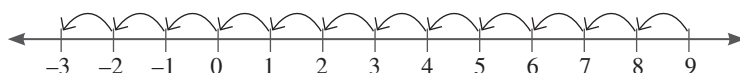
- e) 2



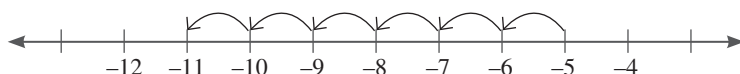
- f) 4



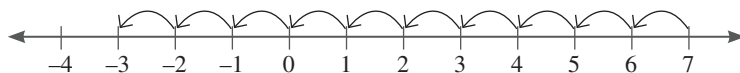
2. a) -3



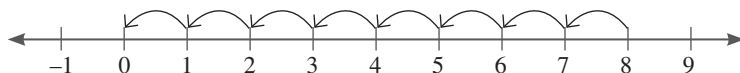
- b) -11



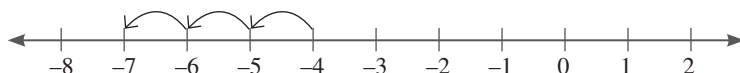
c) -3



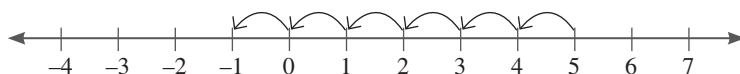
d) 0



e) -7



f) -1



Exercise 8

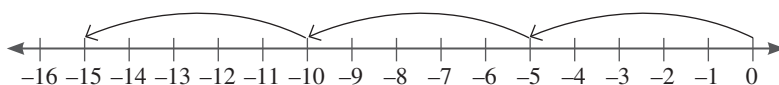
WB page 39

1. a) 5 b) -5 c) 21
 d) -5 e) -11 f) 7
 g) -5 h) -12 i) -7
 j) 0
2. a) $13 - 8 = 5$
 The new temperature is 5°C .
 b) $5 - 7 = -2$
 The temperature is -2°C .
 c) $-2 + 10 = 8$
 The new temperature is 8°C .
3. a) 11 b) 7 c) 10
 d) 5 e) 9 f) -4
 g) -13 h) 5

Exercise 9

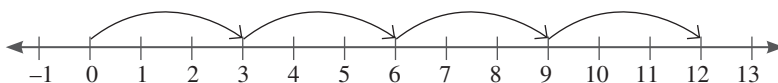
WB page 40

1. a) -15



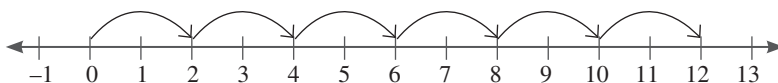
The product is -15 .

b) 12



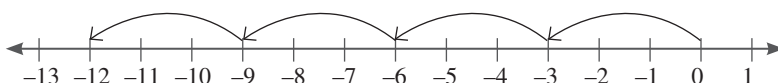
The product is 12.

c) 12



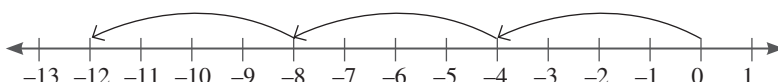
The product is 12.

d) -12



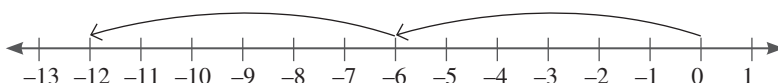
The product is -12.

e) -12



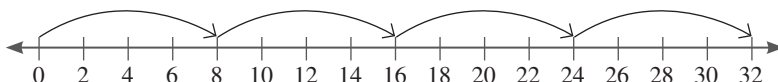
The product is -12.

f) -12



The product is -12.

g) 32



The product is 32.

Exercise 10

WB page 41

- | | | |
|-----------|--------|--------|
| 1. a) -20 | b) -18 | c) 24 |
| d) -15 | e) 28 | f) -28 |
| g) -30 | h) -24 | i) -45 |
| j) 42 | k) -48 | l) -36 |

2. a) If $-2 \times 3 = -6$, then $-2 \times 6 = -6 + (-6) = -12$
- b) If $-4 \times 8 = -32$, then $-4 \times 4 = -32 \div 2 = -16$
- c) If $-3 \times 10 = -30$, then $-3 \times 9 = (-30 - (-3)) = -27$
- d) If $-5 \times 10 = -50$, then $-5 \times 11 = (-50 + (-5)) = -55$
- e) $-4 \times 16 = -4(10 + 6) = (-4 \times 10) + (-4 \times 6)$
 $= -40 + (-24) = -64$
- f) $-6 \times 14 = -6(10 + 4) = (-6 \times 10) + (-6 \times 4)$
 $= -60 + (-24) = -84$

Exercise 11

WB page 42

1. a) $3 \times 6 = 18$
Kwaku baked 18 cookies.
- b) -11
- c) $18 - 11 = 7$
- d) 7 cookies remained
- e) $18 - (+11) = 7$
- f) Learners' own answers
2. a) 1 hour = 60 min; $(60 \times 3) \div 20 = 9$
The lawnmower will have used 9 litres of petrol after 1 hour.
- b) -3
- c) $3 \times 3 = 3 + 3 + 3 = 9$ litres of petrol
- d) $15 - 9 = 6$
So, 6 litres of petrol is left after an hour.
- e) $6 - 9 = -3$
No, the lawnmower will not have enough petrol for 2 hours.
3. $(6 \times 3) + (3 \times 2) = 18 + 6 = 24$
Junior bought 24 toffees and pieces of chewing gum.
4. $3 \times 10 = 30$; $2 \times 10 = 20$
There are 30 pencils and 20 erasers in 10 boxes.
5. $3 \times 9 = 27$
Sally buys 27 packets of peanuts for nine trips.

Compare, add, subtract, multiply and divide fractions

Exercise 1

WB page 44

1.

	Fraction	HCF	Simplified fraction
a)	$\frac{10}{15}$	5	$\frac{2}{3}$
b)	$\frac{9}{18}$	9	$\frac{1}{2}$
c)	$\frac{18}{24}$	6	$\frac{3}{4}$
d)	$\frac{32}{40}$	2	$\frac{16}{25}$
e)	$\frac{4}{32}$	4	$\frac{1}{8}$
f)	$\frac{8}{36}$	4	$\frac{2}{9}$
g)	$\frac{9}{36}$	9	$\frac{1}{4}$
h)	$\frac{18}{45}$	3	$\frac{6}{15}$
i)	$\frac{25}{40}$	5	$\frac{5}{8}$
j)	$\frac{36}{42}$	6	$\frac{6}{7}$
k)	$\frac{8}{12}$	4	$\frac{2}{3}$
l)	$\frac{16}{40}$	8	$\frac{2}{5}$
m)	$\frac{6}{30}$	6	$\frac{1}{5}$
n)	$\frac{14}{49}$	7	$\frac{2}{7}$
o)	$\frac{10}{25}$	5	$\frac{2}{5}$
p)	$\frac{9}{63}$	9	$\frac{1}{7}$

2.

	Fraction	Multiplying numerator and denominator by a factor of HCF	Equivalent
a)	$\frac{2}{5}$	4	$\frac{8}{20}$
b)	$\frac{9}{10}$	3	$\frac{27}{30}$
c)	$\frac{7}{13}$	2	$\frac{14}{26}$
d)	$\frac{3}{7}$	5	$\frac{15}{35}$
e)	$\frac{1}{5}$	6	$\frac{6}{30}$
f)	$\frac{5}{6}$	3	$\frac{15}{18}$

Exercise 2

WB page 45

1. a) > b) < c) > d) = e) <

$$\begin{aligned}
 2. \quad a) &= \frac{20}{28}, \frac{18}{28}, \frac{14}{28}, \frac{5}{28} \\
 &= \frac{5}{28}, \frac{14}{28}, \frac{18}{28}, \frac{20}{28} \\
 &= \frac{5}{28}, \frac{2}{4}, \frac{9}{14}, \frac{5}{7}
 \end{aligned}$$

$$\begin{aligned}
 b) &= \frac{25}{30}, \frac{6}{30}, \frac{12}{30}, \frac{15}{30} \\
 &= \frac{5}{6}, \frac{1}{5}, \frac{2}{5}, \frac{3}{6}
 \end{aligned}$$

$$\begin{aligned}
 c) &= \frac{8}{24}, \frac{12}{24}, \frac{8}{24}, \frac{15}{24} \\
 &= \frac{1}{3}, \frac{2}{6}, \frac{2}{3}, \frac{5}{8}
 \end{aligned}$$

$$\begin{aligned}
 d) &= \frac{12}{18}, \frac{4}{18}, \frac{12}{18}, \frac{13}{18} \\
 &= \frac{2}{3}, \frac{2}{9}, \frac{2}{3}, \frac{13}{18}
 \end{aligned}$$

$$3. \quad a) = \frac{3}{4}, \frac{2}{5}, \frac{1}{6}$$

Exercise 3

WB page 46

$$1. \quad a) \frac{6}{10} = 0.6$$

$$b) 0.44$$

$$c) \frac{1}{3} = 0.33\dots$$

$$d) 0.625$$

$$e) 0.66\dots$$

$$f) \frac{1}{5} = \frac{2}{10} = 0.2$$

2. a) $\frac{40}{100} = 40\%$
 b) $\frac{25}{100} = 25\%$
 c) $\frac{15}{100} = 15\%$
 d) $\frac{755}{1000} = 75.5\%$
 e) 25%
 f) $\frac{125}{1000} = \frac{12.5}{100} = 12.5\%$
3. a) $\frac{44}{100} = 44\%$
 b) $6\frac{5}{10} = \frac{65}{10} = \frac{650}{100} = 650\%$
 c) $\frac{875}{1000} = \frac{87.5}{100} = 87.5\%$
 d) $\frac{7}{10} = \frac{70}{100} = 70\%$
 e) $\frac{66}{100} = 66\%$
 f) $\frac{125}{1000} = \frac{12.5}{100} = 12.5\%$

