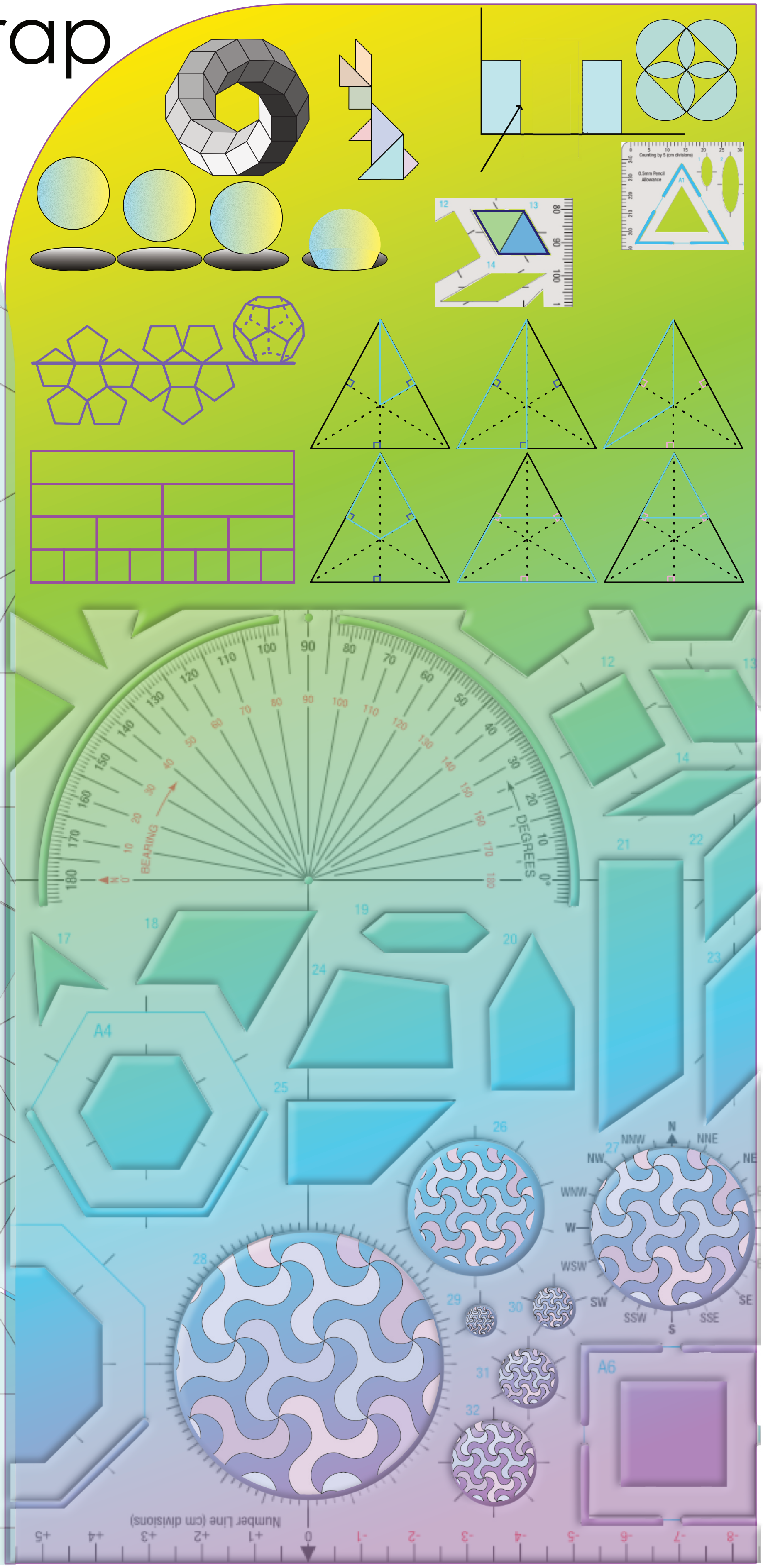
MATHOMAT PRIMARY unwrap

Unwrapping the
MATHOMAT PRIMARY

- Introduces each shape
- Examples of how to use shapes
- Lesson idea excerpts from the Teachers Manual
- Geometry game ideas from the Games & Activities Manual
- Hints and Tips for use in the classroom
- Algebra concepts with MATHOMAT PRIMARY
- Tessellations, 3D objects, Transformation, Fractions and much more.

Look for these guidance icons inside!



INDEX

INDEX

INDEX

Topic | **Page**

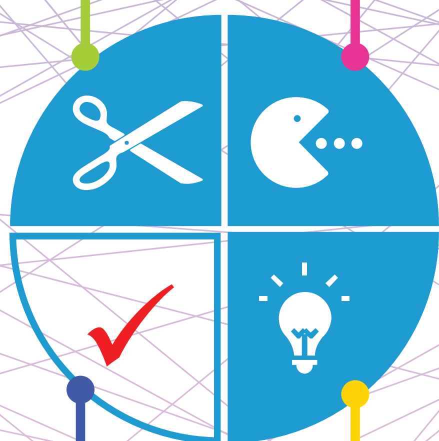
Symbols and Icons

The hand icon: ***indicates manipulation with the template that should be observed by the teacher. Also make sure that the student manipulate the template and not the paper.***

The ear icon indicates an auditory activity or that an activity will be instruction - based. Make sure that the student follow your step-by-step instructions.

The speech bubbles icon indicates a discussion. This suggests that the student's reasoning and viewpoint should be noted before the activity commences.

The eye icon indicates visual perception. The student should observe how the shapes are used - resulting in a certain perspective.



The scissor icon indicates that shapes should be cut out or block shapes from the shape set should be used.

The games icon indicates that there will be a games-based activity in the MATHOMAT Games & Activities manual that relates to the example of work that is shown in this document.

Handy hints and tips will be shown with a red check-mark. Ideas might often include topics / terminology / fields that may not have been done yet. These are merely suggestions that the teacher may use at his/her own discretion.

The lightbulb icon indicates that there is an idea to incorporate the work being discussed to bridge into a different field or topic or to revise a certain concept from another field with the current topic.

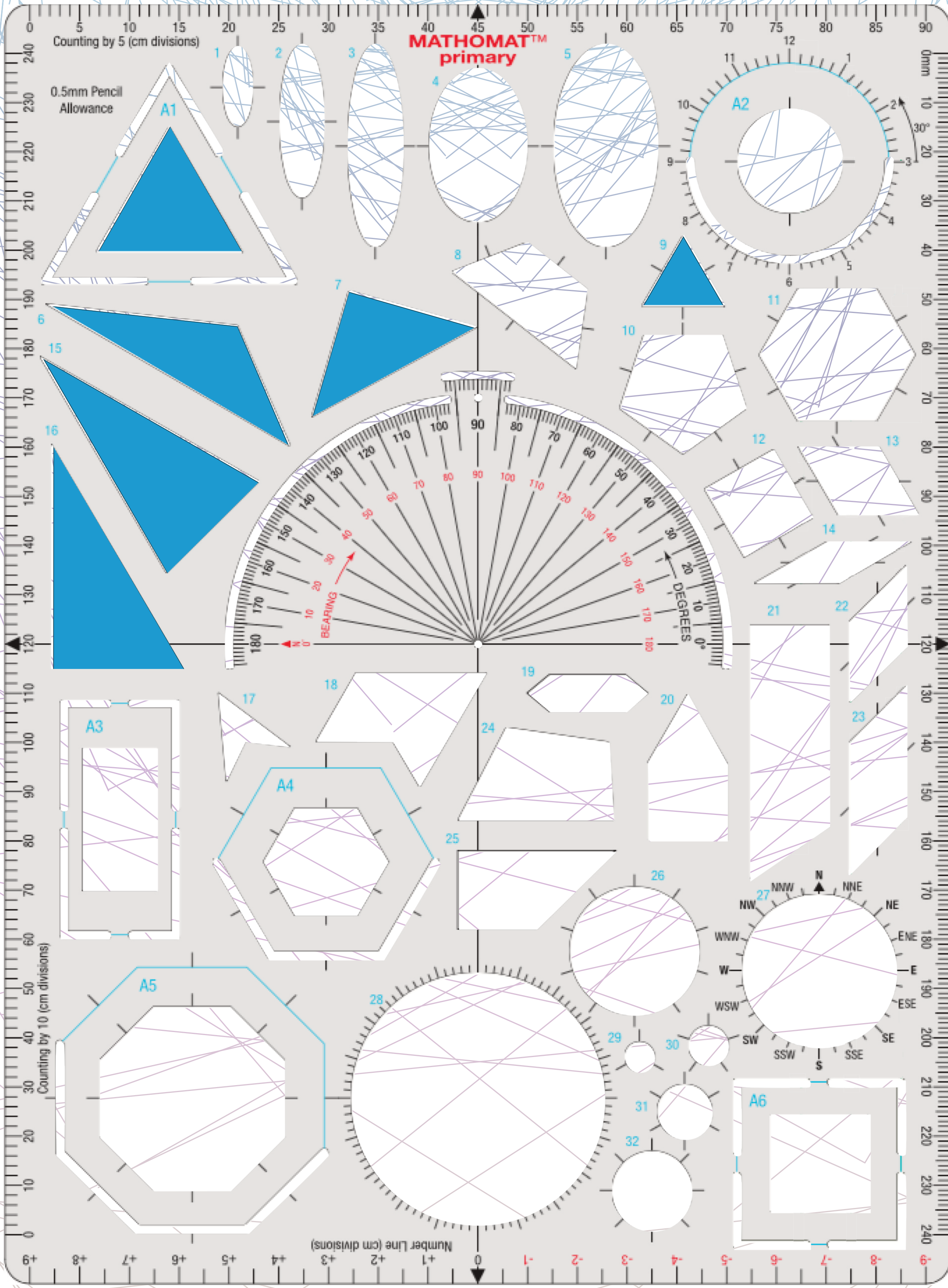
This document sets out to showcase the uses and diversity of the template. These lessons are by no means the full extend of what can be taught using MATHOMAT. Neither were they designed to be used as stand-alone lesson plans. In certain instances the diagrams and sketches in this document are not all drawn to scale, this does not influence the concepts dealt with in this document.

Our manual - and workbook range are designed to give in-depth coverage of the topics on geometry as well as some algebra. Our extensive lesson plans start from the very basics and progress gradually to the more advanced levels.

This document is complemented by the Unwrap for MATHOMAT V2.

The Triangles

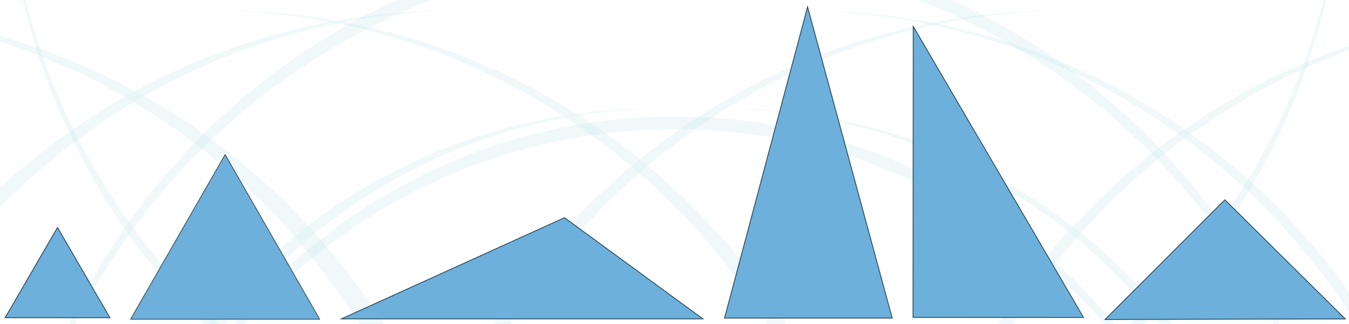
Different types of Triangles



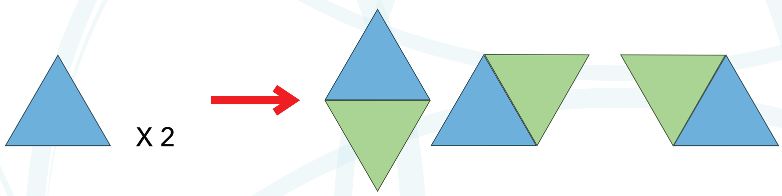
Triangles Examples

Quadrilaterals from Triangles

Building with Triangles to explore properties



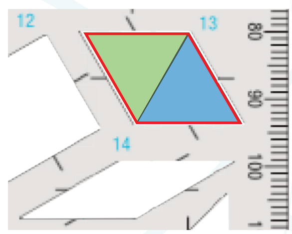
Shape property might be better understood when presented as a hands-on activity.
Have the students use their cut-out shapes or block shapes to complete the activity below. After they have built the composite shape, they must draw it with their MATHOMAT



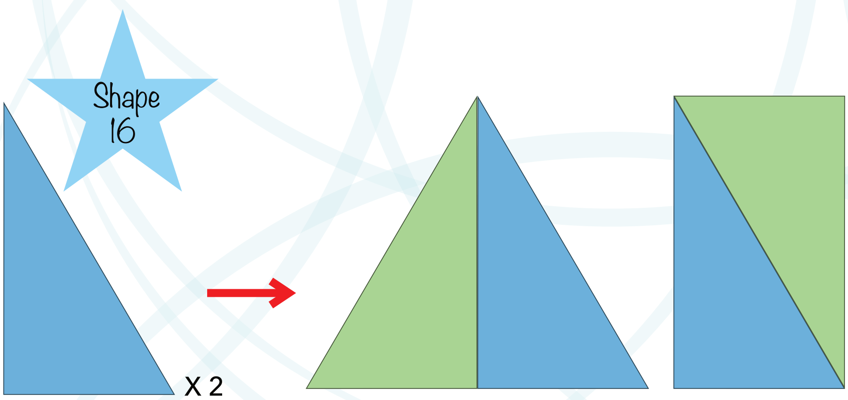
Shape 9

Shape 13

Two of the Equilateral Triangles can only build a rhombus.

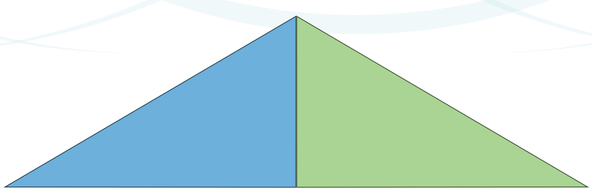


Students can prove this by using two triangles to build one rhombus, fit the rhombus shape over the composite shape and see that it fits perfectly.



Even if the focus here is on shape properties, a lot of transformations are being done. This is certainly a good activity to come back to, when starting with rigid transformations.

Two of the Scalene Right-angled Triangles can build two different - sized isosceles Triangles and a Rectangle.

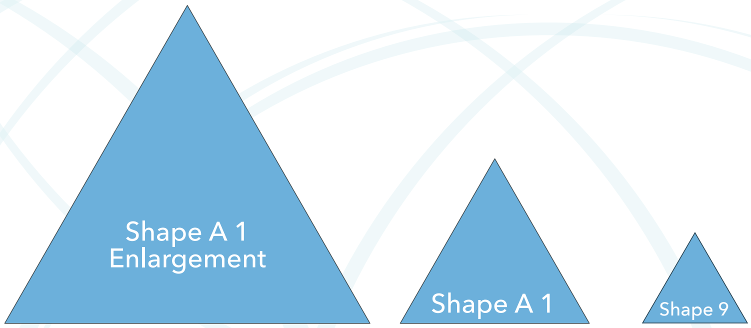


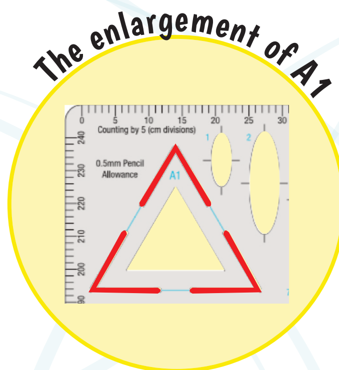
Proof is not an optional extra. Enabling a student to prove concepts, helps them gain much needed confidence in understanding the work.

Triangles Examples

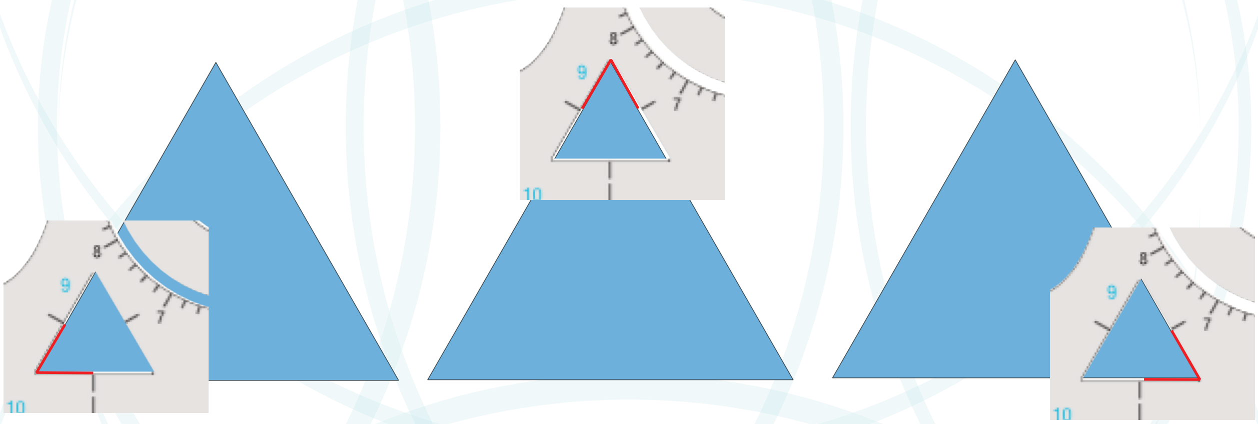
Sorting Triangles according to properties

Draw the following three triangles:

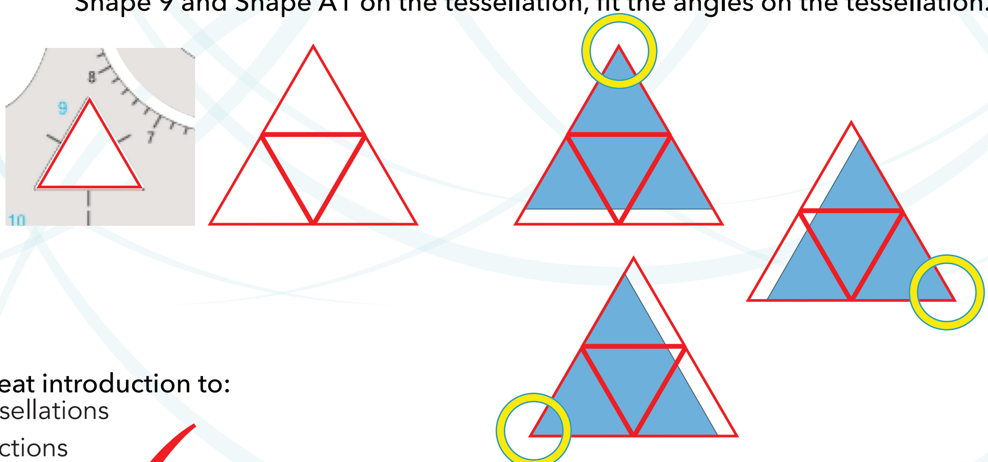




Proving that the angles are the same magnitude.
Use the template on the drawing or the cut-out of Shape A1 - enlargement. Fit it on the triangles that the students have drawn.



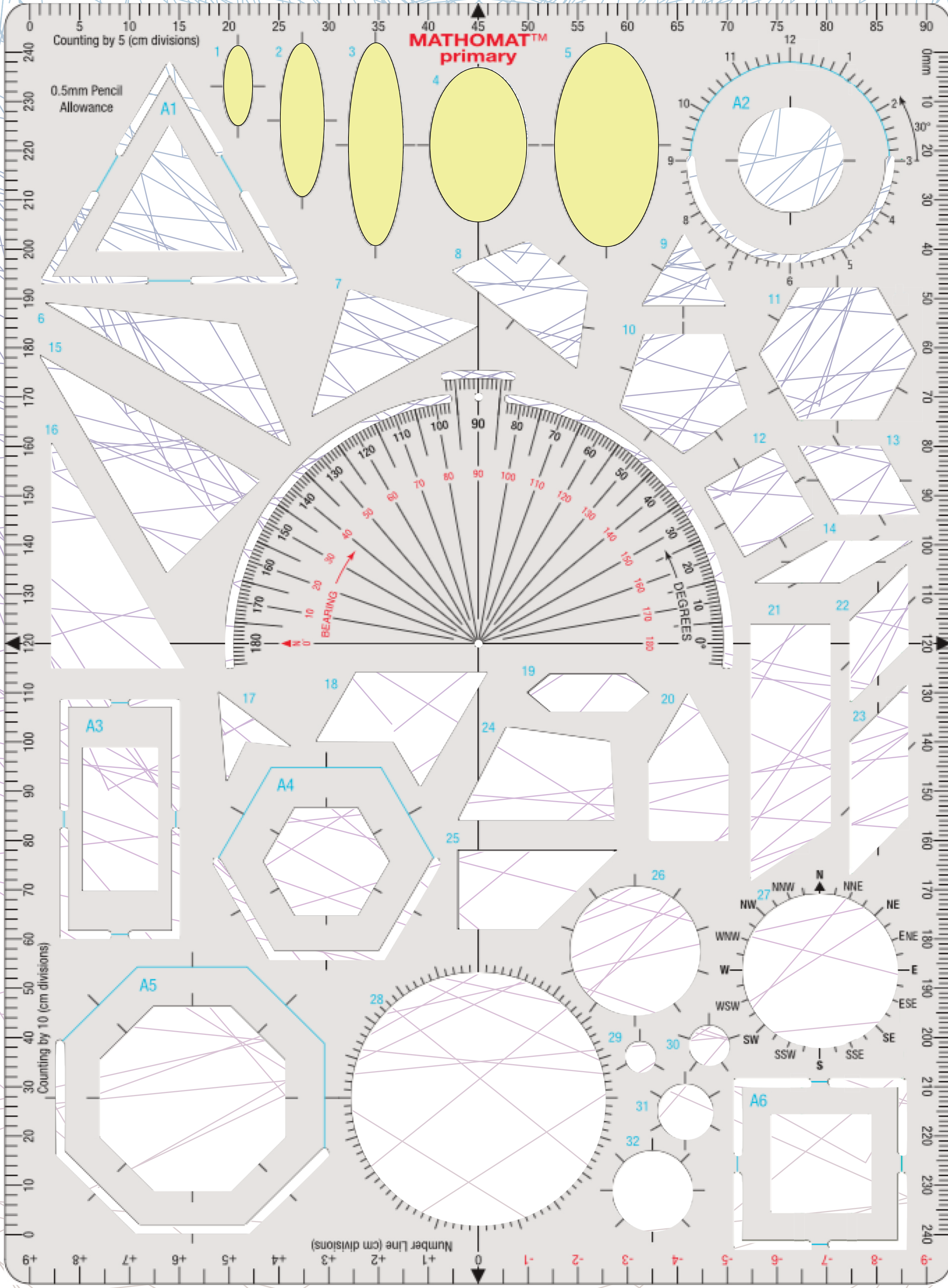
Proving that the angles are the same magnitude. Draw a tessellation of shape 9. Use Shape 9 and Shape A1 on the tessellation, fit the angles on the tessellation.



