education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Just-in-Time Training Workshop
Term 3, 2016

Participants' Handout

Grade 4 – 7

Subject: Mathematics

Endorsed by:

A re Tokafatseng
Seemo sa Thuto
what I do matters

SAOU

NAPTOSA
TEACH WITH DIGNITY

SADTU
SOUTH AFRICAN DEMOCRATIC TEACHERS UNION

Programme

Session 1:	Reflection and Trackers	page 2	*20 mins*
Session 2:	Development in CAPS across three topics Geometric patterns, transformations, probability	page 4	20 mins
Session 3:	Probability	page 5	50 mins
	TEA BREAK		
Session 4:	Geometric patterns	page 8	70 mins
Session 5:	Transformations Tessellations, translation, reflection and rotation Enlargement and reductions	page 14	*70 mins*
Participants summary of key learnings from workshop			*10 mins*
PILO Evaluation of workshop			*10 mins*

Session 1: Reflection and Trackers

Refer to the reminder about the purpose and use of the Tracker on the next page.
Share any highlights from your work with the Tracker and material from the workshops.

- What went well in your school?
- Are teachers finding the planner and tracker useful? How?
- Are teachers managing to cover more of the curriculum than before?
- Are teachers increasing the number of activities done in their classes?
- Are teachers feeling positive and motivated about their teaching?

Grade 4 – 7 Mathematics Trackers

The tracker was discussed and written in consultation with district and provincial officials, particularly subject advisors, as well as union representatives.

The tracker provides classroom management tools:

→ Daily tracking to plan and check your pace and your content delivery

→ Links to CAPS and work schedule

→ Links to textbook/s and DBE workbook

→ Resources you need in the classroom

→ Assessments and record sheets for the Formal Assessment required by CAPS

→ Review and Reflection tools to support you in your teaching

The tracker helps you to:

⇨ plan and prepare lessons

⇨ manage your time well

⇨ cover the content of the curriculum

⇨ cover content sequentially

⇨ complete the formal assessment required.

Use the tracker, resources and your textbook(s) to plan lessons.

LESSON PLANNING:

Lesson Preparation Key steps: Read page 5 – 7 of Tracker

Session 2: Development of CAPS in three topics

Notes about training:

Planning for training for Term 3:

In discussion with district subject advisors, we identified key areas of Term 3 Maths learning and teaching that present difficulties for both teachers and learners:

- *Geometric patterns*
- *Transformations*
- *Probability*

Together we agreed to focus on on these three topics.

The Tracker Term 3 also provides suggestions about the content for this term and there are resources at the back of the tracker.

1. Weighting of topics

CAPS provides guidance on how much time to spend on each of the five content areas of Mathematics across the grades. This weighting should also be used for summative assessment over the year.

- Focus on Patterns, Transformations and Probability. With a partner, make at least three observations about the weighting in this table across the grades and phases.

	Number, operations & relationships	Functions, patterns & algebra	Shape and space (Geometry)	Measurement	Data Handling
Foundation Phase					
Grade 1	65%	10%	11%	9%	5%
Grade 2	60%	10%	13%	12%	5%
Grade 3	58%	10%	13%	14%	5%
Intermediate Phase					
Grade 4	50%	10%	15%	15%	10%
Grade 5	50%	10%	15%	15%	10%
Grade 6	50%	10%	15%	15%	10%
Senior Phase					
Grade 7	30%	25%	25%	10%	10%

Time Allocation per Topic: Grade 4 – 7
According to the year plan (see CAPS) for each grade, these are the time allocations for the three topics:

		Grade 4	Grade 5	Grade 6	Grade 7
Topic	**Term**	**Time in hours**			
Geometric patterns	Two	4	4	6	6
	Four	2	2		3
Symmetry	Two	2	2	2	0
Transformations	Three	3	3	3	6
	Four	3	4	3	
Probability	Four	2	2	2	4,5

Discuss with your group:

- Looking across the grades, what do the changes in time allocations indicate?
- How could you and your school make use of the alignment of times for topics?