Exercise 4

WB page 47

	Fraction	Decimal	Percentage
a)	$\frac{1}{5}$	0.2	20%
b)	$\frac{375}{1000} = \frac{3}{8}$	0.375	37.5%
c)	$\frac{8}{10} = \frac{4}{5}$	0.8	80%
d)	$\frac{36}{50} = \frac{72}{100}$	0.72	72%
e)	$\frac{42}{100} = \frac{21}{50}$	0.42	42%
f)	$6\frac{5}{10} = 6\frac{1}{2}$	6.5	650%
g)	$\frac{9}{12} = \frac{3}{4} = \frac{75}{100}$	0.75	75%
h)	$\frac{2}{100} = \frac{1}{50}$	0.02	2%
i)	$\frac{11}{25} = \frac{44}{100}$	0.44	44%

Exercise 5

WB page 47

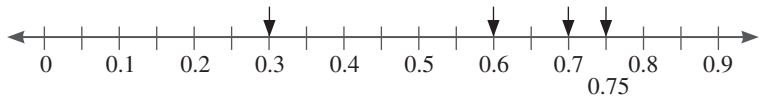
1. a) $>$ b) $>$ c) $>$
 d) $=$ e) $<$ f) $=$

2. a) $= 0.82; 0.8; 0.85; 0.67; 0.875$



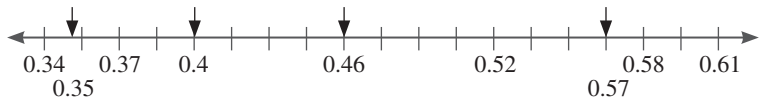
$$\frac{7}{8}; 85\%; 0.82; \frac{4}{5}; \frac{2}{3}$$

- b) $= 0.7; 0.75; 0.6; 0.3$



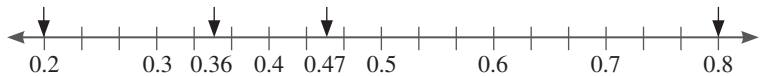
$$\frac{9}{12}; 70\%; 0.6; \frac{1}{3}$$

- c) $= 0.4; 0.46; 0.35; 0.57$



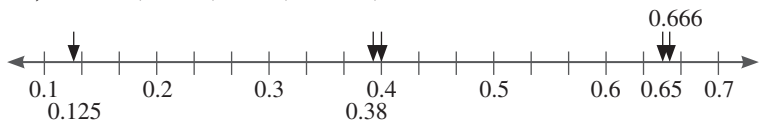
$$4; 7; 0.4; 35\%$$

3. a) $= 0.6; 0.47; 0.8; 0.2$



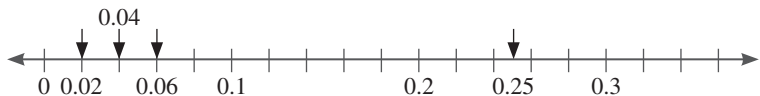
$$20\%; 0.36; \frac{47}{100}; \frac{8}{10}$$

- b) $= 0.4; 0.38; 0.65; 0.125; 0.666$



$$\frac{1}{8}; 0.38; 40\%; 65\%; 0.666$$

- c) $= 0.04; 0.02; 0.06; 0.25$



$$\frac{2}{100}; 0.04; 6\%; \frac{2}{8}$$

$$4. \quad 75\% = \frac{75}{100} = \frac{3}{4}$$

$$\frac{8}{10} = \frac{4}{5}$$

$$\frac{9}{12} = \frac{3}{4}$$

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

$$66.6\% = 66\frac{6}{10}$$

$$\frac{6}{8} = \frac{3}{4}$$

So, $\frac{8}{10}$ and 66.6% are not equal to $\frac{3}{4}$.

Exercise 6

WB page 49

$$1. \quad \text{a)} \quad \frac{12}{5}$$

$$\text{b)} \quad \frac{15}{4}$$

$$\text{c)} \quad \frac{14}{3}$$

$$\text{d)} \quad \frac{45}{7}$$

$$\text{e)} \quad \frac{64}{11}$$

$$2. \quad \text{a)} \quad 1\frac{2}{3}$$

$$\text{b)} \quad 2\frac{2}{7}$$

$$\text{c)} \quad 1\frac{6}{15} = 1\frac{2}{5}$$

$$\text{d)} \quad 4$$

$$\text{e)} \quad \frac{13}{3} = 4\frac{1}{3}$$

$$\text{f)} \quad 3\frac{1}{11}$$

Exercise 7

WB page 50

$$1. \quad \text{a)} \quad \frac{7}{5} = 1\frac{2}{5}$$

$$\text{b)} \quad 3 - 3\frac{3}{9}$$

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

$$= -\frac{1}{3}$$

$$\text{c)} \quad \frac{93}{7} - \frac{54}{7}$$

$$= \frac{39}{7}$$

$$= 5\frac{4}{7}$$

$$\text{d)} \quad 10\frac{5}{6}$$

$$\text{e)} \quad \frac{18}{12}$$

$$= 1\frac{6}{12}$$

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

$$\text{f)} \quad 2\frac{7}{8}$$

$$\begin{aligned}\text{g)} \quad & 6\frac{8}{20} + 3\frac{15}{20} \\ & = 9\frac{23}{20} \\ & = 10\frac{3}{20}\end{aligned}$$

$$\begin{aligned}\text{h)} \quad & 4\frac{7}{10} + 6\frac{5}{10} \\ & = 10\frac{12}{10} \\ & = 11\frac{2}{10} \\ & = 11\frac{1}{5}\end{aligned}$$

$$\begin{aligned}\text{i)} \quad & 5\frac{16}{56} - 2\frac{21}{56} \\ & = 4\frac{72}{56} - 2\frac{21}{56} \\ & = 2\frac{51}{56}\end{aligned}$$

$$\begin{aligned}\text{j)} \quad & \frac{9}{16} - \frac{6}{16} \\ & = \frac{3}{16}\end{aligned}$$

$$\begin{aligned}\text{k)} \quad & 4\frac{21}{30} + 7\frac{20}{30} \\ & = 11\frac{41}{30} \\ & = 12\frac{11}{30}\end{aligned}$$

Exercise 8

WB page 51

$$\begin{aligned}1. \quad & 4\frac{2}{3} - 3\frac{1}{2} \\ & = 4\frac{4}{6} - 3\frac{3}{6} \\ & = 1\frac{1}{6}\end{aligned}$$

Kojo walked $1\frac{1}{6}$ kilometres more.

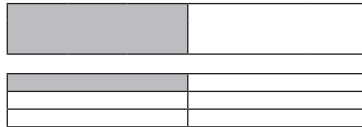
$$2. \quad 7\frac{3}{8} - 4\frac{2}{8} = 3\frac{1}{8}$$

Abena has $3\frac{1}{8}$ m fabric left.

Exercise 9

WB page 51

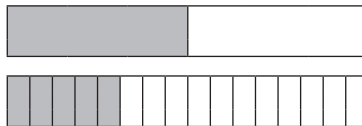
1. a) $\frac{1}{6}$



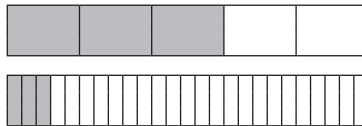
b) $\frac{1}{2} \times \frac{2}{3} = \frac{2}{6}$



c) $\frac{5}{16}$



d) $\frac{8}{25}$



Exercise 10

WB page 52

1. a) $\frac{15}{42} = \frac{5}{14}$ or

$$\frac{5}{6} \times \frac{3}{7} = \frac{5}{2} \times \frac{1}{7} = \frac{5}{14}$$

b) $\frac{14}{45}$

c) $\frac{12}{42} = \frac{2}{7}$ or

$$\frac{4}{7} \times \frac{3}{6} = \frac{2}{7} \times \frac{3}{3} = \frac{2}{7} \times 1 = \frac{2}{7}$$

d) $\frac{16}{40} = \frac{2}{5}$ or

$$\frac{4}{8} \times \frac{4}{5} = \frac{1}{2} \times \frac{4}{5} = 1 \times \frac{2}{5} = \frac{2}{5}$$

2. a) $\frac{4}{1} \times \frac{11}{2}$

$$= 2 \times 11 = 22$$

$$\text{b) } \frac{11}{4} \times \frac{17}{3}$$

$$= \frac{187}{12}$$

$$= 15\frac{7}{12}$$

$$\text{c) } \frac{7}{3} \times \frac{7}{3}$$

$$= \frac{49}{9}$$

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

$$\text{d) } \frac{25}{4} \times \frac{38}{5}$$

$$= \frac{5}{2} \times \frac{19}{1}$$

$$= \frac{95}{2}$$

$$= 47\frac{1}{2}$$

Ratio and its relationship to fractions, multiplication and division

Exercise 1

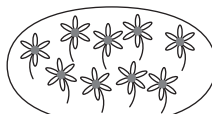
WB page 53

1.
 - a) 6 : 8
 - b) 5 : 10
 - c) 6 : 3
2.
 - a) 2 of shape A can fit into shape B.
 - b) Shape A is $\frac{1}{2}$ of shape B.
 - c) 1 : 2
 - d) 3
 - e) $\frac{1}{3}$
 - f) 1 : 3
 - g) No
 - h) 8 : 12

Exercise 2

WB page 54

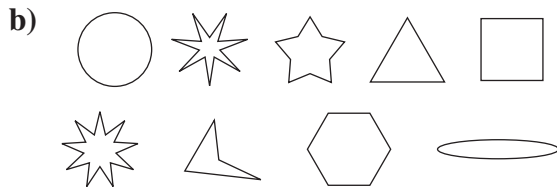
1. a)



