Thinking and Working like a Mathematician

MATHEMATICS
新思维数学
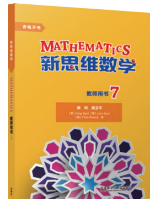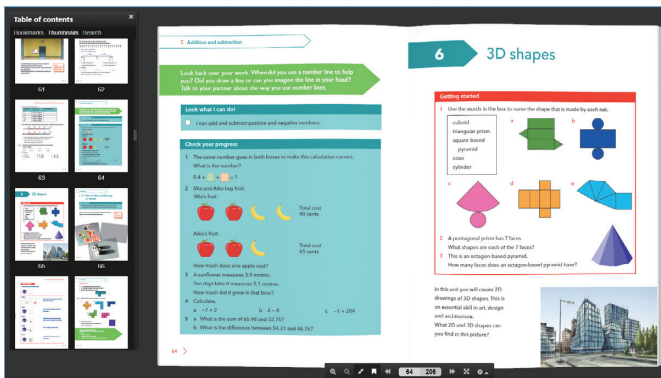
For learners aged 6-18
Content and language integrated learning
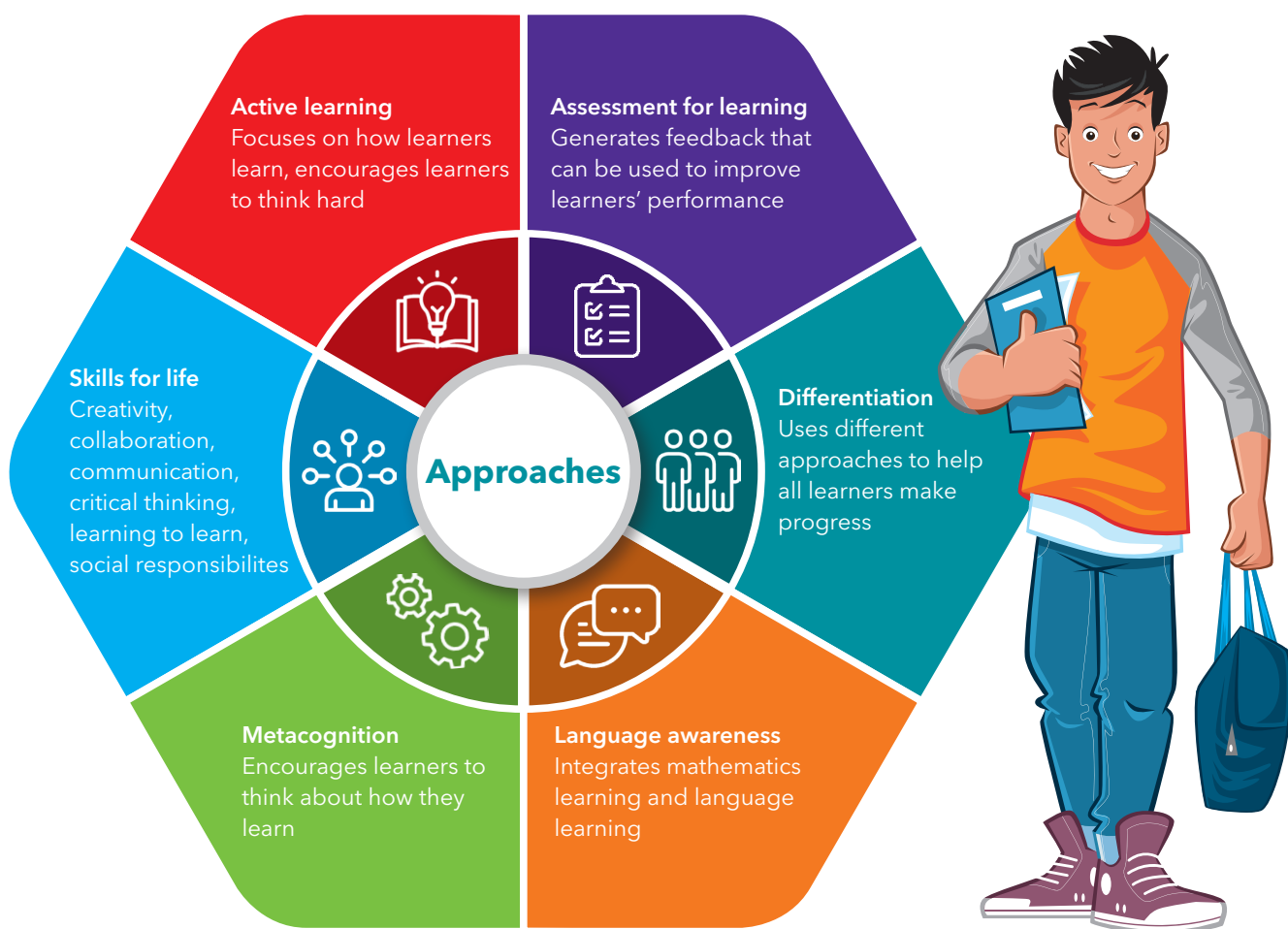**Mathematical and global thinking**

