Grade 4

MATHEMATICS CONTENT BOOKLET: TARGETED SUPPORT

Term 4

A MESSAGE FROM THE NECT

NATIONAL EDUCATION COLLABORATION TRUST (NECT)

Dear Teachers,
This learning programme and training is provided by the National Education Collaboration Trust (NECT) on behalf of the Department of Basic Education (DBE)! We hope that this programme provides you with additional skills, methodologies and content knowledge that you can use to teach your learners more effectively.

What is NECT?
In 2012 our government launched the National Development Plan (NDP) as a way to eliminate poverty and reduce inequality by the year 2030. Improving education is an important goal in the NDP which states that 90% of learners will pass Maths, Science and languages with at least 50% by 2030. This is a very ambitious goal for the DBE to achieve on its own, so the NECT was established in 2015 to assist in improving education and to help the DBE reach the NDP goals.

The NECT has successfully brought together groups of relevant people so that we can work collaboratively to improve education. These groups include the teacher unions, businesses, religious groups, trusts, foundations and NGOs.

What are the Learning programmes?
One of the programmes that the NECT implements on behalf of the DBE is the 'District Development Programme'. This programme works directly with district officials, principals, teachers, parents and learners; you are all part of this programme!

The programme began in 2015 with a small group of schools called the Fresh Start Schools (FSS). Curriculum learning programmes were developed for Maths, Science and Language teachers in FSS who received training and support on their implementation. The FSS teachers remain part of the programme, and we encourage them to mentor and share their experience with other teachers. The FSS helped the DBE trial the NECT learning programmes so that they could be improved and used by many more teachers. NECT has already begun this embedding process.

Everyone using the learning programmes comes from one of these groups; but you are now brought together in the spirit of collaboration that defines the manner in which the NECT works. Teachers with more experience using the learning programmes will deepen their knowledge and understanding, while some teachers will be experiencing the learning programmes for the first time.

Let's work together constructively in the spirit of collaboration so that we can help South Africa eliminate poverty and improve education!

www.nect.org.za

Contents

INTRODUCTION: THREE PRINCIPLES OF TEACHING MATHEMATICS

PRINCIPLE 1: TEACHING MATHEMATICS DEVELOPMENTALLY

What is developmental teaching and what are the benefits of such an approach?

- The human mind develops through phases or stages which require learning in a certain way and which influence whether a child is ready to learn something or not.
- If learners are not ready to learn something, it may be due to the fact that they have not reached that level of development yet or they have missed something previously.
- The idea that children's thinking develop from concrete to abstract (Piaget, 1969), was refined (Miller & Mercer, 1993) to include a middle stage, namely the "concrete-representational-abstract" stages. This classification is a handy tool for mathematics teaching. We do not need to force all topics to follow this sequence exactly, but at the primary level it is especially valuable to establish new concepts following this order.
- This classification gives a tool in the hands of the teacher, not only to develop children's mathematical thinking, but also to fall back to a previous phase if the learner has missed something previously.
- The need for concrete experiences and the use of concrete objects in learning, may gradually pass as learners develop past the Foundation Phase. However, the representational and abstract development phases are both very much present in learning mathematics at the Intermediate and Senior Phases.

How can this approach be implemented practically?

The table on page 7 illustrates how a developmental approach to mathematics teaching may be implemented practically, with examples from several content areas.

What does this look like in the booklet?

Throughout the booklets, within the topics, suggestions are made to implement this principle in the classroom:

- Where applicable, we suggest an initial concrete way of teaching and learning a concept and we provide educational resources at the end of the lesson plan or topic to assist teachers in introducing the idea concretely.
- Where applicable, we provide pictures (representational/semi-concrete) and/or diagrams (representational/semi-abstract). It may be placed at the clarification of terminology section, within the topic itself or at the end of the topic as an educational resource.
- In all cases we provide the symbolic (abstract) way of teaching and learning the concept, since this is, developmentally speaking, where we primarily aim to be for learners to master mathematics.

PRINCIPLE 2: TEACHING MATHEMATICS MULTI-MODALLY

What is multi-modal teaching and what are the benefits of such an approach?

- We suggest that teachers present mathematics topics in three forms to provide for all learners' learning styles and preferences. They (a) explain the idea by speaking about a topic, (b) illustrate it by showing pictures or diagrams and finally (c) present the idea by symbolising it in numbers and mathematical symbols.
- Teaching in more than one form (multi-modal teaching) includes hearing the same mathematical idea in spoken words (auditory mode), seeing it in a picture or a diagram (visual mode) and writing it in a mathematical way (symbolic mode).
- Learners differ in the way they learn and understand mathematical ideas. For one learner it is easier to understand through hearing and for the other through seeing. That is why we open both pathways to the symbolic mode – because here they do not have a choice, they all have to reach that mode, be it through hearing or seeing.

How can this approach be implemented practically?

The table on page 8 illustrates how a multi-modal approach to mathematics teaching may be implemented practically, with examples from several content areas.

What does this look like in the booklet?

Throughout the booklets, within the topics at the Senior Phase, we suggest ways to apply this principle in the classroom:

- The verbal explanations under each topic and within each lesson plan, provide the "speak it" or auditory mode.
- The pictures and diagrams give suggestions for the "show it" mode (visual mode).
- The calculations, exercises and assessments under each topic and within each lesson plan, provide the "symbol it" or symbolic mode of representation.

PRINCIPLE 3: SEQUENTIAL TEACHING

What is sequential teaching and what are the benefits of such an approach?

- Learners with weak basic skills in mathematics will find future topics increasingly difficult. A solid foundation is required for a good fundamental understanding.
- In order to build a solid foundation in maths, we teach concepts systematically. If we teach concepts out of that order, it can lead to difficulties in grasping concepts.
- Systematic teaching according to CAPS builds progressive understanding and skills.
- In turn, this builds confidence in the principles of a topic before he/she is expected to apply the knowledge and proceed to a higher level.
- We have to continuously review and reinforce previously learned skills and concepts.
- If learners link new topics to previous knowledge (past), understand the reasons why they learn a topic (present) and know how they will use the knowledge in their lives ahead (future), it can help to motivate them and to remove many barriers to learning.

How can this approach be implemented practically?

If a few learners in your class are not grasping a concept, you as the teacher need to take them aside and teach them the concept again (perhaps at a break or after school).

If the entire class are battling with a concept, it will need to be taught again, however this could cause difficulties in trying to keep on track and complete the curriculum in time.

To finish the year's work within the required time and to also revise topics, we suggest:

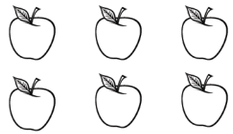
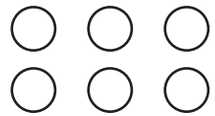
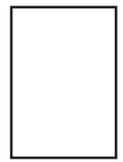
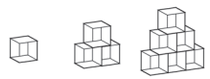
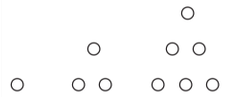
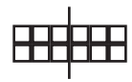
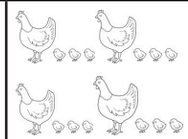
- Using some of the time of topics with a more generous time allocation, to assist learners to form a deeper understanding of a concept, but also to catch up on time missed due to remediating and re-teaching of a previous topic.
- Giving out revision work to learners a week or two prior to the start of a new topic. For example, in Grade 8, before you are teaching Data Handling, you give learners a homework worksheet on basic skills from data handling as covered in Grade 7, to revise the skills that are required for the Grade 8 approach to the topic.

What does this look like in the booklet?

At the beginning of each topic, there are two parts that detail

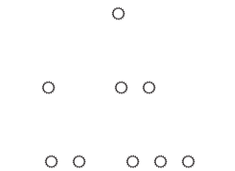
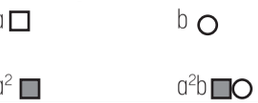
- The SEQUENTIAL TEACHING TABLE lays out the knowledge and skills covered in the previous grade, in the current grade and in the next grade.
- The LOOKING BACK and LOOKING FORWARD summarises the relevant knowledge and skills that were covered in the previous grade or phase and that will be developed in the next grade or phase.

THREE-STEP APPROACH TO MATHEMATICS TEACHING: CONCRETE-REPRESENTATIONAL-ABSTRACT

CONCRETE: IT IS THE REAL THING		REPRESENTATIONAL: IT LOOKS LIKE THE REAL THING		ABSTRACT: IT IS A SYMBOL FOR THE REAL THING	
Mathematical topic	Real or physical For example:	Picture	Diagram	Number (with or without unit)	Calculation or operation, general form, rule, formulae
Counting	Physical objects like apples that can be held and moved			6 apples	$2 \times 3 = 6$ or $2+2+2=6$ or $\frac{1}{2}$ of $6 = 3$ or $\frac{2}{3}$ of $6 = 4$
Length or distance	The door of the classroom that can be measured physically			80 cm wide 195 cm high	Perimeter: $2L + 2W = 390 + 160$ $= 550cm$ Area: $L \times W = 195 \times 80$ $= 15\,600cm^2$ $= 1.56m^2$
Capacity	A box with milk that can be poured into glasses			1 litre box 250 ml glass	$4 \times 250ml = 1\,000ml$ $= 1$ litre or 1 litre $\div 4 = 0.25$ litre
Patterns	Building blocks			1; 3; 6...	$\frac{n(n+1)}{2}$
Fraction	Chocolate bar			6 12	$\frac{6}{12} = \frac{1}{2}$ or $\frac{1}{2}$ of $12 = 6$
Ratio	Hens and chickens			4:12	$4 : 12 = 1 : 3$ Of 52 fowls ¼ are hens and ¾ are chickens, ie 13 hens, 39 chickens
Mass	A block of margarine			500g	$500g = 0,5\ kg$ or calculations like 2 ½ blocks = 1.25kg

Teaching progresses from concrete -> to -> abstract. In case of problems, we fall back <- to diagrams, pictures, physically.