Session 3: Probability

1. What is probability?

Probability means what the chance is that something will happen.

- "There's a 20% chance of rain." When you say twenty per cent chance of rain you mean the chances are 20 out of 100 (per cent) that it will rain.
- "Nine times out of ten I bump into a classmate over the weekend."
- "Fifty percent of patients recover within ten days of treatment."
- "His chance of growing up to be president was less than one in a million."
- My chance of winning the Lotto is about 1 in 43 million!
- Modern life is full of references to probability.

When you talk about probability you are really using fractions! How many "events" out of the total number of events might happen?

2. CAPS requirements

Compare the CAPS requirements across the grades.

5.4 Probability		
Grade 3:	*No probability*	
		Clarification of contents
Grade 4	**Probability experiments** • Perform simple repeated events and list possible outcomes for experiments such as: -- tossing a coin -- rolling a die	**Performing simple repeated events** Doing experiments with a coin is easier than with a die because the coin can only have two outcomes (heads or tails), while rolling the die can have 6 outcomes (numbers1-6). Learners should first **list the possible outcomes** before doing the experiments. They should learn how to record the results of their experiments in a **table using tally marks.**
Grade 5	*The same as Grade 4 and* -- spinning a spinner • Count and compare the frequency of actual outcomes for a series of trials up to 20 trials	They then count how many times heads or tails, or each number, or colour on a spinner, occurs in **20 trials**. If learners do this in groups, the results from all the groups can be collated. They can then compare the number of outcomes that occur as the number of trials increase.
Grade 6	*The same as Grade 5 but for 50 trials*	
Grade 7	• Perform simple experiments where the possible outcomes are equally likely and: -- list the possible outcomes based on the conditions of the activity -- determine the probability of each possible outcome using the definition of probability	

2. Practical experiments

According to CAPS, Intermediate Phase learners only need to have some experiences of probability experiments. Start by giving them some examples so that they can understand what probability means.

Resources: The teacher **must** find a way to provide coins, die, spinners for the learners to use. One for the whole class is not enough!

It is easier to demonstrate probability (the chances) with a coin first because it has only two possible outcomes: heads or tails.

When learners have tossed the coin, seen the outcome of each throw, and listed the results in a tally table for their coin, they can discuss what they found informally.

- Were there more heads or more tails?
- Why do you think it happened like this?
- If you carried on throwing the coin one hundred times, what results do you think you will get?

ACTIVITY 1 - Probability Experiment 1: Heads or tails?

Check that you know which side is 'heads' and which side is 'tails'.
Predict how many times you expect the coin to land on 'heads' out of 10 times.
Throw the coin up in the air 10 times. Each time it lands, write down H (for heads) or T (for tails).

Compare your throws with a friend's. Explain why your answers are different.
Throw the coin in the air 50 times. Copy and complete this tally table to record your throws.
Remember to show 5 throws like this: 𝍸

	Tally	**Total**
heads		
tails		
	Total throws	50

* If the coin is not damaged, it can only land on heads or on tails. We say there are only two possible outcomes of throwing a coin.
* The chances of landing on heads are the same as the chances of landing on tails. We say there is an equal chance of getting heads or tails.
* Each throw of the coin can land on heads or on tails. 10 throws do not always give exactly 5 heads and 5 tails.

ACTIVITY 2 - Probability Experiment 2: What are the chances of rolling a 6 on the die?

Number on die	**Tally**	**Total**
1		
2		
3		
4		
5		
6		
Total throws		50

Encourage learners to make observations about their experiment. Use the language of probability.

The terms you use in probability are conventions of this topic. So they are the **Social knowledge** of probability! Learners are not expected to learn the terms, but you can refer to these terms while they perform trials of their experiment.

- Use the following vocabulary to talk about probability. Use the example of tossing a coin.
  events **outcomes** **frequency** **trials** **equally likely**

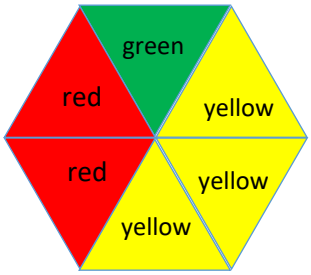
ACTIVITY 3 - Probability Experiment 3: Spinners

How many possible outcomes when you spin this spinner?