A great introduction to:
#Tessellations
#Fractions
#Similarity
#Corresponding angles

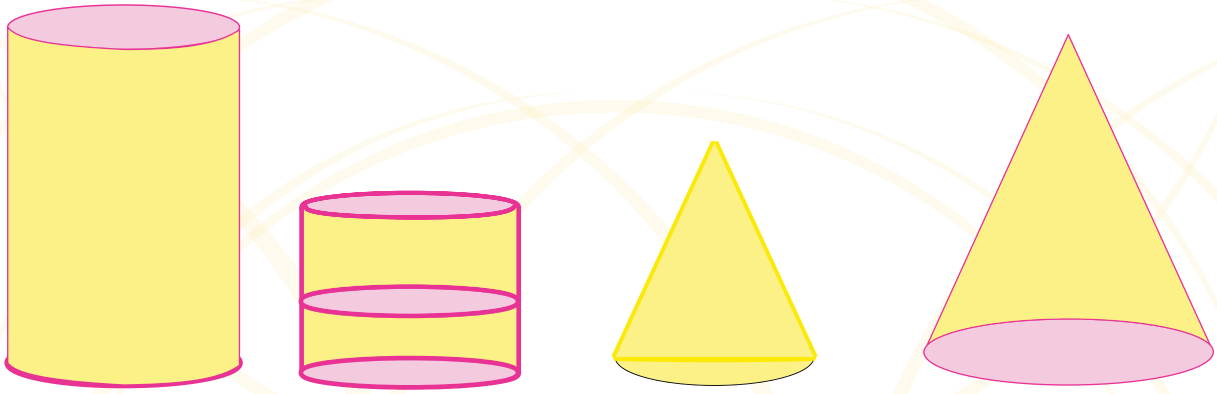
The Ellipses

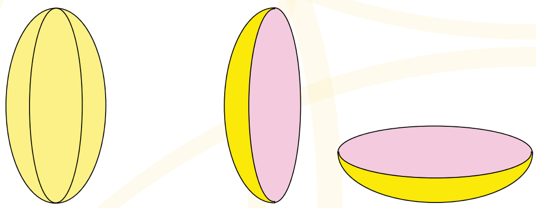
Extending knowledge on curves



Ellipses Examples

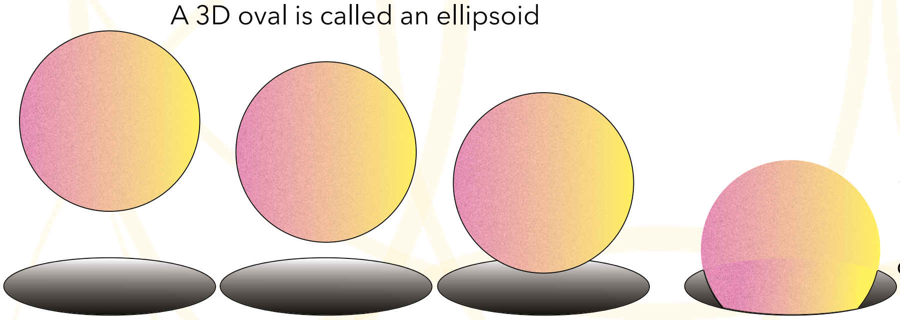
Cylinders and Cones look better when drawn with an ellipse than it does with a circle. Take care to explain that the base is still a circle shape - but how we see it is more like an ellipse.





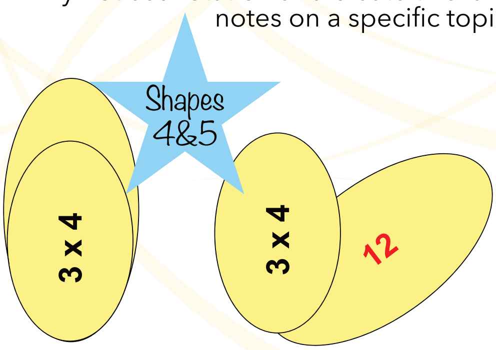
Cross- sections through various 3D objects can result in having an ellipse as a face.

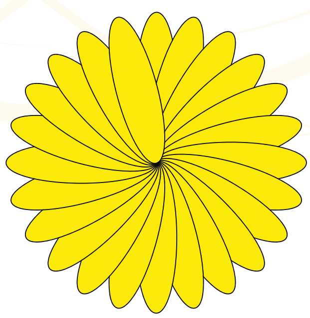
A 3D oval is called an ellipsoid



This sketch would not have worked if a circle was used to show the hole in the ground. The perspective is more correct when using an ellipse.

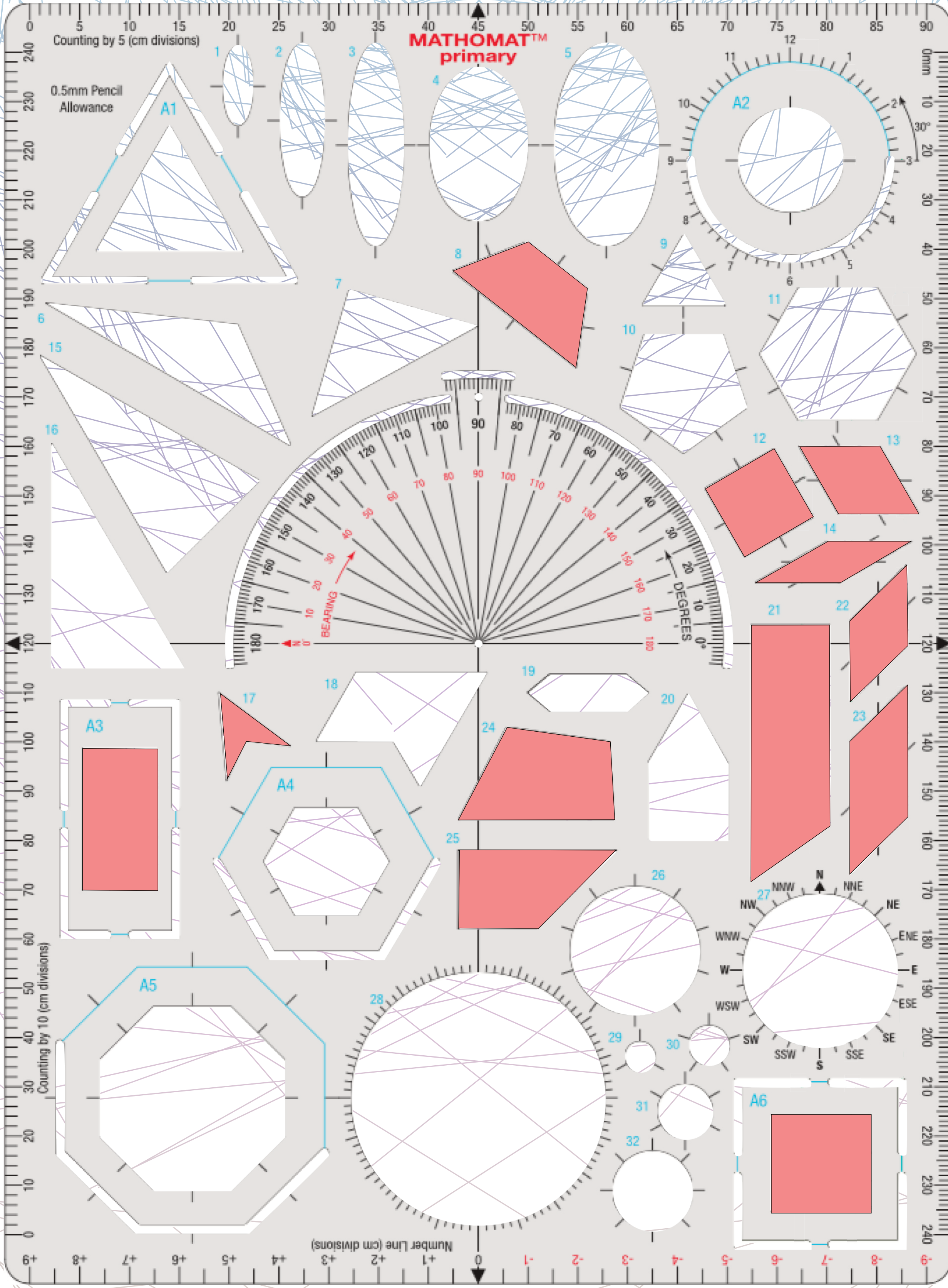
Why not use rotation and create this fan-out flower with two different-sized ellipses. Use it for study notes on a specific topic or fill it with number bonds / times tables.





The Quadrilaterals

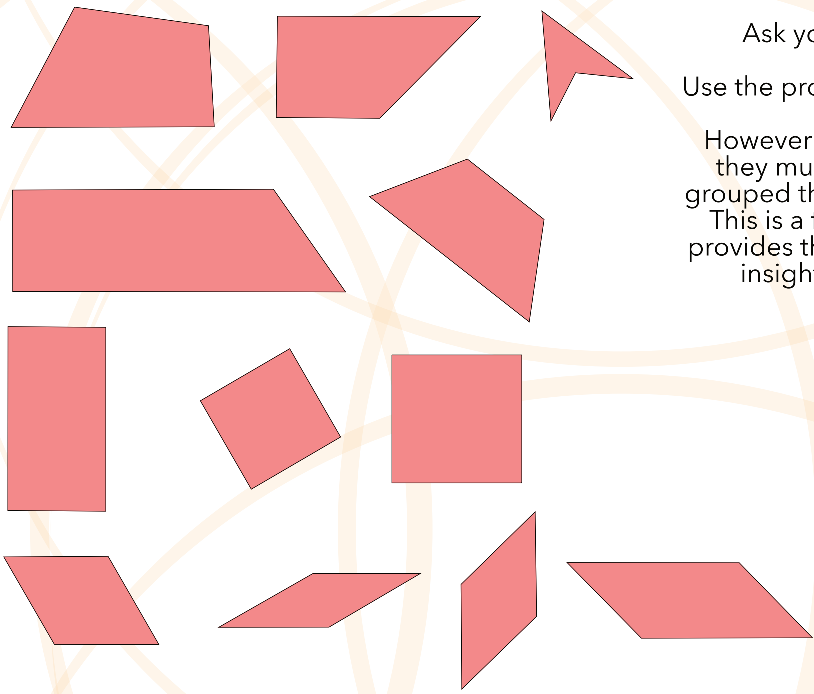
These quadrilaterals include some of the irregular shapes



Quadrilaterals Examples

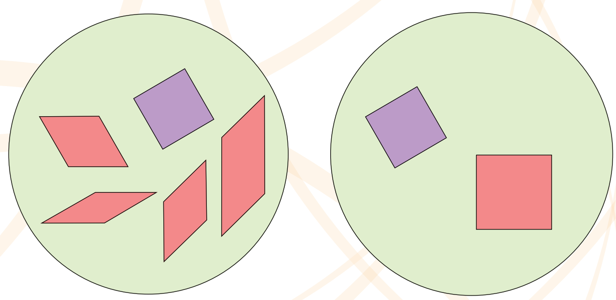
These quadrilaterals include some irregular shapes

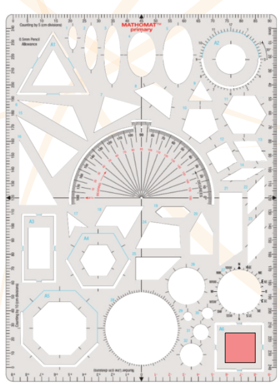
Have the students look and feel their cut-out quadrilaterals. Discuss how they differ and how they are the same. Let the students feel the inside of the quadrilaterals on the template. Does the "inside" angle feel the same as an "outside" angle?

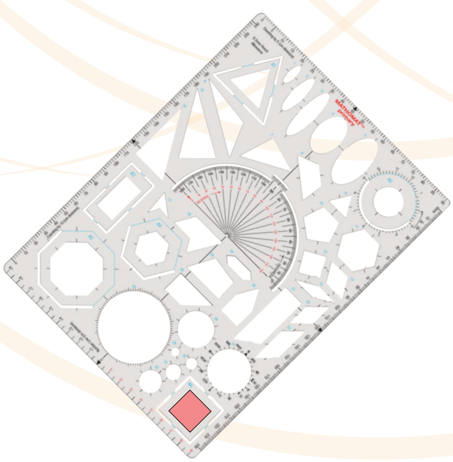


Ask your students to group the quadrilaterals.
Use the protractor to draw a full circle for each group.
However they choose to group them, they must be able to state why they grouped those specific shapes together.
This is a fun exercise for children but provides the teacher with much needed insight into their reasoning and observation skills.

Most of the time it is perception that causes groupings like the circle on the left, where the square is mistaken for a rhombus.
The square has been rotated, but the properties of the shape did not change because of the rotation. Often a student will say that the purple shape in the left circle is a "diamond" or rhombus.



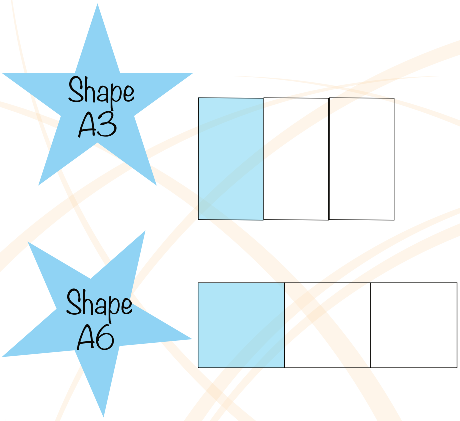




We can prove that the purple square should be in the right-hand circle by using the Square at A 6: Draw the square with the template in the normal position. Now rotate the template and draw the square again. The student will experience the rotation and see they are still using the same shape.

Quadrilaterals Examples

continue

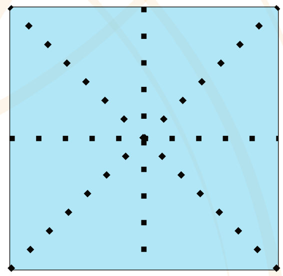


Using the rectangle and square to illustrate continuous fractions, helps students to work with fractions divided in equal-sized portions from the very start.

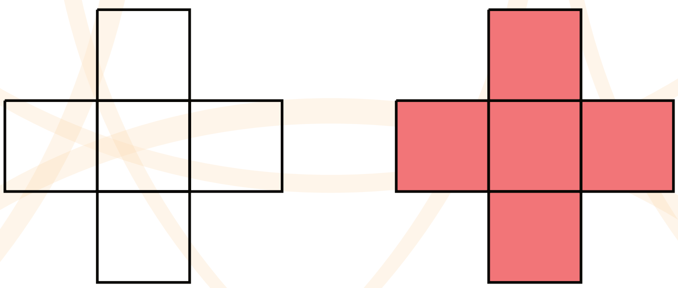
Both of the diagrams on the left shows ⅓. When the two pieces are compared to each other they are not the same size.

This is a good topic for discussion and investigating fractions.

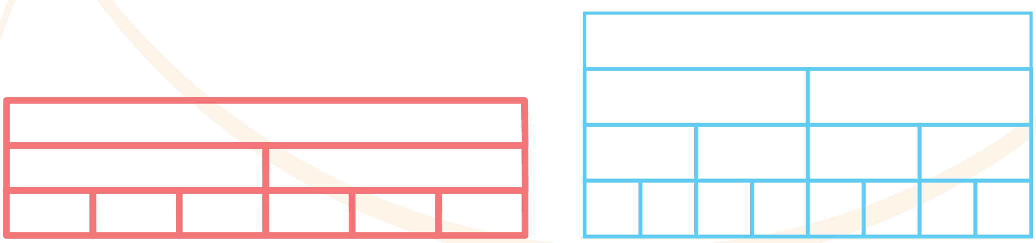
Enlarging the regular shapes will make them easier to explore. The lines of symmetry of the square can be marked out, the shape can be cut out and the symmetry can be proven by folding along the dotted lines.
The important conclusion is that opposite sides must fit on each other as well as opposite angles.



Ask the students to study the two shapes below. Is it possible to draw them by using only four squares?
If we were to calculate the area of the shape, it is possible to reason that the diagram on the left will have either 4 square units or 5 square units. Why is this true?

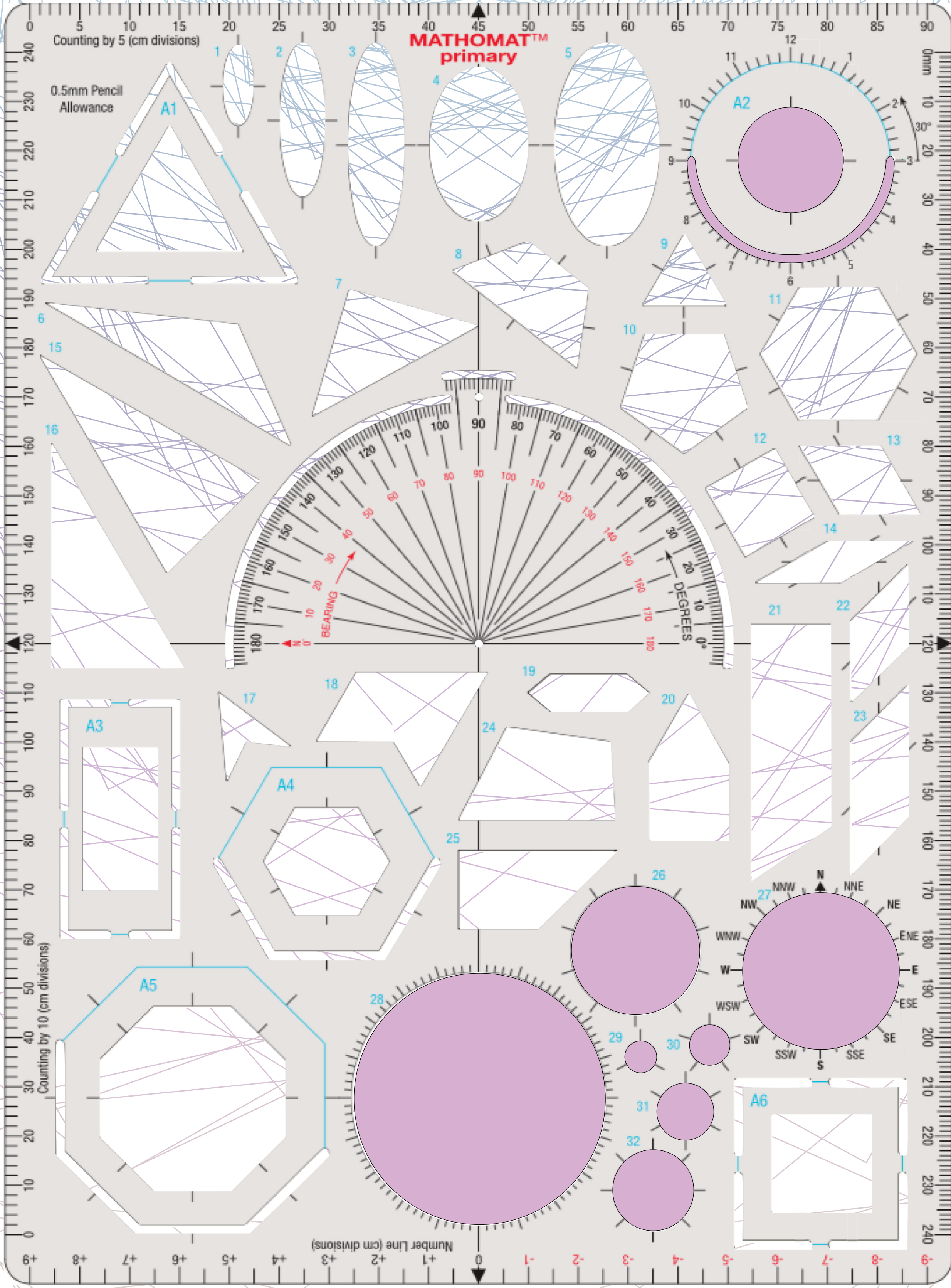


Students can build their own fraction walls, using either the rectangle, square and even the equilateral triangle.
They should not work from ready made fractions charts. To show how equivalent fractions work, drawing it is best as it develops their understanding.