- b) 12 photos in one group and 21 photos in the other group
- c) 9 marbles in one group and 12 marbles in the other



Part to whole ratio



Part to part ratio



Part to whole ratio

Exercise 3

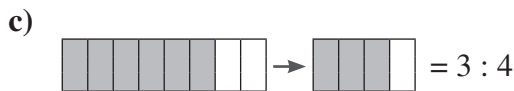
WB page 55

1. a) $\frac{7}{9}$

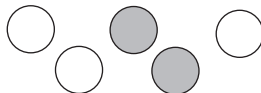
b) $\frac{12}{36} = \frac{1}{3}$

c) $\frac{3}{24} = \frac{1}{8}$

2. a) 1 : 5



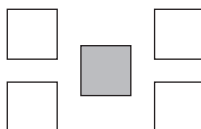
3. a) 2 : 3



b) 1 : 3



c) 1 : 4



Exercise 4

WB page 57

	Ratio	Calculation	Simplest form
1.	$\frac{14}{56}$	$\frac{14 \div 14}{56 \div 14} = \frac{1}{4}$	$\frac{1}{4}$
2.	14 : 21	$14 \div 7 = 2$ $21 \div 7 = 3$	2 : 3
3.	32 : 64	$32 \div 32 = 1$ $64 \div 32 = 2$	1 : 2
4.	$\frac{25}{65}$	$\frac{25 \div 5}{65 \div 5} = \frac{5}{13}$	$\frac{5}{13}$
5.	9 : 3	$9 \div 3 = 3$ $3 \div 3 = 1$	3 : 1
6.	Kwaw reads 5 fiction books and 10 science fiction books	10 : 5 $10 \div 5 : 5 \div 5 = 2 : 1$	2 : 1
7.	12 : 8	$12 \div 4 = 3$ $8 \div 4 = 2$	3 : 2
8.	20 : 32	$20 \div 4 = 5$ $32 \div 4 = 8$	5 : 8
9.	An animal shelter has 12 puppies and 18 kittens to adopt	12 : 18 $12 \div 6 : 18 \div 6 = 2 : 3$	2 : 3
10.	70 : 49	$70 \div 7 = 10$ $49 \div 7 = 7$	10 : 7
11.	9 : 15	$9 \div 3 = 3$ $15 \div 3 = 5$	3 : 5
12.	15 cookies to 40 cakes	15 : 40 $15 \div 5 : 40 \div 5 = 3 : 8$	3 : 8

Exercise 5

1. a) $6 : 4 = 3 : 2$
 b) $\frac{2}{5}$ white paint
 c) $\frac{2}{5}$ of 30 = 12 litres of white paint
 $\frac{3}{5}$ of 30 = 18 litres of green paint
2. a) $\frac{5}{12} \times 36 = 15$ girls in the class
 b) $\frac{5}{12} = \frac{7}{12}$
 $\frac{7}{12} \times 36$
 = 21 boys in the class
 c) boys : girls = 21 : 15
 = 7 : 5
3. a) hockey : soccer = 12 : 8
 = 3 : 2
 b) hockey : total number of cards = 12 : 42
 = 2 : 7
 c) cricket : total = 7 : 42
 = 1 : 6
 d) hockey : basketball = 12 : 15
 = 4 : 5
4. a) Kukua receives $\frac{4}{9}$ of GH¢252 = $\frac{4}{9} \times \frac{252}{1}$
 = $4 \times 28 = \text{GH¢}112$
 Yaw receives $\frac{5}{9}$ of GH¢252 = $\frac{5}{9} \times \frac{252}{1} = 5 \times 28$
 = GH¢140
 b) 112 : 252
 = 4 : 9
5. a) Total number of ice cream sold = 24
 strawberry : total = 3 : 24 = 1 : 8
 b) chocolate : mint = 8 : 6
 = 4 : 3
 c) $240 \div 24 = 10$
 So, one ice cream costs GH¢10.
 d) $8 \times 10 = \text{GH¢}80$
 Chocolate ice cream earned GH¢80.

Exercise 6

WB page 61

1. $\frac{2}{4}$ and $\frac{2}{8}$

$$\frac{2}{4} = \frac{1}{2}$$

$$\text{And } \frac{2}{8} = \frac{1}{4}$$

The ratios are not equivalent.

2.

	Ratio	First equivalent ratio	Second equivalent ratio
a)	2 : 3	8 : 12	10 : 15
b)	$\frac{1}{8}$	$\frac{2}{16}$	$\frac{4}{32}$
c)	13 : 20	26 : 40	39 : 60
d)	3 : 5	12 : 20	18 : 30
e)	$\frac{4}{10}$	$\frac{2}{5}$	$\frac{12}{30}$
f)	4 : 7	12 : 21	16 : 28

3. $60 \div 3 = 20 : 1$

$$\text{And } 90 : 6 = 15 : 1$$

No, the ratio of pages read is not equivalent.

4. $30 : 60 = 1 : 2$

$$\text{And } 45 : 85 = 9 : 17$$

No, the ratios are not equivalent.

5. a) Ama: $10 : 5 = 2 : 1$ and Awo: $12 : 6 = 2 : 1$

b) Yes, the ratios are equivalent forms of each other.

c) bracelets : friends = $2 : 1$

$$2 : 1 = x : 8 \therefore x = 16$$

So, Alena has to make 16 bracelets.

Exercise 7

WB page 62

1.

Water (ℓ)	10	20	25	35	40
Orange juice (ℓ)	30	60	75	105	120

2. apples : tarts = $20 : 5 = x : 20$

$$\therefore x = 80$$

So, Mom would need 80 apples to make 20 tarts.

3. dogs : bag of food = $8 : 1$

$$8 : 1 = 32 : x$$

$$\therefore x = 4$$

So, the shelter needs 4 bags of dog food to feed 32 dogs.

4. flour : pancakes = 3 : 12 = 1 : 4
 $1 : 4 = 9 : x$
 $\therefore x = 36$
 So, you can make 36 pancakes with 9 cups of flour.
5. completed : not complete = 6 : 3 = 24 : 12
 $24 : 12 = 8 : x$
 $\therefore x = 4$
 So, Kacely had 8 + 4 + 12 homework problems in total.
6. texts : calls = 3 : 4; 3 : 4 = 18 : x
 $\therefore x = 24$
 So, Adwana made 24 calls.

Proportion and its relationship to ratios and rates

Exercise 1

WB page 63

1. Means = 5 and 6
 Extremes = 3 and 10
2. a) Not in proportion
 b) In proportion
 c) In proportion
 d) Not in proportion
3. a) $2 : 5 = x : 10$
 $5x = 20; x = 4$
 So, $2 : 5 = 4 : 10$
 b) $4 : 12 = x : 6$
 $12x = 24$
 $\therefore x = 2$
 So, $4 : 12 = 2 : 6$
4. $1 : 7 = x : 35$
 $7x = 35$
 $\therefore x = 5$
 So, 5 pages would hold 35 photos.

Exercise 2

WB page 65

1. $\frac{20}{2} = 10$ words in a minute; $10 \times 10 = 100$.
 So, Sibidoo will be able to type 100 words in 10 minutes.
2. a) $\frac{45}{5} = 9$
 The workers can pick 9 oranges in one minute.

b) $1 \text{ hour} = 60 \text{ min}; 60 \times 9 = 540$

So, the workers can pick 540 oranges in 1 hour.

3. $\frac{124}{6} = 20.66\dots$

The price of one bag of rice is GH¢20.67.

4. Shop 1: $\frac{10}{6} = 1.66$; the price of one box of juice is GH¢1.67.

Shop 2: $\frac{9}{14} = 2.25$; the price of one box of juice is GH¢2.25.

So, she could buy six boxes of juice for GH¢10.

5. $\frac{1}{20} = 0.5$; the price of one can of cola is GH¢0.50.

$15 \times 0.5 = 7.50$

So, the cost of 15 cans of cola is GH¢7.50.

6. $\frac{8}{2} = 4$; Keku's granny uses 4 balls of wool to knit a jersey.

$4 \times 3 = 12$

So, she would need 12 balls of wool to knit 3 jerseys.

Exercise 3

WB page 66

1. a) $15,000 \times 15 = 225,000$

So the length of the river is $225,000 \div 100 = 2,250 \text{ m}$

b) $2,250 \div 1,000 = 2,250 \text{ km}$

c) $150 \times 100,000 = 15,000,000 \text{ cm}$

$15,000,000 \div 5 = 3,000,000$

So the scale is 1 : 3,000,000.

2. $5.5 \times 100 = 550$

So, the actual length of the bedroom is 550 cm.

$550 \div 100 = 5.5$

The actual length is 5.5 m.

3. $125 \text{ m} = 12,500 \text{ cm}$

$\frac{12,500}{500} = 25 \text{ cm}$

So, the model will be 25 cm tall.