MODES OF PRESENTING MATHEMATICS WHEN WE TEACH AND BUILD UP NEW CONCEPTS

Examples	**SPEAK IT - explain** • To introduce terminology • To support auditory learning • To link mathematics to real life	**SHOW IT - embody** • To help storing and retrieving ideas • To help visual learning • To condense information to one image	**SYMBOL IT - enable** • To promote mathematical thinking • To convert situations to mathematics • To enable calculations
IP: Geometric patterns	"If shapes grow or shrink in the same way each time, it forms a geometric pattern or sequence. We can find the rule of change and describe it in words. If there is a property in the shapes that we can count, each term of the sequence has a number value" "You will be asked to draw the next term of the pattern, or to say how a certain term of the pattern would look. You may also be given a number value and you may be asked, which term of the pattern has this value?**"**	 T1 T2 T3 T4 Question: (a) Draw the next term in this pattern. (b) Describe this pattern. What is the value of the 9th term of this pattern (T9)? **Which term has a value of 120?** To draw up to the 9th term of the sequence and to find out which term has a value of 120, is slow. One is now almost forced to deal with this problem in a symbolic way.	Say out loud: 1; 3; 6... 1; 3; 6; 10... 1; 3; 6;10;15 Inspect the number values of terms: T1: 1 = 1 T2: 3 = 1+2 T3: 6 = 1+2+3 T4: 10 = 1+2+3+4 T9: 45 = 1+2+3+4+5+6+7+8+9 General rule: The value of term n is the sum of n number of consecutive numbers, starting at 1.
SP: Grouping the terms of an algebraic expression	"We can simplify an algebraic expression by grouping like terms together. We therefore have to know how to spot like terms. Let us say we have to sort fruit in a number of baskets and explain the variables or the unknowns in terms of fruits. Try to imagine the following pictures in your mind:"	Although not in a real picture, we can paint a mind picture to help us understand the principle of classification: • Basket with green apples (a) • Basket with green pears (b) • Basket with green apples and green pears (ab) • Basket with yellow apples (a^2) • Basket with yellow apples and green pears (a^2b) Or in diagram form 	Group and simplify the following expression: $4b - a^2 + 3a^2b - 2ab - 3a + 4b + 5a - a - 2ab + 2a^2b + a^2b$ $= -3a + 5a - a + 4b + 4b - 2ab - 2ab - a^2 + 3a^2b + 2a^2b + a^2b$ $= a + 8b - 4ab - a^2 + 6a^2b$

TOPIC 1: WHOLE NUMBERS: ADDITION AND SUBTRACTION

INTRODUCTION

- These first two topics on whole number, together with the same topic later this term, all together run for 8 hours.
- It is part of the Content Area 'Numbers, Operations and Relationships' an area which is allocated 50% of the total weight shared by the five content areas in Grade 4.
- For Term 4, this unit covers the range of 5 digits for general number concepts and 4 digits for addition and subtraction operations.
- The purpose of this unit is to revise and consolidate the work of the previous three terms.

SEQUENTIAL TEACHING TABLE

GRADE 3 FOUNDATION PHASE	GRADE 4 INTERMEDIATE PHASE	GRADE 5 INTERMEDIATE PHASE
LOOKING BACK	CURRENT	LOOKING FORWARD
NOTE: All number ranges in CAPS indicate the minimum requirement ("to at least ...")		

• General number concept up to 3 digit numbers
• Order numbers in ascending or descending order
• Add and subtract whole numbers of 3 digits
• Use strategies:
  • building up/breaking down
  • number lines
  • rounding off to tens
	• General number concept up to 5 digit numbers
	• Round off to 10, 100 and to 1 000
	• Represent odd and even numbers to 1 000
	• Add and subtract whole numbers of 4 digits
	• Use strategies:
	  • building up/breaking down
	  • number lines
	  • rounding off/compensating
	  • using addition/subtraction as inverse operations
		• General number concept up to 6 digit numbers
		• Round off to 5, 10, 100 and 1 000
		• Represent odd and even numbers to 10 000
		• Add and subtract whole numbers of 5 digits
		• Use strategies:
		  • building up/breaking down
		  • number lines
		  • rounding off/ compensating
		  • using addition/subtraction as inverse operations
		  • adding/subtracting in columns

GLOSSARY OF TERMS

Term	Explanation/Diagram
Whole numbers	Whole numbers are the counting numbers and zero (0,1,2,3...).
Digit, number, place value and number value	Digit: A digit is a symbol that is used to represent a quantity. There are ten digits: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. Number: We use the ten digits in the base ten number system in different positions to build numbers: 524 is a three-digit number. Place value: In the number 524, for example, the digit 2 is in the position with a place value of ten (10's). Number value: In the number 524, for example, the digit 2 in the tens position has a number value of 20.
Building up and breaking down	We break down (expand) a number into the numbers that were added to build it up, eg 36 = 30 + 6. We build up a number by writing those numbers as one number, like 30 + 6 = 36.
Rounding up or rounding down	We round a number when we make it make it bigger or smaller to a place value that makes it easier to work with. For example, rounding 31 to 30 (nearest 10) or rounding 296 to 300 (nearest 100).
Compensating	Compensating is a strategy to add or subtract where we change the second number to a "friendly number" by rounding it up/down and then adjusting the answer .
Inverse operations	Inverse operations are opposite operations that undo each other. Addition and subtraction are inverse operations.
Estimation	A close guess of the actual answer, which we do not actually calculate in writing. Rounding is a handy way of estimating.

SUMMARY OF KEY CONCEPTS

Introduction

Facts that learners need to know in Grade 4:

- Adding or subtracting zero, does not change the number (69 + 0 = 69 and 72 – 0 = 72).
- It does not matter in which order we add numbers (15 + 16 = 16 + 15), but it does matter in which order we subtract numbers (16 – 15 = 1, but 15 – 16 is not the same).
- In addition, the grouping does not matter. In this example both grouping and order were changed in addition 15 + (3 + 5) = (15 +3) + 5, but in subtraction it matters (15 - 8) -3 = 4, but 15 – (8 – 3) = 10].

Estimating by rounding

Learners can estimate through rounding.

Example:
Estimate the total price of a jacket at R469 and a pair of shoes at R339.

R469 ≈ R500 and R339 ≈ R300, therefore R469 + R339 ≈ R800

Rounding and compensating

Round up/down to change the second number to a friendly number and adjust the answer.

Examples:

a. 334 + 58 (round up) → 334 + 60 → 394 (adjust) → 394 – 2 = 392

b. 148 + 33 (round down) → 148 + 30 → 178 (adjust) → 178 + 3 = 181

c. 94 – 58 (round up) → 94 – 60 → 34 (adjust) → 34 + 2 = 36

d. 82 – 33 (round down) → 82 – 30 → 52 (adjust) → 52 – 3 = 49

Addition and subtraction strategies

1. ADDITION

There are two ways to use the expanded notation in addition:

a. both parts are broken down or expanded, either horizontal or vertical

b. only the second part is broken down (expanded)

a. Expanded notation: break-down method (both parts expanded)

Example (horizontal):

1 793 + 3 224	= 1 000 + 700 + 90 + 3 + 3 000 + 200 + 20 + 4	(expand both numbers)
	= (1 000+3 000) + (700+200) + (90+20) + (3+4)	(group)
	= 4 000 + 900 + 110 + 7	(add like terms)
	= 5 017	

Example (vertical):

3 813 + 4 324

3 000	+	4 000 =	**7 000**	(add thousands horizontally)
800	+	300 =	**1 100**	(add hundreds horizontally)
10	+	20 =	**30**	(add tens horizontally)
3	+	4 =	**7**	(add units horizontally)
			= 8 137	**(add totals vertically)**

b. Expanded notation: break-down method (only one part expanded)

Example:
4 435 + 1 749
4 435 + 1 000 → 5 435 + 700 → 6 135 + 40 → 6 175 + 9 → 6 184

2. SUBTRACTION

There are two ways to use the expanded notation in subtraction:

a. Both parts are broken down (expanded), horizontally or vertically

b. Only the second part is expanded or broken down

a. Expanded notation (break-down method, both parts expanded)

NB: This method is complicated and learners will need assistance to help them gain a good understanding.

Example (horizontal):

3 452 – 2 184

= (3000 + 400 + 50 + 2) – 2000 – 100 – 80 – 4	(expand both numbers)
= (3000 – 2000) + (400 – 100) + (50–80) + (2 – 4)	(group, bracket, + between groups)
= (3000 – 2000) + (400 – 100) + (40 – 80) + (12 – 4)	(borrow from 50 to make 12)
= (3000 – 2000) + (300 – 100) + (140 – 80) + 8	(borrow from 400 to make 140)
= 1000 + 200 + 60 + 8	(add answers for final answer)
= 1 268	

Teaching tip: Leave lines open in between! START SUBTRACTING FROM THE UNITS

Example: (vertical)
4 232 –1 438

	2	–	8	= (cannot)
	12	–	8	= **4** ← **Open line, filled in if/when needed)**
+ **20**	~~30~~	–	30	= (cannot)
	120	–	30	= **90** ← **Open line, filled in if/when needed)**
+ **100**	~~200~~	–	400	= (cannot)
	1 100	–	400	= **700** ← **Open line, filled in if/when needed)**
+ **3 000**	~~4 000~~	–	1 000	= **2 000**
	4 232	–	1 438	= **2 794**

b. Expanded notation (break-down method, second number expanded)

NB: START SUBTRACTING FROM THE LARGEST, IN THIS CASE THE THOUSANDS

Example (horizontal):
5 842 – 3 614
5 842 – 3 000 → 2 842 – 600 → 2 242 – 10 → 2
232 – 4 → 2 228

TOPIC 2: MASS

INTRODUCTION

- This unit runs for 6 hours.
- It is part of the Content Area 'Measurement', an area which is allocated 15% of the total weight shared by the five content areas in Grade 4.
- This unit covers practical measuring of 3-D objects, the use of measuring instruments in grams and kilograms, calculations and simple problem solving related to mass.
- The purpose of this unit is to extend learners' knowledge of mass from mostly an informal "feeling" about mass, to using a variety of measuring instruments and measurement units which can be calculated exactly.

SEQUENTIAL TEACHING TABLE

GRADE 3 FOUNDATION PHASE	GRADE 4 INTERMEDIATE PHASE	GRADE 5 INTERMEDIATE PHASE
LOOKING BACK	LOOKING BACK	CURRENT
• Practical work to estimate, measure, record, compare and order mass using balance scales and non-standard measures • Describe mass of objects by counting and stating mass in informl units • Use language of comparison to describe mass • Read and compare mass on commercial packaging in kilograms and grams • Measure own mass in kilograms using bathroom scales	• Practical work to estimate, measure, record, compare and order mass of 3D objects • Measuring instruments include bathroom scales, kitchen scales and balances, including reading between calibration lines • Units used are grams and kilograms • Calculations involve converting between units, whole units and fractions • Problem solving in mass contexts	• Practical work to estimate, measure, record, compare and order mass of 3D objects • Measuring instruments include bathroom scales, kitchen scales and balances • Units used are grams and kilograms • Calculations involve converting between units, whole units and fractions • Problem solving in mass contexts

GLOSSARY OF TERMS

Term	Explanation / Diagram
Mass of 3D objects	Mass is the amount of matter in an object. It does not matter how big the object is, or how much its volume is.
Unit of mass: gram	Gram (g) is a standard unit that we use to measure mass. Standard means that it is the same all over the world.
Unit of mass: kilogram	Kilogram (kg) is a standard unit that we use to measure mass. It is 1 000 times more than a gram.
Balance scales	An instrument that has a balanced beam and two pans. When the pans contain exactly the same mass, the beam is in balance.
Digital scales	An instrument to measure mass that shows the amount in kilograms or grams electronically.
Analogue scales	Analogue scales have round dials, where a pointer moves clockwise according to the mass of the object. There are markings with equal spaces in between the numbers to indicate amounts.

SUMMARY OF KEY CONCEPTS

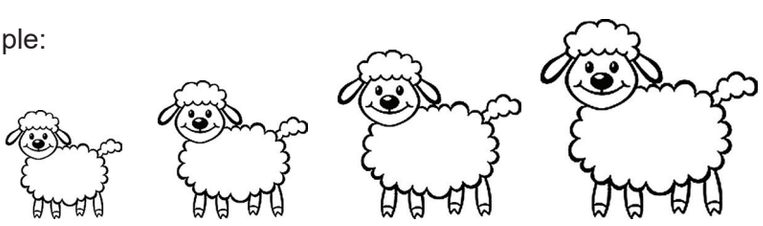
Understanding the Concept of Mass

1. Mass is how heavy or light something is. The size of the object does not always matter, because some small things have a higher mass than some bigger things.