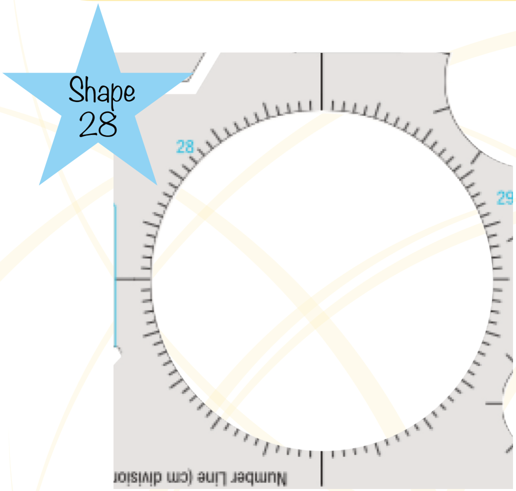
The Circles

A variety with specific uses

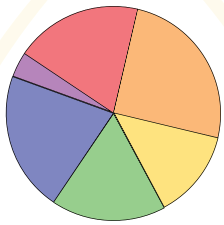


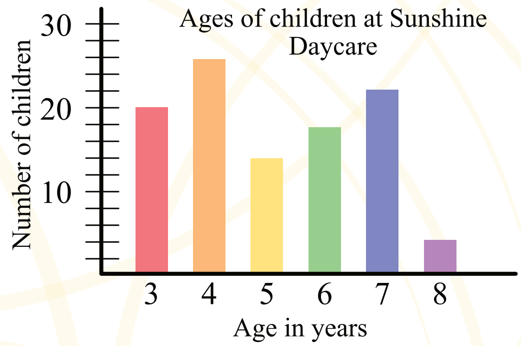
Circles Examples

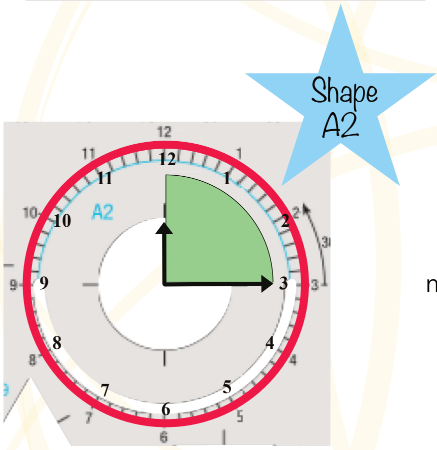
Representing Data, Time, Fractions



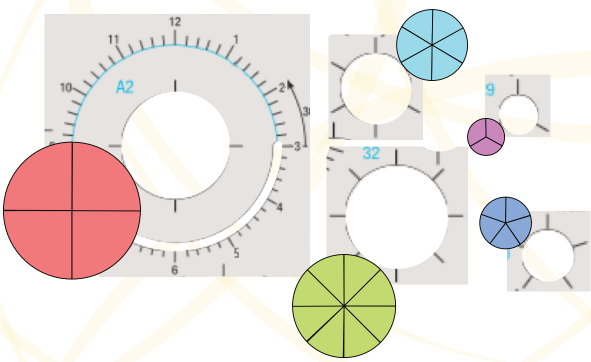
This circle is the biggest on the template and may be used for pie-charts as the divisions are marked off in hundreds. Working from a bar graph to a pie-chart is easy when using this circle for the pie chart and any of the rectangles for the bar graph.



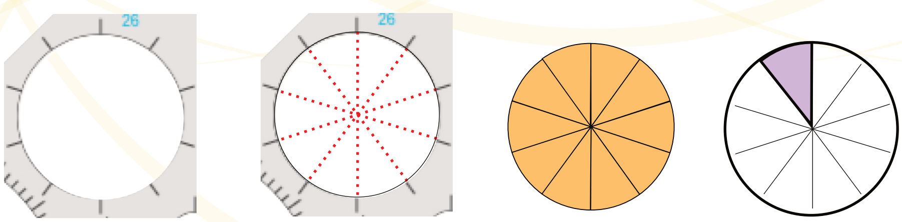




The enlargement of A2 is perfect for use as a clock-face and has been marked as such. This does involve some manipulation either by rotating the template or by reflecting it - which is ideal for building spatial ability.Turn the circle into fractions and use it alongside the clock-face - this way halves and quarters can be visualized.



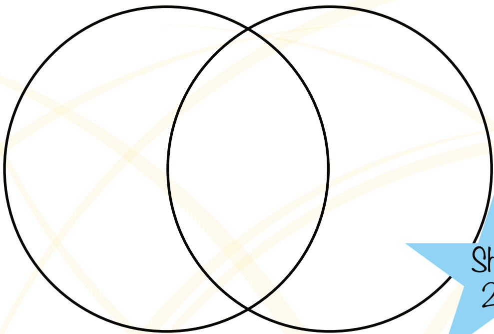
A selection of circles to use for fractions.
It is critical that students have presentations of fractions where each portion is the same size.



Steps to create fractions, select a circle, mark off the points, divide into sectors.

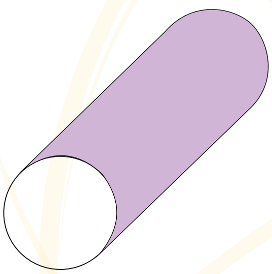
Circles Examples

Patterns, Venn-diagram, 3D objects, Decomposing



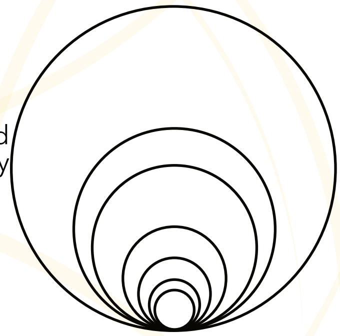
Quick and easy Venn diagrams - the circle from the protractor can be used for this as well.

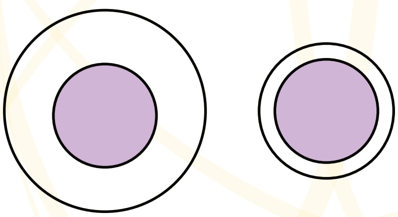
Shape 28



Creating 3D objects by using the 2D shapes.

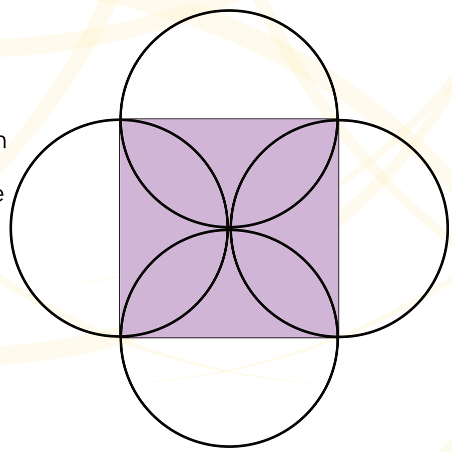
Exploring patterns and properties of circles by using them in art projects or patterns.

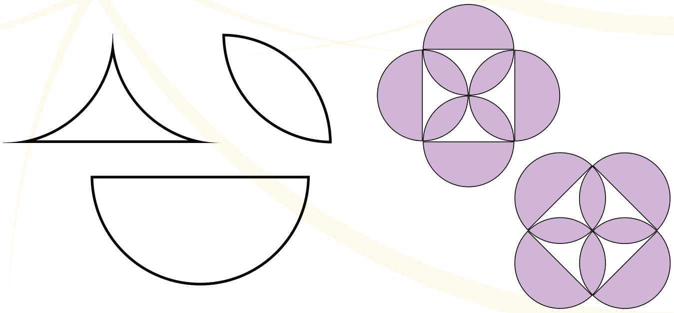




Some optical illusion experiments will have students understand the power of perspective in geometry. Both of the coloured in circles are same size.

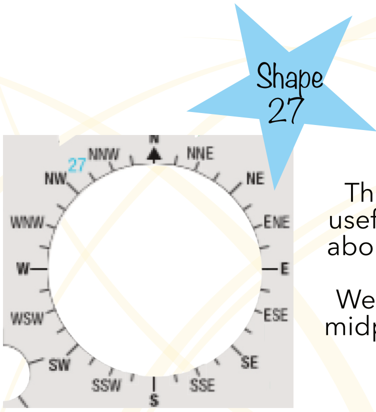
This diagram shows the intersections of the circles with the square. Some very intricate questions on area has been developed from using only certain parts of these types of diagrams. It is very useful for students to see how figures can be decomposed into their respective units.





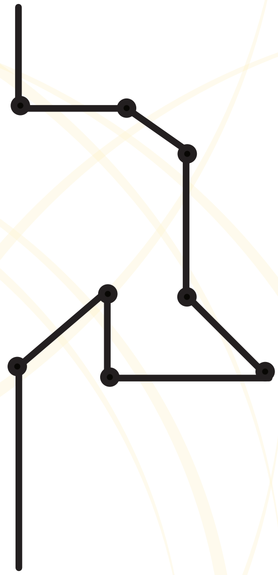
Circles Examples

Compass rose and Protractor

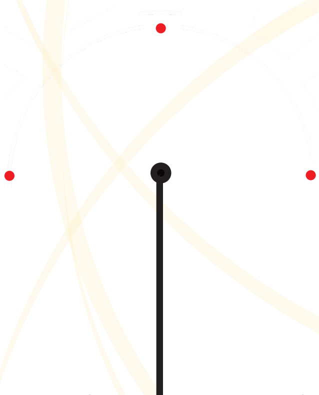


The compass rose is a very useful feature, understanding about the midpoint of a circle is important.
We will be working from the midpoint of the compass-rose each time.

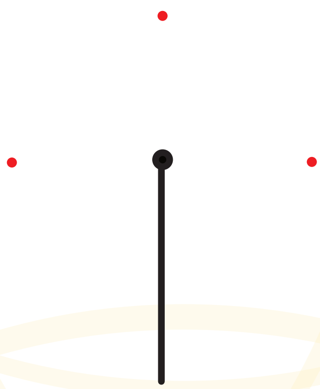
Each point on the direction - line represents a change in direction.



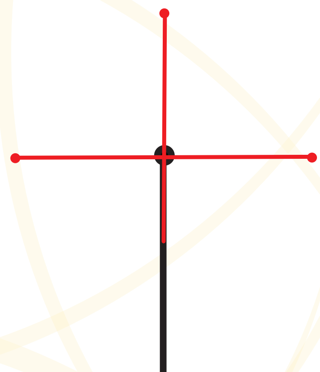
STARTING POINT



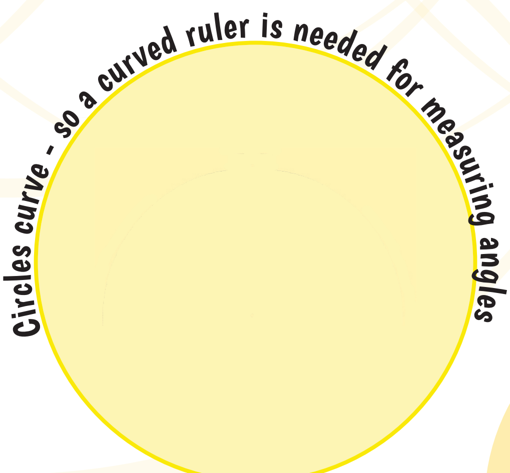
Place the protractor on the point and mark the 0°, 90° and 180° off by using the holes in the template.



The three points will be joined so that it forms a cross-hair.



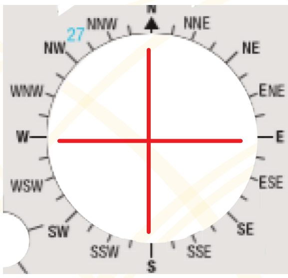
Each point should be marked off like this.



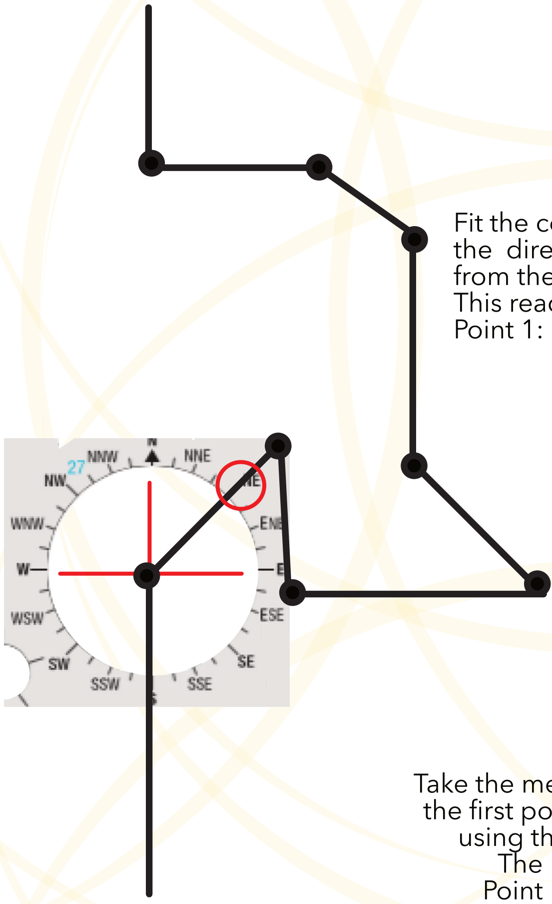
It is a good idea to informally introduce degrees just by letting the students take note of the three points they are marking off with the protractor.
Have them focus on the movement they are making along the curve.

Circle Examples

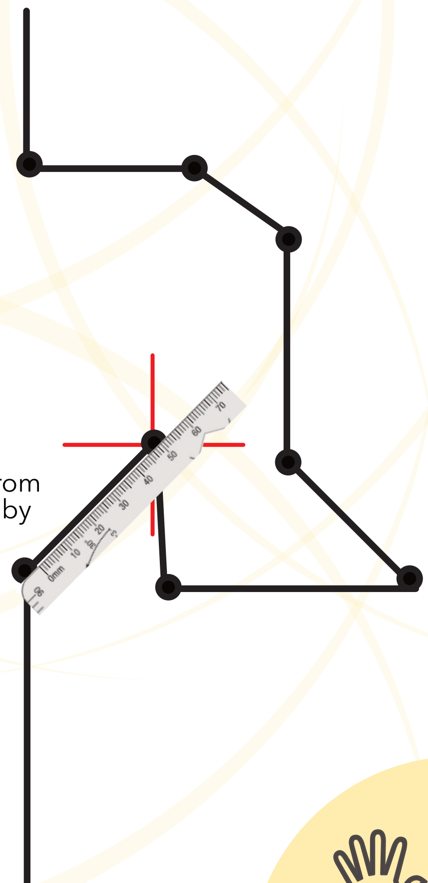
Compass Rose and Protractor



Fit the compass-rose so that the cross-hair lines up at North, East, South and West.
The midpoint of the compass-rose will line up on the point of the direction-line.



Fit the compass-rose on each point of the direction- line. Read the direction from the compass and write it down.
This reading will be:
Point 1: North East.

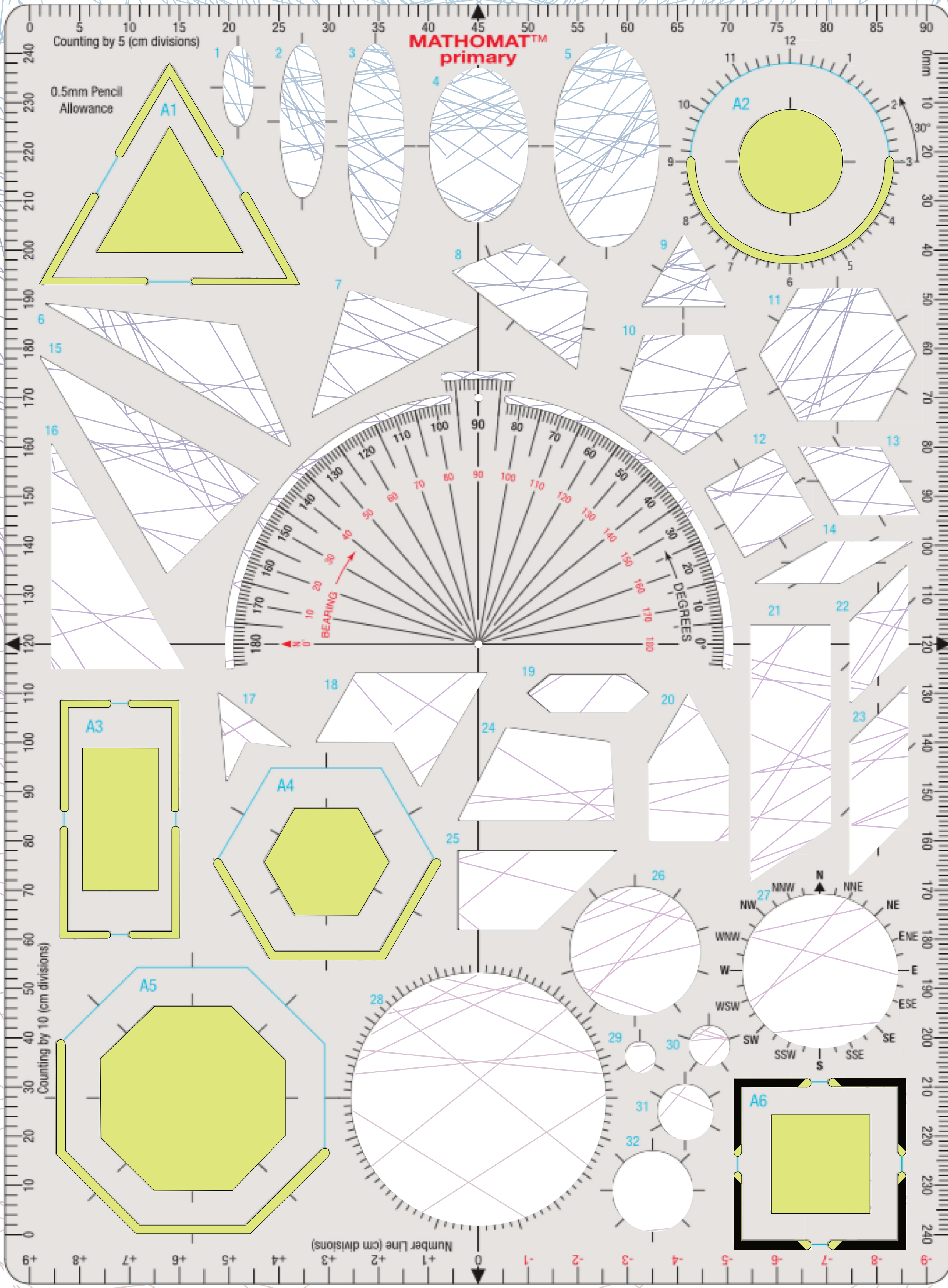


Take the measurement of the line from the first point to the second point, by using the mm ruler on the side.
The reading will now be:
Point 1: North East, 45 mm.

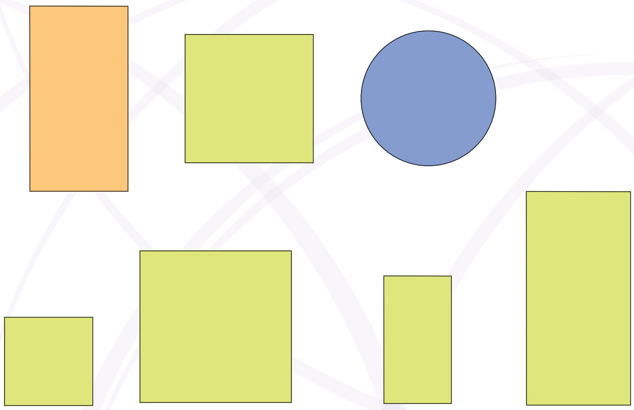
If formal measurement has not yet been mastered, use the side of a shape on the template and see which one is the closest to fit the distance.

The Attribute Block Cluster

These shapes represent those found in a shape-set

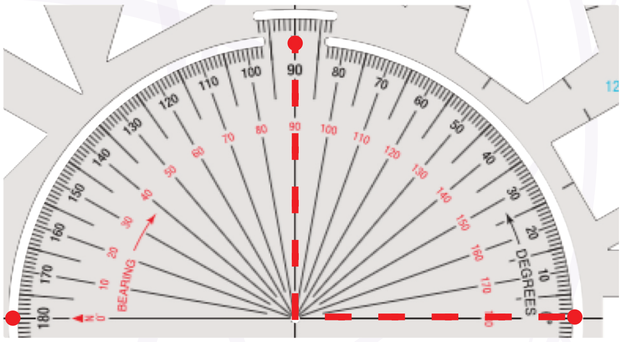


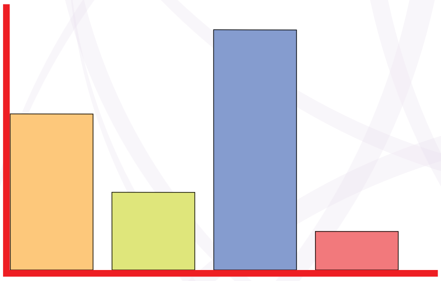
Attribute Shapes Examples



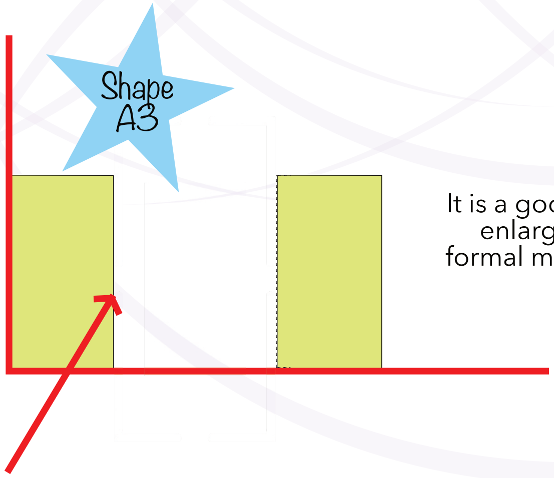
Shape patterns can be copied along with colours. Use existing shape pattern cards or use those provided in the manual's resources section.

Use the protractor to mark off points for axes. These will be used to represent a bar-graph.





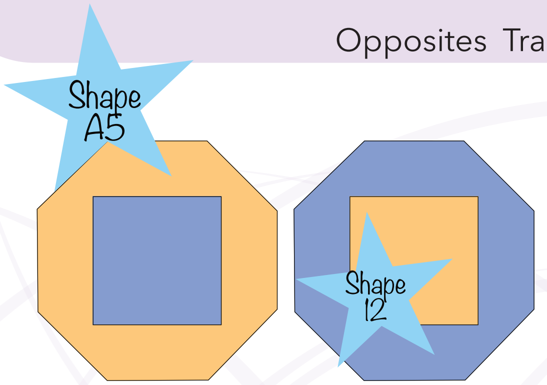
Students can use the ruler-side of the template to mark off intervals.



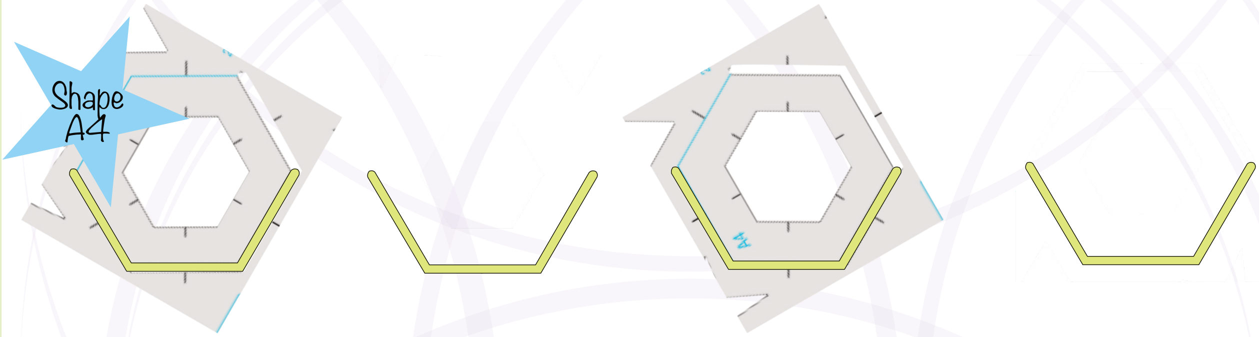
It is a good idea to use the rectangle's enlargement to space the bars if formal measurement has not yet been mastered.