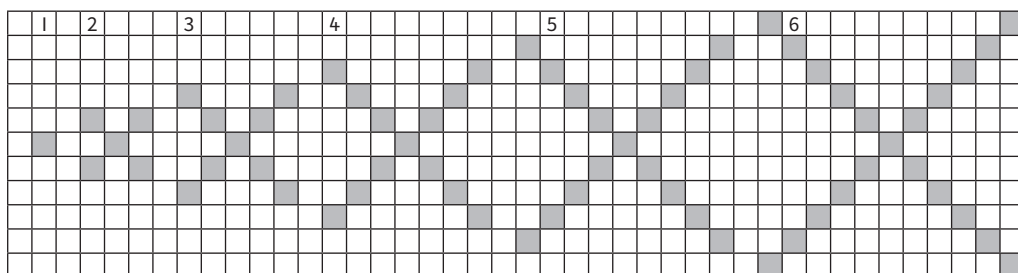
Topic 2: Algebra

Determine the pattern rule to make predictions

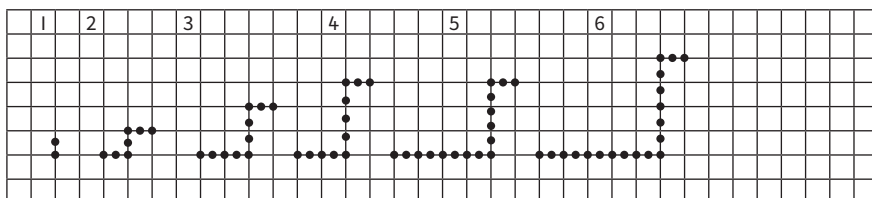
Exercise 1

WB page 67

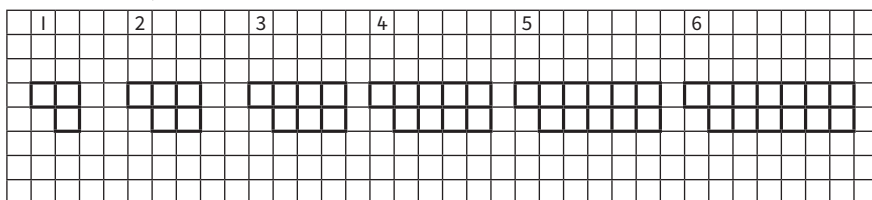
1. a)



b)



c)



2. a) Row 1: □

Row 2: □□□□□□

Row 3: □□□□□□□□□□

Row 4: □□□□□□□□□□□□□□

Row 5: □□□□□□□□□□□□□□□□

Row 6: □□□□□□□□□□□□□□□□□□

b) Five blocks are added each time to the previous row.

c)

Row	1	2	3	4	5	6	7	8	9
Number of blocks	1	6	11	16	21	26	31	36	41

So, row 9 will contain 41 blocks.

3. a)



b) Pattern $\frac{3}{8}$: 16 matches; Pattern 5: 26 matches

Pattern 4: 21 matches; Pattern 6: 31 matches

c) Five matches are added each time to the previous pattern (shape).

Exercise 2

WB page 69

1. a)

Row number	1	2	3	4	5	6
Number of seats	5	7	9	11	13	15

b) The number of seats in a row is twice the row number plus 3.

c) Number of seats in row 6: $(2 \times 6) + 3 = 15$

Number of seats in the whole classroom:

$$5 + 7 + 9 + 11 + 13 + 15 = 60 \text{ seats}$$

2. b) 2; 4; 6; **8; 10; 12**

Proof $4 + 2 = 6$

Next terms: $6 + 2 = 8$; $8 + 2 = 10$; $10 + 2 = 12$

c) 45; 36; **27; 18; 9**

Rule: Start at 45, subtract 9 from the previous number.

Proof: $45 - 9 = 36$

Next terms: $36 - 9 = 27$; $27 - 9 = 18$; $18 - 9 = 9$

d) 6; 14; 22; **30; 38; 46**

Rule: Start at 6, add 8 to the previous number.

Proof: $6 + 8 = 14$

Next terms: $22 + 8 = 30$; $30 + 8 = 38$; $38 + 8 = 46$

e) 2; 5; 10; **17; 26; 37**

Rule: The first two terms are 2 and 5. Find the next terms by adding 2 plus the difference between the previous two terms.

Proof: $5 + 2 + 3 = 10$

Next terms: $10 + 2 + 5 = 17$; $17 + 2 + 7 = 26$;

$26 + 2 + 9 = 37$

OR: Square the term number and add 1 to determine the numbers (terms) in the pattern.

Proof:

Term number	1	2	3	4	5	6
Number	1	5	10	17	26	37

3.

Column A	Column B
Add 7	2; 9; 16; 23; 30
Subtract 4	20; 24; 20; 16; 12
Subtract 3 (remember the rules for integers)	8; 5; 2; -1; -4

Exercise 3

WB page 71

1.

	Column A	Column B
a)	2; 5; 8; 11	$3n + 3$
b)	6; 9; 12; 15	3 times $n + 1$
c)	0; 4; 8; 12	1 less than 3 times n
d)	4; 7; 10	$4(n - 1)$

2.

	Pattern	Rule in words	Algebraic rule
a)	1; 5; 9; 13; ...	Difference is 4. Multiply the term number by 4 and then subtract 3.	$4n - 3$
b)	1; 4; 7; 9; ...	Difference is 3. Rule: Multiply the term number by 3 and then subtract 2.	$3n - 2$
c)	5; 8; 11; 14; ...	Difference is 3. Rule: Multiply the term number by 3 and then add 2.	$3n + 2$

(Note: term number = input)

3.

	Rule	Term 2 ($n = 2$)	Term 5	Term 11
a)	$2n - 3$	$(2)(2) - 3$ $= 1$	$(2)(5) - 3$ $= 7$	$(2)(11) - 3$ $= 19$
b)	$7n + 4$	$(7)(2) + 4$ $= 18$	$(7)(5) + 4$ $= 39$	$(7)(11) + 4$ $= 81$
c)	$5n - 2$	$(5)(2) - 2$ $= 8$	$(5)(5) - 2$ $= 23$	$(5)(11) - 2$ $= 53$

Understand algebraic expressions

Exercise 1

WB page 72

- In a linear relationship, any change in an input value will result in a corresponding change in the output.
- In a proportional relationship, one value increases/decreases as the other value increases/decreases. The ratio always stays the same.

3. a)

Adult	1	2	3	4
Children	6	12	18	24

- Variable: n
- Six times the input (n)
- $6n$
- $6 \times 7 = 42$. So, 42 learners are going to the zoo, if seven adults are to accompany them.

4. a)

Number of sheets	1	2	3	4	5
Cost (GH¢)	1	3	5	7	9

- Multiply the input value by 2 and then subtract 1.
- $2n - 1$
- $(2 \times 8) - 1 = 15$. So, it would cost GH¢15 to print 8 A4 sheets.
- It is a proportional relationship. As the number of A4 colour sheets increases, the cost increases.
- Yes

Exercise 2

WB page 74

1.

	Expression	Terms	Variables	Coefficient	Constant term
a)	$5m + 3p - 7$	3	2	2	1
b)	$4n + 6y + 5$	3	2	2	1
c)	$3x + 2(y + 4) + 5$	3	2	2	2

2.

	Variables	Constants	Coefficient	Expression
a)	$x; y; z$	9	-3; 2; 1	$-3x + 2y + 2 + 9$
b)	$m; n; p$	-4	5; -2; 4	$5m - 2n + 4p - 4$
c)	$s; t$	6	8; 6; 10	$8s + 6t + 10t + 6$

Exercise 3

WB page 74

1. a) $x - 5$

b) $\frac{x}{6}$

c) $11 - a$

d) $y + 8$

e) $3x - 5$

f) $2m + 6$

g) $\frac{12}{3p}$

h) $(p + q) - 7$

2. a) $3a + 2$

b) $\frac{2y - 3}{7}$

c) $\frac{5x}{2} + 8$

3. a) $a \rightarrow \times 2 \rightarrow + 2a$

b) $2 \rightarrow x(y + 3)$
 $= 2 \rightarrow xy \rightarrow + \rightarrow 2 \rightarrow \times 3$

c) $x \rightarrow + 7 \rightarrow \div 2$

Exercise 4

WB page 76

1. a) $P = (2x + 1 + 4)$

$A = 4(2x + 1)$

b) $P = 2(4x + 2 + 2y)$

$A = (4x + 2)(2y)$

Perimeter of figure

$$\begin{aligned} &= 4y + 3 + 3x + 3 + 2y + 8 + 2v + 3 + 3x + 3 + 4y + \\ &\quad 3 + 2 + 3 \\ &= 6x + 12y + 28 \end{aligned}$$

Solve problems with a single variable and a whole number coefficient

Exercise 1

WB page 78

1. a) $x + 2y$
- b) $7 + 4 - 2g$
 $= 11 - 2g$
- c) $9x + 4xy$
- d) $2a + 6a + 4 = 7$
 $= 8a - 3$
- e) $3x + 15 - 2x$
 $= 3x - 2x + 15$
 $= x + 15$
- f) $30 - 18c$
- g) $7x + 3x - 4x + 2y - 4y + y$
 $= 6x - y$
- h) $4mn - 9mn + 6m - 3m + 4n - 5n$
 $= -5mn + 3m - n$
- i) $2p - 3p + 3x - 3x + 5xy - 8xy$
 $= -p - 3xy$

Exercise 2

WB page 79

1. a) $3(4) + 7$
 $= 12 + 7 = 19$
- b) $4(4) + 2 - (3)(4)$
 $= 18 - 12 = 6$
- c) $\frac{(2)(4)}{6} + 5 - 4$
 $= \frac{8}{6} + 5 - 4$
 $= 8 + 30 - 24$
 $= 14$
2. a) $4(2) + 3(4)$
 $= 8 + 12$
 $= 20$

$$\begin{aligned}
 \text{b)} \quad & 3(2)(2) + 5(4) \\
 & = 3(4 + 20) \\
 & = 12 + 60 \\
 & = 72 \\
 \text{c)} \quad & \frac{4(4)}{2(2)} + 3(4) - 6 \\
 & = 4 + 12 - 6 \\
 & = 10
 \end{aligned}$$