Example:
The size of 1 kg sugar, 1 kg flour, a one litre bottle of water (which has a mass of 1 kg) and a 1 kg block of polystyrene differs a lot.

2. The mass of a human being or an animal that grows bigger, becomes more, because its bones and flesh and fat become more. The mass of a lamb growing into a big sheep is shown below:

Example:



a. 5 kg b. 12 kg c. 24 kg d. 54 kg

Units of Mass

1. The standard unit for measuring mass is the gram. This is used worldwide. A paperclip has a mass of about 1 gram, a 10c coin has a mass of 2 grams; a 50c coin has a mass of 5 grams, and a R5 coin has a mass of almost 10 grams.

1 gram 2 grams 5 grams 10 grams

2. The kilogram is the standard unit of measurement for heavier items. There are 1 000 grams in one kilogram, so 1 000 paper clips or a hundred R5 coins has a mass of 1 kilogram. One litre of water has a mass of one kilogram (without the mass of the container).

Estimating Mass in Grams and Kilograms

1. Use various familiar objects to ask learners if they would use grams or kilograms to find the mass of these objects.

Example:




Chair	Pencil	Bicycle	Butter	Butterfly

2. The mass of the little girl is 22 kg. Estimate the mass of the man and his fish, the baby, the taller girl, the grandfather and the grandmother.

Example:

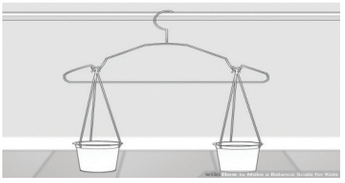




Little girl	Man	Fish	Baby	Tall girl	Grandfather	Grandmother
22 kg						

Using Mass Measurement Instruments

1. Balancing scales are instruments that have a balanced beam and two pans. When the pans contain exactly the same mass, they are at the same height (exactly level). To find the mass of objects, one can place them in one pan and put weights in the other, until the pans are at the same height. You can make a balance with a clothes hanger and margarine tubs on strings.

Put the correct number and mass of coins in one side of the scale and the object in the other. Find the mass (in grams) of half an apple, a sandwich, an eraser, and a pen.

Record your findings in a table.

Item	Coins in balance	Mass
Half apple		
Sandwich		
Eraser		
Pen		

2. Digital scales are instruments that show the amount in kilograms or grams electronically. Bathroom scales usually measure in kilograms and kitchen scales measure in grams. Digital scales have no pointers like on an analogue scale, but show the reading in numbers immediately.

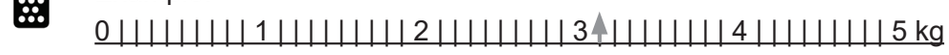

3. Analogue scales are marked in numbers showing grams or kilograms, with spaces in between,like the markings on a ruler, just in a circular way and not straight like a ruler. Some measure in kilograms only, some in grams only and some in both kilograms and grams. Most analogue scales have only some numbers marked, with lines and spaces in between for the missing numbers. Analogue scales have round dials.


Teaching tip: If it is possible, bring as many of the above items into the classroom and allow learners to find the mass of themselves and/or various smaller objects.

Reading off scales on unmarked lines:

Not all the markings or lines on scales are marked with numbers, but learners have to understand what the unmarked lines mean:

Example:



The mass is more than ___ kg but less than ___ kg, and close to ___ kg. It is ___ kg and ___g

Example:

Each unmarked line stands for ___ g. The arrow is at a point that is more than ____g, but less than ____ g, and closest to ____ g. It is standing at ___ g.

Doing calculations in mass

1. Add: 500 g + 2 kg 700 g = _____ kg _____ g
   = _____ kg _____ g

   (Solution: 3 kg 200 g)

2. Subtract: 6 kg 600 g – 800 g = _____ g – _____ g
   = _____ kg _____ g

   (Solution: 5 kg 800 g)

3. Multiply 456 g x 7

   (Solution: 3 kg 192 g)

4. Divide 232 kg ÷ 8

   (Solution: 29 kg)

5. Round off 97 531g to the nearest 1 000 g

   (Solution: 98 000g)

TOPIC 3: PROPERTIES OF 3D OBJECTS

INTRODUCTION

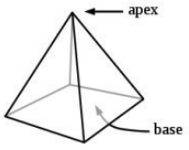
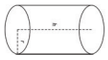
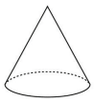
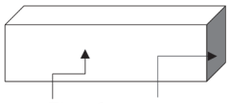
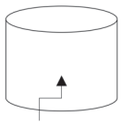
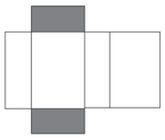
- This unit runs for 4 hours.
- It is part of the content area 'Space and Shape' and together with the other topics in this content area, it represents 15% of the total weight allocated to the content area in Grade 4.
- The unit covers 3D knowledge and skills pertaining to geometrical shapes and related concepts and terminology.
- The purpose of this unit is to confirm learners' knowledge and experience with objects of the third spatial dimension and some of their qualities in real life.

SEQUENTIAL TEACHING TABLE

GRADE 3 FOUNDATION PHASE	GRADE 4 INTERMEDIATE PHASE	GRADE 5 INTERMEDIATE PHASE
LOOKING BACK	CURRENT	LOOKING FORWARD

• Cover range of 3D shapes:
  • balls (spheres)
  • box shapes (prisms)
  • cylinders
  • pyramids
  • cones
• Observe properties of 3D objects
  • 2D shape of faces
  • flat/curved surfaces
	• Cover range of 3D shapes:
	  • spheres
	  • rectangular prisms
	  • cylinders
	  • cones
	  • square based pyramids
	• Recognise properties of 3D objects
	  • 2D shape of faces
	  • flat/curved surfaces
	• Make 3D models out of polygons
		• Cover range of 3D shapes:
		  • various prisms
		  • cubes
		  • cylinders
		  • pyramids
		  • cones
		• Compare cubes and rectangular prisms
		• Know properties of 3D objects
		  • 2D shape of faces
		  • number of faces
		  • flat/curved surfaces
		• Make 3D models out of polygons
		• Cut open boxes, trace and describe their nets

GLOSSARY OF TERMS

Term	Explanation/Diagram
Three-dimensional geometrical shape (3D objects)	Objects that occupy space and have form and which can be measured in three directions or dimensions like a box, of which the length, breadth and height can be measured.
Properties	The qualities by which we recognise and describe things.
Prism	A 3D object which has two ends that are the same shape and size, and sides that are rectangles. 
Pyramid	A 3D object with a base of any shape and triangular sides that all meet at one point at the top in an apex. 
Apex	The vertex of a pyramid or a cone which is its highest point when it stands on its base, or the top point opposite the base.
Rectangular prism	A 3D object of which all sides are rectangles and all sides meet at a right angle. A brick or a shoebox is a rectangular prism.
Cube	A 3D shape or object with six equal square sides. 
Cylinder	A 3D object with two flat ends equal in size that are circles and one curved side. For example, a tin.  .
Cone	A 3D object with a circular flat base joined to a curved side that ends in an apex on top . 
Flat surface	A flat suface is a straight 2D shape, called a face. 3D objects with flat surfaces have edges, like a box or a tin.
Curved face or surface	An object with surfaces which are rounded (not straight or flat), like an egg. There are no edges or corners. 
Face	A face is the side of a solid shape (flat or curved side).  Flat faces  Curved face
Net	A flattened out 3D object showing the 2D shapes that form its faces. When this is folded up, it forms the 3D object. 

SUMMARY OF KEY CONCEPTS

Introduction

Learners progress in Grade 4 from informal knowledge of 3D shapes to formal knowledge.

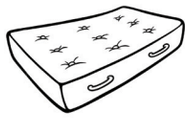
Linking between real objects, geometrical shapes and their surfaces

Use the following points to ensure learners become familiar with naming 3D objects with their mathematical names and recognising the mathematical object when looking at everyday objects.

a. Identify an object in the real world and label it with its geometrical name.

b. Give learners the name of a geometrical object and find an object of that kind.

c. Discuss which (sur)faces of the 3D objects are flat and which are curved.

3D OBJECT	REAL OBJECT	REAL OBJECT	REAL OBJECT	STRAIGHT OR CURVED SURFACES
Rectangular prism	mattress 	 box	toffee 	
Sphere	 earth	 ball	 beads	
Cylinder	 battery	fish tin 	 candle	
Cone	 ice cream cone	 traffic cone	 party hat	
Square based pyramid	 pyramid in Egypt	 roof on a square house	 stack toy	

Linking between 3D objects and their 2D surfaces

a. Cut out the 2D nets of shapes.

b. Fold shapes up to form a 3D object.

c. Label the object with its geometrical name.

d. Count the faces, name them and describe whether the surfaces are flat or curved.

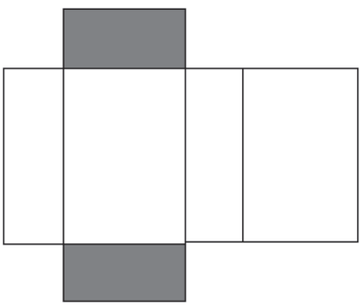
Teaching tip: Learners may cut tabs ("wings") if they want to glue the shapes together. These are not provided, because we want to emphasise the actual faces of the shape.

Teaching tip: To draw nets of 3D objects, a good start is at the base(s) of the shape.

Example:
Rectangular based prism:

Step 1:
Draw two rectangular bases

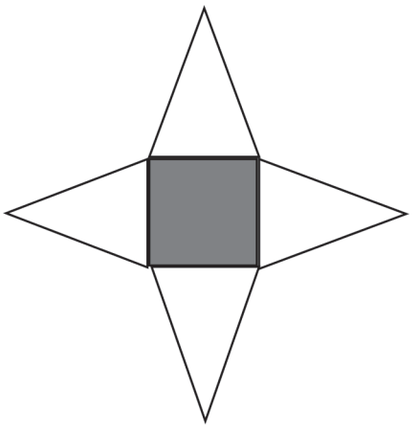
Step 2:
Insert the rectangular sides



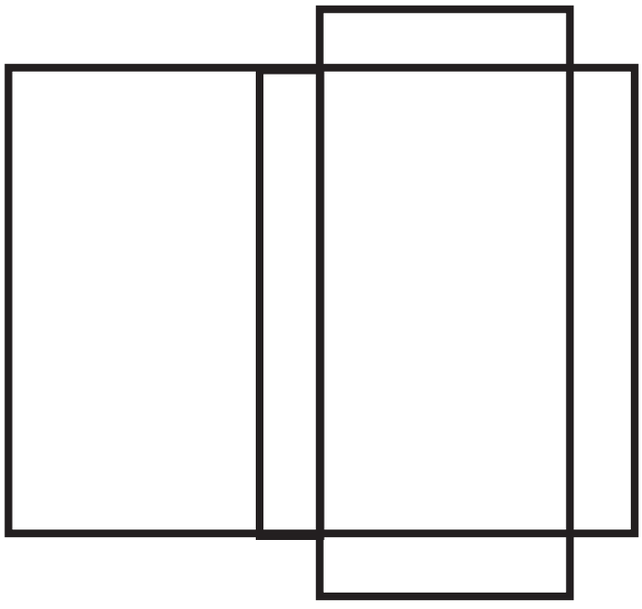
Example:
Square based pyramid:

Step 1:
Draw the square base

Step 2:
Add four equal triangular sides

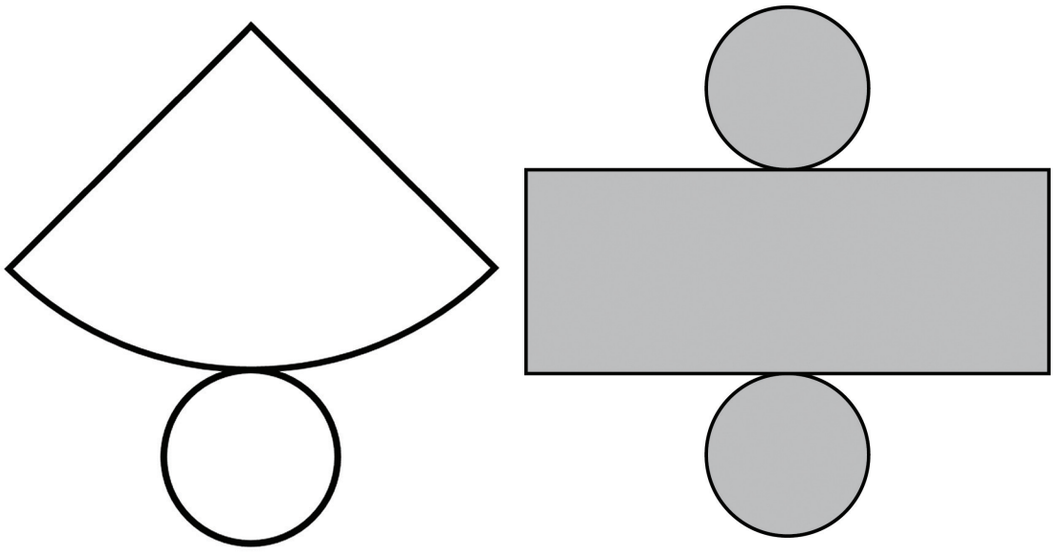


Learners should bring a box to school and unfold it carefully and look at the 2D shapes formed once it has been flattened out.

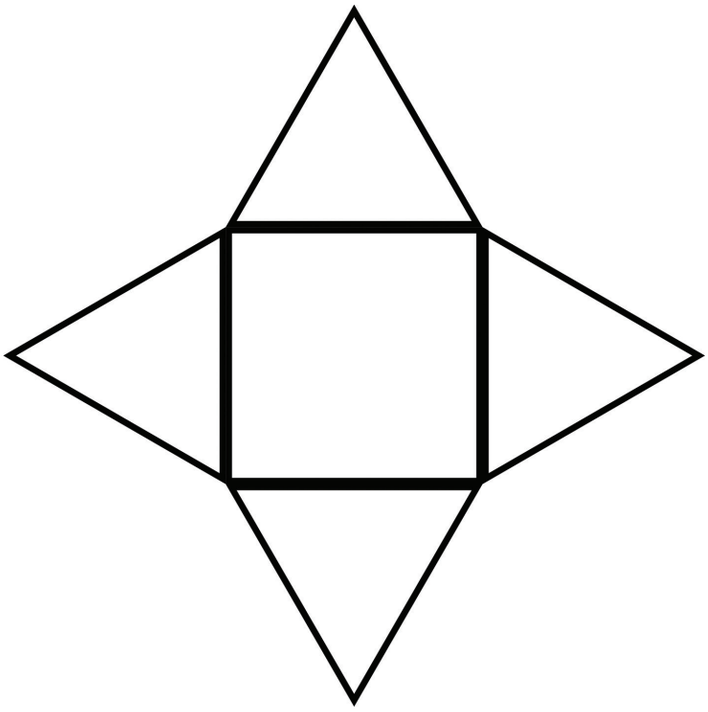


More shapes to investigate

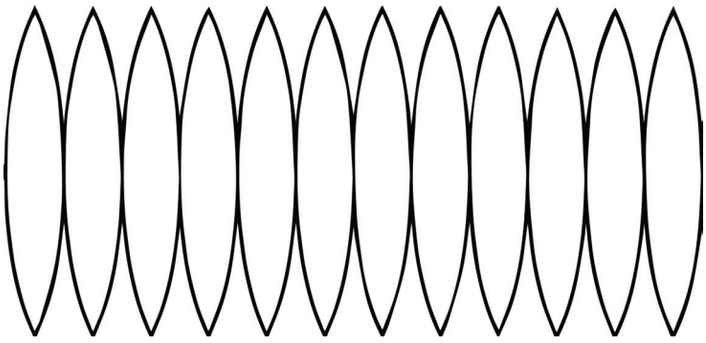
1. Look at the two shapes below with curved sides and explain how the curved and straight sides work to form the shape.

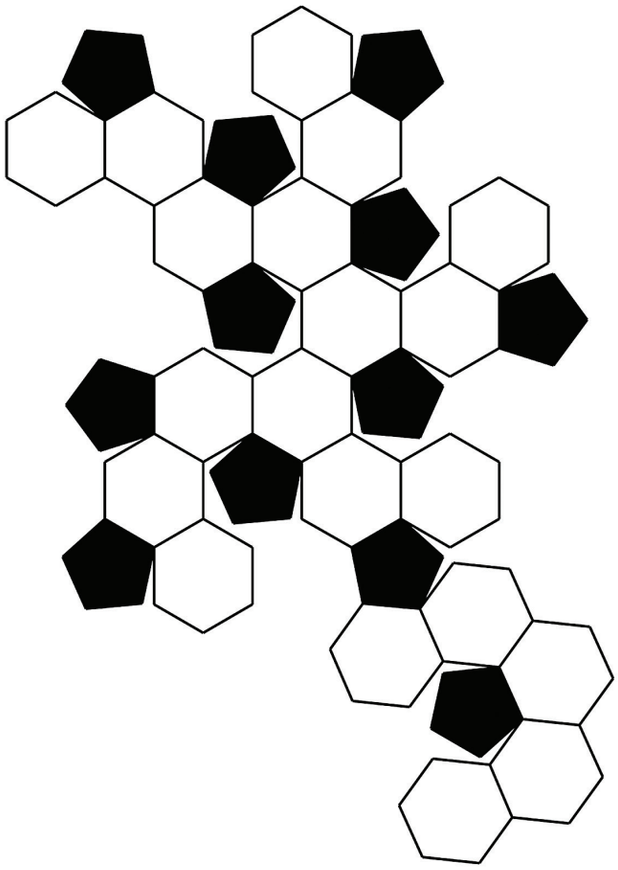


2. Fold this shape and name it.



3. Challenge yourself with the two challenges below:





TOPIC 4: COMMON FRACTIONS

INTRODUCTION

- This unit runs for 5 hours.
- It is part of the Content Area 'Numbers, Operations and Relationships' an area which is allocated 50% of the total weight shared by the five content areas in Grade 4.
- For Term 4, this unit covers a range of problem solving contexts and diagrams with a focus on thirds, fifths and sixths.
- The purpose of this unit is to consolidate learners' understanding of equivalent forms and the magnitude of fractions as well as the use of fractions in contextual problems.

SEQUENTIAL TEACHING TABLE

GRADE 3 FOUNDATION PHASE	GRADE 4 INTERMEDIATE PHASE	GRADE 5 INTERMEDIATE PHASE
LOOKING BACK	CURRENT	LOOKING FORWARD
• Use and name unitary and non-unitary fractions including halves, thirds, quarters, fifths, sixths and eighths • Recognise fractions in diagram form • Realise that two halves, three thirds, four quarters etc form one whole • Realise that two quarters and a half are the same, that two eighths and a quarter are the same • Write fractions as 1 half; 2 thirds; 4 fifths etc.	• Compare, order fractions with different denominators including halves, thirds, quarters, fifths, sixths, sevenths and eighths • Describe and compare common fractions in diagram form • Add fractions with the same denominators • Recognise and describe that division and fractions are equivalent concepts • Solve problems with fractions in context including grouping and equal sharing • Recognise and describe equivalent forms of fractions of which the denominator is a multiple of another	• Count forwards and backwards in fractions • Compare and order common fractions to at least twelfths • Add and subtract fractions with same denominators • Add and subtract fractions of whole numbers which result in whole numbers • Add and subtract mixed numbers • Recognise, describe and use the equivalence of division and fractions • Solve problems with fractions including equal sharing and grouping • Recognise and describe equivalent forms of fractions of which the denominator is a multiple of another

GLOSSARY OF TERMS

Term	Explanation / Diagram
Common fraction	A fraction is a part or parts of a whole that has been shared equally into a number of parts. A fraction can also be a part of a number of things that have been divided into equal groups.
Denominator	The number of equal parts into which a whole has been divided, or the number of equal smaller groups into which a bigger group has been divided. We write that number under the fraction line, for example, $\frac{2}{5}$.
Numerator	The number that tells us how many parts or groups we are dealing with. That number appears above the fraction line, for example, $\frac{2}{5}$.
Fractions and whole numbers	When all the parts of something are together, they form a whole. $\frac{6}{6}$ is a whole, but $\frac{5}{6}$ is a fraction.
Fractions and mixed numbers	When we have a whole or a number of wholes and also a fraction, we call it a mixed number, for example, $3\frac{1}{4}$.

SUMMARY OF KEY CONCEPTS

Describing and Ordering Fractions

The key to ordering fractions is to be able to easily compare them. Finding a common denominator and using equivalent fractions is a skill required.