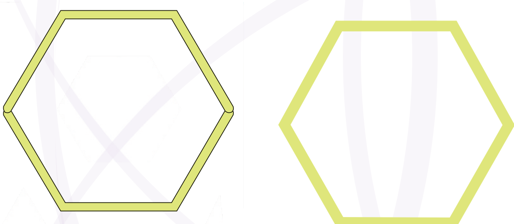
Attribute Shape Examples

Opposites Transformation Enlargement

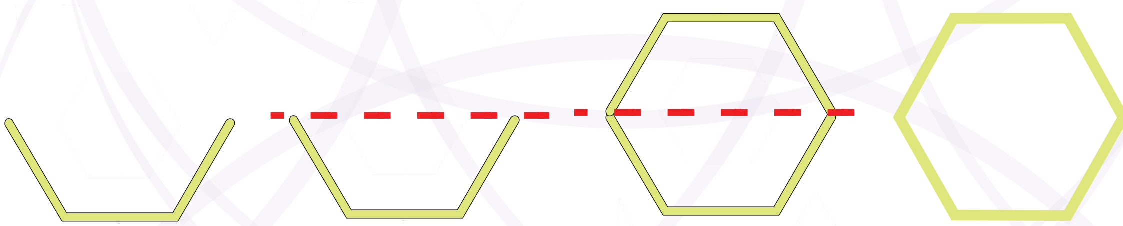


Use the Attribute shapes according to what has been taught in class. Combine them to create specific combinations.
This examples shows: Opposite colours but same shapes.





One way to complete the Hexagon is to rotate the template.
Match the blue line on the lines already drawn.

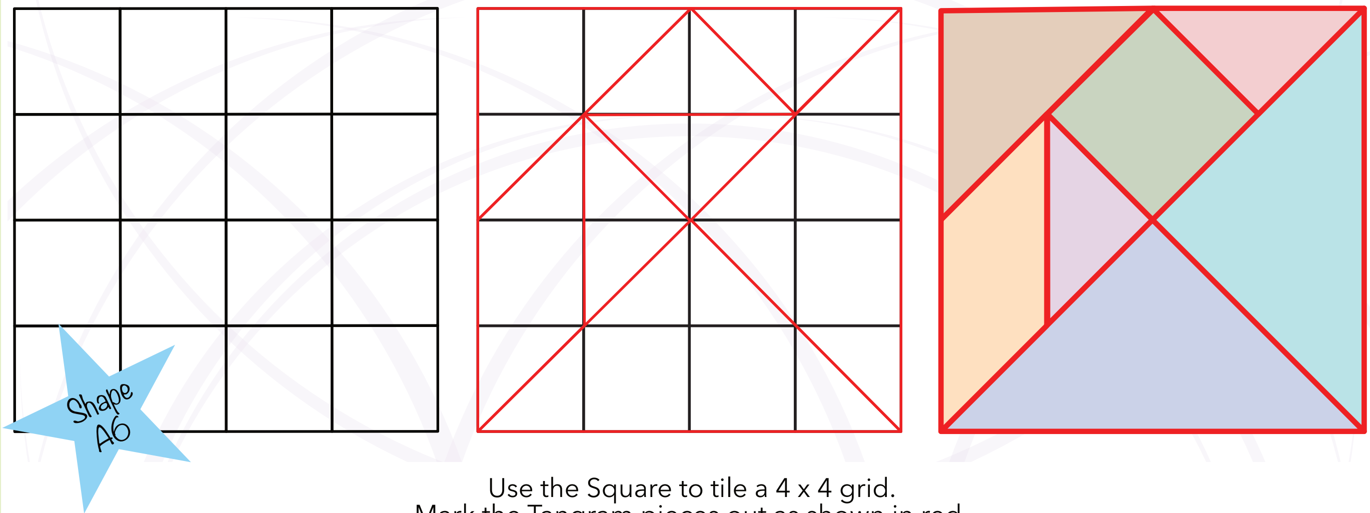


Another way of completing the Hexagon is to reflect the template across a horizontal line.

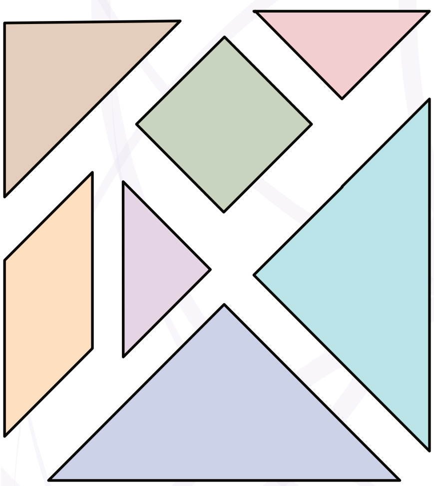
Each student will choose a method that they prefer to the other. It is, however very important that they practice BOTH methods to develop spatial abilities.

Attribute Shape Examples: Tangrams

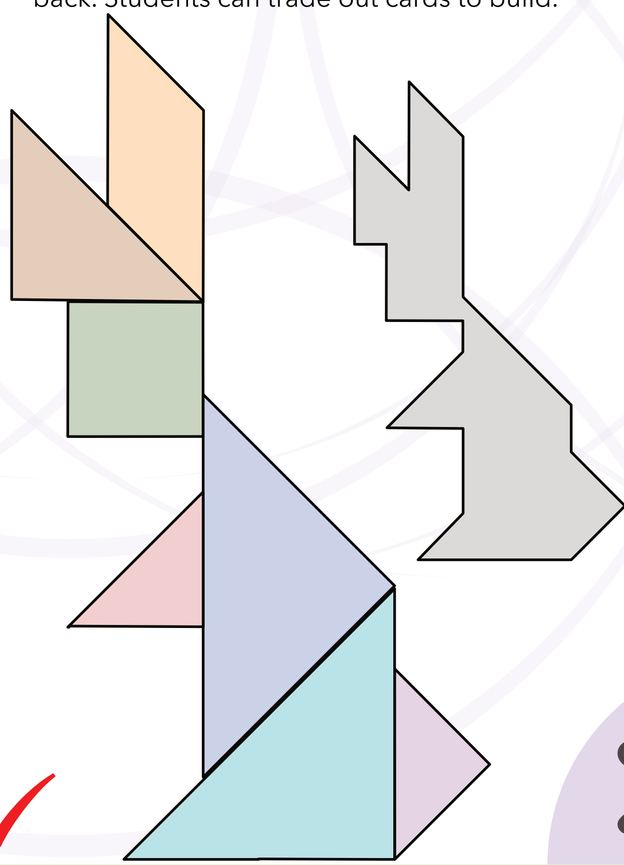
Create a Tangram



Use the Square to tile a 4 x 4 grid.
Mark the Tangram pieces out as shown in red.
Colour them different colours or keep them a solid colour.



Have the students build any object / animal / person.
Trace the outlines on a piece of paper, and supply the solution at the back. Students can trade out cards to build.



These shapes can be transformed by using:

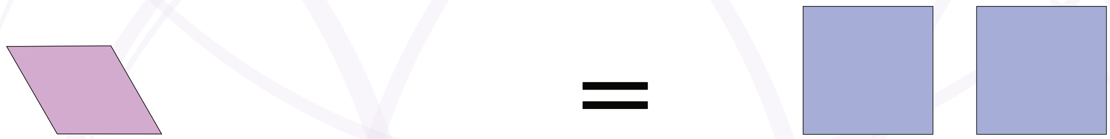
- Rotation
- Reflection
- Translation

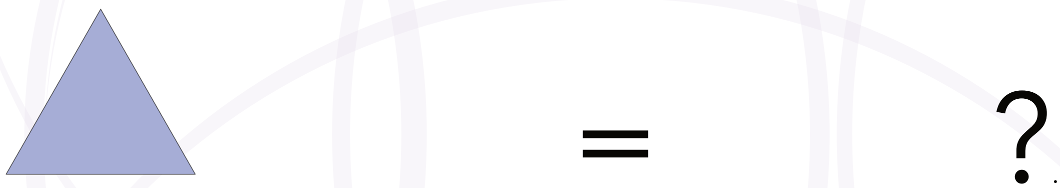
Use the shapes from the MATHOMAT FRACTION cards in the Teachers Manual to create more challenging figures.

Attribute Shape Examples: Algebra

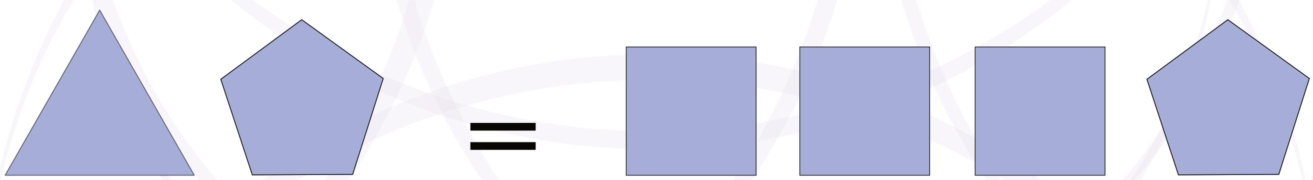
Bridging Geometry and Algebra

This critical thinking exercise shows an equation

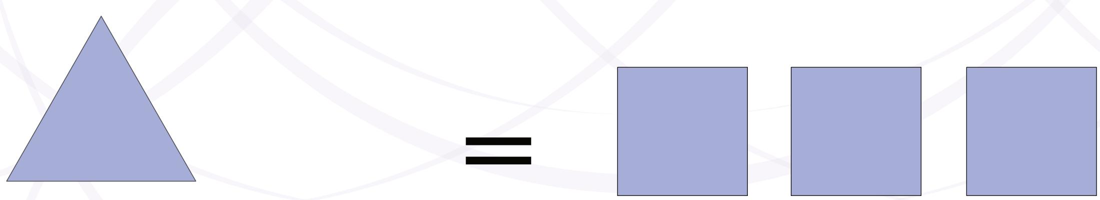




The first line presents a fact, the second line helps us to pinpoint that two squares will be the equivalent of one rhombus.
So, the student should re-write the first line and substitute the rhombus with two squares.



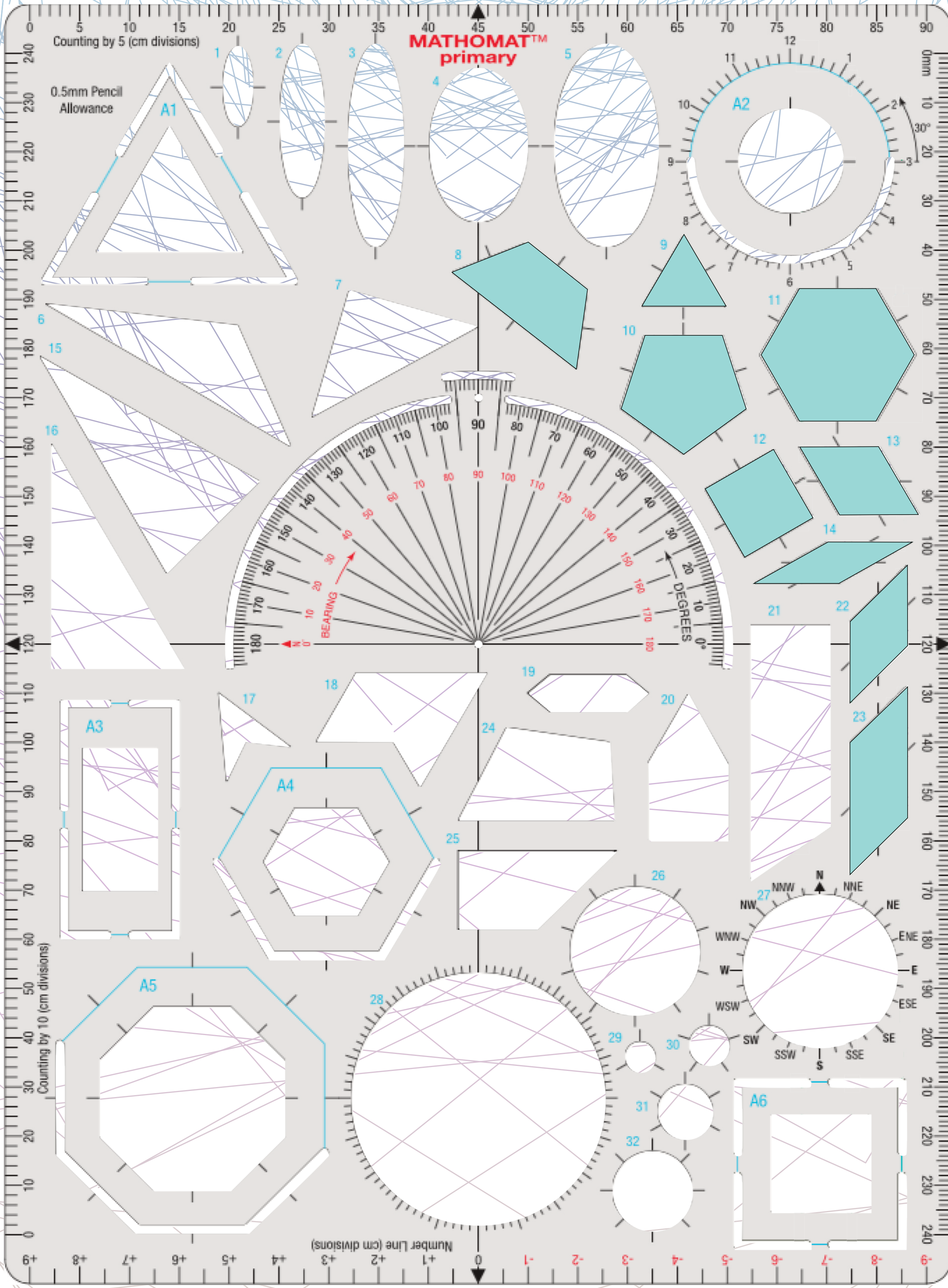
It should now be easier for the student to deduct that one Triangle is equal to three Squares.



Introduce values for each shape and progress to a point where only numbers are used.

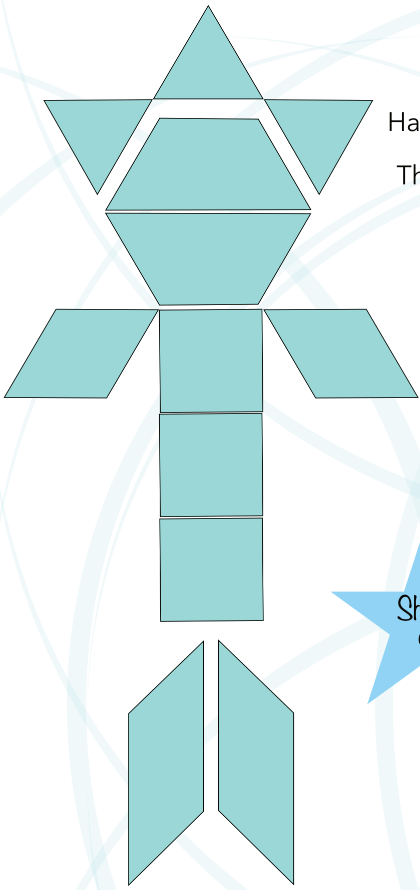
Pattern Block Cluster

Shape pictures Tessellations Transformations



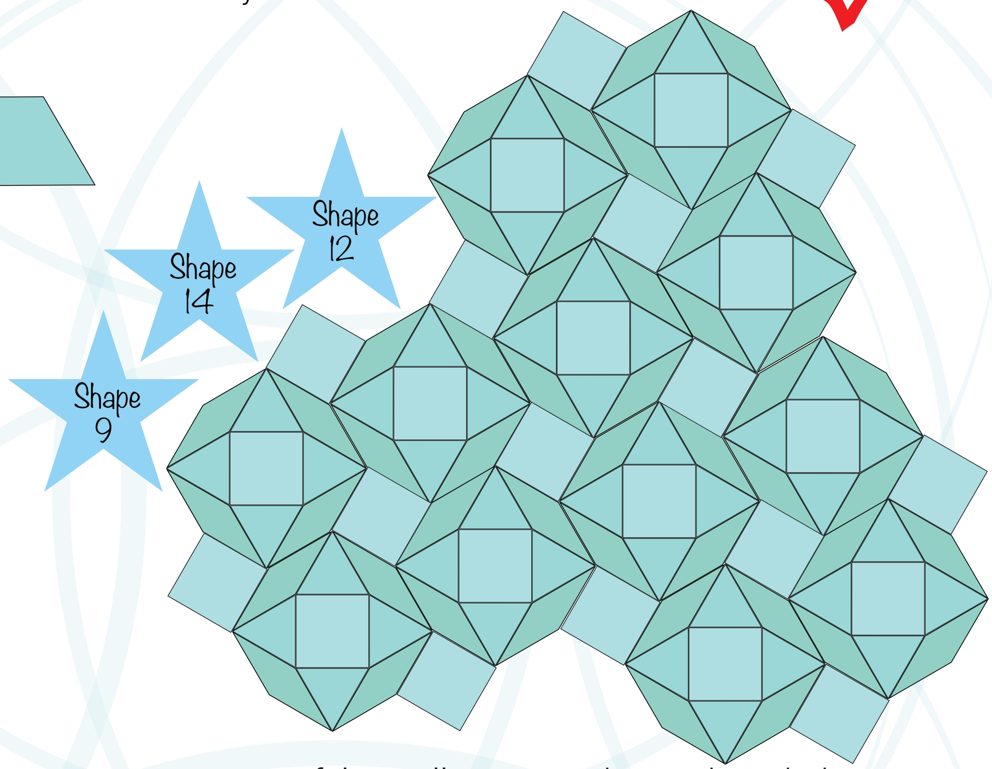
Pattern Block Cluster

Shape pictures Tessellations Transformations

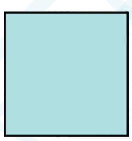


Have students invent their own picture or copy a shape card.
This activity can be done as visual- or auditory recall exercise.

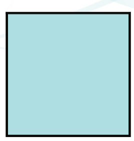
Make sure that the student manipulate the template and not the paper.



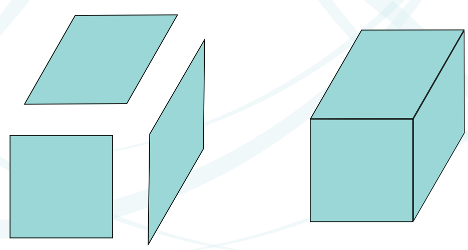
Beautiful tessellations can be made with the Pattern block cluster's shapes.



Draw the square



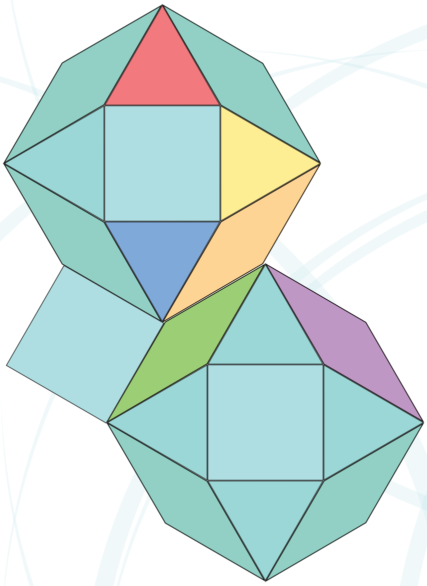
Fit the bottom-side of the triangle onto the top-side of the square



Faces of a cube clustered together for easy 3D drawings.

Pattern Block Cluster

Tessellations Transformations

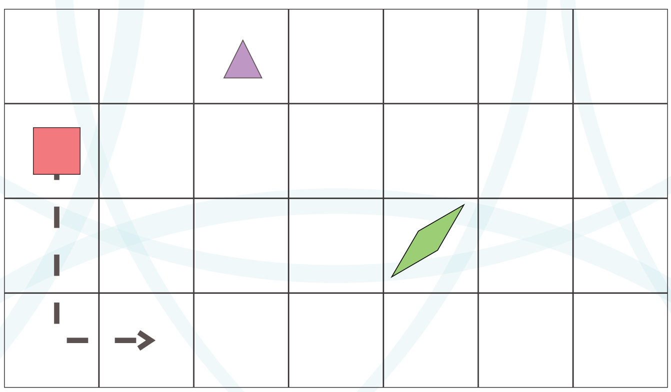


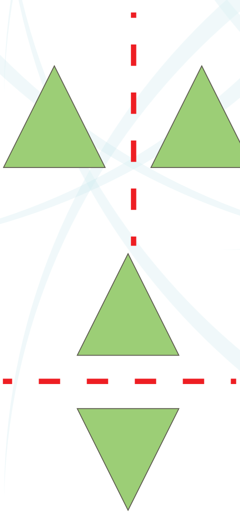
This is a portion of the transformation from the previous page.
The shapes can be numbered or coloured different colours.

Discuss the transformations of the shapes:

Red triangle to Yellow triangle.	Rotation - clockwise
Red triangle to Blue triangle.	Reflection - horizontal
Orange rhombus to green rhombus.	Translation
Green rhombus to Purple rhombus.	Reflection - vertical

Use the square (the bigger the better) to draw a grid. Have the students move cut-out shapes in the transformation that is being dictated.
For example: Red square: Translate two down and one to the right.



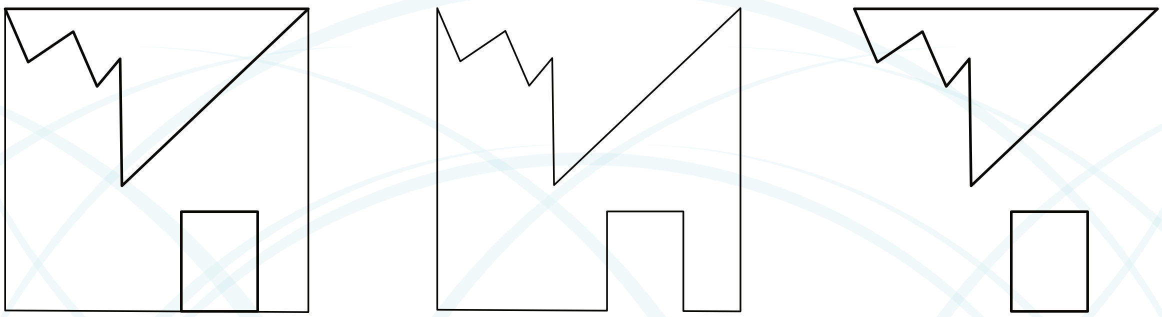


Look at the two reflections of the triangle.
Experiment with the rotation of the triangle as well. Some transformations seem to have no 'effect' unless we add some features.