What are the possible outcomes?

Which colour are you more likely to land on?

Which colour has the least probability of being landed on?



Session 4: Patterns

Activity 1

Have you ever wondered why the new curricula for Mathematics has a whole topic dedicated to Patterns in primary school? Discuss the following questions:

1. Did you learn about patterns at school yourself?
2. Do you and the teachers at your school spend much time on teaching patterns?
3. Briefly share your experiences of teaching patterns at school.
4. Brainstorm ways in which patterns help us to understand the world better.
5. Read the article below. It lists many ways in which patterns are important in life and in mathematics. Think of examples for at least three of the points below.

- Patterns provide a sense of order in what might otherwise appear chaotic. When you notice that things happen in a certain pattern - even something as mundane as a bus always stopping at a certain corner at 5pm - order is provided.
- Patterns allow us to make “educated guesses”. Similarly, we make many common assumptions based on recurring patterns.
- Understanding patterns aids in developing mental skills, critical thinking and logic.
- Patterns can provide a clear understanding of mathematical relationships. For example, if you see and understand the patterns in multiplication tables, there is less to memorize as you extend the patterns.
- Understanding patterns can provide the basis for understanding algebra. Without being able to recognize the appearance of patterns the ability to be proficient in algebra will be limited.
- Understanding and identifying the underlying patterns in a mathematical problem helps us to find the answers more easily. In a way, recognising and using patterns is a form of logical thinking.
- Knowledge of patterns is transferred into many fields of science discovery and medical research – how cells behave, genetics etc. Science is largely based on making a hypothesis and hypotheses are often based on understanding patterns and predicting the outcomes of patterns observed.
- Understanding animal patterns has been used to help endangered species.
- Understanding weather patterns not only allows us to predict the weather, but also predict the common impact of extreme weather which can aid in devising the appropriate response in an emergency situation.

… you cannot gain the benefit of patterns if you can't see them and you can only see them if you understand them.

Adapted from http://www.mathworksheetscenter.com/mathtips/mathpatterns.html

NOTE: Our other two topics in this workshop also work with patterns. Transformations of shapes are patterns of shapes that change position and orienation. Probability needs the learner to look for and predict patterns of possible outcomes.

2. Geometric patterns across the grades

Describe the development of concepts in the topic geometric patterns, from Foundation Phase to Intermediate Phase and then to Grade 7.

	2.1 Geometric Patterns
Grade 1	**Copy, extend and describe** a) simple patterns made with physical objects b) simple patterns made with drawings of lines, shapes or objects **Create own patterns** c) with physical objects; by drawing lines, shapes or objects **Patterns around us** Identify, describe in words and copy geometric patterns d) in nature; from modern everyday life; from our cultural heritage *Start copying and extending patterns using physical objects and once learners are comfortable with using a crayon or pencil, start copying and extending patterns by drawing them*
Grade 2	Same as for Grade 1 and complex patterns
Grade 3	Same as for Grade 1 and more complex patterns
	2.1 Number Patterns
Grade 4	**Equivalent forms** Determine equivalence of different descriptions of the same relationship or rule presented • verbally • in a flow diagram • in a table • by a number sentence
	2.2 Geometric patterns
Grade 4	**Investigate and extend patterns** • Investigate and extend geometric patterns looking for relationships or rules of patterns -- represented in physical or diagram form -- sequences not limited to a constant difference or ratio -- of learner's own creation • Describe observed relationships or rules in learner's own words **Input and output values** Determine input values, output values and rules for the patterns and relationships using flow diagrams **Equivalent forms** • Determine equivalence of different descriptions of the same relationship or rule presented -- verbally -- in a flow diagram -- by a number sentence
Grade 5	*Same as for Grade 4*
Grade 6	*Same as for Grade 4* and represented in tables • Describe the general rules for the observed relationships
Grade 7: **2.1 Numeric and geometric patterns**	
Investigate and extend patterns *Same as for Grade 6 and justify* the general rules for observed relationships between numbers in own words	
2.2 Functions and relationships	
Input and output values e) Determine input values, output values or rules for patterns and relationships using: -- flow diagrams -- tables -- formulae **Equivalent forms** f) Determine, interpret and justify equivalence of different descriptions of the same relationship or rule presented: -- verbally -- in flow diagrams -- in tables -- by formulae -- by number sentences	
2.3 Algebraic expressions	
Algebraic language • Recognize and interpret rules or relationships represented in symbolic form • Identify variables and constants in given formulae and/or equations	