Example:

- Arrange in ascending order: $\frac{1}{4}$ pizza, $\frac{1}{2}$ pizza and $\frac{3}{8}$ pizza

  (Solution: $\frac{1}{4}$ or $\frac{2}{8}$ pizza, $\frac{3}{8}$ pizza, $\frac{1}{2}$ or $\frac{4}{8}$ pizza)

- Arrange in descending order: $\frac{2}{3}$ of the class, $\frac{1}{2}$ of the class and $\frac{5}{6}$ of the class

  (Solution: $\frac{5}{6}$ of the class, $\frac{2}{3}$ or $\frac{4}{6}$ of the class, $\frac{1}{2}$ or $\frac{3}{6}$ of the class)

Adding Common Fractions with the Same Denominator

Example:

- Calculate or draw a shape to add $\frac{1}{5}$ and $\frac{4}{5}$

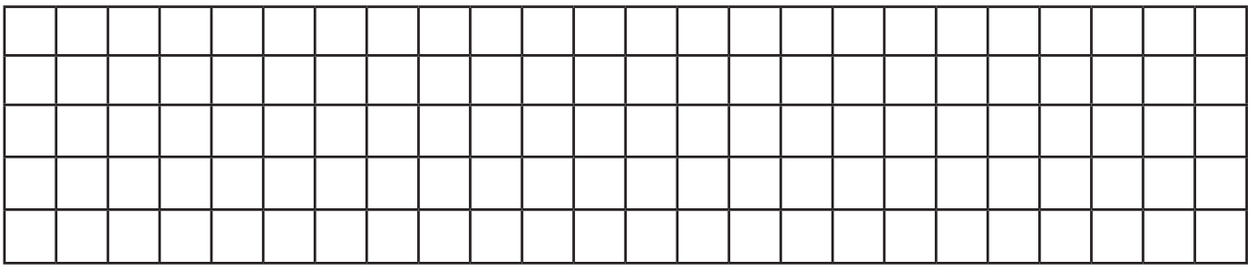
  (Solution: $\frac{1}{5} + \frac{4}{5} = \frac{5}{5} = 1$)

- Calculate or draw a shape to add $\frac{5}{7}$ and $\frac{3}{7}$

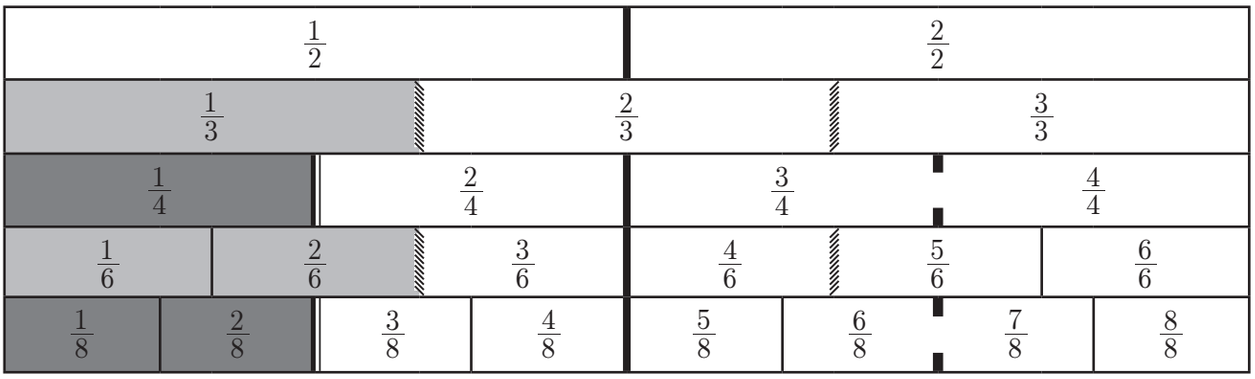
  (Solution: $\frac{5}{7} + \frac{3}{7} = \frac{8}{7} = 1\frac{1}{7}$)

Equivalent Fractions

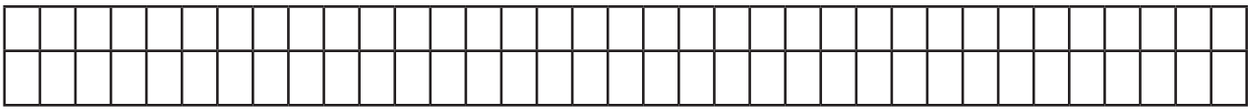
a. Use the grid below to build a fraction wall, with halves, thirds, quarters, sixths and eighths. Shade each type of fraction differently. Show five pairs of equivalent fractions. Write them down in numbers.



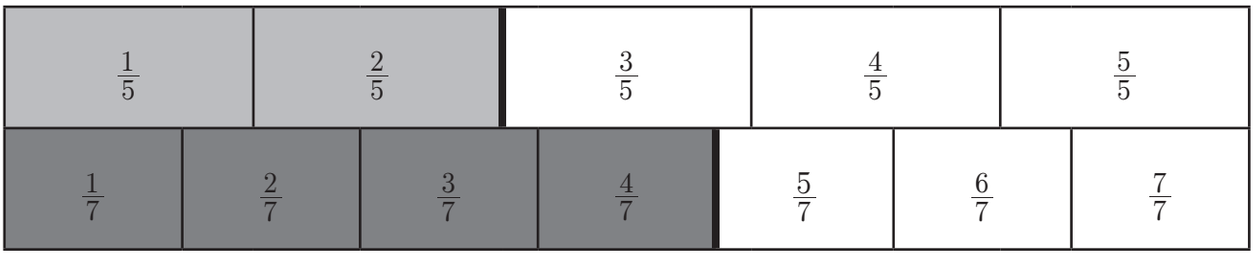
(Solution: On the fraction wall, mark out fractions and show by shading that, for example, that $\frac{1}{3} = \frac{2}{6}$)



Build your own fraction wall with fifths and sevenths. Which is bigger, $\frac{2}{5}$ or $\frac{4}{7}$?



(Solution: It is clear which fraction is bigger – note the importance of working on grid paper: to compare fractions with different denominators, use as many blocks as the LCD of both denominators, in this case 35 blocks were used to ensure that fifths and sevenths can both be indicated exactly)



Solving problems with fractions

- Mom has to use $\frac{3}{4}$ of 360 gram flour. How much is that?

  (Solution: $\frac{1}{4}$ of 360 gram is 90 gram [360 ÷ 4]; $\frac{3}{4}$ of 360 gram is 90 x 3 = 270 gram)

- Melissa divides 240 ml milk in fifths. How much is each fifth?

  (Solution: $\frac{1}{5}$ of 240 ml is 48 ml [240 ÷ 5])

- Write down as division sums:

  a. $\frac{1}{5}$ of 20

  (Solution: 20 ÷ 5 = 4; $\frac{1}{5}$ of 20 = 4)

  b. $\frac{1}{8}$ of 24

  (Solution: 24 ÷ 8 = 3; $\frac{1}{8}$ of 24 = 3)

  c. $\frac{1}{6}$ of 18

  (Solution: 18 ÷ 6 = 3; $\frac{1}{6}$ of 18 = 3)

  d. $\frac{1}{7}$ of 28

  (Solution: 28 ÷ 7 = 4; $\frac{1}{7}$ of 28 = 4)

TOPIC 5: WHOLE NUMBERS: DIVISION

INTRODUCTION

- This unit runs for 3 hours.
- It forms part of the content area: 'Numbers, Operations and Relationships' and counts a part of 50% allocated to this content area in the final exam.
- The unit covers division of a whole 3-digit number by a 1-digit number, using various calculation strategies as well as problem solving in written and oral form.
- The purpose of this unit is for learners to deepen their understanding of division and refine their calculation skills.

SEQUENTIAL TEACHING TABLE

GRADE 3 FOUNDATION PHASE	GRADE 4 INTERMEDIATE PHASE	GRADE 5 INTERMEDIATE PHASE
LOOKING BACK	CURRENT	LOOKING FORWARD
• Divide numbers up to 100 by 2. 3. 4. 5 and 10 • Use appropriate symbols [÷ and =]	• Divide at least 3 digit numbers by 1 digit numbers • Solve problems involving equal sharing. unequal sharing and grouping with remainders • Use rounding and opposite operations to estimate and check solutions • Solve problems of equal sharing and grouping leading to solutions that are fractions	• Divide at least 3 digit numbers by 2 digit numbers • Solve problems involving equal sharing and grouping with remainders • Solve problems of equal sharing and grouping leading to solutions that are fractions

GLOSSARY OF TERMS

Term	Explanation / diagram
Division: equal sharing	Sharing out of a quantity into a number of equal portions or groups. Examples: a. Equal sharing: Share 35 sweets among 7 children [35 ÷ 7 = 5] b. Equal groups: Pack 35 sweets in packets of 5 [35 ÷ 5 = 7]
Division: unequal sharing	When an amount is shared out differently for each person. This can also be called proportional sharing, or sharing in a specific ratio. Example: Mom divides 35 potatoes in 5 parts. She keeps three of the parts and gives two of the parts to Grandmother. The potatoes were unequally shared: Mom kept 21 and Grandmother received 14 potatoes.
Remainder	The amount that is left over after dividing one number by another number. Example: 25 ÷ 7 = 3 with a remainder of 4 It is useful to teach learners at an early stage that the remainder is actually a fraction. In this example the answer could therefore also be given as $3\ \frac{4}{7}$
Inverse operation	Multiplication is the inverse, or the opposite operation of division. Example: 60 ÷ 4 = 15 and 15 x 4 = 60
Multiple	The multiples of a number (eg. 5) are the products when we multiply that number by any natural number. 15 is a multiple of 5, because 5 x 3 = 15

SUMMARY OF KEY CONCEPTS

Writing division- and multiplication facts

To apply the idea that multiplication and division are opposite operations, learners may write the opposite statement(s) of the given statement.

Example:

a. Write two division statements from 23 x 3 = 69 (69 ÷ 3 = 23 and 69 ÷ 23 = 3)

b. Write a multiplication fact from 69 ÷ 3 = 23 (23 x 3 = 69)

Dividing by equal sharing resulting in fractions

This type of division is learned in Grade 4 by diagrams or pictures, for learners to see in the picture/diagram how the remainder is shared to form fractions.

Example:
Share 9 chocolate bars equally amongst 4 children, A, B, C, and D

(Solution: 9 ÷ 4 = 2 and $\frac{1}{4}$)

Division Strategies

1. Estimation
   Estimate by rounding both numbers to "friendly" numbers which will allow a mental calculation, because the idea of estimation is that it is done without written calculation.

   Example:
   38 ÷ 4 ≈ 40 ÷ 4 ≈ 10

2. Breaking down the number(s) and building up the answer
   a. Breaking down the first number (the dividend)

      Example:
      96 ÷ 3 = (90 ÷ 3) + (6 ÷ 3)
      = 30 + 2
      = 32

      Check your answer by multiplication:
      32 x 3 = 96

b. Breaking down the second number (the divisor)

Example:
78 ÷ 6 = 78 ÷ 2 ÷ 3
= 39 ÷ 3
= 13
Check your answer by multiplication:

13 x 6 = 78

OR 13 x 3 = 39 and 39 x 2 = 78

3. Clue Board
For a clue board, use the divisor to write down a few multiples of that number.

Example:
236 ÷ 9:

20 x 9 = 180 236–180= 56
\+ 5 x 9 = 45 56 – 45 = 11
\+ 1 x 9 = 9 11 – 9 = 2
26 with a remainder of 2 .

2 x 9 = 18
3 x 9 = 27
5 x 9 = 45
10 x 9 = 90
20 x 9 = 180

236 ÷ 9 = 26 with a remainder of 2

4. Using multiplication to divide
If two numbers are multiplied, the product can be divided by any of the two numbers and the other number is the answer.

Example:
6 x 7 = 42
Therefore 42 ÷ 7 = 6 and 42 ÷ 6 = 7

Finding the first number or the second number

A sense for division is cultivated if learners find the missing number. This also creates an awareness of the use of inverse operations.

Example:
66 ÷ ☐ = 33 ☐ ÷ 7 = 8 45 ÷ 5 = ☐ ☐ ÷ 8 = 12
(Solution: 66 ÷ 2 = 33; 56 ÷ 7 = 8; 45 ÷ 5 = 15; 96 ÷ 8 = 12)

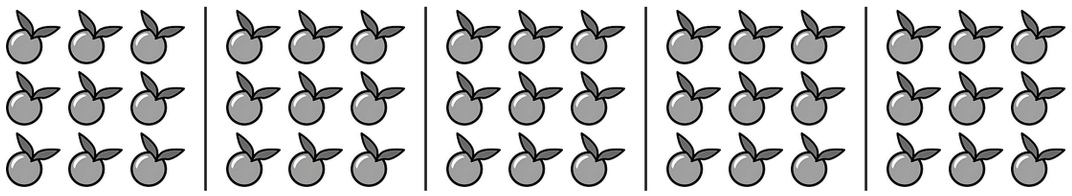
Sharing unequally

Sharing unequally is a new concept. The work done in division so far includes grouping and equal sharing problems, involving whole numbers. These included problems such as:

Sharing equally:
Mamikie has 18 oranges, she shared these oranges among her 3 friends. How many oranges does each friend get?