FLTRP *Mathematics* is an international course for learners aged 6-18. The course integrates content learning and language learning, covers the four main areas of number, geometry & measure, statistics & probability and algebra, encourages the learners to think and work like scientists. FLTRP *Mathematics* offers full support for learners and teachers through various materials including Learner's Book, Workbook and Teacher's Resources.
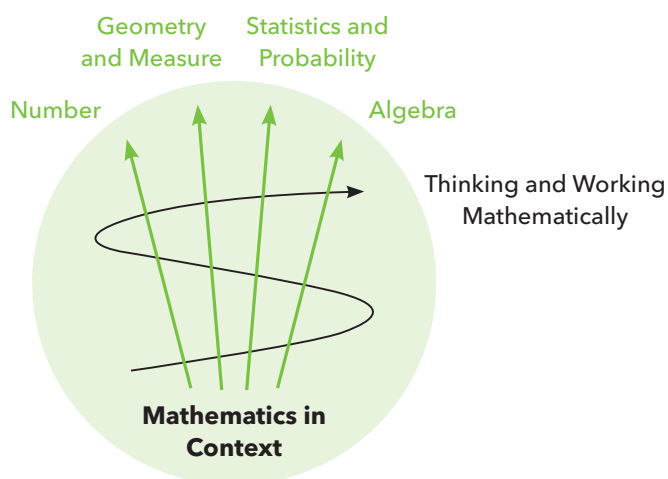
Components

Paper	Learner's book	Workbook	Teacher's book (2023)
Digital	Digital versions can be accessed via FLTRP's website and APP of Unistudy		• Diagnostic, end-of-unit, mid-point, end-of-year tests and answers • Answers to learner's book and workbook questions • Language worksheet ...

Approaches

Active learning
Focuses on how learners learn, encourages learners to think hard

Assessment for learning
Generates feedback that can be used to improve learners' performance

Skills for life
Creativity, collaboration, communication, critical thinking, learning to learn, social responsibilites

Differentiation
Uses different approaches to help all learners make progress

Metacognition
Encourages learners to think about how they learn

Language awareness
Integrates mathematics learning and language learning

Features

- Content and language integrated learning
- Coverage of four main areas of mathematics
- Thinking and working mathematically
- Materials to support learning, teaching and assessment

Geometry and Measure   Statistics and Probability

Number   Algebra

Thinking and Working Mathematically

Mathematics in Context

Number of learning hours

Stage 1-6: 4-5 hour per week

Stage 7-9: 2-3 hours per week

Learner's resources

〉 Learner's book

A variety of investigations, activities and questions to help learners develop mathematical skills.

1 Questions or activities that help learners think and talk about what they already know about this topic

2 What learners will learn in each topic

3 Important topic-specific words

4 Step-by-step way to solve a problem

5 Investigations for learners to practice and develop practical skills, to promote active learning and deep understanding

6 Questions asking learners to think about their learning

7 List summarizing the important ideas that learners have learned in the topic

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Learner's book page (15.3)

15.3 The area of a triangle

> ### 15.3 The area of a triangle

In this section you will …
- derive and use the formula for the area of a triangle.

Key word
perpendicular height

The area of a triangle is always half of the area of the rectangle that surrounds it, as these diagrams show.

surrounding rectangle

height
base

You find the area of a rectangle by multiplying the base by the height. So, the area of a triangle will be a half of the base multiplied by the height.

You can use algebra to write the formula as: Area $= \frac{1}{2} \times$ base $\times$ height

or simply: $A = \frac{1}{2}bh$

Note that the height measurement of the triangle **must** be the **perpendicular height**, from the base to the opposite vertex.

Tip
The height must be at right angles (90°) to the base.

Worked example 15.3

a Work out the area of this triangle.

6 cm
8 cm

b Work out the area of this compound shape.

4 cm
3 cm
5 cm

Answer

a $A = \frac{1}{2}bh = \frac{1}{2} \times 8 \times 6$
   $= 24\,\text{cm}^2$

Write down the formula. Then substitute the values for b and h.
Work out the answer. Remember to include the units (cm²).

317

Probability page

4 Probability

Getting started

1 Write one of these phrases to describe the chance of each event happening.

It will happen   It might happen   It will not happen

a You will see a monster today.
b You will write something at school today.
c You will flip a coin once and it will land on heads.