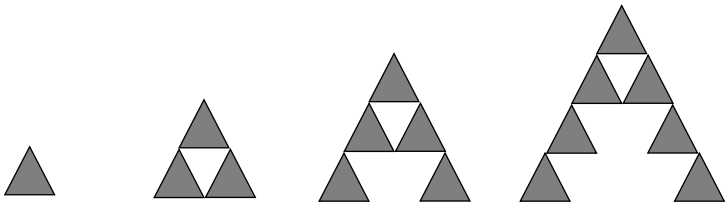
Activity 2

Patterns is part of the topic Functions, patterns and algebra that is studied in every phase across the curriculum. By Grade 7 it has a weighting of 25% of the year's work.

This activity shows you how geometric patterns and number patterns prepare learners for work in functions, algebra and graphs.

Look at the geometric pattern made from shaded triangles:

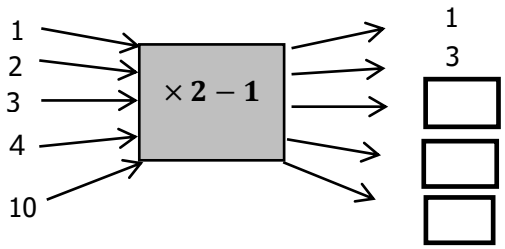
Picture 1 **Picture 2** **Picture 3** **Picture 4**



1. Draw the next shape in the pattern.
2. Explain your thinking to a partner. How do you know what the next shape is?
3. Describe what the 10th shape looks like without drawing it.
4. How many shaded triangles are added each time?
5. Find the pattern that links the Picture number and the number of triangles.

If we take the order of the shapes into account (their ordinal value), then we can make a flow diagram and a table of values from the geometric pattern.
Complete the flow diagram.

Position number Rule Number of triangles



Position	1	2	3	4	5	6	10	n
Number of triangles	1	3	5					

6. What rule can we use to link the position of the number to the number?
7. Is there a way to get from 1 to 3 and from 2 to 5 that will also get you from 3 to 7?
8. If the position is 50, what is the number?
9. If the number of triangles is 37, what is the position of the shape?

10. If the position is n, what is the number of triangles?
11. If we use x to represent any position of the number, and y to represent the number of triangles, what rule can we use to find y?

This is algebra! The relationship between x and y is based on a pattern (which we have used as a rule). This section is not expected from Intermediate Phase learners, but by Grade 7 they will be using it.

Some patterns are easy to recognise,but others are “hidden” in the numbers!

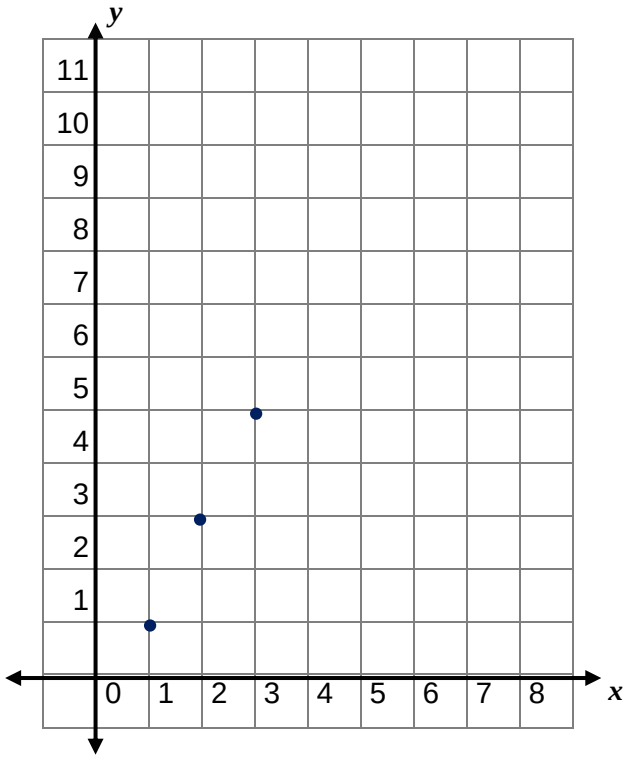
One more step, and we can link algebra to a graph of a function.