Grouping:
Mamikie has 18 oranges, she shared these oranges among her friends. Each of her friends got 3 oranges and Mamikie was left with nothing. How many friends got the oranges?

Sharing unequally can be introduced using graphics:



Mamikie shares 45 oranges so Thumi gets two fifths and Tom gets three fifths.

Divide 45 oranges in 5 equal groups first, which means there are 9 oranges in a group. Thumi gets 2 x 9 = 18 oranges and Tom gets 3 x 9 = 27 oranges.

TOPIC 6: PERIMETER, AREA AND VOLUME

INTRODUCTION

- This unit runs for 7 hours.
- The topic is part of the content area 'Measurement'. Together with other topics, the topic counts 15% of the total weight allocated to the five content areas in Grade 4.
- The unit covers shapes and objects in three dimensions of perimeter, area and volume.
- The purpose of the unit is to measure perimeter in units of length and to count the square units in area and the cubic units in volume.

SEQUENTIAL TEACHING TABLE

GRADE 3 FOUNDATION PHASE	GRADE 4 INTERMEDIATE PHASE	GRADE 5 INTERMEDIATE PHASE
LOOKING BACK	CURRENT	LOOKING FORWARD
• Investigate the distance around shapes and objects in informal units • Investigate area by tiling and counting square units • Investigate volume by packing. unpacking and counting of cubic units	• Measure the perimeter of shapes • Find the area of shapes by counting squares on a grid • Find volume of objects by packing and/or counting cubes or blocks	• Measure and calculate perimeter in standard units • Find area of shapes using squares on a grid • Understand square units • Find volume/capacity of containers and objects • Understand cubic units

GLOSSARY OF TERMS

Term	Explanation/Diagram
Perimeter	The total distance around the outside of a shape.
Measurement units of perimeter	The one dimension of the distance around a shape is measured in units of length. with a ruler or measuring tape.
Area	The amount of space that an area covers.
Measurement units of area	The two dimensions of the area of a shape is measured in square units.
Volume	The amount of space that an object takes up.
Measurement units of volume	The volume of a solid object is measured in cubic units.

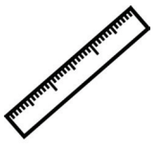
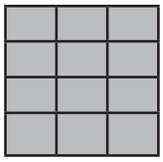
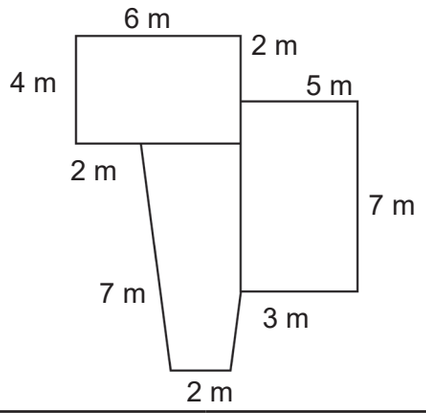
SUMMARY OF KEY CONCEPTS

Introduction

Learners build on their knowledge of the properties of shapes and objects and in this unit they start measuring the three dimensions involved in the various shapes and objects.

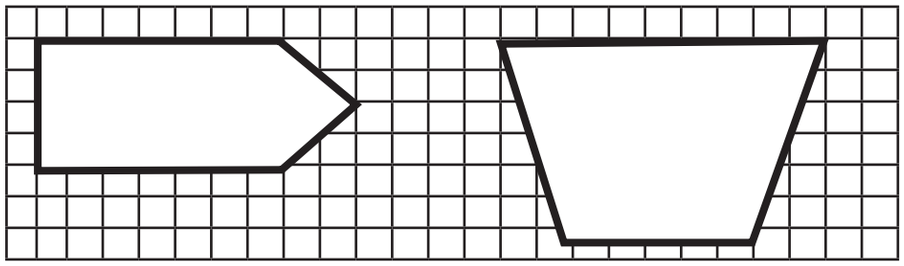
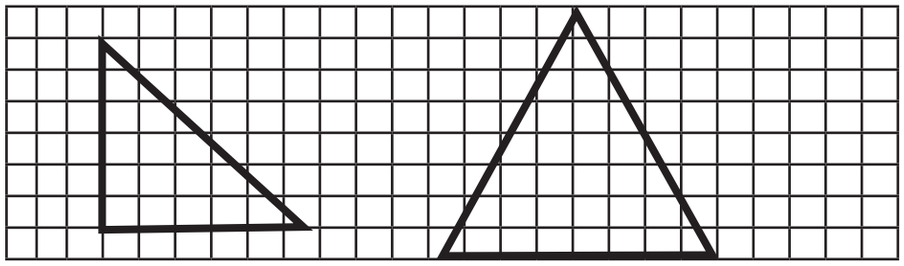
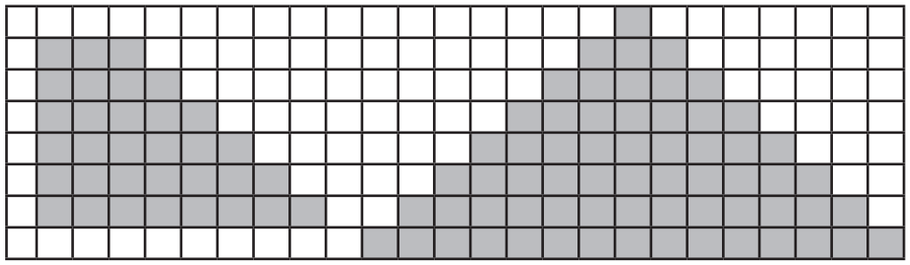
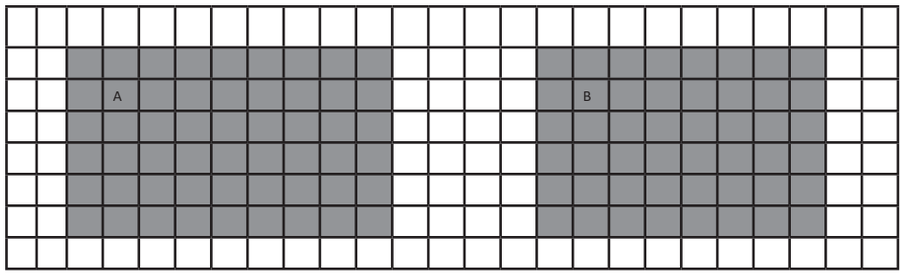
Perimeter

Practically, learners can measure and record the length around a shape, both of real objects and of the picture of an shape, in standard units of metre or centimetre.

SHAPE	INSTRUCTIONS	PERIMETER IN UNIT OF LENGTH
Cup 	Use a string and go all around the top end of the cup. Cut the string and lay it on your ruler to measure the distance in centimetres. Do the same for the bottom end of the cup and calculate the difference.	The distance around the top end of the cup is _____ cm. The distance around the bottom end of the cup is _____ cm. The difference in the distance around the top end and the bottom end of the cup is _____ cm.
Ruler 	Use a string and go all around the outside edge the ruler. Cut the string and lay it on your ruler to measure the distance in centimetres.	The distance around the ruler is _____ cm. This means the perimeter of the ruler is _____ cm
The picture of a shape 	Use this table as a rectangle. Measure it's length and breadth (width) then find the perimeter.	Measured perimeter of the table: The breadth of this table is _____cm. The length of this table is _____cm. The perimeter of this table is _____cm.
		Calculate the perimeter of this house on its outside. Write it down as an addition sum.

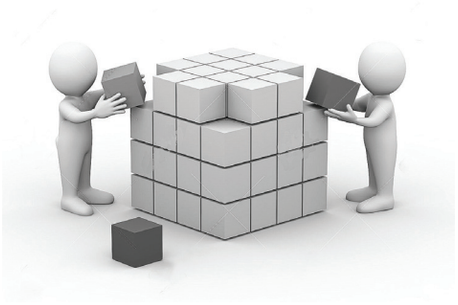
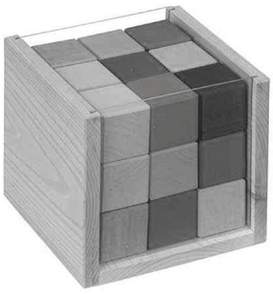
Area

Tiling is a way of covering a surface. Learners measure area by estimating and counting the number of square units needed to cover it. They learn that area is reported in square units.

PICTURES OF THE SQUARE UNITS THAT COVER AN AREA	NUMBER OF SQUARE UNITS
	Estimate the area of the shapes and write it in square units.
	Either count the square units that cover these triangles, or estimate the square units.
	a. Count the square units that cover the shaded shapes. b. Find the perimeter of both shapes in units of length.
 a. Perimeter rectangle A b. Area rectangle A b. Perimeter rectangle B b. Area rectangle B	a. Measure the length and width of the rectangles by counting the units. Calculate their perimeters. b. Measure the areas of the rectangles by counting the square units that their surfaces cover

Volume

1. Learners need to stack and count physical cubes to confirm their concept of volume. When they stack cubes, they measure the volume

PICTURE OF HOW 3D OBJECTS ARE MADE UP OF CUBIC UNITS	NUMBER OF CUBES AND EXPLANATION
What is the volume of the object in the picture below? **Explain in words why you say so.** 	
What is the volume of the object in the picture below? **What do we call the object?** 	
How many cubic units are in this object? 	

TOPIC 7: POSITION AND MOVEMENT

INTRODUCTION

- This unit runs for 2 hours.
- It is part of the Content Area 'Space and Shape (Geometry)' an area which is allocated 15% of the total weight shared by the five content areas in Grade 4.
- This unit covers the location and positions of objects with grid references and on maps.
- The purpose of this unit is practical, for learners to find their way on, and directions from a diagrammatic representation.

SEQUENTIAL TEACHING TABLE

GRADE 3 FOUNDATION PHASE	GRADE 4 INTERMEDIATE PHASE	GRADE 5 INTERMEDIATE PHASE
LOOKING BACK	CURRENT	LOOKING FORWARD
• Follow verbal directions to move around in the immediate environment	• Locate positions of objects following alpha-numeric grid references • Locate positions of objects on a map using alpha-numeric references	• Locate positions of objects, drawings and symbols following alpha-numeric references on grids and on a map • Follow directions by tracing a path between positions on a map

GLOSSARY OF TERMS

Term	Explanation/diagram
Grid	A pattern of blocks or cells running sideways [in rows] and downwards [in columns. The rows are labelled with numbers [1. 2. 3...] and the columns are labelled with letters [A. B. C...]
Grid reference position	A particular cell in a grid. where a column and a row meet. The name of that cell is the label of that column and the label of that row. like B3
Alpha-numeric grid	A grid with letters from the alphabet for the columns and counting numbers for the rows.
Reference	A position on a grid that can be shown or pointed to.