Exercise 3

WB page 80

$$\begin{aligned}
 1. \quad & x + 3 = 9 \\
 & x + 3 - 3 = 9 - 3 \\
 & x = 6 \\
 2. \quad & 8p = 72 \\
 & \frac{8p}{8} = \frac{72}{8} \\
 & p = 9 \\
 3. \quad & \frac{y}{7} = 4 \\
 & \frac{y}{7} \times \frac{7}{1} = 4 \times 7 \\
 & y = 28 \\
 4. \quad & 25 - n = 14 \\
 & 26 - n + n = 14 + n \\
 & 25 = 14 + n \\
 & 25 - 14 = 14n - 14 \\
 & n = 11 \\
 5. \quad & m - 5 = 11 \\
 & m - 5 + 5 = 11 + 5 \\
 & m = 16 \\
 6. \quad & 3m = 27 \\
 & \frac{3m}{3} = \frac{27}{3} \\
 & m = 9 \\
 7. \quad & \frac{p}{4} = q \\
 & \frac{p}{4} \times \frac{4}{1} = q \times 4 \\
 & p = 4q
 \end{aligned}$$

8. $x - 7 = 19$
 $x - 7 + 7 = 19 + 7$
 $x = 26$
9. $\frac{14}{x} = 2$
 $\frac{14}{x} \times \frac{x}{1} = 2 \times x$
 $14 = 2x$
 $\frac{14}{2} = \frac{2x}{2}$
 $x = 7$
10. $5 = z - 7$
 $5 + 7 = z - 7 + 7$
 $12 = z$
 $z = 12$
11. $19 + y = 23$
 $19 + y - 19 = 23 - 19$
 $y = 4$
12. $y + 7 = 18$
 $y + 7 - 7 = 18 - 7$
 $y = 11$

Exercise 4







WB page 82

1. a) $x + 4 = 17$
 $x = 13$
- b) $\frac{x}{3} = 8$
 $x = 24$
- c) $x - 6 = 13$
 $x = 19$
2. $\frac{48}{6} = x$
 $x = 8$
The cost of each can of cat food is GH¢8.
3. $4 \times 75 = 300$.
So, Araba earned GH¢300 during the holiday.
4. $x + 14 = 25$
 $x = 11$
So, Aba volunteered 11 hours in the second week.
5. $33 - 8 = x$ or $8 + y = 33$
 $x = 25$ $y = 25$
So, Eba's distance was 25 cm.

6. $12 + y = 25$
 $y = 13$
 So, Kamla's friend has 13 cards.
7. $\frac{1}{3y} = 15$
 $y = 45$
 So, the length of the pool is 45 m.

Exercise 5

WB page 84

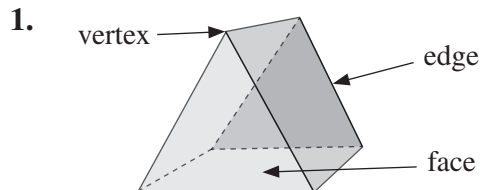
1. a) There are 23 books in total on two shelves. There are 5 books on one shelf. How many books are on the second shelf?
- b) A number minus $7 = 18$. What is the number?
2. a)  +  -  = 5.725
 = 2.725,  = 5.275 and  = 2.275
- b) $5 + 5 + 5 = 15$
 $1 - 5 + 7 = 11$
 $1 + 5 + 7 = 13$
 $\triangle = 1, \square = 5, \bigcirc = 7$

Topic 3: Geometry and measurement

Understand prisms

Exercise 1

WB page 85



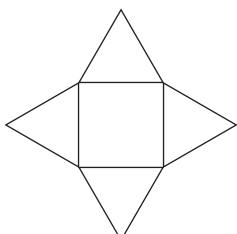
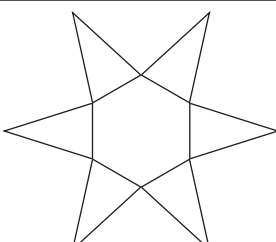
2. a) cylinder
b) pyramid
3. From left to right: triangular pyramid; rectangular prism; hexagonal prism; rectangular prism

Exercise 2

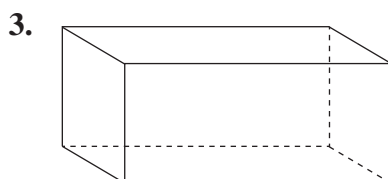
WB page 86

1.

Type of solid	Number of faces	Number of vertices	Number of edges	Draw the net
Rectangular prism	6	8	12	
Cylinder	2	0	2	
Triangular prism	5	6	9	

Type of solid	Number of faces	Number of vertices	Number of edges	Draw the net
Square-based pyramid	5	5	8	
Hexagonal prism	8	12	12	

2. a) Rectangular prism
b) Triangular prism
c) Square-based pyramid
d) Sphere
e) Triangular prism



Exercise 3

WB page 88

1. Rectangle
Trapezium

2.	Shape	Vertical cross section	Horizontal cross section
	Rectangular prism	Square	Rectangle
	Cylinder	Rectangle	Circle
	Square-based pyramid	Triangle	Square
	Triangular prism	Triangle	Rectangle
	Cone	Triangle	Circle
	Triangular pyramid	Triangle	Triangle

3. Yes

- 4.** a) E b) B c) B d) C
 e) A f) A g) E h) E
 i) D j) A

Exercise 4

WB page 90

	Shape	Number of vertices	Number of faces	Number of edges	Diagram of 3D shape
A	Square	8	6	12	Cube
B	Rectangle	8	6	12	Rectangular prism
C	Rectangle	6	5	9	Triangular prism
D	Triangle	6	5	9	Triangular prism
E	Square	5	5	8	Square-based pyramid
F	Hexagon	7	7	12	Hexagonal-based pyramid
G	Triangle	4	4	6	Triangular-based pyramid
H	Pentagon	10	7	15	Pentagonal prism

Exercise 5

WB page 92

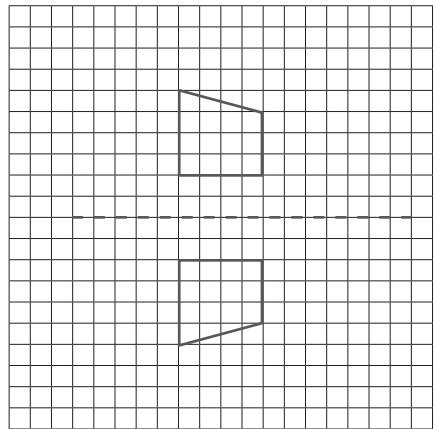
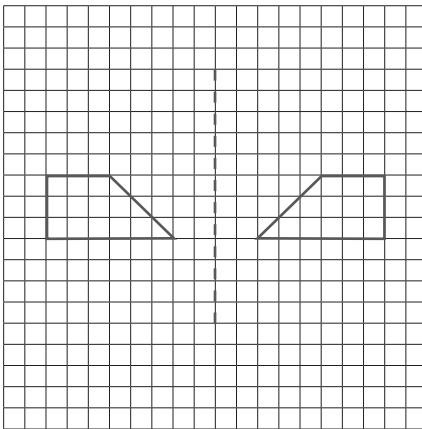
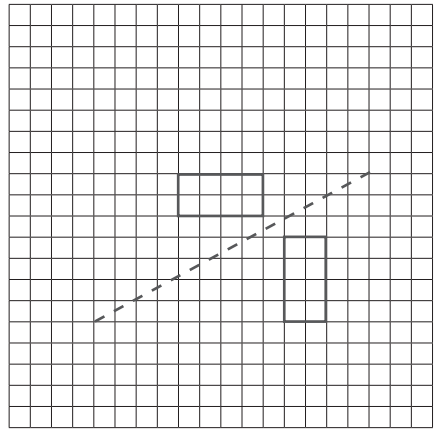
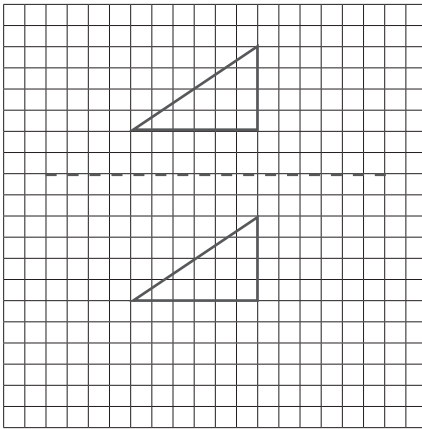
1. Learners' own work
2. Learners' own work
3. Learners' own work

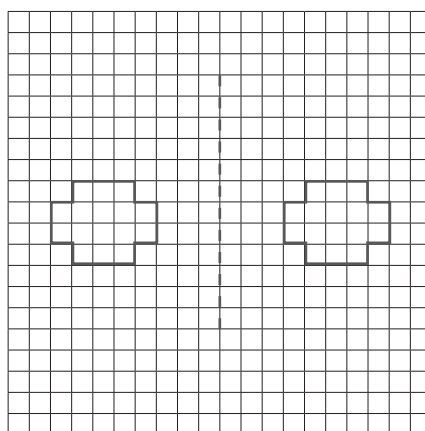
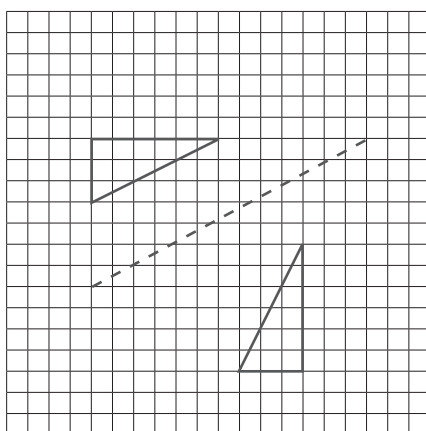
Perform a single translation on a 2D shape

Exercise 1

WB page 97

1.
 - a) Horizontal line of reflection
 - b) Vertical line of reflection
 - c) Horizontal line of reflection
 - d) Diagonal line of reflection
- 2.