We can plot points on a grid (called the Cartesian plane) to represent the position and the value of each pair of numbers in the table.

By convention, we use x-values on an x-axis (just a number line) and y-values on a y-axis (another number line placed vertically across the x-axis).

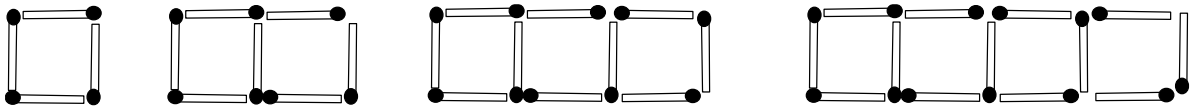
Position x	1	2	3	4	5	6	7	
Number y	1	3	5					

Plot the points



Activity 3: Matchstick patterns

1. Sipho builds squares, like this:



Picture 1 **Picture 2** **Picture 3** **Picture 4**

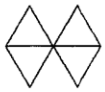
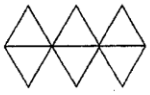
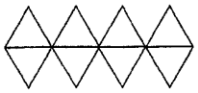
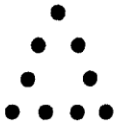
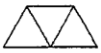
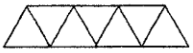
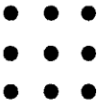
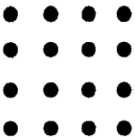
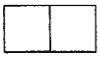
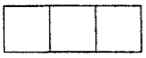
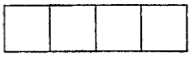
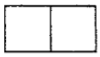
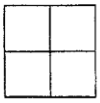
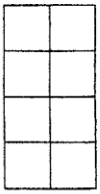
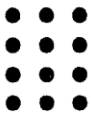
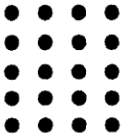
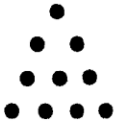
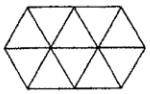
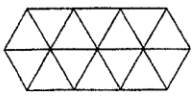
a) How many squares are made in Picture 5?
b) How many matches does he use to form:

(i) 5 squares (ii) 100 squares?

c) Sipho has 454 matches. How many squares can he form in this way?

Activity 4

1. For each of the patterns below, identify the pattern and explain it verbally, show it in a flow diagram and a table and write a rule for the nth term.
2.
    a) Which patterns use adding or subtracting a constant number?
    b) Which patterns use mulitplying or dividing by a constant number?
    c) Which patterns are "not limited to a constant difference or ratio"?
    d) Using the CAPS information, identify how far to go with these questions for each grade, from Grade 4 – 7.

	1st STEP	2nd STEP	3rd STEP	4th STEP	5th STEP
A					
B					
C					
D					
E					
F					
G					
H					
I					

Session 5: Transformations

Activity 1

Compare the CAPS requirements across the grades.