2 Sylvester counted the different colour flowers in the garden. These are the flowers.

a Which tally chart shows the flowers Sylvester counted?

A
Colour	Number of flowers
Red	||
Yellow	|||
Blue	|||| ||

B
Colour	Number of flowers
Red	||
Yellow	||||
Blue	||||	

C
Colour	Number of flowers
Red	||||
Yellow	|||
Blue	||||	

b Which colour flower are you most likely to see in the garden?
c Which colour flower are you least likely to see in the garden?

3 Spinner A   Spinner B

Are you more likely to get a red spin on Spinner A or Spinner B? Explain why.

52

Symmetry page

6.2 Symmetry

Think like a mathematician

Investigate the number of lines of symmetry in these regular polygons.

a Trace the shapes and draw on their lines of symmetry.
You could use a mirror or you could fold them to find the lines of symmetry.

A   B   C   D
E   F   G   H

b Copy and complete this table to record the characteristics of each shape.

Shape	Name	Sides	Vertices	Lines of symmetry
A				
B				
C				

Assess how well you have found all the lines of symmetry in shapes.
- Which lines of symmetry were easiest to find?
- Which lines of symmetry were hardest to find?
- What will you look for or check to help you find lines of symmetry in shapes in the future?

Look what I can do!

☐ I can find all the lines of symmetry in patterns.
☐ I can find all the lines of symmetry in 2D shapes.

83

Exercise 12.1

1 A fraction strip is 15 cm long. Majak is marking thirds on the strip.

   a Where should he mark $\frac{1}{3}$? At ___ cm.

   b Where should he mark $\frac{2}{3}$? At ___ cm.

2 A fraction strip has tenths marked at 5 cm, 10 cm, 15 cm, 20 cm, 25 cm, 30 cm, 35 cm, 40 cm and 45 cm. How long is the whole fraction strip?

3 a Draw a ring around $\frac{1}{10}$ of the marbles.

   b What fraction of the marbles are not ringed?

4 Here is $\frac{1}{3}$ of a set of cars. How many cars are in the whole set?

5 Find these fractions of 20.

20	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{10}$	$\frac{3}{4}$
		X			

183 ⟩

8 Exercises giving learners the chance to apply what they have seen in the worked example

9 Questions looking back at some of the content learners learnt in this unit, helping teachers check their learners' progress
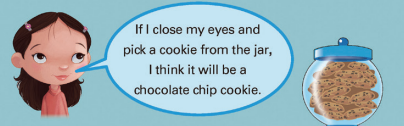
Check your progress

1 Complete this regular pattern.

   Draw a regular sequence of your own and describe it to your partner.

2 A cookie jar contains oatmeal cookies and chocolate chip cookies.

   If I close my eyes and pick a cookie from the jar, I think it will be a chocolate chip cookie.

   Zara picks five cookies.
   Complete the table to show the results.

Oatmeal cookies	
	I

   Describe the results.
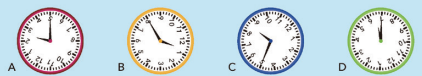   _____
   _____
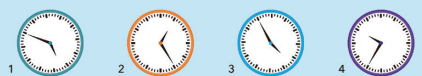
219 ⟩

Project 2

Rolling clock

The picture shows a clock rolling down a slope.

Here are some pictures of different clocks that are on the slope. What times do they show? How do you know?

A   B   C   D

Here are four more rotated clocks. They show 3 o'clock, 10 minutes past 10, 20 minutes to 4 and half past 11.

1   2   3   4

Which is which?
How do you know?

10 Project involving making something or solving a problem, for deeper investigation of mathematical concepts

11 Definitions and index of key words for language support

Glossary

accurate, accurately	correct, without any mistakes	17
analogue clock	clock that shows the time using pointers called hands	182
angle	a measurement of turn	170
anticlockwise	in the opposite direction to the movement of the hands of a clock	170

anticlockwise

array	a regular arrangement of equal groups in an evenly spaced grid	87
calendar	an organised arrangement of the days, weeks and months, usually for 1 month or 1 year	109

APRIL

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

229 ⟩

〉 Workbook

Questions for learners to practice what they have learnt in class. 3 tiered sections for each topic.

Tier 1: Focus

For extra support; helps learners to master the basics

Tier 2: Practice

For all learners; helps learners to become more confident in using that they have learnt

Tier 3: Challenge

For more confident learners; encourages further learning and extension

〉 Digital

Digital versions of Learner's book and Workbook can be accessed via FLTRP's website and APP of Unistudy.