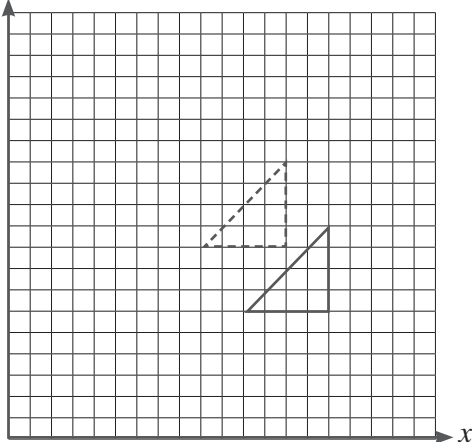




Exercise 2

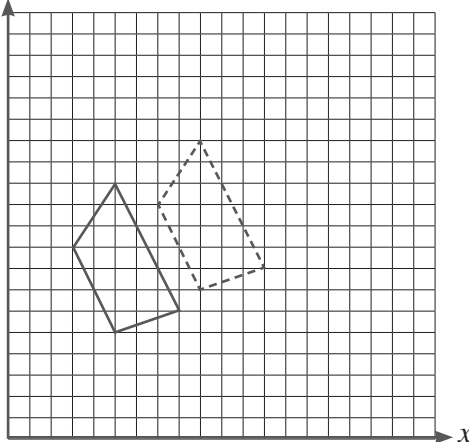
WB page 99

1. a) y



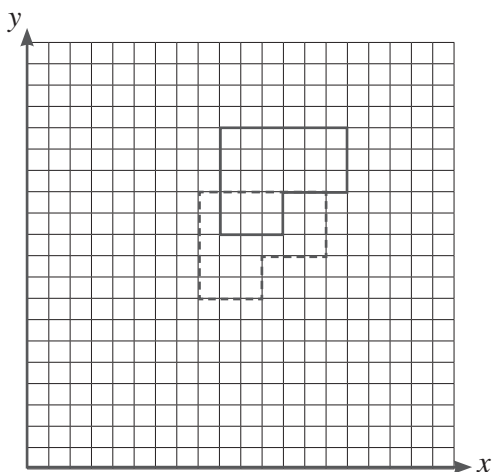
$$\begin{pmatrix} -2 \\ 3 \end{pmatrix}$$

b) y



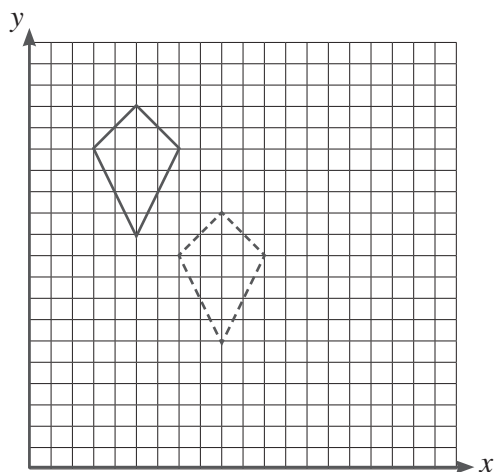
$$\begin{pmatrix} 4 \\ 2 \end{pmatrix}$$

c)



$\begin{pmatrix} -1 \\ -3 \end{pmatrix}$

d)



$\begin{pmatrix} 4 \\ 5 \end{pmatrix}$

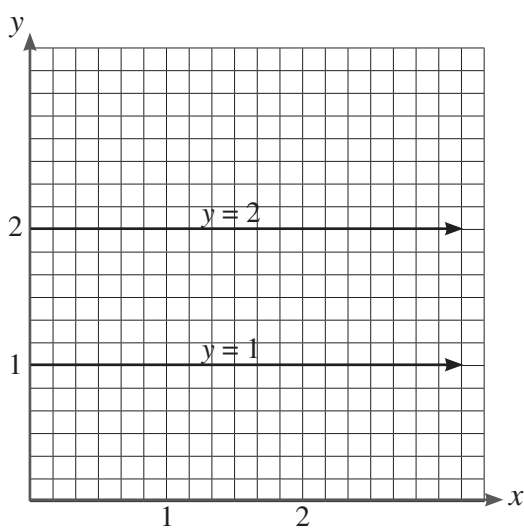
2. a) $\begin{pmatrix} -2 \\ 6 \end{pmatrix}$

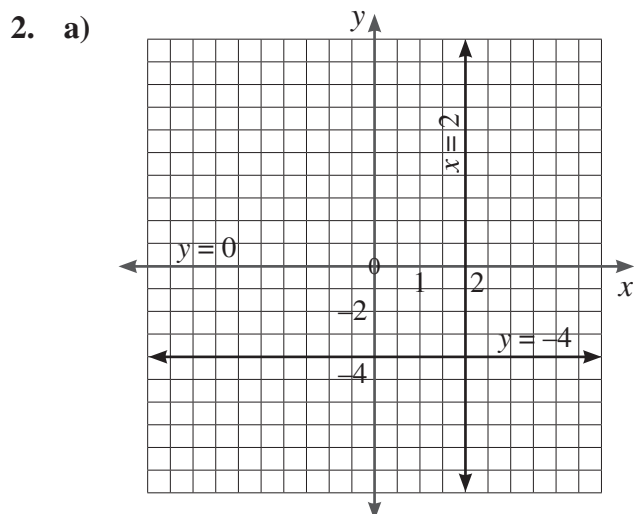
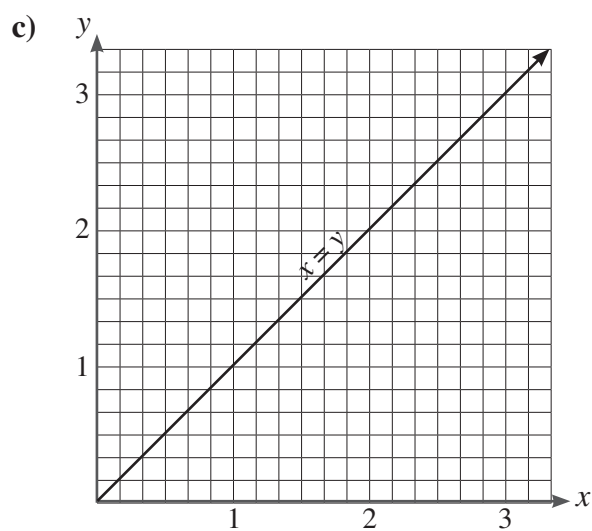
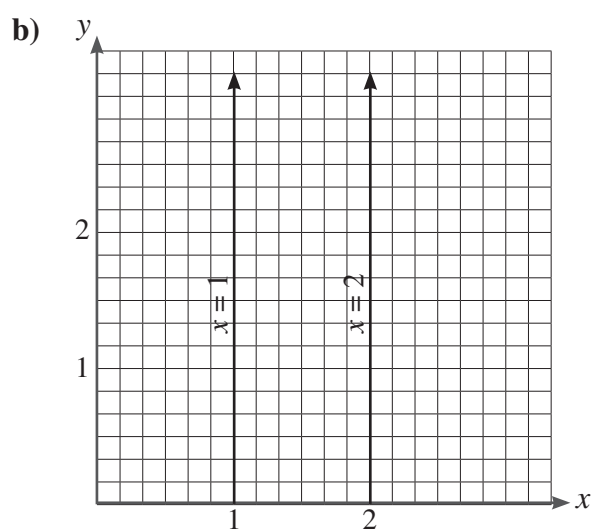
b) $\begin{pmatrix} 0 \\ -13 \end{pmatrix}$

Exercise 3

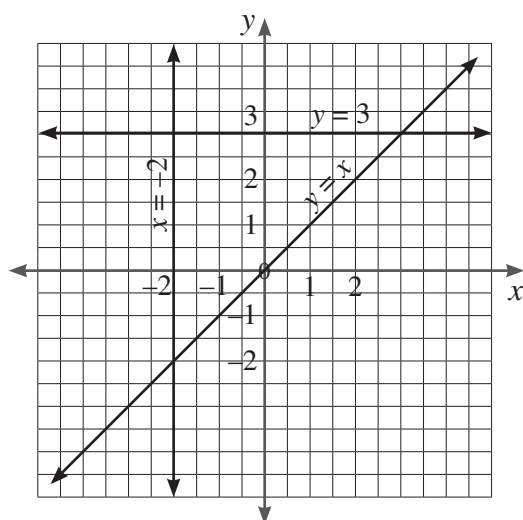
WB page 101

1. a)

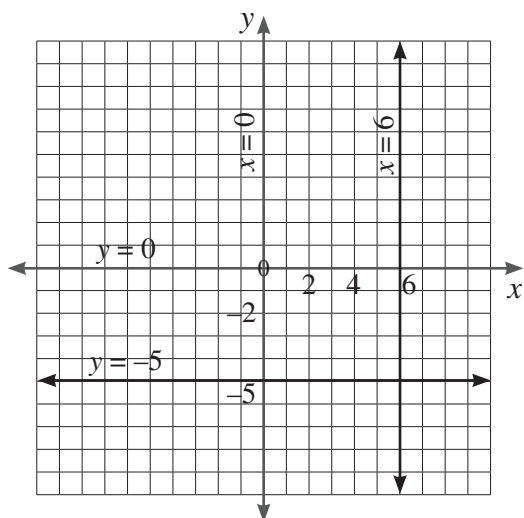




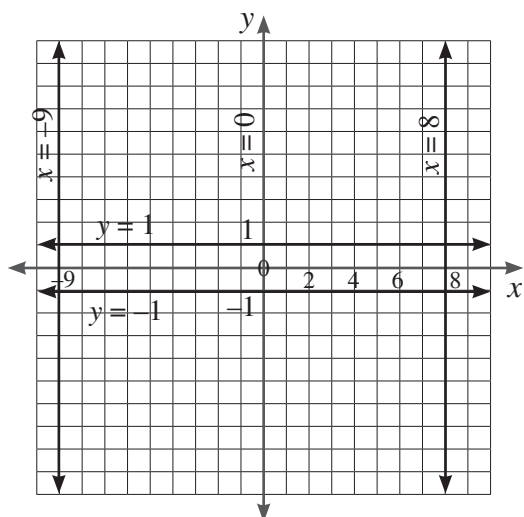
b)



c)