3.3 Symmetry	
Grade 3	• Recognise and draw line of symmetry in 2-D geometrical and non-geometrical shapes. • Determine line of symmetry through paper folding and reflection
Grade 4, 5 and 6	Recognise, draw and describe line(s) of symmetry in 2-D shapes
3.4 Transformations	
Grade 4	**Build composite shapes** • Put 2-D shapes together to make different composite 2-D shapes including some shapes with line symmetry. **Tessellations** • Pack out 2-D shapes to make tessellated patterns including some patterns with line symmetry. **Describe patterns** • Refer to lines, 2-D shapes, 3-D objects and lines of symmetry when describing patterns -- in nature; from modern everyday life; our cultural heritage
Grade 5	Use transformations to make **composite shapes** • Make composite 2-D shapes including shapes with line symmetry by tracing and moving a 2-D shape in one or more of the following ways: by rotation; by translation; by reflection Use transformations to make **tessellations** • Make tessellated patterns including some patterns with line symmetry by tracing and moving 2-D shapes in one or more of the following ways: by rotation; by translation; by reflection **Describe patterns:** • Refer to lines, 2-D shapes, 3-D objects, lines of symmetry, rotations, reflections and translations when describing patterns in nature; from modern everyday life; our cultural heritage
Grade 6	**Enlargement and reductions** • Draw enlargement and reductions of 2-D shapes to compare size and shape of triangles; quadrilaterals **Describe patterns:** *same as for Grade 5*
Grade 7	• Recognize, describe and perform translations, reflections and rotations with geometric figures and shapes on squared paper • Identify and draw lines of symmetry in geometric figures **Enlargements and reductions** • Draw enlargements and reductions of geometric figures on squared paper and compare them in terms of shape and size

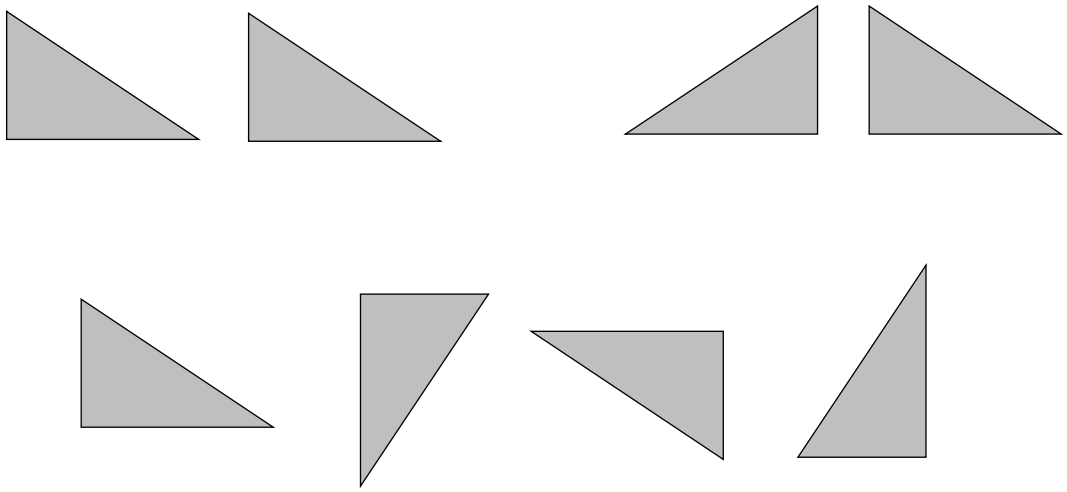
1. What is new in each grade?
2. Extract only the most important words about tessellations and transformations from CAPS to add to the table below to summarise this topic across the grades.
3.
   a) Compare and describe the *conceptual* development from Grade 3 to Grade 4 to Grade 5.
   b) What do you notice about the work in Grade 6 and Grade 7?
   c) Add notes to your summary based on your discussion of the questions.

Grade 4	Grade 5	Grade 6	Grade 7
Build composite shapes; Include lines of symmetry. Tessellations:			Draw lines of symmetry
	Tessellations and transformations:	Enlargements and reductions:	Draw all transformations on squared paper
Describe: Refer to lines, shapes, objects, lines of symmetry, (transformations of shapes) when describing patterns -- in nature; from modern everyday life; our cultural heritage			

Activity 2:

1. Quick recap:

Can you explain what is means to translate (or slide), reflect (or flip) and rotate (or turn) shapes? Explain to a partner using the triangle shapes here. Use arrows and write the words for each kind of transformation.