Teacher's resources
(2023)

❯ Teacher's book

Everything teachers need to deliver the course, including Teacher's Book and digital resources.

Unit plan:
topics in the unit
- learning hours
- learning content
- available resources

Background knowledge
Prior knowledge required to access the unit

Teaching skills

Language support
Ideas for teaching new vocabulary

Common misconceptions

Topic learning plan:
- learning objective
- learning intentions
- success criteria

❯7 Statistics

Unit plan

Topic	Approximate number of learning hours	Outline of learning content	Resources
7.1 Answer non-statistical questions (categorical data). Record, organise and represent categorical data using practical resources and drawings.	6	• Learners will be asked to record and organise data answers to non-statistical questions. They will be asked to record the data in a personal way before they record it systematically. • They will work individually, in pairs or as a group and whole class.	Learner's Book Section 7.1 Workbook Section 7.1 Resource sheet 7A Resource sheet 7B Resource sheet 7C Resource sheet 7D Additional teaching ideas for Section 7.1
7.2 Record, organise and represent categorical data using Venn diagrams. Describe data from primary and secondary sources. Discuss conclusions made by self and others.	6	Learners will be asked to record, organise and represent data using Venn diagrams to sort numbers or objects using one criterion; explain choices using appropriate language including 'not'.	Learner's Book Section 7.2 Workbook Section 7.2 Worksheet 7A Worksheet 7B Worksheet 7C Language worksheet 7A Language worksheet 7B Resource sheet 7E Resource sheet 7F Resource sheet 7G Additional teaching ideas for Section 7.2 **Digital Classroom:** Unit 7 Venn diagrams

Cross-unit references
Digital Classroom: Unit 7 multimedia enhancement
Digital Classroom: Unit 7 activity
Learner's Book Check your progress
Language worksheet 7A
Language worksheet 7B

89 ❯

BACKGROUND KNOWLEDGE

This unit teaches learners to order and compare units of time. It also teaches them how to apply their understanding of the days of the week and the months of the year to dates and to use a calendar. By the end of the unit, learners will be able to order units of time and record dates in words and numbers. To start the unit, learners need to have some experience of the days of the week and months of the year and have everyday experience of units of time.

The days of the week are easier to recall than the months of the year because learners experience them repeatedly every day. Discussing the date daily with learners will help them to recall the pattern of days and months.

Periods of time within a day are also easier for learners to understand because they can recall the start and end of the period. Units of time longer than a day are more difficult to remember simply because they take longer to experience. Focus on linking days, weeks and months through the calendar. Years are best related to the learners'

ages, but they will still find it difficult to relate to how long a year is.

Digital Classroom: Use the Unit 7 animation to introduce the content of this unit. The i button will explain how to use the animation.

Supporting learners with the Getting started exercise
Learners explored the days of the week and months of the year in Stage 1. Remind them that all of the days of the week have 'day' at the end of the word. Sing a days of the week song together or talk through a typical school week to revise the order of the days.

The months of the year have few patterns. Use a calendar to support ordering the months. One with the year on a page is much easier for learners to use. They could draw a path from January to December to emphasise the order. At the end of each row, the day numbers continue at the beginning of the next row. One-month-on-a-page calendar layouts are usually organised in this way.

TEACHING SKILLS FOCUS

Formative assessment
There are two main types of assessment:

- Summative assessment assesses skills and knowledge at the end of a period of learning. Examples include end-of-unit, end-of-term or end-of-year tests. If a scheme of work is used, some or all of these may be provided.

- Formative assessment (also known as assessment for learning) is ongoing assessment. It is used to help the teacher support learners within the current session and to inform the teacher what to teach next.

Within any session, teachers must continually assess learners to ensure they are making progress and not developing misunderstandings. There are many different ways to carry out formative assessment,

- Encourage pairs or groups of learners to discuss the activity. Listen in to check understanding.

- Ask open-ended questions to check and deepen understanding. For example, 'Tell me how you worked out your answer?' or, 'Is that always true?'

- Give immediate feedback to learners during any activity to help them make progress.

The teacher must be an active listener and observer, asking questions where necessary to clarify their observations. Teachers then use the information to decide whether they need to spend more time on something or if it is safe to move on. These observations will also inform further teaching in the next session or sessions.

Before each session, ask yourself how you will know what the learners have learnt and understood. At the end of a session, ask yourself what the learners know and how you will build on that in the next session.