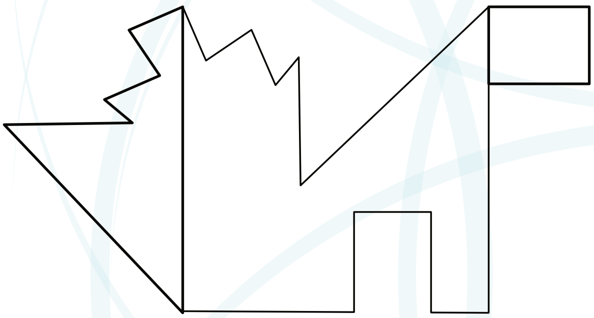
Let the students move the whole template as they perform the transformations until they are confident to just draw in the requested transformation.

Tessellation - based Puzzle

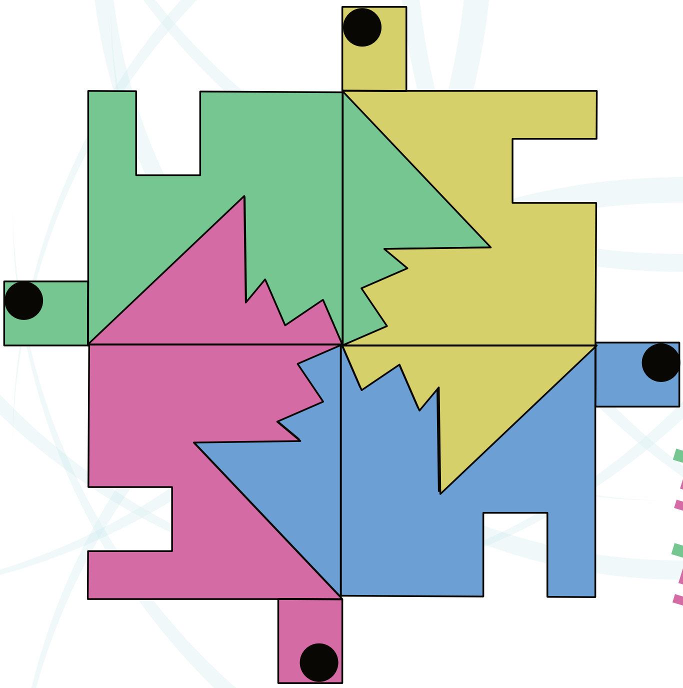
Create a Tessellation-based Puzzle with Irregular Shapes

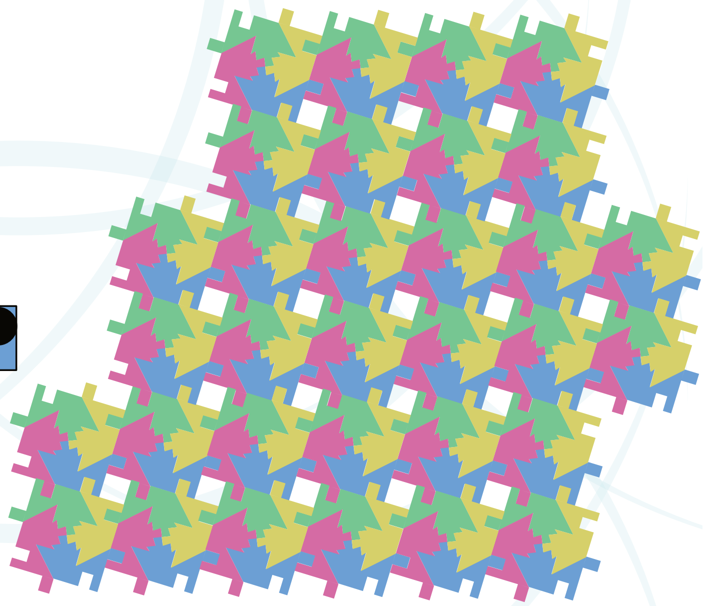


Use the protractor to make a large square, use some shapes on the template to create a cut-out. The students can use the ruler on the side to create the cut-out pieces as well.



Let the students see if their pieces can be put together to form an animal or object.
Add in some eyes or detail to personalize the puzzle.

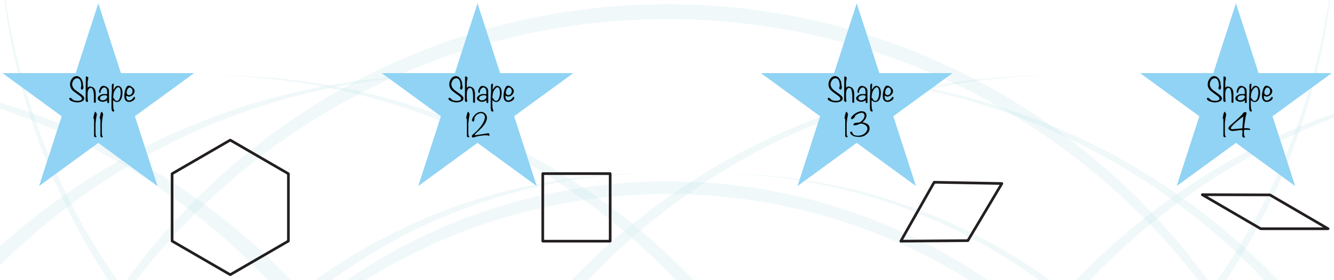




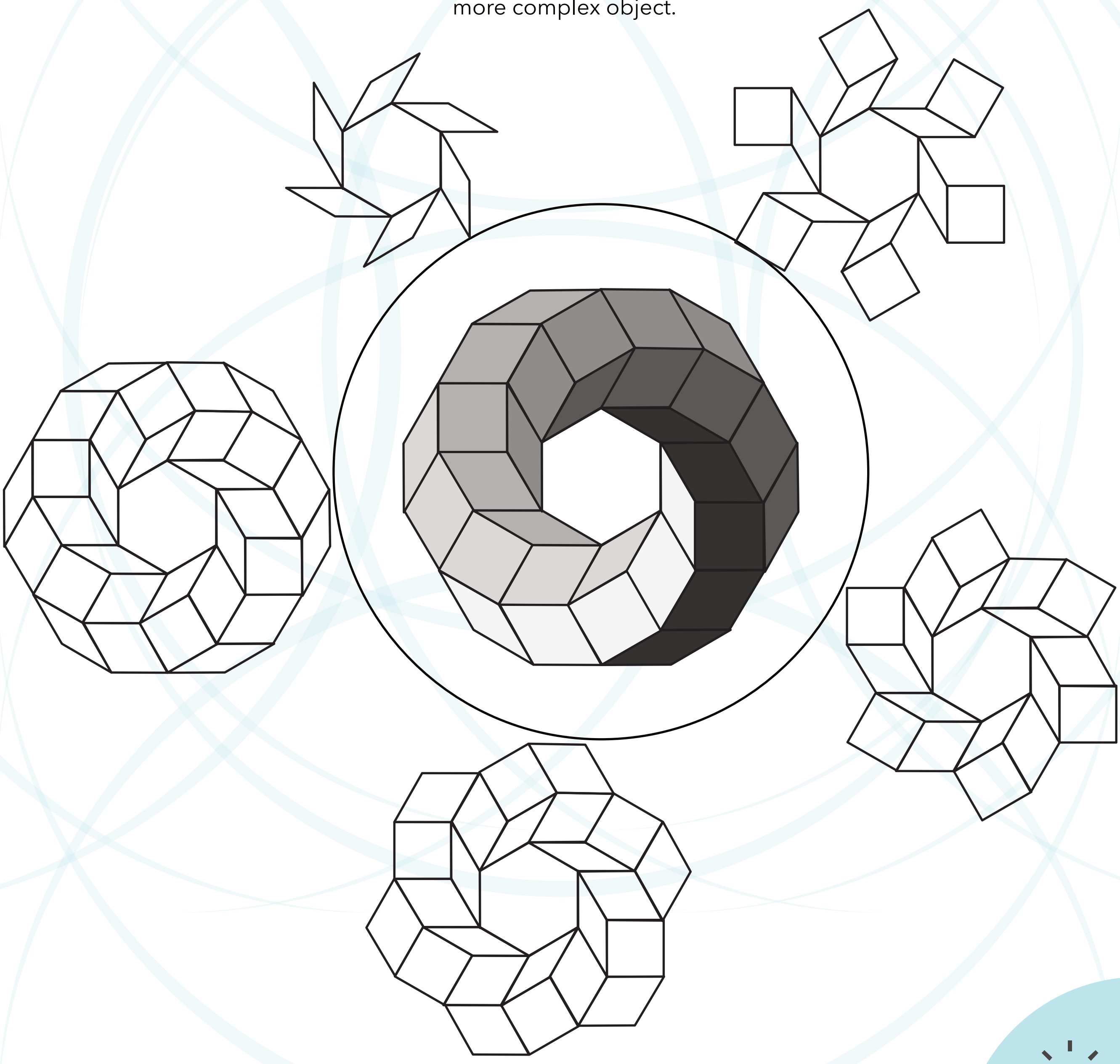
These type of tessellations makes use of irregular shapes. There is a white square that forms and may be coloured as part of the tessellation, although to be mathematically correct - a tessellation may not have open spaces, hence it is only tessellation-based.

3D Objects - Cube cluster

More Complex 3D Objects with the Cube

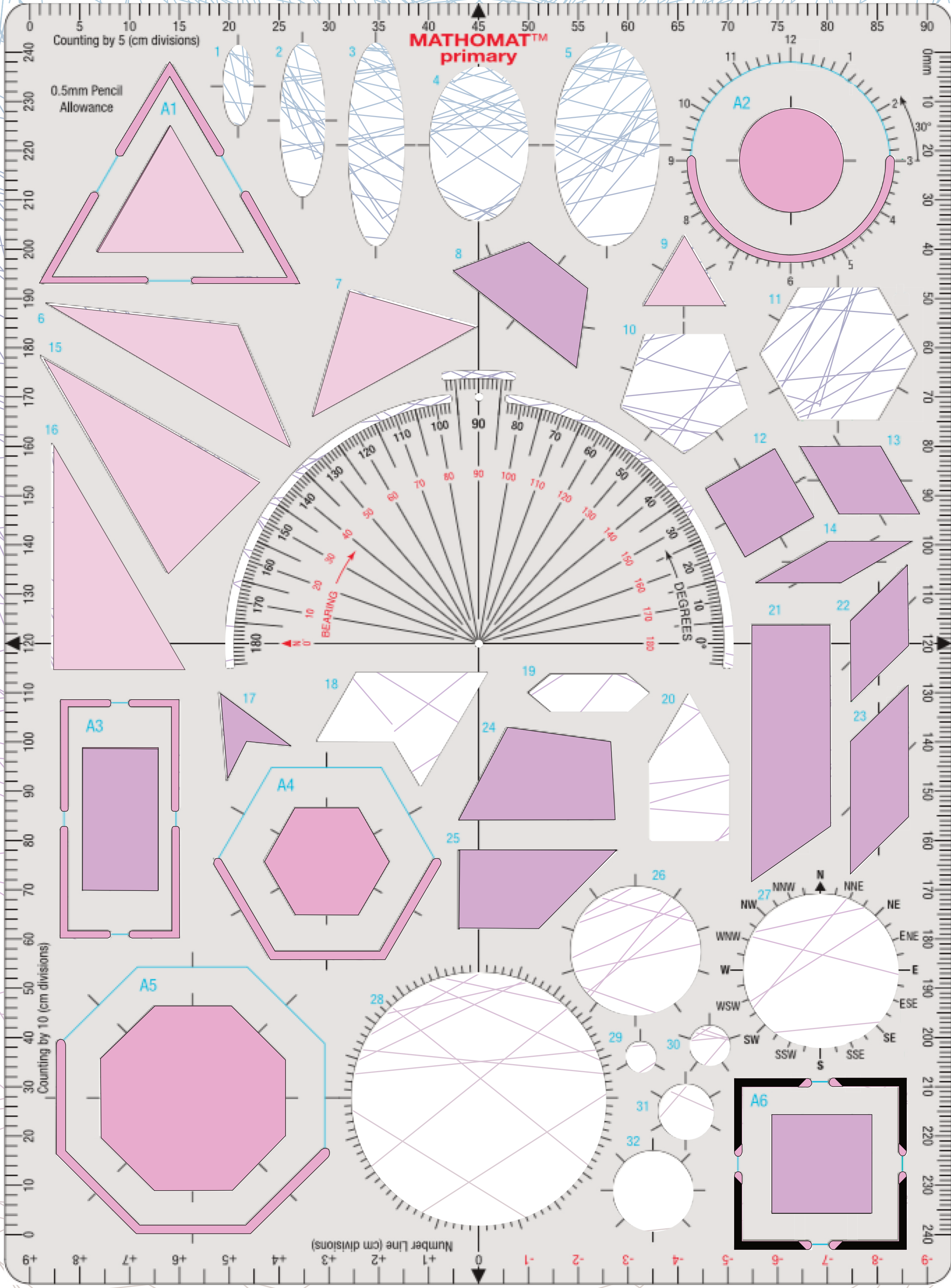


The cluster for the cube can also be used. The cube can then be transformed by means of rotation creating a more complex object.



Play around with colouring the finished object. Different shades lighter and darker will result in a different - looking object.

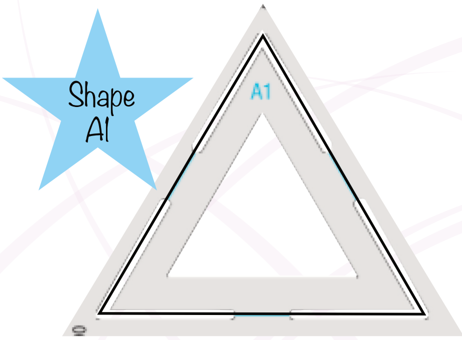
3D Objects



MATHOMAT™
primary
Counting by 5 (cm divisions)
0.5mm Pencil Allowance
Counting by 10 (cm divisions)
Number Line (cm divisions)
BEARING
DEGREES
0mm
30°
A1
A2
A3
A4
A5
A6
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW

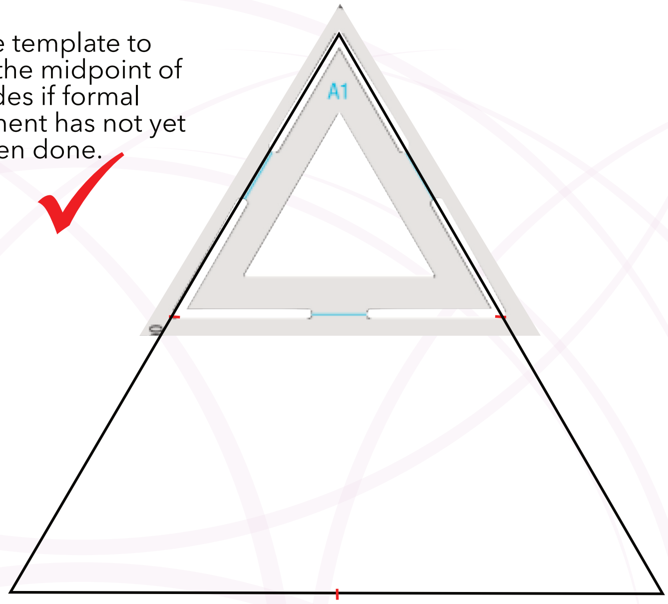
Tessellation puzzle

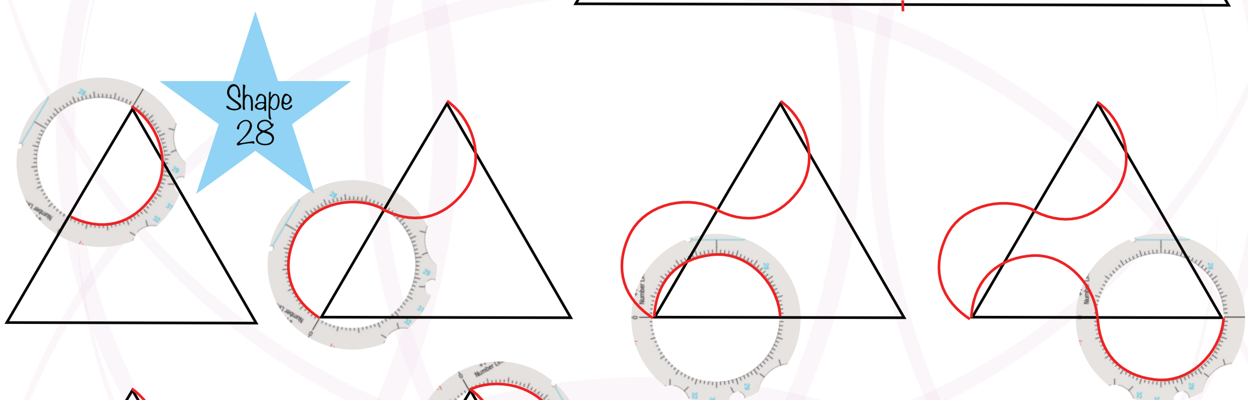
Create a Tessellation Puzzle with Circles

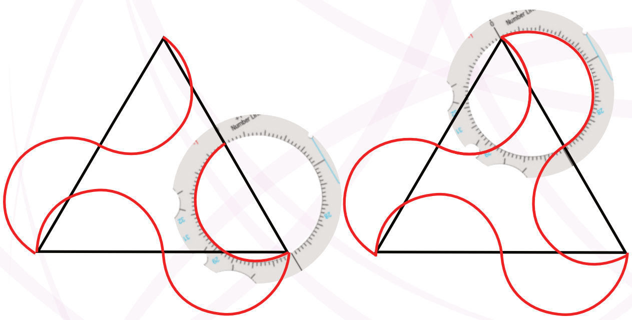


Enlarge the Attribute Triangle by a factor of two. Measure the side and mark a point halfway on each of the sides. Draw the triangle lightly in pencil.

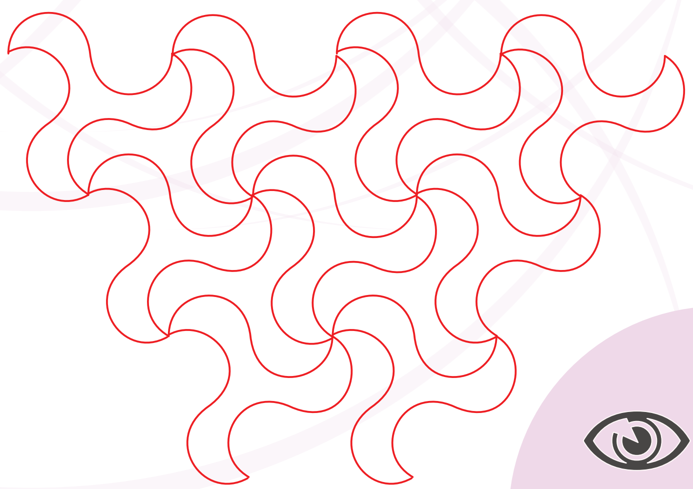
Use the template to measure the midpoint of the sides if formal measurement has not yet been done.

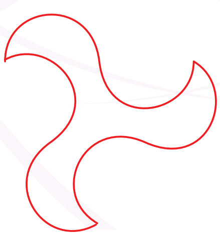






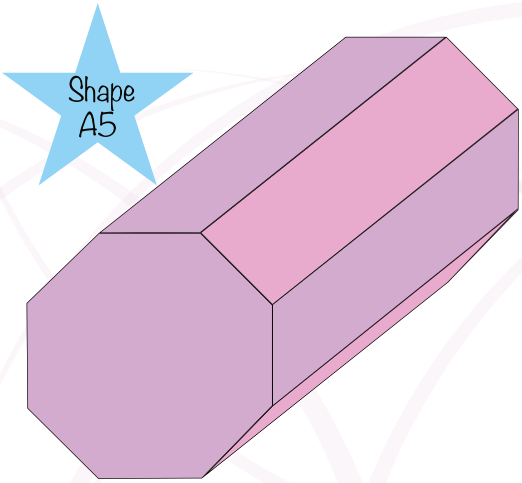
Use Circle no 28 as shown to create two semi-circles on each side of the triangle. One semi-circle should be inside the Triangle and the other on the outside of it.



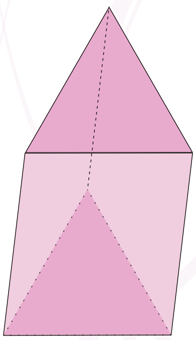


Erase the pencil marks and cut out the semi-circle pattern.

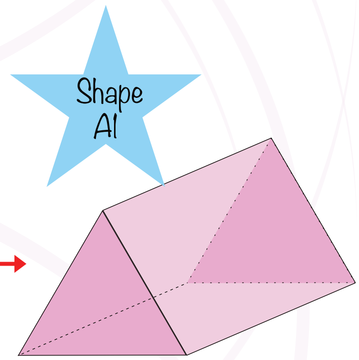
3D Objects Examples

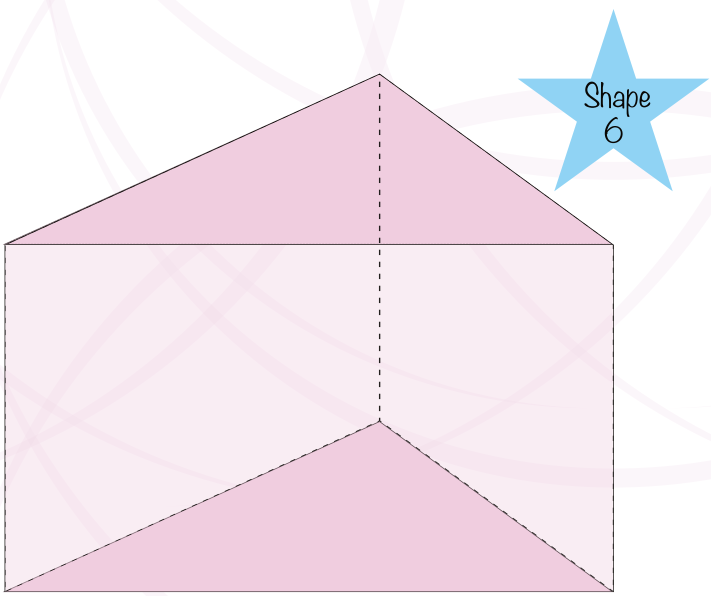


Many 3D objects can be drawn by pairing certain 2D shapes.
This prism was drawn using two octagons and connecting corresponding vertices.