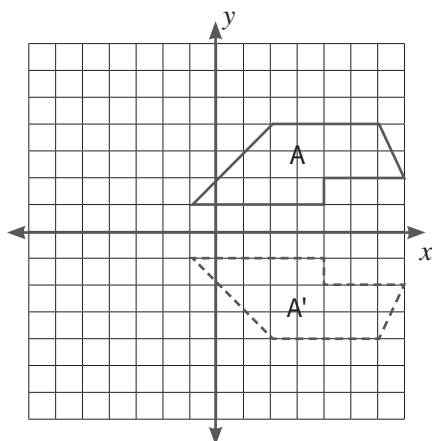


d)

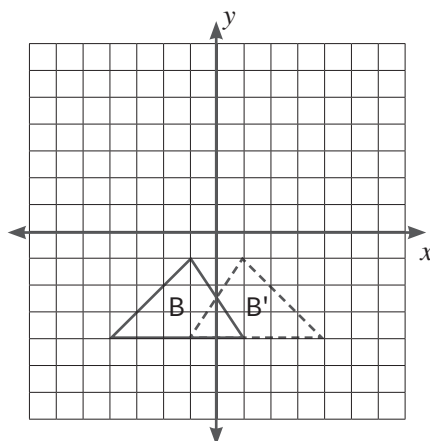


3. a) $a: y = -1$
 b) $b: y = 3$
 c) $c: x = -5$
 d) $d: y = x$

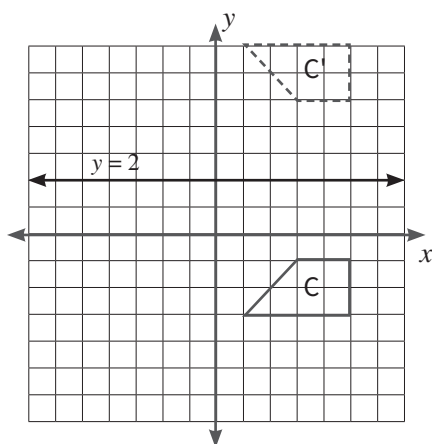
4. a)



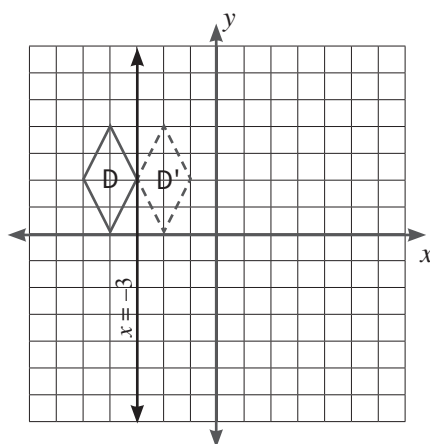
b)



c)



d)



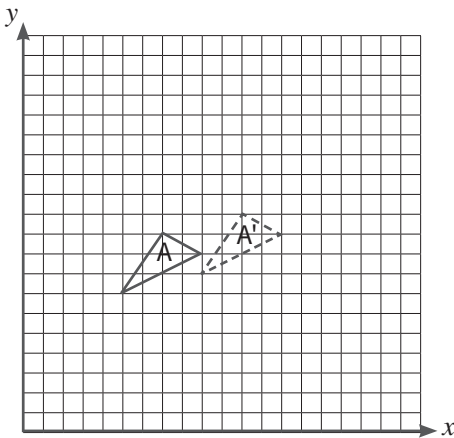
5. a) $x = 1$
 b) $y = x$

Exercise 4

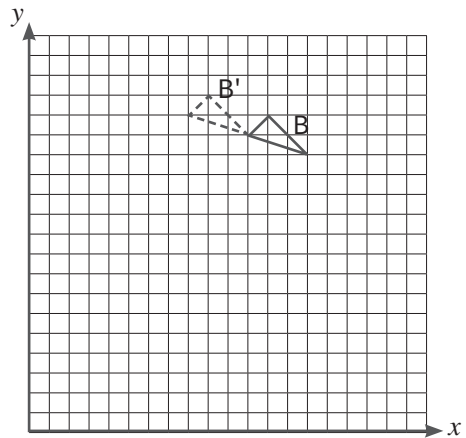
WB page 106

1. a) 6 units to the left and 3 units up
b) 4 units to the right and 2 units down

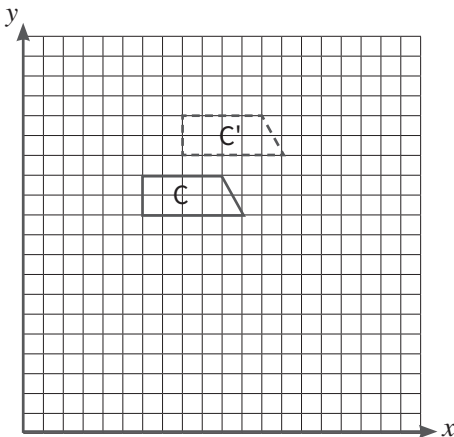
2. a)



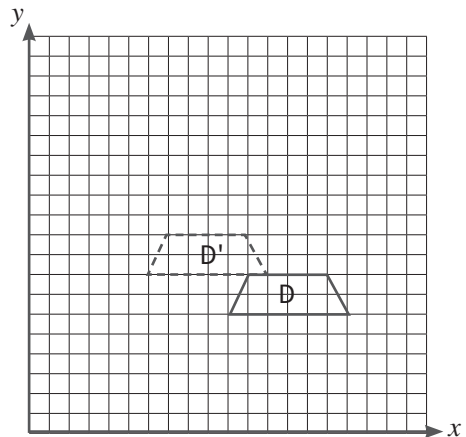
b)



c)

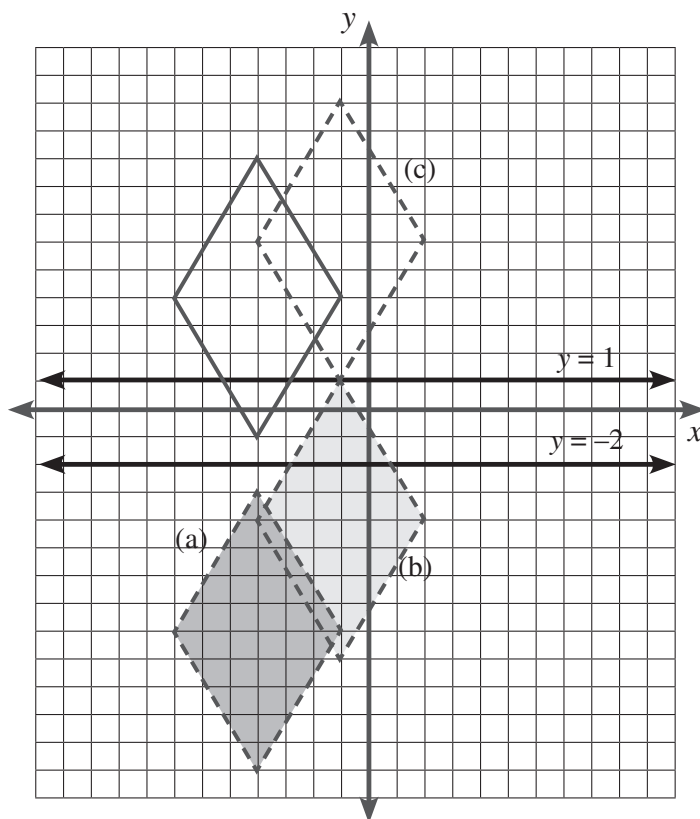


d)



3. a) $\begin{pmatrix} 10 \\ 0 \end{pmatrix}$
b) $\begin{pmatrix} 9 \\ 7 \end{pmatrix}$
c) $\begin{pmatrix} -4 \\ -5 \end{pmatrix}$
d) $\begin{pmatrix} 11 \\ 3 \end{pmatrix}$
e) $\begin{pmatrix} 0 \\ 16 \end{pmatrix}$
f) $\begin{pmatrix} 1 \\ -13 \end{pmatrix}$

4. a) to c)



d) $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$

Topic 4: Data

Create, label and interpret line graphs

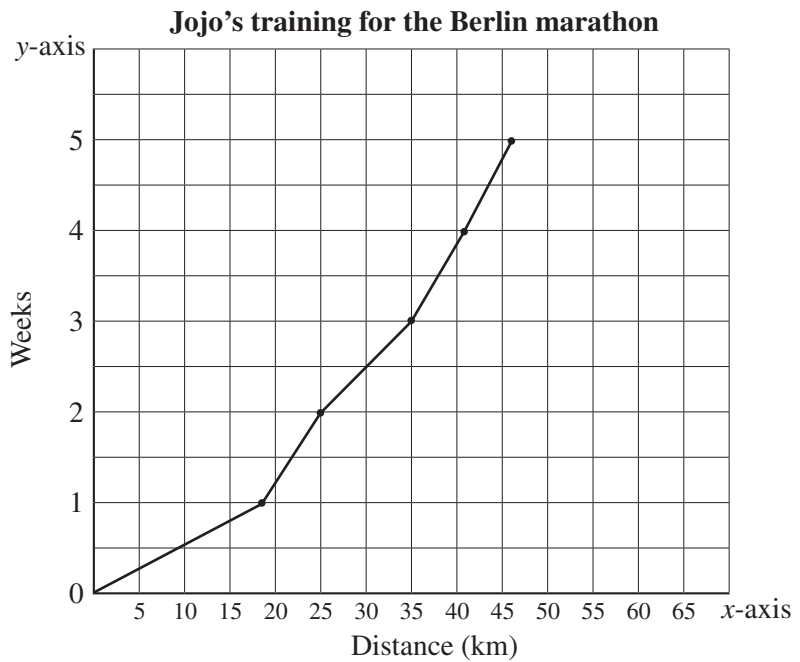
Exercise 1

WB page 109

1. a)