10.1 Pictograms and bar charts

LEARNING PLAN

Framework codes	Learning objectives	Success criteria
3Ss.02	• Record, organise and represent categorical and discrete data. Choose and explain which representation to use in a given situation – pictograms and bar charts.	• Learners will use examples of pictograms and bar charts to record, organise and represent their own discrete data. They will choose and explain which graph to use in a given situation.
3Ss.03	• Interpret data, identifying similarities and variations, within datasets, to answer non-statistical and statistical questions and discuss conclusions.	• Learners will interpret given data, as well as their own, identifying similarities and differences within the dataset to answer questions and discuss results.

LANGUAGE SUPPORT

Plan the introduction of new words in a suitable context, with relevant objects, apparatus, pictures or diagrams. Explain their meanings carefully and rehearse them several times. Encourage their use in context, particularly through questioning.
Represent: to be a sign or symbol of something
Discrete data: data that can be counted; for example, days of the week

Axes: plural of axis, meaning more than one
Axis: a fixed line on a graph to show the position of a point
Bar graphs: graphs that use bars to represent data. They are also called bar charts.

Common misconceptions

Misconception	How to identify	How to overcome
Not understanding the need for accurate data.	Observe learners working in pairs or small groups. Listen to how they talk about data.	Discuss the need for accurate data, giving an example of when inaccurate data leads to misunderstanding. For example, have a class vote about where they would like to go for a day out of school, then choose the least popular idea. Ask, 'Is this what the data showed? What do we need to change?'
Not understanding what information needs to be collected.	Listen as learners take part in whole class or group discussions to see if they understand the meaning of data.	Use posters or pictures to visually show what data means and the different ways of showing it. Refer to it whenever it is appropriate; for example, the number of school lunches compared to packed lunches.

126 ❯

7 ❯

Clear section structure Selection of teaching ideas

Guidance on TWM questions

Homework ideas

Assessment ideas

Project guidance

Starter idea
Which animal? (10 minutes + 10 minutes Getting started exercise)

Resources: Learner's Book

Description:

Draw a blank pictogram on the board with the categories cat, bird, fish and giraffe.

cat	
bird	
fish	
giraffe	

Ask the questions, 'If you were an animal, what animal would you be? Put up your hand if you would like to be a … '

Fill in the pictogram as learners give their answer for each animal.

Ask questions about the data, such as, 'How many of you want to be a giraffe? How many more . . . than . . . are there? Which animal has the fewest votes? What is the difference between the number of birds and the number of cats?'

At the end of 10 minutes, ask the learners to complete the Getting started exercise in the Learner's Book. This will allow you to see if there is anything further that needs revisiting before starting the rest of the unit.

Main activity idea
Revisiting pictograms (40 minutes)

Learning intention: Record, organise and represent categorical and discrete data. Choose and explain which representation to use in a given situation – pictograms.

Resources:
- Learner's Book Exercise 10.1 question 1
- Workbook Exercise 10.1 questions 1, 5 and 8 to be used for homework
- Resource sheet 10A
- Cubes

Description:

Remind the class that pictograms are a simple way to represent data using pictures. A pictogram must have a title and the pictures need to be the same size and be equally spaced. A picture can represent a number and half a picture can represent half of that number. A key must be included to show what the symbols/pictures mean. Show these by drawing them on the board, using different colours, as you say them. For example:

white	
red	
black	
silver	

represents 2 cars

This shows a pictogram where each image represents two cars.

When making a key for a pictogram, at this stage it's important to remember that you will need to do a key of only one item = 1 car or one item = 2 cars but nothing more complex.

Ask questions such as, 'How many red cars? How many blue cars? Which colour is represented most?' Remind learners that they should be counting each picture as two.

Ask, 'If there were two and a half blue cars in the pictogram, how many cars does that represent?' [5]

Give each pair of learners a copy of Resource sheet 10A. Ask them to talk to each other about the data. Remind them to look at the key.

Give learners time to find and write four things that they know by looking at and interpreting the data.

Type of book	Number
adventure	
picture	
comedy	
history	

Draw a table on the board and ask the class for feedback. Complete the table, showing the number of each type of book.

Ask questions such as:

Which type of book is the most popular?

Which type of book is the least popular?

How many more adventure books were borrowed than picture books?

Explain that we can use these ideas to help us multiply using factors. Use Worked example 2 in the Learner's Book to demonstrate this method.

Calculate 18 × 5 using factors	
$18 = 9 \times 2$ So, $18 \times 5 = 9 \times 2 \times 5$ $= 9 \times 10$ $= 90$ Answer: 90	9 and 2 are factors of 18. The associative law allows you to multiply numbers in any order, so you can do 2×5 first.

Ask learners to calculate the following using this method.

14×5 12×5 15×4

Answer: 70   60   60

This activity leads nicely into questions 1 and 2 of Exercise 5.2 in the Learner's Book.