Connecting vertices does not always show the 3D object from the perspective we need.
Rotating the object does not always give us the best view.



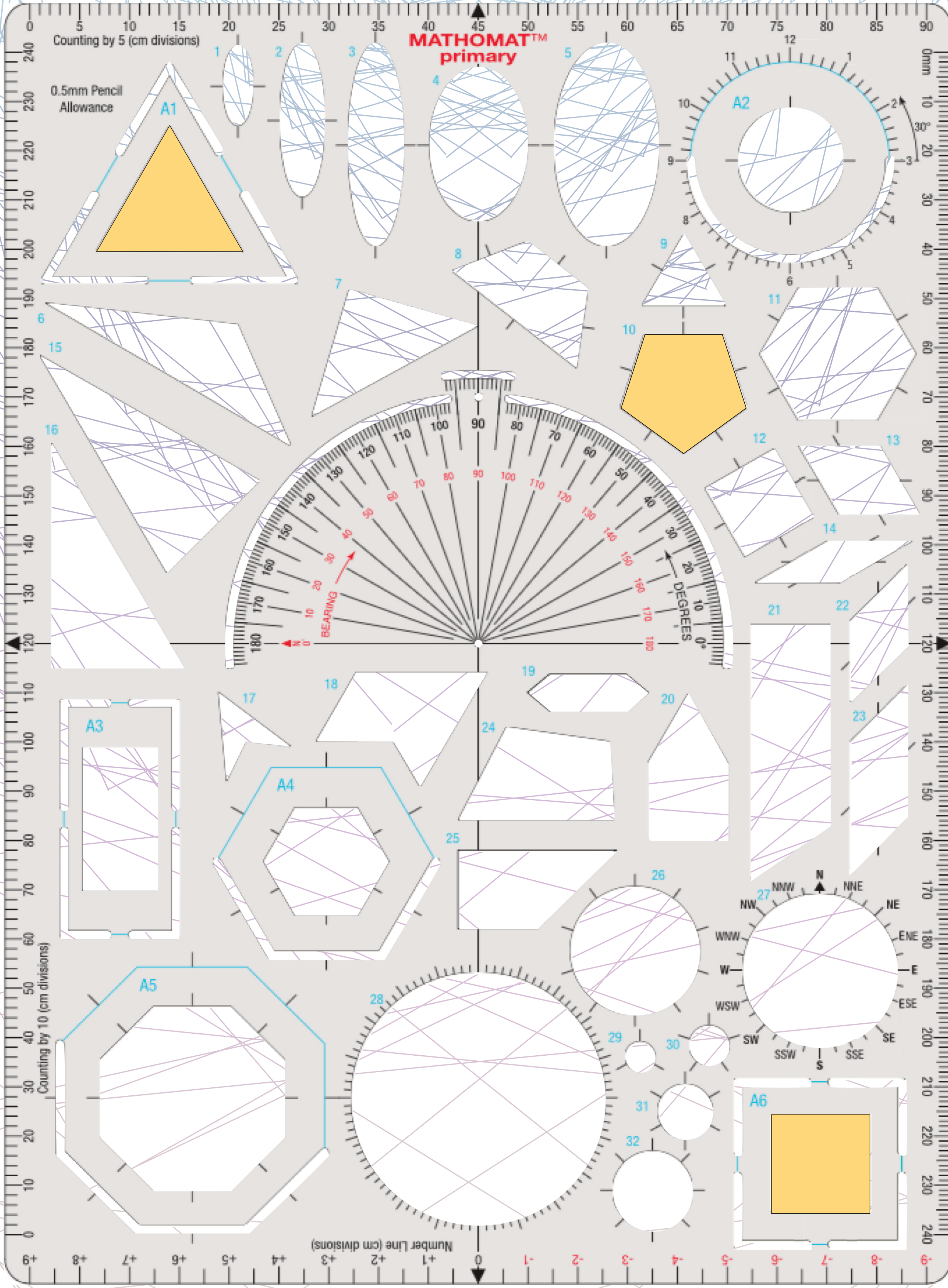


The scalene triangle was used for this perspective and the corresponding vertices were joined.

It is a good idea to informally introduce corresponding vertices by having students draw two of the same shapes and marking the corresponding vertices with the same colour.

Nets

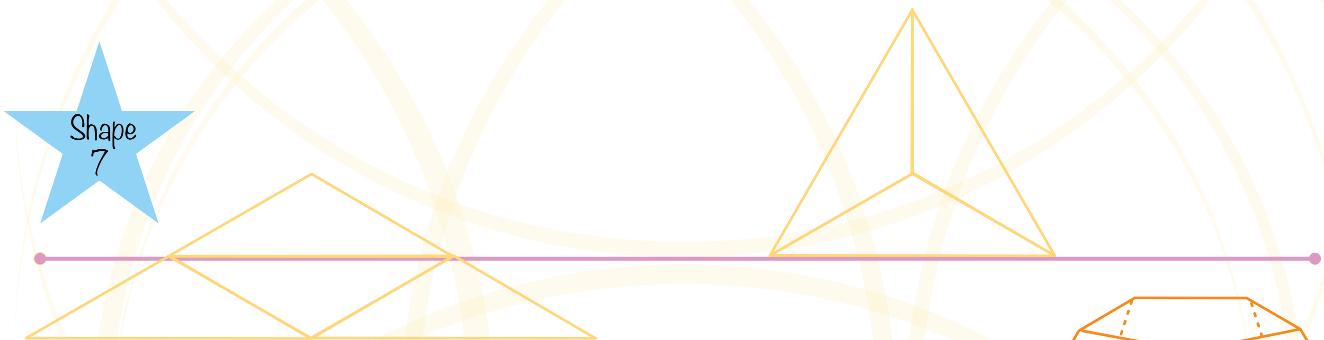
Drawing Nets and 3D Objects



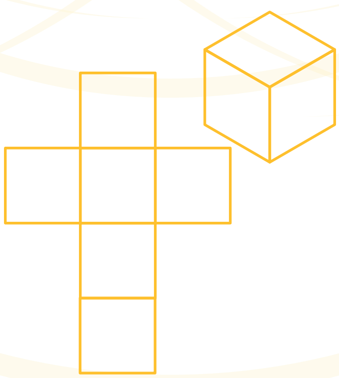
Nets Examples

Some nets that can be made with the template

Have the students draw a guideline for the nets to make sure they sketch them accurately.



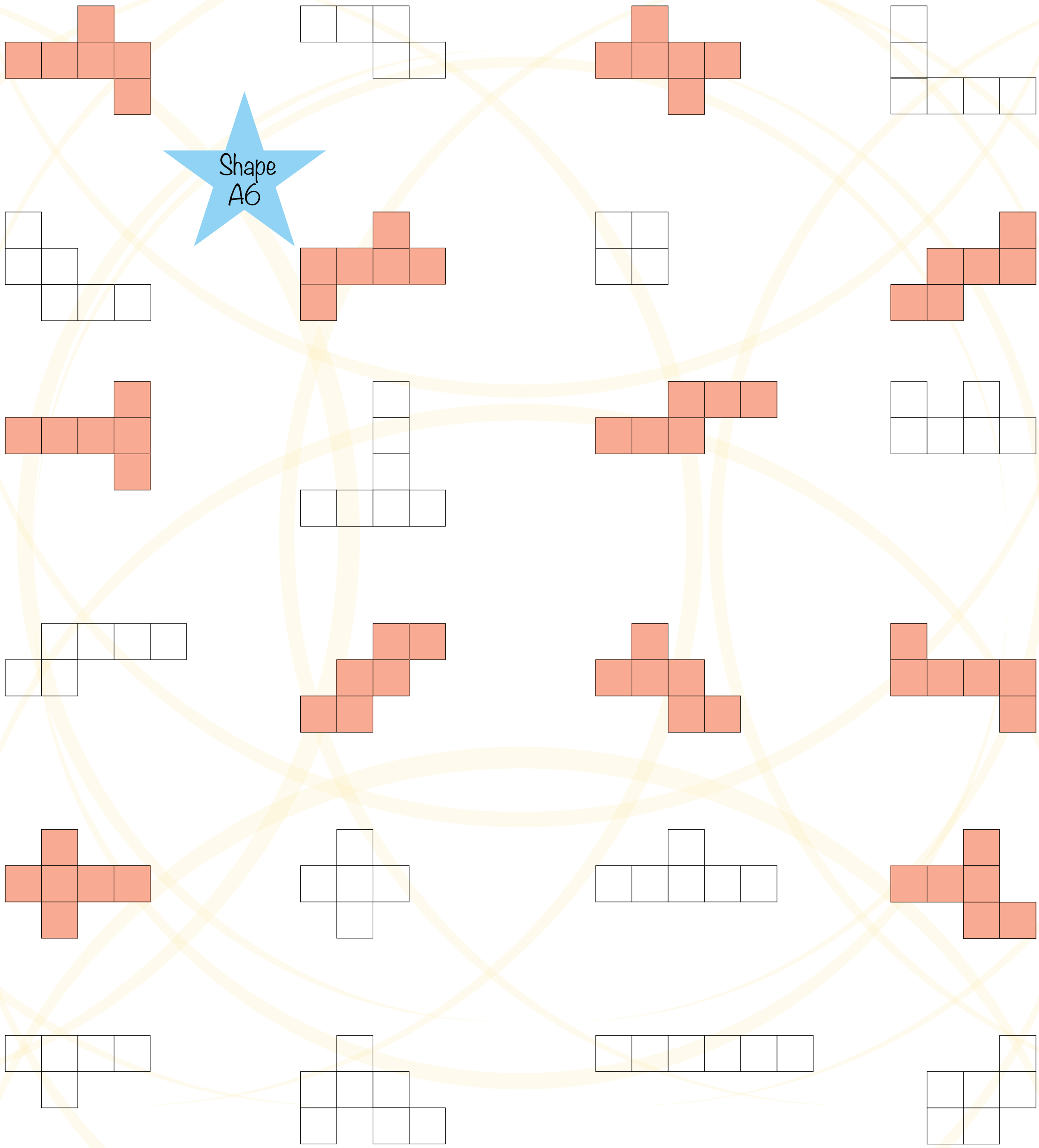
Once the nets are drawn, they can cut it out and fold into 3D objects.



Nets Examples

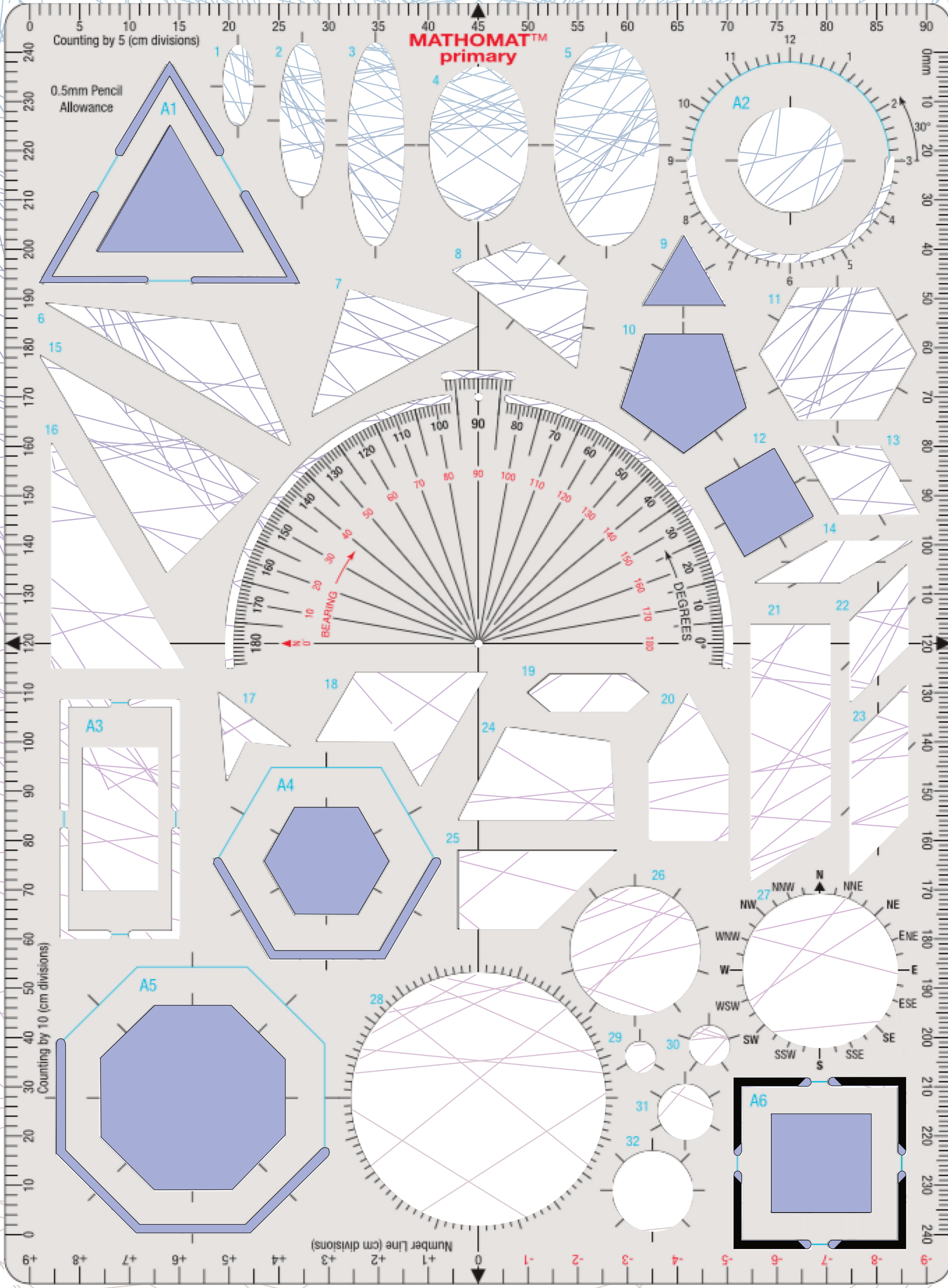
Eleven nets for the cube

There are eleven nets for a cube. Those that will fold into Cubes have been coloured in.



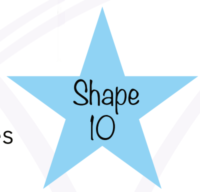
Let students discuss why some
nets cannot fold into a cube.

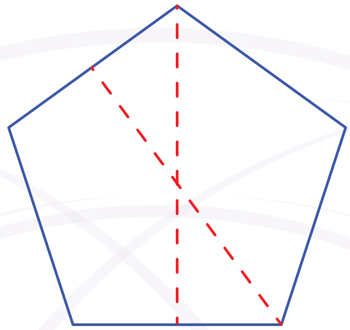
Regular Polygon Enlargement



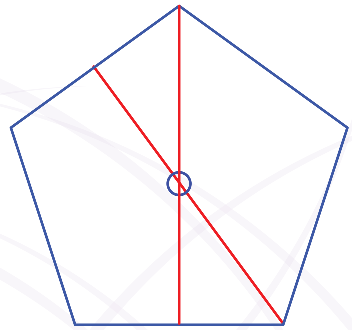
Regular Polygon Enlargement

There are five midpoints marked along each of the sides of the Pentagon. Draw the pentagon, and mark them off on

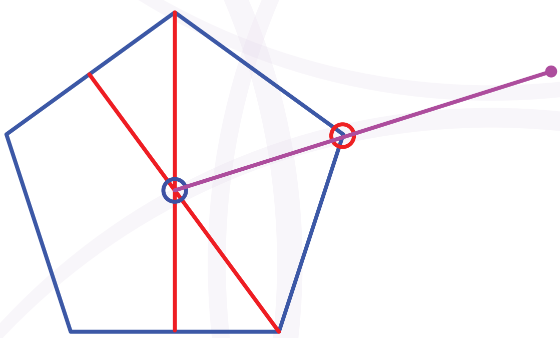




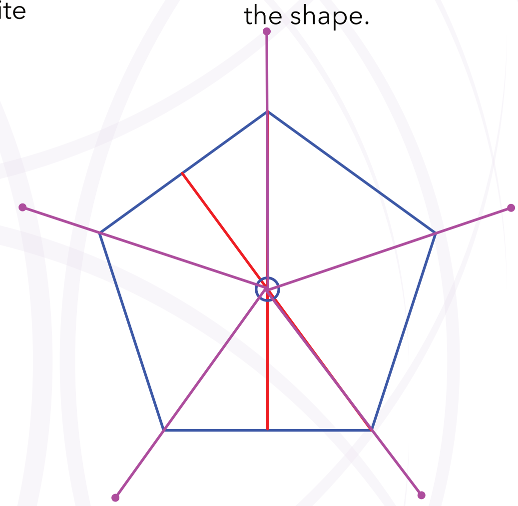
Draw from any two of the points marked off, a straight line to the vertex opposite the side.



The intersection of the two lines serves as the centre of the shape.



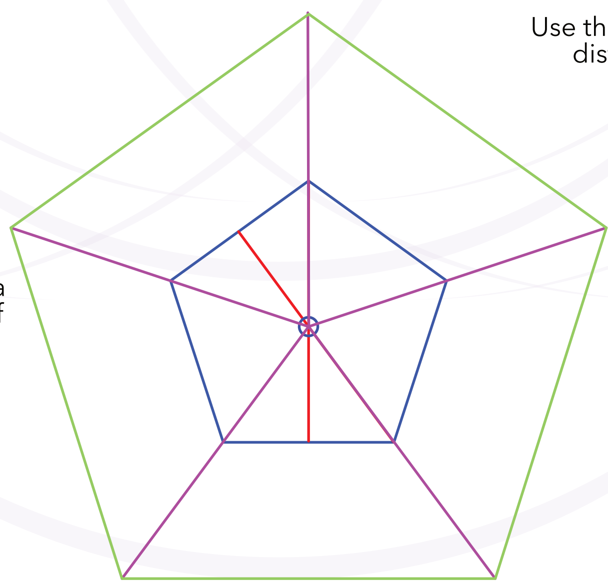
From the centre of the shape, measure a specific distance through the vertex of the shape. In our diagram the line is drawn but in reality we just measure the distance and mark a point at the end of it. You can draw it in pencil and later erase it. The longer the distance, the bigger the enlargement will be.



All five lines from the centre should be the same length.

Connect the five lines as shown in the diagram. The pentagon has been enlarged. The factor of enlargement can be determined by measuring the original length of one side of the pentagon and writing it as a ratio to the length of one of the enlargement's sides.

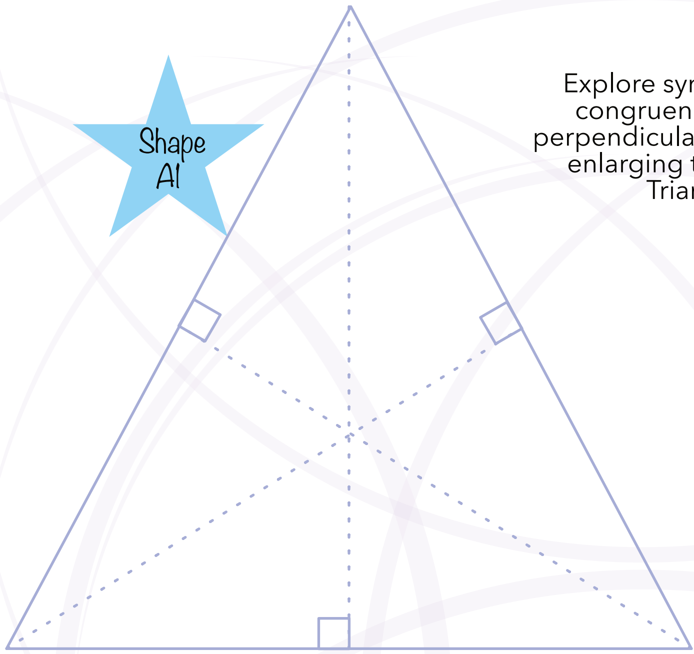
Enlargement: Green side length÷ Blue side length = scale factor.



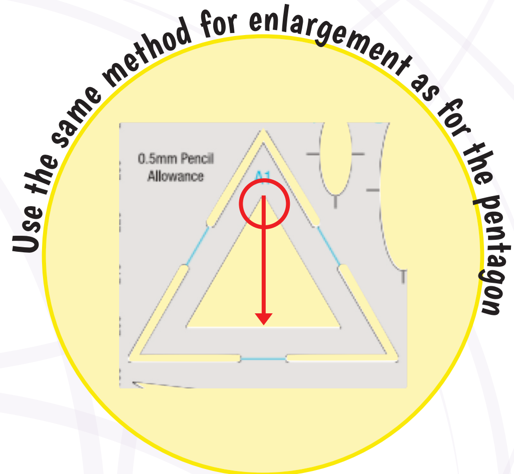
Use the mm ruler to measure the distances from the centre.

Regular Polygon Enlargement

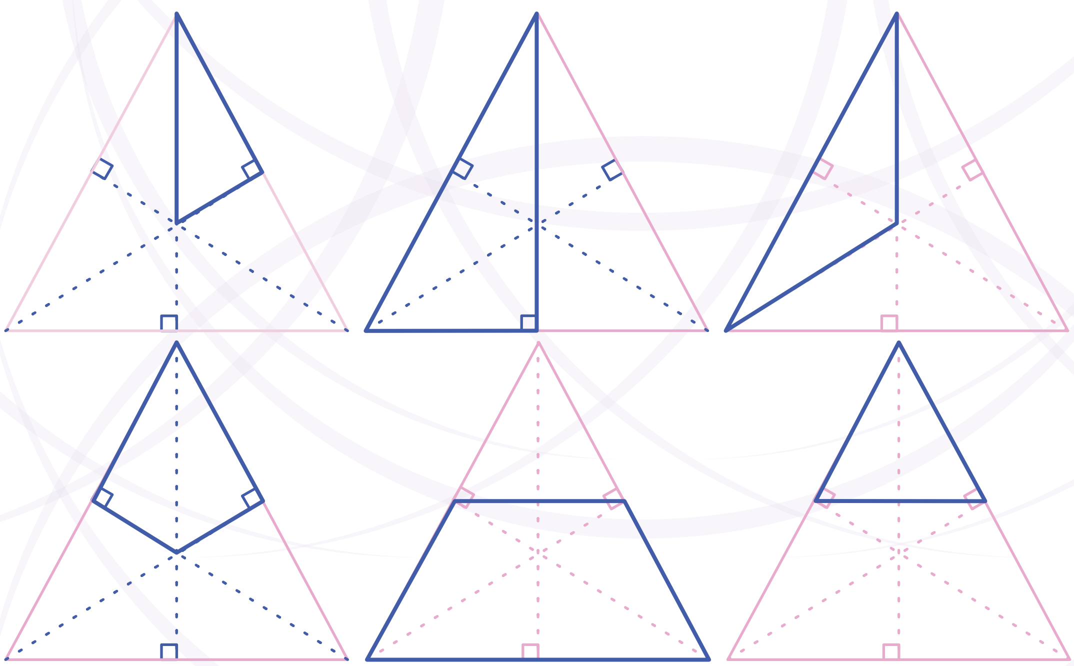
Explore shape properties



Explore symmetry and congruency with the perpendicular bisectors, by enlarging the Regular Triangle.