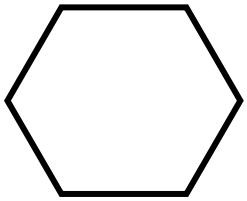


We use the words translation, reflection and rotation (nouns from the verbs) in mathematics. The learners do not need to learn the words, but they do need to recognise them to be able to complete questions about the transformations.

Enlargement is also considered to be a transformation. The important difference to note is that enlargement changes the size of the shape in proportion to the original shape. The other transformations change the position and orientation of the shape without changing its size and shape.

2. Work through the activities below.
3. Then think about
    a) Which grade(s) is it suitable for?
    b) which CAPS requirements does it address?
    c) What thinking is needed to complete the activity – what concepts need to be understood and how does your brain need to work to complete the activity?

Exercise A

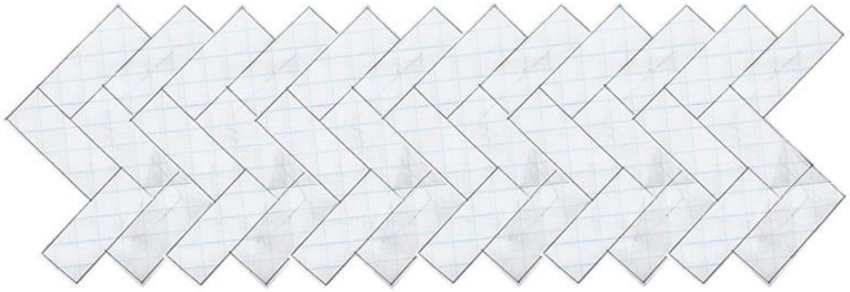


1. Trace around the shape and cut it out.
2. Name the shape.
3. Place your shape on your page and trace around it.
4. Translate your shape in different ways. Trace around each new translation.
5. Create a pattern of at least 15 translations of your shape. There should be no gaps or overlaps.
6. Colour your tessellation.
7. Write a sentence to explain how you have moved copies of one shape to make your pattern.

Exercise B

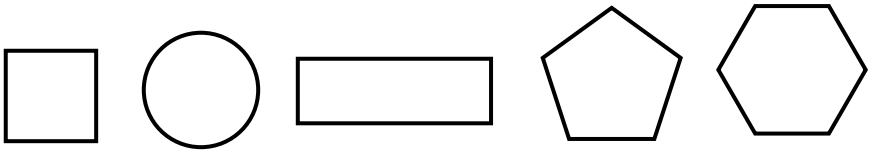
Copy and cut out this rectangle.

Use your rectangle to create the following tiling pattern.
Find ways to translate, reflect and rotate your cut out rectangle and keep making the pattern.



Exercise C

Which of the following shapes can be used *on their own* to make a tessellating pattern?
Which shapes can you use *together* to make a tessellating pattern?



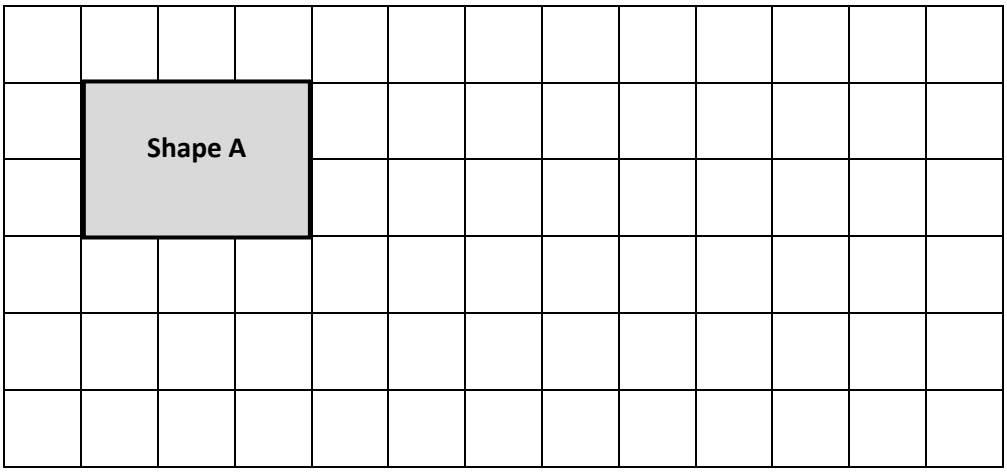
Exercise D

Make your own 2-D shape and make your own tessellating pattern.
Use at least 15 copies of your shape and colour your tessellation.
Describe your pattern. Use the following questions to help you:

a) Name the shape you used to make the tessellation.
b) How many times did you move your shape and copy it?
c) Are there any gaps or overlaps in your pattern?
d) Did you use translations, reflections or rotations of your shape to make the pattern?

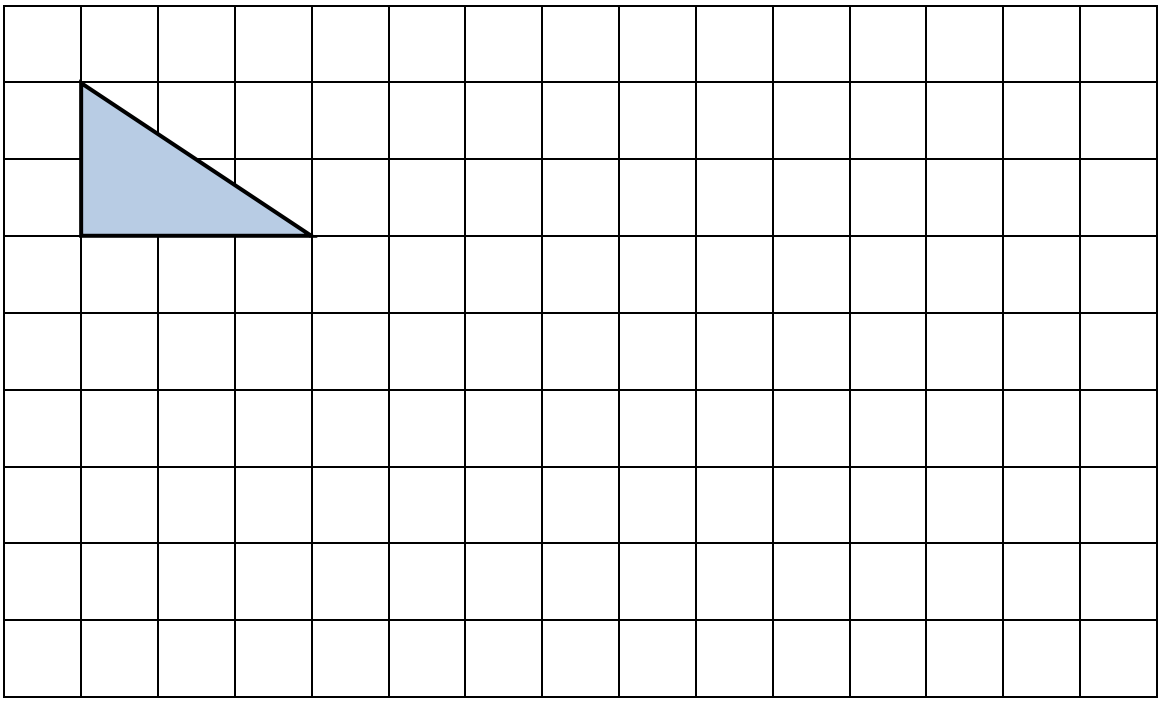
Exercise D

Use squared paper to draw a shape that is an enlargement of shape A.
Double the length of all the sides of shape A. Call your new shape B.



Compare the area in number of squares of shape A with the area of shape B. What do you notice?
Compare the perimeter of shape A with the perimeter of shape B. What do you notice?

Exercise E



Draw an enlargement of the triangle with all its sides doubled.
Draw an enlargement that has sides three times longer than this triangle.
Compare the areas and the perimeters of your 3 triangles. Write what you notice about enlarging a triangle.

Exercise F

Reduce these two shapes by halving their dimensions. Draw the new shapes.