> **Differentiation:** Give learners time to get started, but if any learners are stuck you may need to group them together so you can provide further support while the rest of the class continue with the examples. Challenge more confident learners to use a dice to create digits for 2-digit by 1-digit multiplication calculations that they can answer using a variety of methods. For each calculation they should say which is the most efficient method and why.

Plenary idea
Multiplication shuffle (an activity for pairs) (10 minutes)

Resources: A set of 0–9 digit cards.

Description: Shuffle the cards and place them face down in a pile.

Take turns to take three cards and arrange them to make the multiplication calculation with the biggest answer.

When both learners have arranged their cards they each complete their calculation and then share their method and result. The learner with the bigger answer wins the round.

This game can be extended to multiply a 3-digit number by a 1-digit number, scoring points for the smaller/bigger number.

> **Assessment ideas:** Peer assessment as learners check their partners' answers. Learners can play multiplication games while you focus on questioning targeted individuals. You could ask learners how they decided the order for their cards.

More teaching ideas are available to download from Cambridge GO (as part of this Teacher's Resource).

Guidance on selected *Thinking and Working Mathematically* questions
Learner's Book Exercise 5.2, question 3

Learners will show they are **critiquing (TWM.07)** when they compare methods to identify the advantages and disadvantages of each. There is no right answer to which method is 'best' as it depends on the numbers in the questions and the learner's understanding.

For example, when calculating 47×5 some may prefer to use the mental method $47 \times 10 = 470$ and halve the answer to give 235. Others may feel comfortable using the grid method, but not yet feel ready to use a standard method, and some will use a standard method regardless of the numbers involved. It is important that learners reflect on the most appropriate method for them. Do not encourage them to use standard methods until they are ready.

Homework ideas
1 Make a poster to show different methods of multiplication.
2 Find examples of arrays in the real world and add them to a class display. Examples could include Scouts and Guides marching in columns; and packaging.

Assessment ideas
- Suggest to learners that they check the two Look what I can do! sections and discuss these with their partners, reflecting on their progress through the unit and what they can do to improve their performance.
- **Digital Classroom:** Use the Unit 5 activity with the whole class to check their knowledge. The i button will give you more information.
- Ask learners to complete the Check your progress exercise in the Learner's Book. Address any issues that arise and consider using the worksheets to give learners confidence before they work on the End of unit 5 test.
- In **Digital Classroom**, you can use the Hundred square digital manipulative with your class to identify multiples and factors of numbers up to 100. Press the i button for more information about how to use this manipulative.

PROJECT GUIDANCE: PROJECT 6 CONSIDERING COORDINATES

This guidance accompanies the project in the Learner's Book.

Why do this project?

This task encourages learners to think deeply about the possible orientations of squares and the possible directions of mirror lines, and how these possibilities affect the coordinates of the corners of a square. In supporting or challenging some plausible-sounding mathematical ideas, learners will practise drawing a variety of different squares and mirror lines to use as evidence to **convince** others of their thinking.
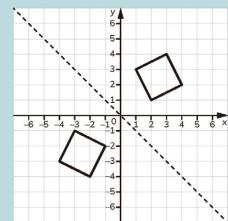
Possible approach

You can download the Project 6 resource sheet from Cambridge GO for a set of blank coordinate grids.

Display a coordinate grid on the board and draw a square where the sides are parallel to the axes, as in the first picture in the Learners' Book. Invite learners to discuss in pairs what they notice about the square and then share their ideas with the class. What do learners notice about the coordinates of the corners?

Draw a different square in the same orientation. Provide some time for learners to work with their partners to find the coordinates and discuss any patterns they see. Ask different pairs what they have noticed and encourage them to explain why this might happen. Do learners think there is anything that will always be true about the coordinates of the corners of a square?

Read Arun's first statement as a class and choose different learners to explain what Arun means. Give learners some time to work together in pairs to draw different squares on different coordinate grids, working out the coordinates and checking whether or not they support Arun's statement. After some time, bring learners back together to discuss their squares. What types of square have corners that all have different x-coordinates? Why?

Discuss Arun's second statement and check that all learners understand it. Allow time for learners to draw squares and mirror lines to test this statement. As you walk round the room, listen out for pairs who are explaining their reasoning to convince each other whether or not a particular square and mirror line will give another square with different x- and y-coordinates. In the plenary, choose some of these learners to explain how they found an example which challenges Arun's statement. One example that disproves both of Arun's statements is below, but learners might find a variety of different ways of proving Arun's ideas wrong.

Key questions

When that point is reflected in the mirror line, how do the coordinates change?

What do you notice? Will that always happen? Why/why not?

Can you draw a square that looks very different from that one?