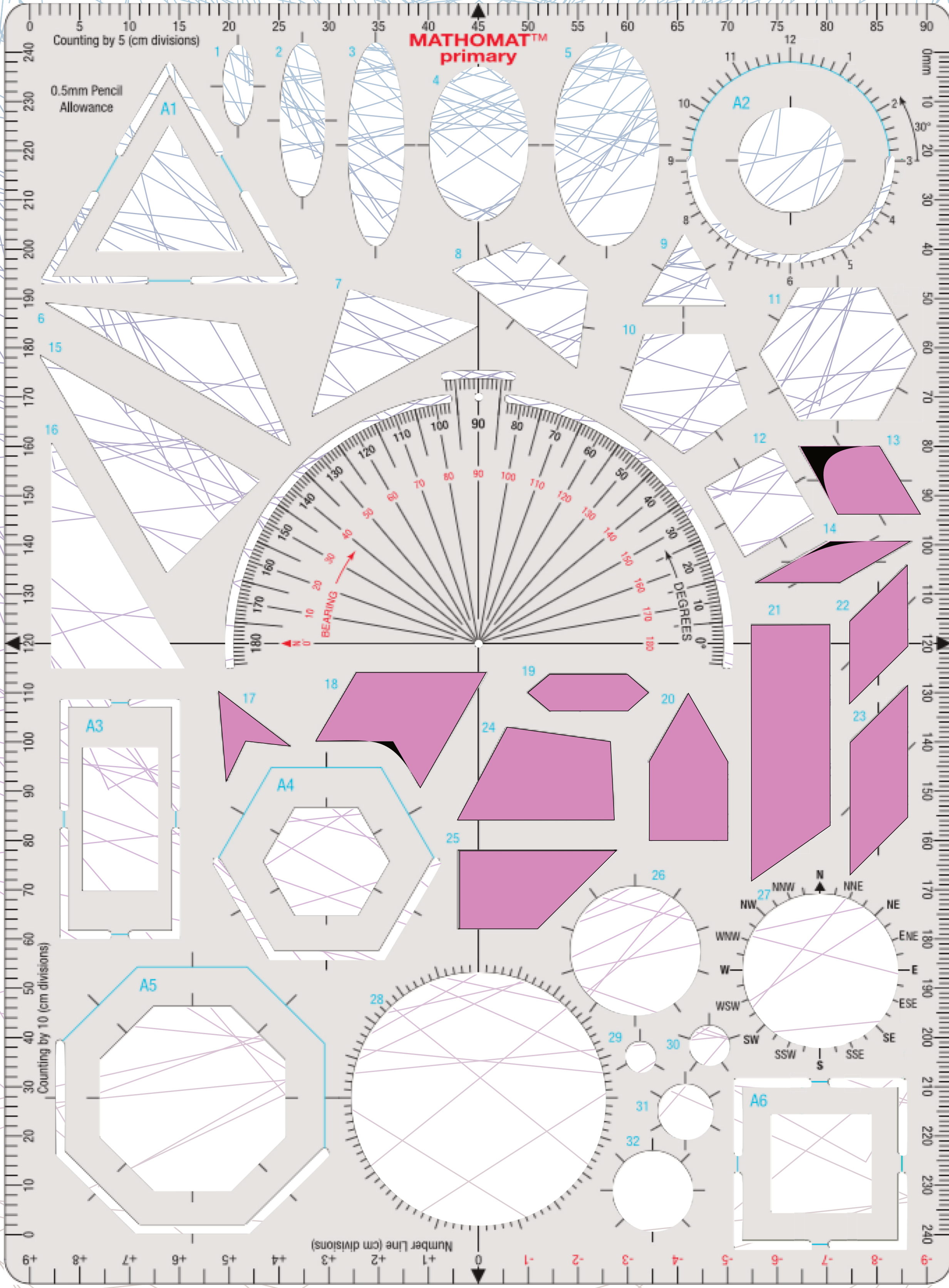
There are no markings for the centre of the sides. Use the vertices to draw a perpendicular line to the opposite side. Do this for all three vertices.



Let the students count the number of triangles inside the big shape.
Let them see how many other shapes they can find.
These type of activities are very important, especially for Circle Theorems in geometry.

Irregular Quadrilaterals, Pentagons and Hexagons

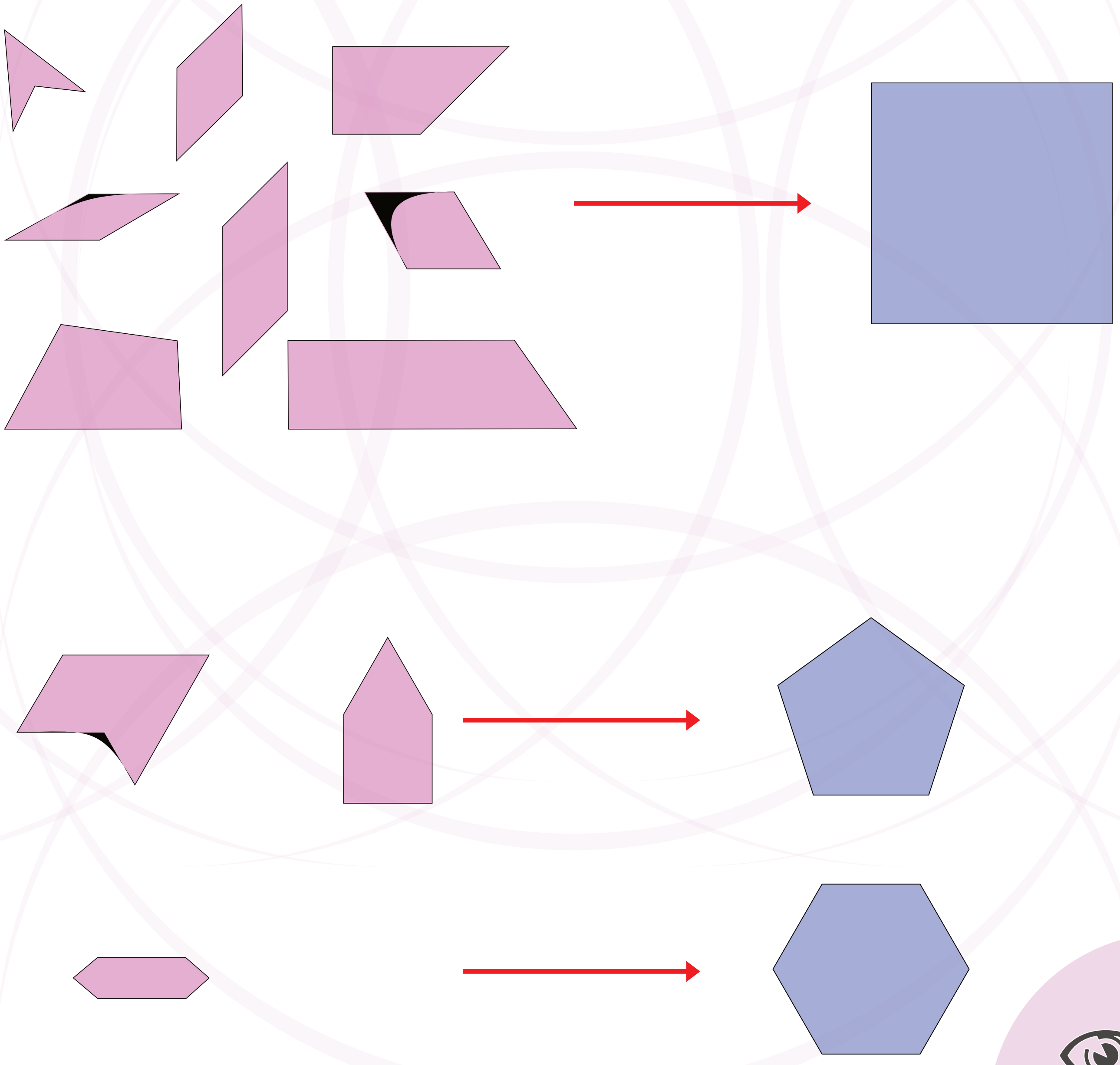
Introducing properties of irregular shapes



Irregular Quadrilaterals, Pentagons and Hexagons Examples

Sorting Irregular shapes

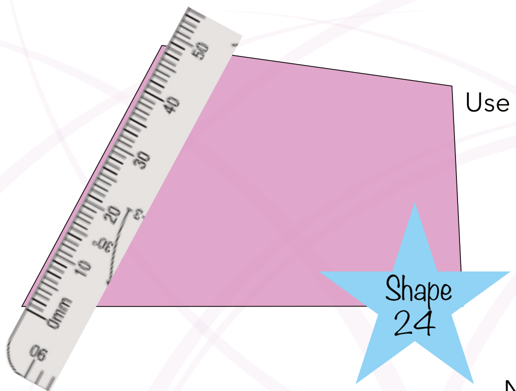
For many students, a shape is only recognizable if it is a regular shape. With the template there is an introduction to lots of irregular shapes.
Have the students count the sides and angles and fit the irregular shape with its regular polygon.



Irregular Quadrilaterals Examples

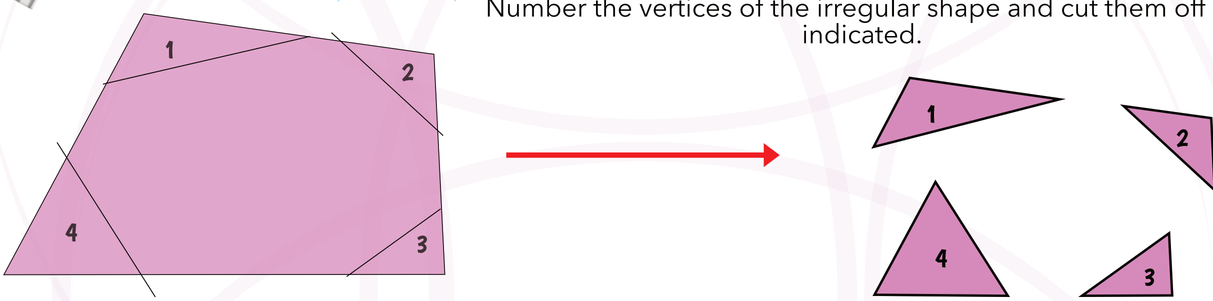
Exploring Properties of Irregular shapes

Exploring the difference between irregular and regular shapes.

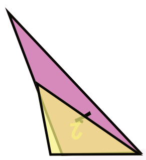


Use the ruler on the side and measure the sides of the irregular shape. If all are not the same length, then the shape is irregular.

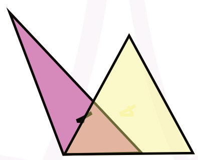
Number the vertices of the irregular shape and cut them off as indicated.



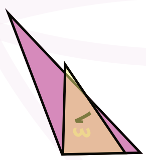
Take the pieces that were cut off and fit them onto each other.



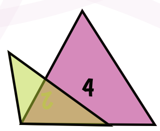
1 and 2 does not fit.



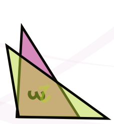
1 and 4 does not fit.



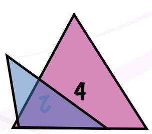
1 and 3 does not fit.



2 and 4 does not fit.



2 and 3 does not fit.



3 and 4 does not fit.

These types of proofs builds a firm basis for further studies on irregular shape properties.

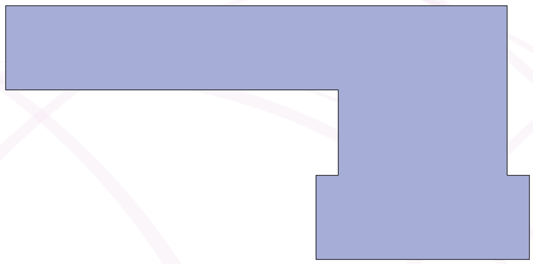
Use the manual to see how we enlarge irregular shapes and work from the enlarged shape for this proof.

Irregular Quadrilaterals Examples

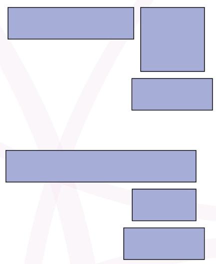
Area and Perimeter

Exploring ways to calculate area.

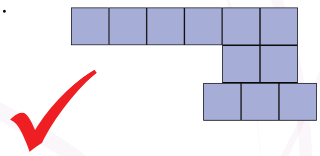
Introducing irregular shapes as known shapes, fused together (composite shapes) is another perspective on irregular shapes.

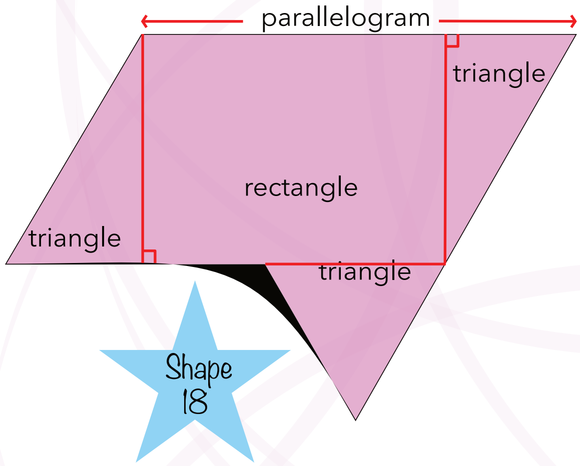


See how many ways there are to decompose the shape

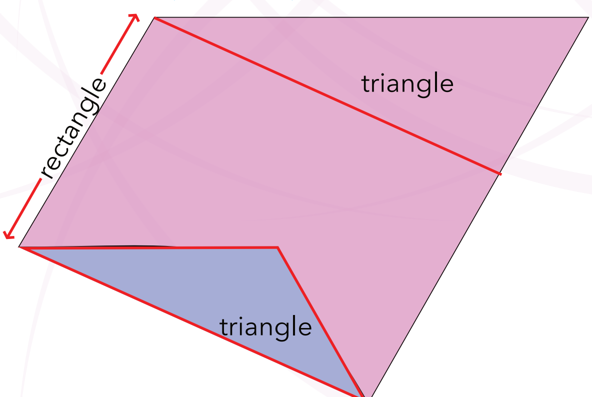


As a recap on area, draw these rectangles by using squares, then the area will be easy to calculate without formal measurements or a formula.





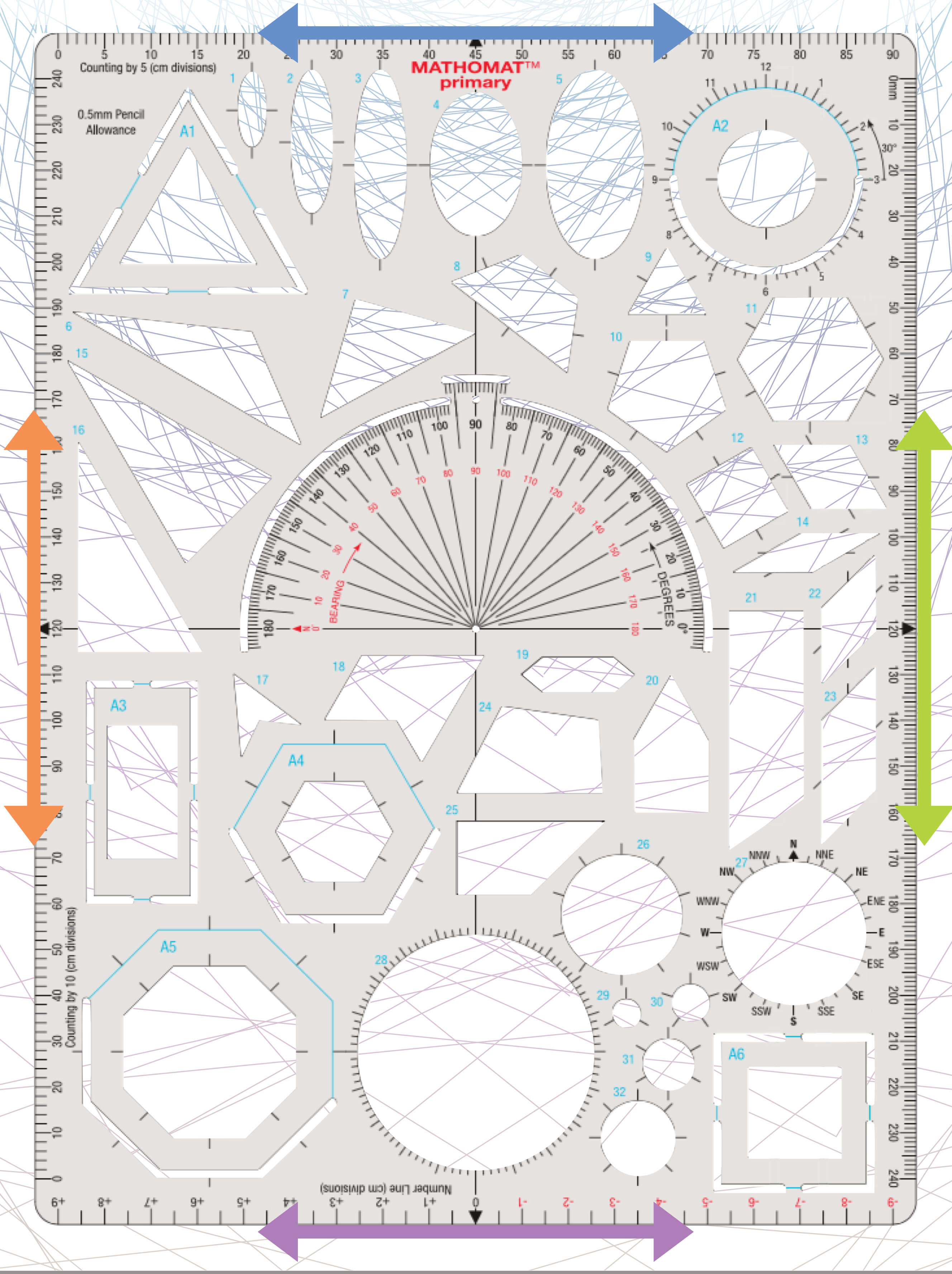
Let the students see how many ways they can find to decompose this irregular shape. Enlarge it to get a better idea.
For area, it will be easier to decompose into triangles.
Area can be calculated by adding the pink shapes' area up.



Instead of breaking up into smaller known shapes, how about a combination of breaking up and completing using known shapes?
Now area can be calculated: Add the pink triangle to the pink and purple rectangle and subtract the purple triangle.

The enlargement of irregular shapes are dealt with in the teachers manual.

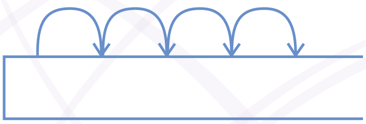
Rulers



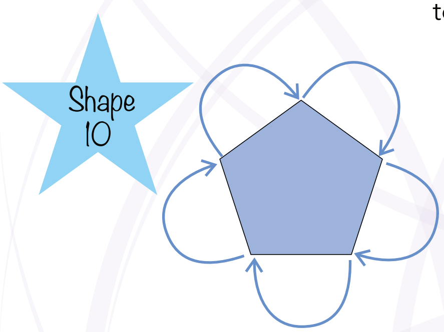
Counting by 5 (cm divisions)
MATHOMAT™
primary
0.5mm Pencil Allowance
BEARING
DEGREES
Counting by 10 (cm divisions)
Number Line (cm divisions)

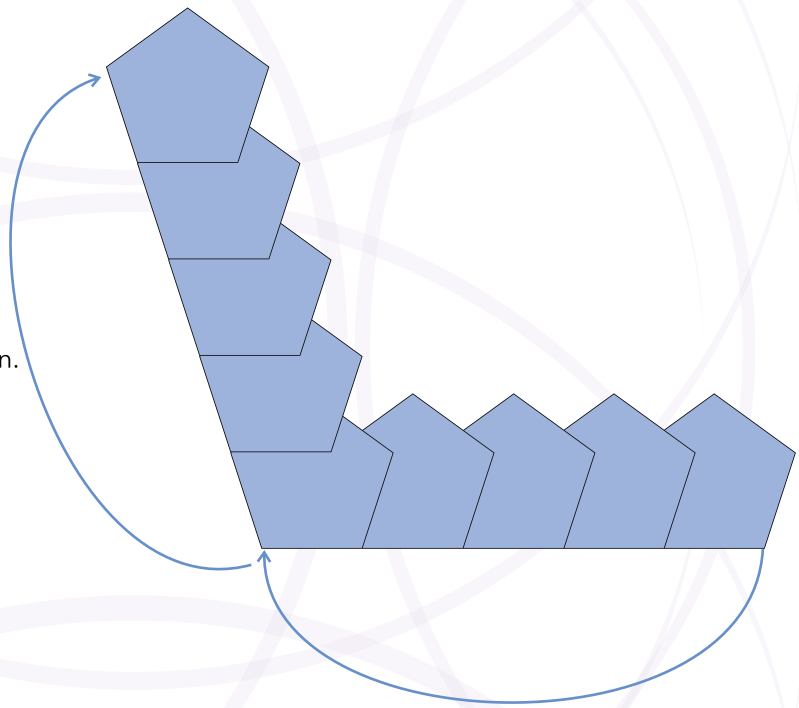
Rulers Examples

The top ruler on the template is marked off in multiples of five. This is a handy way to rote count in fives. Each division is 5cm in length.
Multiplication can be shown on the ruler - Four hops of five each equals 20.