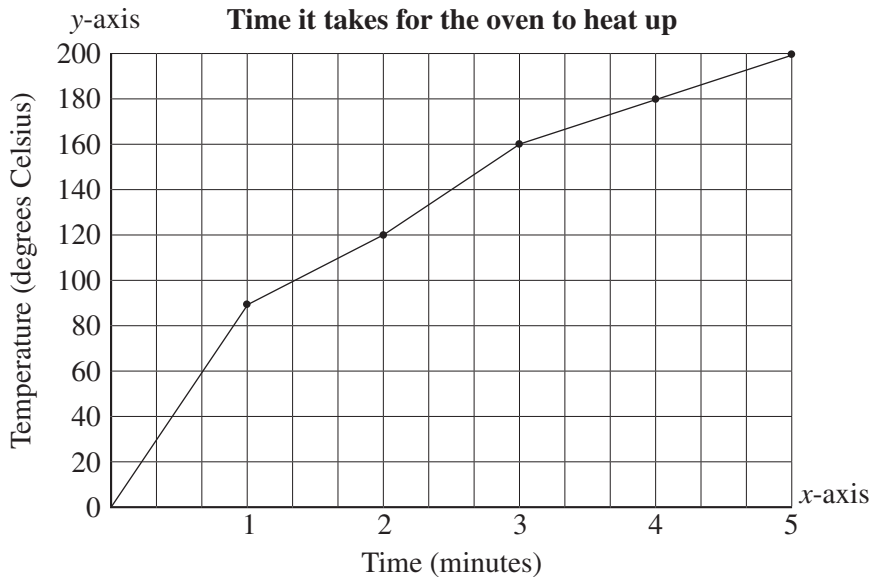
Distance (km)	18	25	35	46	51
Week	1	2	3	4	5

b)



c) Week 4

2. a)



- b) 5 minutes
- c) Between 2 and 3 minutes
- d) Yes, up to the point (temperature) of the oven's temperature capacity.

Exercise 2

WB page 111

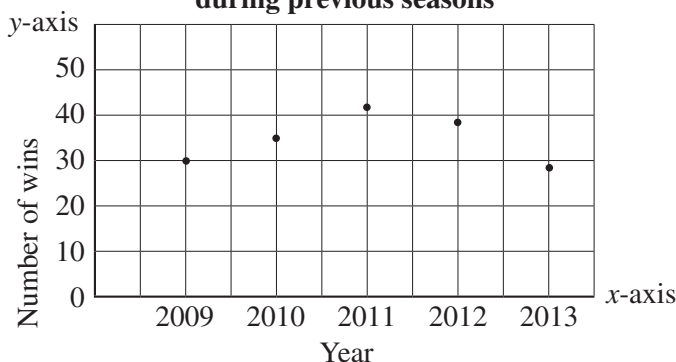
- 1. a) Continuous data can **take any value** in the range of values, so it is represented using a **line graph**.
- b) Discrete data can be **counted**. **Discrete data** is represented by using a **series of points on a graph**.
- 2. Line graph: mass of new-born puppies
Points: number of learners in the school
- 3.

	Data	Continuous or discrete	How to represent data
a)	Number of soccer games won in the season	Discrete	Series of points
b)	Growth of a plant in a year	Continuous	Line graph
c)	Number of sneakers sold at a shoe store	Discrete	Series of points
d)	Distance travelled in car	Continuous	Line graph

	Data	Continuous or discrete	How to represent data
e)	Depth of deep-sea diver below sea level	Continuous	Line graph
f)	Time spent on social media per week	Continuous	Line graph

4. a) Discrete data. The data values are whole numbers.

b) **Number of wins a local soccer club had during previous seasons**



c) 2013

Exercise 3

WB page 113

- 38 people
 - 10 people
 - The number of adults decreased as the weeks go by.
 - Between 4 and 6 people
- 6:00 p.m.
 - 2.75 mm
 - Approximately 5.25 mm
 - Approximately 3 mm
- He travelled 45 km from home.
 - He stopped to rest and drink water.
 - He travelled back home.
 - During the first hour and then again between the 6th and 7th hour and the 7th and 8th hour.
 - 10 km
 - 110 km
 - He became tired; he had to cycle uphill for certain distances; etc.

Select, justify and use appropriate methods of collecting data

Exercise 1

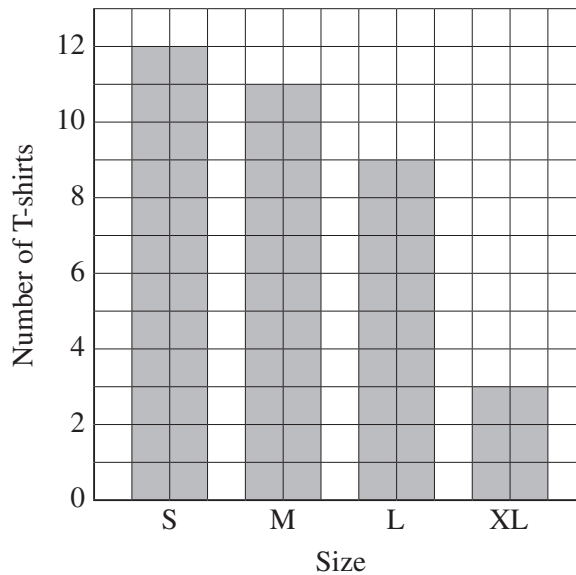
WB page 117

1. a)

Size	Tally	Frequency
S		12
M		11
L		9
XL		3
Total		35

b)

Sizes of T-shirts members of a netball team wear



c) Small

d) Extra large (XL)

2. a)

Stationery item	Tally	Frequency
Erasers	III III	8
Rulers	III III II	12
Pencils	III III III I	16
Files	III III	10
A4 sheets	III III III III	18
Plastic wrap	III	5
Markers	III III	8

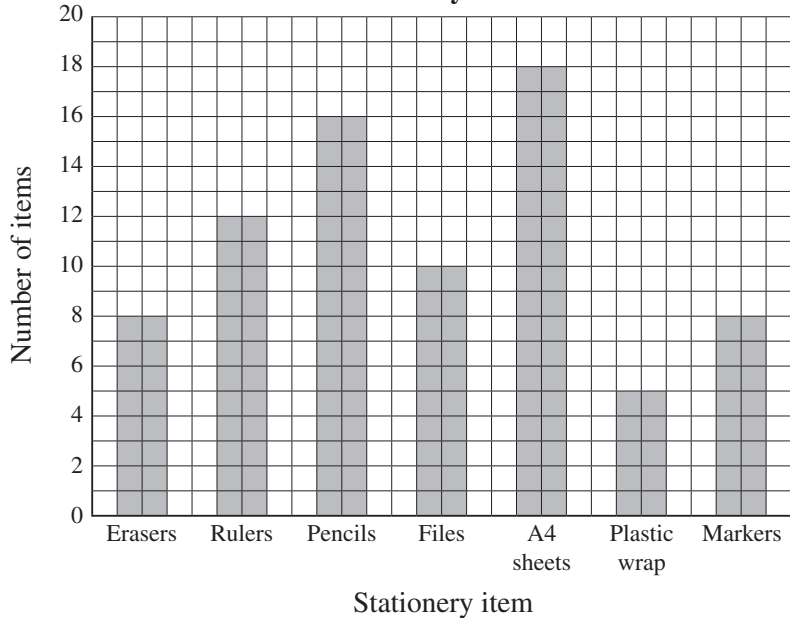
b) A4 sheets

c) Plastic wrap

d) 77 items

e)

Items sold at a stationery store in one weekend

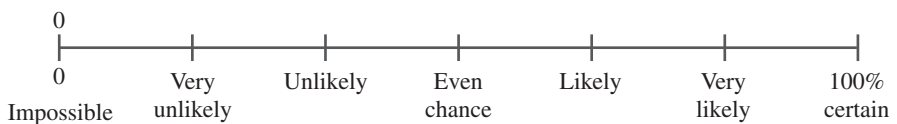


Understand probability

Exercise 1

WB page 119

1.



2. a) Certain

b) Impossible

c) Likely

d) Likely

(Answers to (c) and (d) will depend on learners' own perception and experiences.)

e) Likely

Exercise 2

WB page 120

1. a) i) $\frac{2}{12} = \frac{1}{6}$ ii) $\frac{5}{12}$
b) $\frac{1}{8}$
c) $\frac{0}{21} = 0$
d) Theoretical probability = $\frac{1}{8}$;
experimental probability = 0
2. a)–b) Learners' own work
c) i) $\frac{2}{6} = \frac{1}{3}$
ii) Learners' own answers
iii) Theoretical probability: $\frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$
iv) $\frac{2}{6} = \frac{1}{3}$
3. a) $\frac{10}{50} = \frac{1}{5}$ b) $\frac{1}{6}$
c) $\frac{40}{50} = \frac{4}{5}$ d) $\frac{5}{6}$
e) $\frac{28}{50} = \frac{14}{25}$ f) $\frac{3}{6} = \frac{1}{2}$
4. a) $\frac{1}{2}$ b) $\frac{1}{2}$
5. a) $\frac{12}{50} = \frac{6}{25}$
b) $\frac{12}{50} + \frac{18}{50} = \frac{30}{50} = \frac{3}{5}$
c) $\frac{20}{50} = \frac{2}{5}$
6. a) i) $\frac{15}{100} = \frac{3}{20}$
ii) $\frac{20}{100} = \frac{1}{5}$
b) i) 50 people
ii) 80 people

ESSENTIAL Mathematics Primary 6

Teacher's Guide

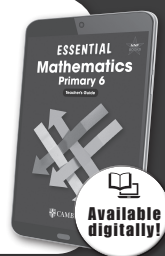
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