SUMMARY OF KEY CONCEPTS

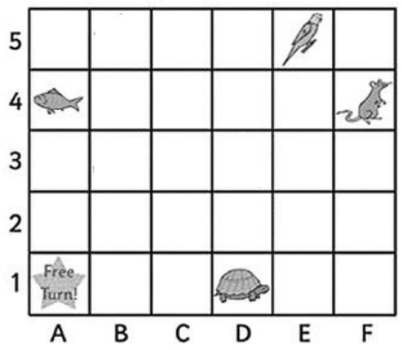
Introduction

In Grade 4, the idea is to find objects and places in relation to grid references. The notation of writing a reference point is important. We write the column coordinate first, which is a letter of the alphabet, and the row coordinate second, which is a number, for example B3.

Locating objects on a grid

Their first introduction to grid referencing must preferably be to find single objects on a grid and to get the referencing right.

Example:



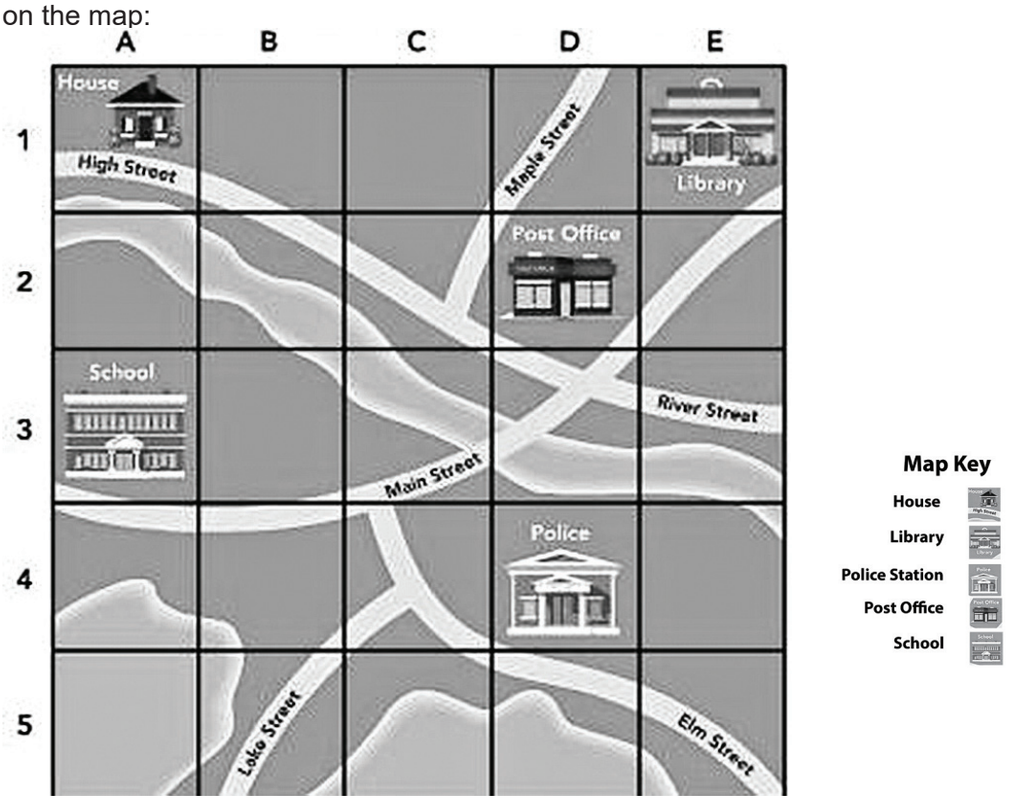
At what grid position do we find

a. a mouse
b. a free turn sign
c. a tortoise
d. a bird
e. a fish

Locating places on a map using grids

Example:

Write down the grid reference points (the coordinates) of the following places on the map:



a. The house

b. The library

c. The police station

d. The post office

e. The school

f. The crossing of River Street and Main Street

TOPIC 8: TRANSFORMATIONS

INTRODUCTION

- This unit runs for 3 hours.
- It is part of the Content Area 'Space and Shape' an area which is allocated 15% of the total weight shared by the five content areas in Grade 4.
- This unit covers the creation of composite 2D shapes, tessellations, rotation, reflection and translation as well as describing patterns in the environment.
- The focus of this unit is on tessellations and describing patterns in real life.

SEQUENTIAL TEACHING TABLE

GRADE 3 FOUNDATION PHASE	GRADE 4 INTERMEDIATE PHASE	GRADE 5 INTERMEDIATE PHASE
LOOKING BACK	CURRENT	LOOKING FORWARD
• Recognise and experience lines of symmetry by folding geometric and non-geometric 2D shapes • Observe and recognise symmetry and transformations in nature and in the environment	• Recognise, draw and describe lines of symmetry in 2D shapes • Create composite 2D shapes by putting together various 2D shapes with line symmetry • Tessellate patterns with 2D shapes, some with line symmetry • Describe patterns in terms of the line of symmetry with an informal idea of the transformations, reflection, translation and rotation • Observe and recognise symmetry and transformations in nature and the environment	• Recognise, draw and describe lines of symmetry in 2D shapes • Use transformations to build composite 2D shapes by tracing and moving 2D shapes by rotation, by translation or by reflection • Use transformations to tessellate patterns with 2D shapes • Observe and recognise symmetry and transformations in nature and in the environment

GLOSSARY OF TERMS

Term	Explanation / Diagram
Symmetry	The quality of having two parts that match each other.
Tessellation	2D shapes that fit together closely in a repeated pattern without gaps or overlapping.
Transformation	A pattern made of one or more shapes: • the shapes must fit together without any gaps • the shapes should not overlap
Reflection	A transformation in which a geometric figure is reflected across a line, creating a mirror image.
Translation	A type of transformation where the original image is repeated, but has moved its position to the left or the right, and/or up or down.
Rotation	A type of transformation where the The original image is turned around about a point, clockwise or anticlockwise.
Composite Shapes	Shapes that are made up from a number of other shapes.
Pattern	A design that is repeated, mostly to decorate something, for example on furniture, fabric or paper.

SUMMARY OF KEY CONCEPTS

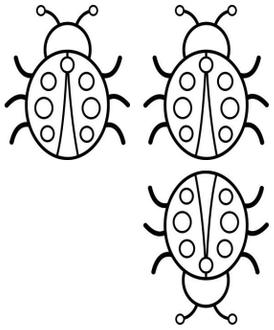
Recognising and describing patterns in real life

Note: It is important that learners recognise transformations such as symmetry and reflections around them.

Here are a few ideas of how to encourage this.

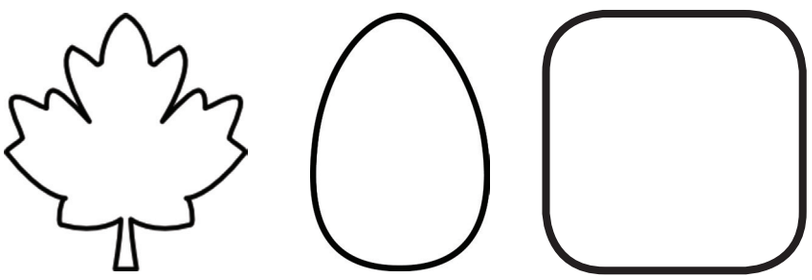
1. Describe the shape and the pattern of the honeycomb. Tessellate five more cells. Draw a line of symmetry for all the bees. Try to draw one more bee on one of your honeycomb cells.

2. a. Colour the second ladybug in the first row in red and black.
   b. Colour the ladybug yellow that is reflected horizontally from the red and black ladybug.
   c. Colour the ladybug green that is reflected vertically from the red and black ladybug.



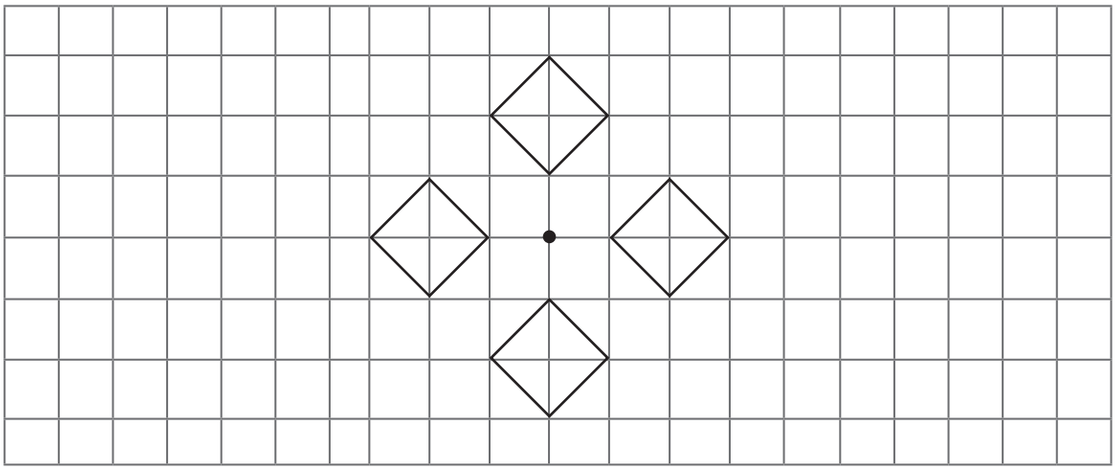
Recognising and drawing lines of symmetry in nature and in pictures

Draw a line of symmetry in the leaf and the egg. In the frame, draw a flower with symmetry.

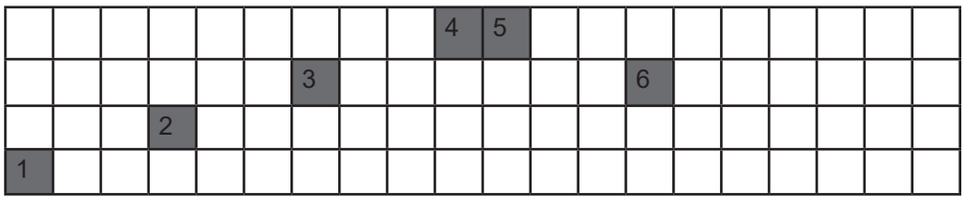


Recognising and describing patterns of transformation of 2D shapes

a. Choose one diamond, number it then describe how each of the other three diamonds were transformed from your original diamond.

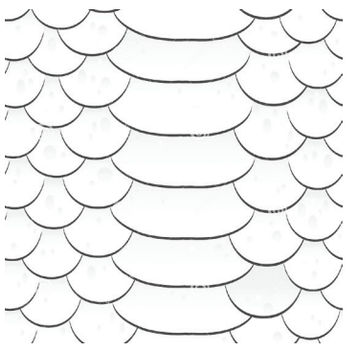


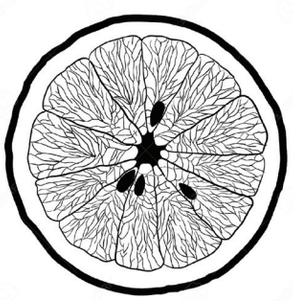
b. Describe what happened each time to the square marked 1 until it reaches position 4. Then shade the squares that would represent number 7 and number 8 if the pattern continued.
Describe what you see if you compare group 1 to 4 to the group 5 to 8.