Possible support

Some learners might need to be encouraged to rotate the paper to find squares and mirror lines in different orientations.

Possible extension

Ask learners to look carefully at one of Arun's statements and think about situations in which it would be true. Does the first statement always work if the sides of the square are parallel to the coordinate axes? What about when the square is turned by 45 degrees? Does the second statement only work if the mirror line is vertical? Does it matter what orientation the square is in for the second statement?

› Digital

- Introductory material
- Approaches to learning and teaching
- Worksheet
- Language worksheet
- Diagnostic, end-of-unit, mid-point, end-of-year tests and answers
- Answers to learner's book and workbook questions

› Active learning

What is active learning?

Active learning is a teaching approach that places student learning at its centre. It focuses on how students learn, not just on what they learn. We, as teachers, need to encourage learners to 'think hard', rather than passively receive information. Active learning encourages learners to take responsibility for their learning and supports them in becoming independent and confident learners in school and beyond.

Research shows us that it is not possible to transmit understanding to learners by simply telling them what they need to know. Instead, we need to make sure that we challenge learners' thinking and support them in building their own understanding. Active learning encourages more complex thought processes such as evaluating, analysing and synthesising, which foster a greater number of neural connections in the brain. Although some learners may be able to create their own meaning from information received passively, others will not. Active learning enables all learners to build knowledge and understanding in response to the opportunities we provide.

Why adopt an active learning approach?

We can enrich all areas of the curriculum, at all stages, by embedding an active learning approach.

In active learning, we need to think not only about the content but also about the process. It gives learners greater involvement and control over their learning. This encourages all learners to stay focused on their learning, which will often give them greater enthusiasm for their studies. Active learning is intellectually stimulating and taking this approach encourages a level of academic discussion with our learners that we, as teachers, can also enjoy. Healthy discussion means that learners are engaging with us as a partner in their learning.

Learners will be better able to revise for examinations in the sense that revision really is 're-vision' of the ideas that they already understand.

Active learning develops learners' analytical skills, supporting them to be better problem solvers and more effective in their application of knowledge. They will be prepared to deal with challenging and unexpected situations. As a result, learners are more confident in continuing to learn once they have left school and are better equipped for the transition to higher education and the workplace.

What are the challenges of incorporating active learning?

When people start thinking about active learning into practice, they often make the mistake of thinking more about the activity they want to design than about the learning. The most important thing is to put the learner and the learning at the centre of our planning. A task can be quite simple but still get the learner to think critically and independently. Sometimes a complicated task does not actually help to develop the learners' thinking or understanding at all. We need to consider carefully what we want our learners to learn or understand and then shape the task to activate this learning.

Excerpts from the *Approaches to learning and teaching* series, courtesy of Cambridge University Press and Cambridge Assessment International Education: cambridge.org/approachestolearning

Name _____ Date _____

Worksheet 5A: Word problems (1)

Which operation do you use to solve each word problem?
Record your number sentence.

Mum buys 13 apples and 6 bananas. How many apples and bananas does she buy altogether?	Marcus rolls a dice 5 times. Each time he rolls a 2. What is his total score?
Thirty children are split into teams of 5. How many teams are there?	How many toes are there on 4 people's feet?
There are 48 seats on the bus. Twenty people get on. How many empty seats are there?	There are 36 pages in Zara's book. She reads 5 pages. How many pages does she have left to read?
A baker makes 24 chocolate cookies and 10 raisin cookies. How many cookies does he make altogether?	Share 8 sweets between 2 children. How many sweets do they have each?

Name _____ Date _____

Language worksheet 12A

1 Complete the sentences with words from the box.

total	ratio	side	equivalent ratio	multiplies	simplest form

...d out what flavour of ice cream the children in her year like.

_____ of preferring chocolate to vanilla is 5 : 4 in its

_____. Emma needs to find the c _____ knowing that

...hildren prefer chocolate. If she d _____ five by five,

... That means she can multiply the other e _____ of

...t twenty. The f _____ number of children in the

...the columns in the table. Then complete the table.

...n fruit for his friends for after their football match.

...ents each and the oranges cost 15 cents each.

...n the ratio of apples to oranges = 3 : 2

...d oranges did he buy?