Use a pentagon:
One Pentagon = 5 hops
Ten Pentagons = 20 hops
This is a good way to use shapes to extend knowledge on proportion and to prove the algebraic calculation.





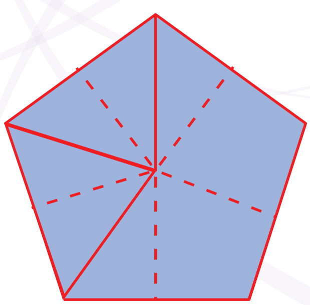
Use a factor of five to enlarge the pentagon.

Have a look at the following:

One Pentagon = 5 unit perimeter

Enlarged by factor of 5 Pentagon = 25 unit perimeter.

Let the class predict what happened to the area of the enlarged pentagon.



Decompose the pentagon into triangles to work out area.

Rulers Examples

Introduce the integer ruler as the 'reflection' ruler. If students are able to notice what a reflection of a shape does, they will be able to tie that information in with integers when they see that the distance from zero for additive inverses stay the same. This distance is the reflection form zero to the positive side of the distance from zero to the negative side.
Horizontal movement to the right has an opposite or "reflection" which is movement to the left. The number of units moved is important.
Five units to the right has an opposite of five units to the left.

Vertical movement upwards has an opposite or "reflection" which consists of movement down. The number of movements moved is important.
Seven units up has and opposite of seven units down.

These movements mimic the Cartesian Plane to which they will be introduced at a later stage and is very important.

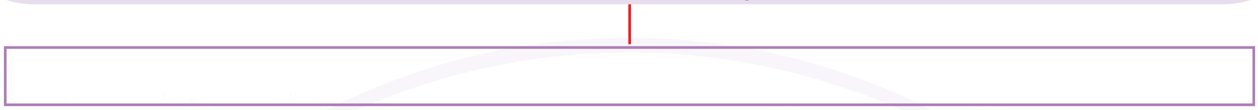
The ruler on the right-hand side of the template is marked off in multiples of 10.
A very good visual reminder that multiplying by ten will have a distinct pattern of having the same number we multiply ending in a zero.
Use this ruler for addition and subtraction sums.

The mm ruler on the right-hand side is used for formal measurement of shapes, perimeter and enlargements, to name a few.

Let the student use different coloured dry-erase markers and let them mark off answers to an auditory mental math test on the applicable ruler that is indicated by you. Have the colours correspond to the numbers of the test.
Let them compare their markings with the student next to them. A fun way to write a quick informal test/quiz.

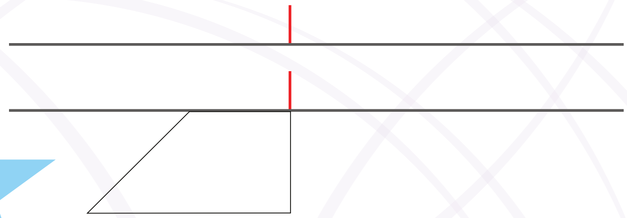
Rulers Examples

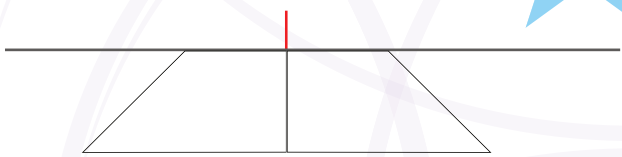
Introduction to Integers



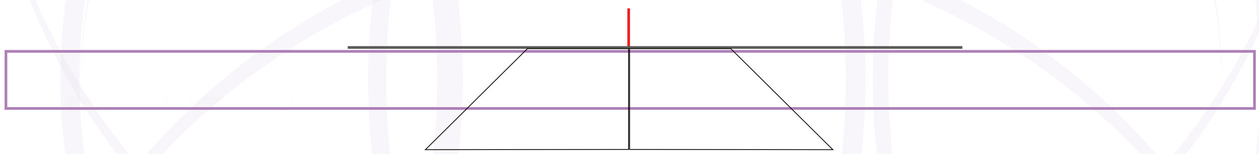
Mark the centre of the integer ruler at the arrow (zero point)
Draw a light pencil line to act as a guideline.

Use the Right-angled trapezium and line up the top side with the guideline, draw the shape. Make sure the top-right vertex lines up with the point marked off in red.

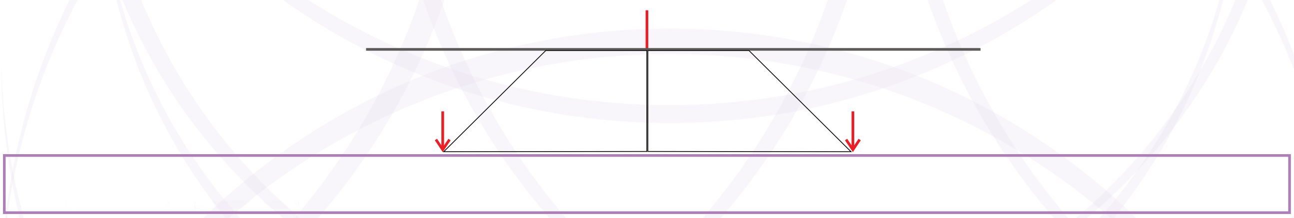




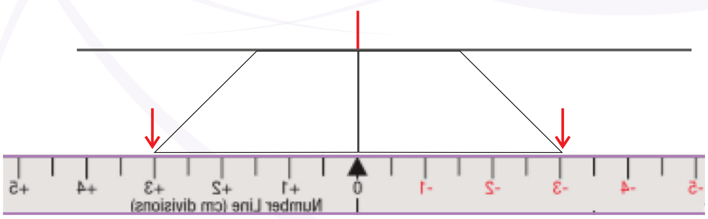
Reflect the template and draw a second Right-angled trapezium so that it has a common side with the first one.



Line up the ruler with the point that was marked off initially. Move the ruler down, perpendicularly.

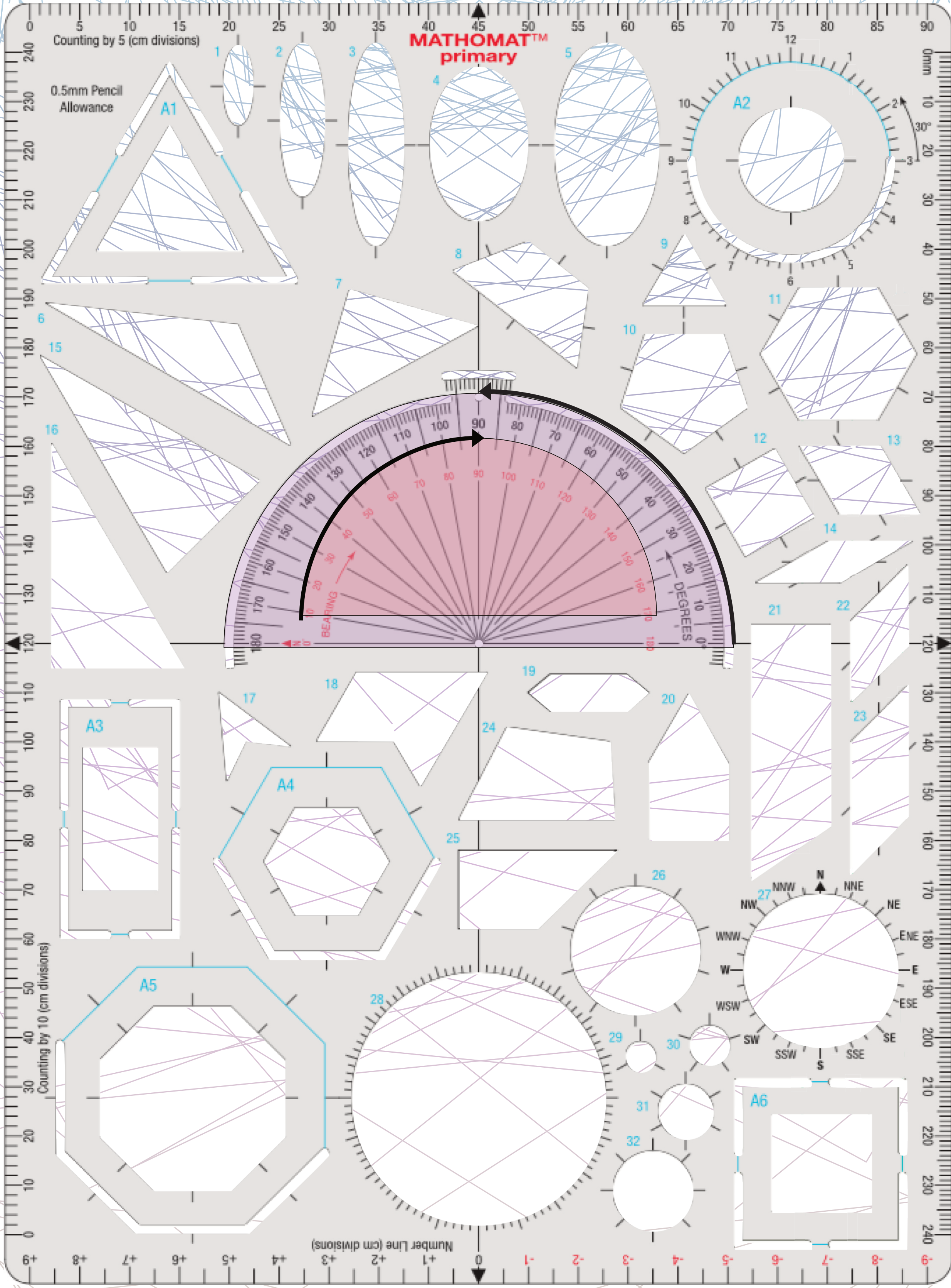


The reflected shape is the opposite of the first one we drew. By reading the units on the ruler we see that +3 is the opposite of -3 and we have proof that this is indeed true because if we reflect the template, the integer line will line up at these two points again.



Protractor

The Protractor and Bearing Scales

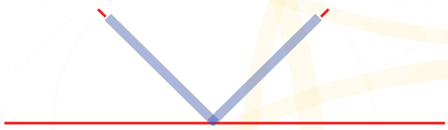


Protractor Examples

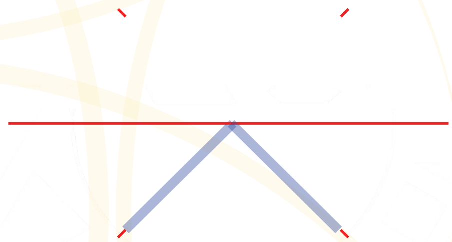
Polygons Enlargements and Transformation

I highly recommend the lesson on rotation as a basis of what an angle is before teaching angles with a protractor.
Distance is a concept that students are familiar with before they start formal measurement with a normal ruler - so the same goes for angles. We gradually build their concrete concepts of an angle before we measure angles.

Reflect the template making sure the bottom line is on the guideline again.

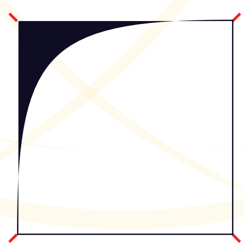


Draw a guideline. Place the protractor on it. Use a dry-wipe marker to emphasize the lines at the 45° and 135° points on the template (blue lines) and also mark them off on the curve of the protractor on the paper with a pencil (red marks).



Use the blue lines as a guide to where the next red marks should be made - because the template is reflected younger students may have difficulty reading the numbers correctly.

There will be four red marks



Join them with a pencil

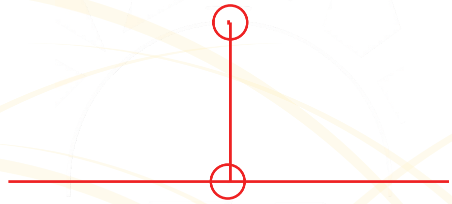
A quick way to get an enlargement for one of the regular polygons.

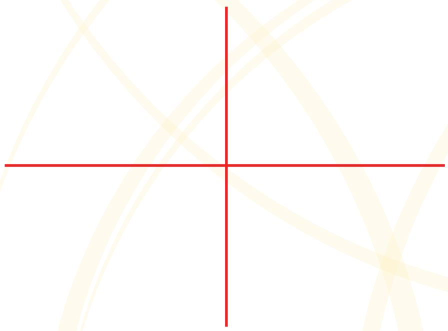
This activity bridges circles and polygons and encourages students to see the relationship between shapes, degrees, angles and circles

Protractor Examples

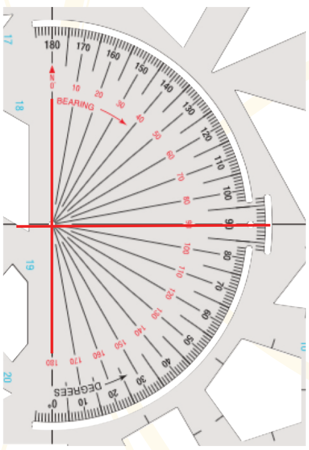
Bearing

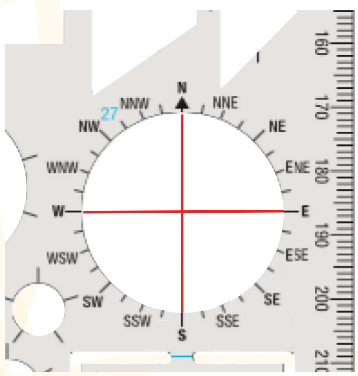
The guideline we use will look like a cross-hair. We refer the cross hair as a system of axes.
Draw a horizontal line across the bottom and mark a point off at 90° and the bottom middle of the protractor where there is a hole.



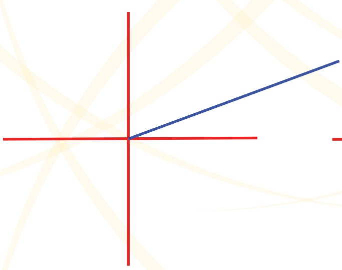


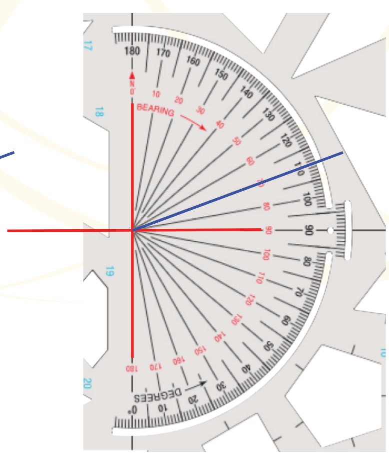
Extend the vertical line downwards.

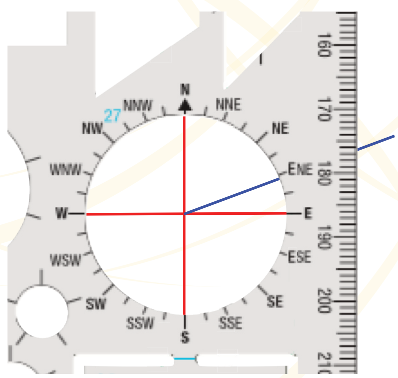




Practice placing the protractor and compass rose correctly on the lines.
Point out that both the protractor and compass rose shows NORTH at the top.







Add in a coloured line and measure the bearing and direction of the coloured line.

Teacher Manual Excerpts

Chapter 1

Fractions

Fractions are often hard to draw - hence pupils are left to draw them as best they can even if portions are not the same size. This is really not ideal as fractions are based on the fact that when we divide, we have equal-sized portions.

Visually representing 1/7 or any odd numbered denominator is also not an easy task, especially if a continuous fraction is needed.

This chapter shows how we use the MATHOMAT Primary template to accomplish all the different types of representations.

We cover the basics of fractions and gradually work up to more intricate fraction properties.

A fractions game is explained - the cards are in the back of this manual under the resources section.

The aim of this chapter is to not only teach what fractions are and how they work but also how to represent them visually and how to make use of those representations when dealing with word problems.

In Chapter 1

- What is a fraction?
- Teaching fractions with MATHOMAT
- The traditional fraction-wall
- Visualizing and drawing fractions
- Different representations
- Bridging from fractions into area and perimeter
- Bridging from fractions into composite shapes
- Bridging from fractions into tessellations
- Visually explaining fraction rules
- Choosing which representation is best for different kinds of problems
- Geometry fractions with MATHOMAT
- Word Problems
- Fractions exercises

Vocabulary

- Numerator
- Denominator
- Unit shape
- Attribute shapes
- Discrete representations
- Continuous representations
- Area models
- Transitivity
- Symmetry
- Reflexivity

What you will need:

- MATHOMAT PRIMARY template

Cut outs of the following shapes:

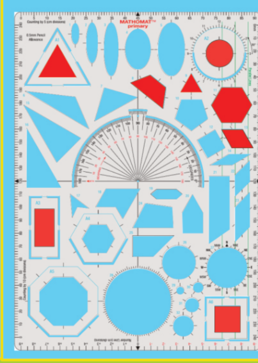
- Shape 8 Trapezium x 2
- Shape 11 Hexagon x 1
- Shape 13 Rhombus x 3
- Shape 9 Triangle x 6

The Mathomat Fractions - game

This is under the resources section at the back of the book.

On the template:

The shapes used in this chapter



AVAILABLE MATERIAL FOR MATHOMAT

Teacher's manual

- Lesson plans
- Activities
- Guidance
- Hints and Ideas
- Topic specific information

Student Workbook

- Activities
- Worksheets
- Investigations
- Theorems

Constructions Manual

- Constructions without a compass
- Three different ways for each construction
  - Base level
  - Mid level
  - Advanced level

Games and Activity Guide

Authentic games and activities to encourage student involvement.

Critical Thinking skills development

Spatial Ability development

Encouraging mathematical exploration

Teacher Manual Excerpts

Fractions

Two triangles makes one rhombus

1 triangle is ½ of a rhombus

Three triangles makes one trapezium

1 triangle is ⅓ of a trapezium

Six triangles makes one hexagon

1 triangle is ⅙ of a hexagon.

The important thing for them to notice is that all the triangles are the same size. Let them prove it by placing the template on the shapes and see if the triangle fits on all the triangles they drew.

Next they can prove it by cutting the triangles out and comparing the size.

The regular shapes are great to use when teaching halves.

Draw the following shapes:

- Shape 11 - Hexagon
- Shape 8 - Trapezium
- Shape 13 - Rhombus

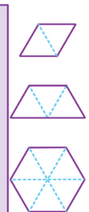
Use the triangle, shape 9, to see how many triangles can be drawn inside the other shapes.

The triangle is used as the unit shape - this means the smallest part that the other shapes consist of or can be divided into.

If your students have not yet learned about all the shape names yet, have them colour the shapes in specific colours and then ask them to use a certain amount of a specific colour to build another coloured shape.

You may use numbers as well.

Have the students draw the shapes again, this time let them fold along the blue lines. The smallest shape that all of them can fold into is the triangle.



By drawing fraction walls, students discover that these wall work with a unit shape.

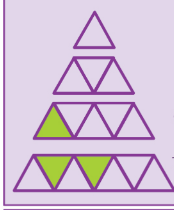
Use the following:

- Shape A 3 - Rectangle
- Shape A 1 - Triangle
- Shape A 6 - Square

The way in which we will manipulate the template when drawing fractions walls is almost the same as when we tessellate.

This representation comes in handy when a student must indicate odd denominator fractions.

It is often difficult for students to divide a rectangle, square or circle into odd numbers. This is a good way to have an odd denominator fraction represented in a continuous way.



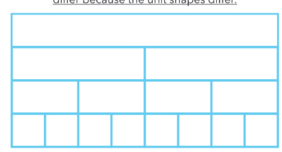
A discrete representation of two fifths.

Let the students tessellate this triangle.

Let them find shapes they have used on page 3 and have them colour it in.

This fraction wall was done with squares.

Let them compare 1/2 of the square fraction wall with 1/2 of the rectangle fraction wall. They must see that the sizes differ because the unit shapes differ.



A rectangular fraction wall.

This fraction wall is best done when the paper is in landscape orientation. They can start with however many rectangles are necessary and expand as needed.

Fractions Game

The idea of this game is to get students to pay attention to the denominator of the fraction.

They should understand that the denominator and numerator conveys information about the fraction.

This game aims to help them remember that for addition and subtraction the denominator must be the same.

How to play: For an even number of players

Two players will present a card in one turn.

Take turns to throw the dice.

If the denominators on the card should change depending on the operator on the dice then player One gets the two cards.

If the denominators on the card should stay the same depending on the operator on the dice, then player Two gets the two cards.

You can adapt the game to fit the content you are teaching on fractions.

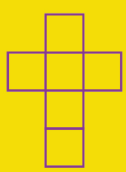
Winner is the one with the most cards.

Use the largest square on the template and draw a net for a cube.

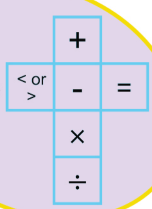
There are 11 nets for a cube, we only provide one for this exercise.

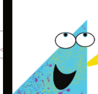
Draw the following net:

- Shape A 6 - Square



Mark the cube with operational signs the students are familiar with.



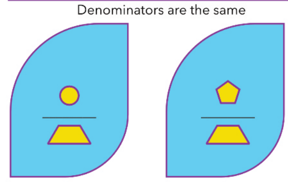


Fractions Game Examples

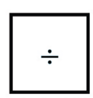
You will find the full set of cards for the game at the back of this book in the resources section.

Before the game starts the players must decide who will keep the cards for a "denominators change" and who keeps it for a "denominators stay".

Denominators are the same



Player one Player two

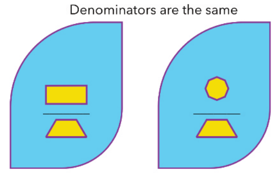


Rule states that for dividing fractions, the denominators do not need to be the same.

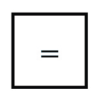
OUTCOME: Cards show same denominator so it stays. (If cards showed different denominators they will stay as well.)

Player Two gets the cards

Denominators are the same



Player one Player two

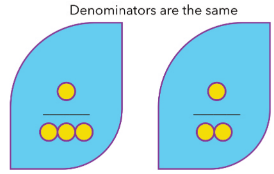


Rule states that for equating fractions, the denominators need to be the same.

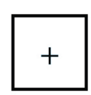
OUTCOME: Cards show same denominator so it stays.

Player Two gets the cards.

Denominators are the same



Player one Player two



Rule states that for adding fractions, the denominators need to be the same.

OUTCOME: Cards show different denominators so they must change

Player One gets the cards.

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