Recognising and describing patterns in nature

1. Describe the following patterns in nature:
   a. A snake skin pattern...
   b. Orange segments...

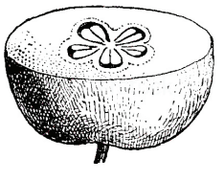




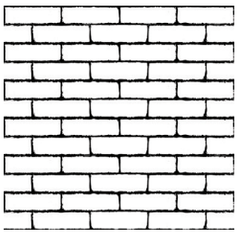
2. Describe the pattern and different natural symmetries in this picture of leaves:

3. Describe the patterns which you see in objects in the world around us.









TOPIC 9: GEOMETRIC PATTERNS

INTRODUCTION

- This unit runs for 2 hours.
- It is part of the Content Area 'Patterns, Functions and Algebra' an area which is allocated 10% of the total weight shared by the five content areas in Grade 4.
- This unit covers the same work as in Term 2, namely geometric (visual) patterns, distinguishing the nature of sequences and finding the rules for the patterns.
- The purpose of this unit is to confirm the newly acquired concepts of Term 2.

SEQUENTIAL TEACHING TABLE

GRADE 3 FOUNDATION PHASE	GRADE 4 INTERMEDIATE PHASE	GRADE 5 INTERMEDIATE PHASE
LOOKING BACK	CURRENT	LOOKING FORWARD
	• Extend geometric patterns • Identify a sequence in a geometric pattern • Find a rule in a number sequence • Use flow diagrams to describe geometric patterns • Design own geometric patterns	• Extend geometric patterns • Identify a sequence in a geometric pattern • Find a rule in a number sequence • Use flow diagrams to describe geometric patterns • Design own geometric patterns

GLOSSARY OF TERMS

Term	Explanation/diagram
Pattern	A sequence of shapes, pictures or numbers that are arranged according to a rule.
Geometric pattern	An ordered list of shapes or a sequence that follows a certain pattern.
Term	Term is the position of a shape in the sequence.
Rule	The rule of the pattern is a description of the constant change that happens to every following term.
Constant difference	If the pattern changes by adding the same number each time or by subtracting the same number each time, there is a constant difference between all the terms in the sequence.
Representation of geometric pattern	The shapes in a geometric pattern form a pattern because of their arrangement and structure. We can represent this structure in various ways like words, a flow diagram or numbers.
Flow diagram	A visual way to represent a geometric pattern, with the term to the left, the rule in the middle and the number value of the geometric pattern to the right.

SUMMARY OF KEY CONCEPTS

Geometric patterns with a constant ratio

1. Pictures or geometrical shapes that repeat in a way by which they change a number of times more or less (in other words by multiplication or division), are said to have a constant ratio. Complete row number 4 and read the various representations of this pattern afterwards.

   Row 1 (number 1)
   Row 2 (number 2)
   Row 3 (number 4)
   Row 4 (number 8)

   The rule of the pattern is that we multiply each term by 2.
   We can represent this pattern in various ways:

   a. The pattern in words: The number in every row is multiplied by two.

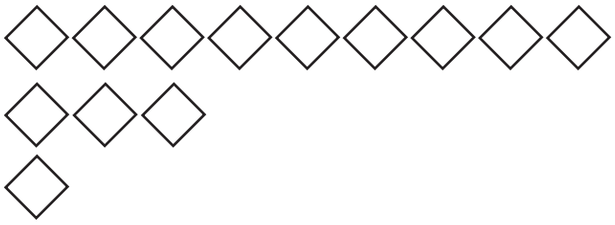
   b. This pattern as a story: There were two men who could make hats.

      They each trained two more men to make hats. Each of those men trained two other men, and so it went on.

   c. The pattern in numbers: 2 x 2 = 4; 4 x 2 = 8 and so on.

2. Investigate the geometric pattern below. What type of pattern is it? Describe the number of diamond shapes in words and find the the rule:

   Row 1
   Row 2
   Row 3

   (divide by three)

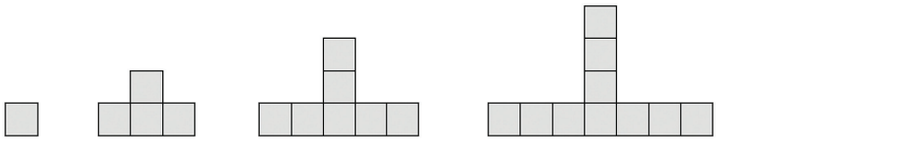
Geometric patterns with a constant difference

1. This pattern tells the story of the school's tennis club and their tennis balls. In week 2, 3 and 4 the coach found that 5 balls disappeared each week. How many balls were there in week 1 and how many will there be in week 5?

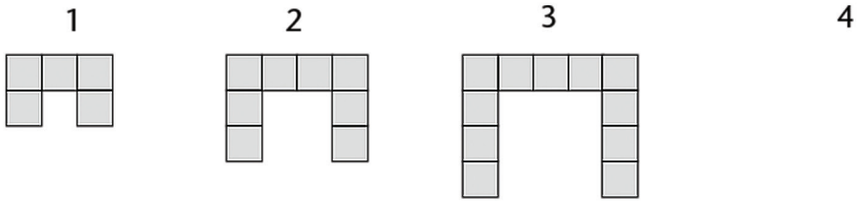
Week 1:

Week 2:
☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯
Week 3:
☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯☯
Week 4:
☯☯☯☯☯☯☯☯☯☯☯☯☯
Week 5:

2. Give number values to the pattern below in words and in numbers. What are the rules for both patterns? For each pattern, say how many squares will be in the following one.



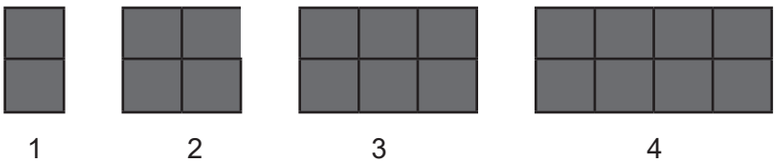
(1 ; 4 ; 7 ; 10 - the rule is add 3 each time. The 5th pattern will have 13 squares)

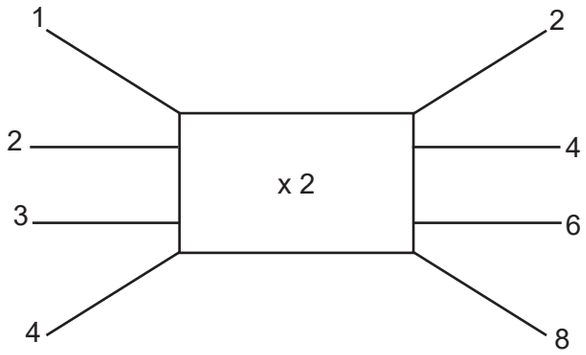


(5 ; 8 ; 11 - the rule is to add three each time. The 4th pattern will have 14 squares)

Flow diagram

Find the rule and represent the geometric sequence below in a flow diagram:





TOPIC 10: PROBABILITY

INTRODUCTION

- This unit runs for 2 hours.
- It is part of the Content Area 'Data Handling' an area which is allocated 10% of the total weight shared by the five content areas in Grade 4.
- This unit introduces the idea that there are possible outcomes of experiments.
- The purpose of this unit is to experience various possibilities in the outcomes of experiments.

SEQUENTIAL TEACHING TABLE

GRADE 3 FOUNDATION PHASE	GRADE 4 INTERMEDIATE PHASE	GRADE 5 INTERMEDIATE PHASE
LOOKING BACK	CURRENT	LOOKING FORWARD
	• Perform simple experiments • List the possible outcomes of events • Use tallies to record outcomes	• Perform simple repeated experiments • List the possible outcomes of events or experiments • Make tally tables to record actual outcomes • Count and compare the frequency of outcomes

GLOSSARY OF TERMS

Term	Explanation / Diagram
Experiment	Something you do to find out what will happen, like tossing a coin twenty times to see how many times it lands on each side.
Event	A simple event is when one experiment is done and it has one outcome, for example you toss a coin once, and you get tails. Another event is when you toss the coin again and you get heads. Each time you do the experiment and you have an outcome, it is an event.
Outcome	The result of a trial, like when I tossed the coin, it landed heads up, therefore the outcome is "heads up".
Frequency	The number of times that an event occurred.
Probability	The chance that the event will occur during an experiment.
Possible outcomes	The number of outcomes that may occur, like rolling a die has six possible outcomes.
Impossible	An outcome that will never happen, like the die can never land on 7 because there is no 7 on the die.

SUMMARY OF KEY CONCEPTS

In Grade 4, learners only perform experiments and record the outcomes of the events of experiments. They also list the possible outcomes of the event. They do not predict the outcome of a particular event, but a sense for prediction is created.

Calculating probability

Probability is the chance that an event will occur when we do an experiment. This chance is calculated out of all the possible outcomes. The coin may land heads up or tails up, which are two possible outcomes. The probability to land heads up is one out of two, or we can say half ($\frac{1}{2}$) of the time it may land heads up.

Example:

a. The probability that a dice will land with a 2 on top, is 1 out of 6 because there is one two and six numbers altogether on the die.

b. The probability that a die will land with an odd number on top, is 3 out of 6 ($\frac{3}{6}$) because there are three odd numbers on a die out of a total of six numbers.

Frequency table

A frequency table has to have a column for all the possible outcomes, a column for the tallies and a column for the number of times that that outcome occurred (the frequency), and a row underneath for the total number of trials that were conducted, where all the frequencies are added.

Example:
Jim did an experiment with a spinner with five colours. He did fifty trials and recorded the results in a frequency table.

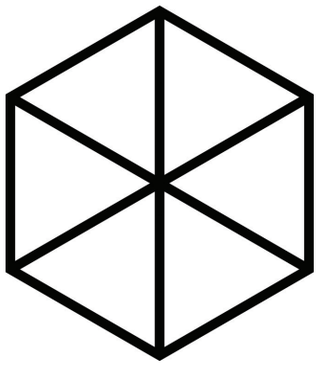
Possible outcomes	Tallies	Frequency
Red	𝍸 / / / /	9
Green	𝍸 𝍸 / /	12
Yellow	𝍸 𝍸 /	11
Blue	𝍸 / / /	8
Brown	𝍸 𝍸	10
Total number of trials that were conducted		**50**

a. How many times did the spinner land on yellow?

b. How many times is that out of the total trials that Jim performed?

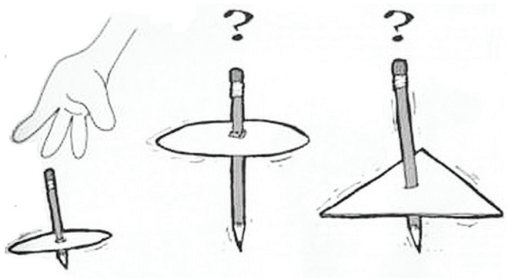
Doing an experiment and recording the outcomes

- Make yourself a spinner and colour it in six different colours.
- Mark each segment with numbers from one to six.
- Stick a pin though its middle point and spin it 30 times,each time tallying the outcome.



a. Draw a frequency table and record all trials.

Possible outcomes (numbers)	Tallies	Frequency



Notes

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