			Total cost

Name _____ Date _____

Stage 7 End-of-unit 9 test

1 Write the first three terms of each of these sequences.

a First term is 40, term-to-term rule is add 5.
_____ [2]

b First term is 5, term-to-term rule is multiply by 2, then subtract 4.
_____ [2]

2 This sequence of patterns is made from dots.

a Complete the table to show the number of dots in each pattern. [2]

Pattern number	1	2	3	4	5
Number of dots					

b Work out the number of dots in the tenth pattern. [1]

3 Work out the rule for the nth term for each of these sequences.

a 4, 8, 12, 16, … _____ [1]

b 4, 5, 6, 7, … _____ [1]

c −4, −3, −2, −1, … _____ [1]

4 Work out the missing outputs from these function machines.

a
$$\begin{matrix} 3 \\ 4 \\ 5 \end{matrix} \rightarrow \boxed{\times 3} \rightarrow$$
[2]

b
$$\begin{matrix} 10 \\ 20 \\ 30 \end{matrix} \rightarrow \boxed{\div 2} \rightarrow$$
[2]

› Supporting

1 **Training**

2 **Conference**

3 **Competition**

4 **Research**

Unit framework

148 units in four areas

Stage	Number	Geometry and measure	Statistics and probability
1	1 Numbers to 10 3 Fractions 5 Working with numbers to 10 9 Numbers to 20 11 Fractions (2) 13 Working with numbers to 20	2 Geometry 4 Measures 6 Position 8 Time 10 Geometry (2) 12 Measures (2) 15 Time (2) 16 Position, direction and patterns	7 Statistics 14 Statistics (2)
2	1 Numbers to 100 5 Working with numbers to 100 6 Money 8 Numbers to 100 (2) 10 Calculating	2 Geometry 3 Measures 7 Time 11 Geometry (2) 12 Telling the time 13 Measures (2) 15 Symmetry, position and movement	4 Statistics 9 Statistics (2) 14 Pattern and probability
3	1 Numbers to 1000 3 Addition, subtraction and money 5 Multiplication and division 7 Fractions of shapes 9 More addition and subtraction 11 More multiplication and division 12 More fractions	4 3D shapes 6 Measurement, area and perimeter 8 Time 13 Measure 14 Time (2) 15 Angles and movement 17 Pattern and symmetry	2 Statistics: tally charts and frequency tables 10 Graphs 16 Chance
4	1 Numbers and the number system 3 Addition and subtraction of whole numbers 5 Multiplication, multiples and factors 7 Fractions 9 Comparing, rounding and dividing 11 Fractions and percentages 13 Addition and subtraction 15 Special numbers 17 Multiplication and division	2 Time and timetables 6 2D shapes 8 Angles 12 Investigating 3D shapes and nets 14 Area and perimeter 18 Position, direction and movement	4 Probability 10 Collecting and recording data 16 Data display and interpretation
5	1 The number system 3 Numbers and sequences 5 Addition and subtraction 7 Fractions, decimals and percentages 9 Addition and subtraction of fractions 11 Multiplication and division 13 Ratio and proportion 15 Multiplying and dividing fractions and decimals 17 Number and the laws of arithmetic	2 2D shape and pattern 6 3D shapes 10 Angles 14 Area and perimeter 16 Time 18 Position and direction	4 Averages 8 Probability 12 Data
6	1 The number system 2 Numbers and sequences 4 Addition and subtraction (1) 6 Fractions and percentages 8 Addition and subtraction (2) 10 Multiplication and division (1) 12 Ratio and proportion 14 Multiplication and division (2) 16 The laws of arithmetic	5 2D shapes 7 Exploring measures 11 3D shapes 13 Angles 17 Transformations	3 Averages 9 Probability 15 Data

Stage	Number	Geometry and measure	Statistics and probability	Algebra
7	1 Integers 3 Place value and rounding 4 Decimals 7 Fractions 10 Percentages 12 Ratio and proportion	5 Angles and constructions 8 Shapes and symmetry 14 Position and transformation 15 Shapes, area and volume	6 Collecting data 11 Graphs 13 Probability 16 Interpreting results	2 Expressions, formulae and equations 9 Sequences and functions 11 Graphs

8	1 Integers 3 Place value and rounding
	4 Decimals 7 Fractions
	10 Percentages
	12 Ratio and proportion
		5 Angles and constructions
		8 Shapes and symmetry
		14 Position and transformation
		15 Distance, area and volume
			6 Collecting data
			11 Graphs 13 Probability
			16 Interpreting and
			   discussing results
				2 Expressions, formulae
				   and equations
				9 Sequences and functions
				11 Graphs

9	1 Number and calculation
	3 Decimals, percentages and rounding
	8 Fractions
	11 Ratio and proportion
		5 Angles
		7 Shapes and measurements
		13 Position and transformation
		14 Volume, surface area and
		   symmetry
			6 Statistical investigations
			12 Probability
			15 Interpreting and
			   discussing results
				2 Expressions and
				   formulae
				4 Equations and
				   inequalities
				9 Sequences and functions
				10 Graphs

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