Released March 2018

Year 5

Small Steps Guidance and Examples

Block 2 – Properties of Shapes

White Rose Maths

Year 5 – Yearly Overview

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Number – Place Value			Number – Addition and Subtraction		Statistics		Number – Multiplication and Division		Perimeter and Area		Consolidation
Spring	Number – Multiplication and Division			Number – Fractions						Number – Decimals & Percentages		Consolidation
Summer	Number – Decimals				Geometry- Properties of Shapes			Geometry- Position and Direction	Measurement- Converting Units		Measures Volume	Consolidation

Week 5 to 7 – Geometry: Properties of Shapes

Overview

Small Steps

- Measuring angles in degrees
- Measuring with a protractor (1)
- Measuring with a protractor (2)
- Drawing lines and angles accurately
- Calculating angles on a straight line
- Calculating angles around a point
- Calculating lengths and angles in shapes
- Regular and irregular polygons
- Reasoning about 3D shapes

NC Objectives

Identify 3D shapes, including cubes and other cuboids, from 2D representations.

Use the properties of rectangles to deduce related facts and find missing lengths and angles.

Distinguish between regular and irregular polygons based on reasoning about equal sides and angles.

Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles.

Draw given angles, and measure them in degrees.

Identify: angles at a point and one whole turn (total 360°), angles at a point on a straight line and ½ a turn (total 180°) other multiples of 90°

Measuring Angles in Degrees

Notes and Guidance

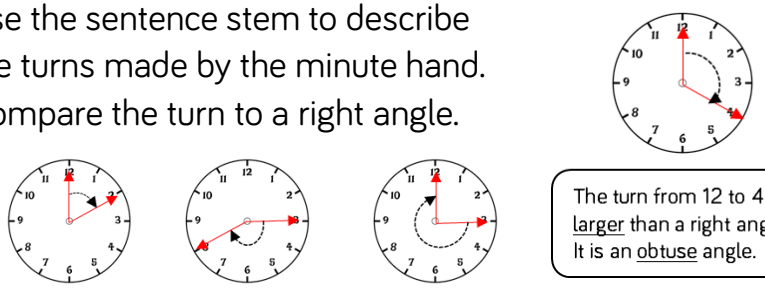
Children recap on acute and obtuse angles. They identify 360 degrees around a point (whole turn), 180 degrees and 90 degrees. Children also recognise and deduce common angles, for example, 45 degrees, 135 degrees and 270 degrees.
They are introduced to reflex angles explicitly for the first time.
Children define angles in terms of degrees and as fractions of a whole.

Mathematical Talk

What is an angle? Can you identify an acute angle on the clock?
Can you identify an obtuse angle?
What do we call angles larger than 180° but smaller than 360°?
What angles can you identify on the compass point?
How many degrees will that angle have?
What fraction of a full turn is it?

Varied Fluency

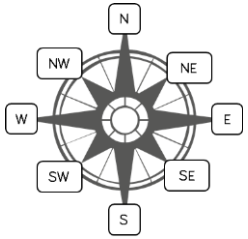
1 Use the sentence stem to describe the turns made by the minute hand. Compare the turn to a right angle.



The turn from 12 to 4 is larger than a right angle. It is an obtuse angle.

The turn from ___ to ___ is _____ than a right angle.
It is an _____ angle.

2 Use the compass to complete the table.



Turn	Degrees	Type of Angle	Fraction of a turn
North East to South East Clockwise	90°	Right Angle	$\frac{1}{4}$ of a turn
North West to North West Clockwise			
South West to South East Anti-clockwise			
South West to _____ clockwise	180°		
North East to East Clockwise			$\frac{1}{8}$ of a turn

Measuring Angles in Degrees

Reasoning and Problem Solving

Which angle is the odd one out?

180° 45° 79° 270°

Could another angle be the odd one out for a different reason?

79° is the odd one out because the others are all common angles. They would appear as a compass point. Other answers possible.

Always, sometimes, never.

- If I turn from North East to North West it will be 180°
- If I turn from East to North West it will be an obtuse angle.
- If I turn from South West to South my turn will be larger than 350°

- Always
- Sometimes
- Never

Pick a starting point on the compass and describe a turn to your partner. Use the mathematical words to write your clues:

- Clockwise
- Anticlockwise
- Degrees
- Acute
- Obtuse
- Reflex
- Right angle

Can your partner guess where you will finish?

Lots of possibilities. Children can be challenged further, for example,

I am equivalent to three right angles, I start at North West and turn clockwise, where do I finish?

Measuring with a Protractor (1)

Notes and Guidance

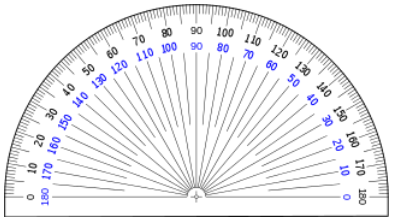
Children develop their understanding of acute angles. They use a protractor for the first time to measure angles less than 90°. Children also make estimations and use their understanding of right angles to help with estimating acute angles.
Children need to develop their understanding of using the protractor from both scales and should use their knowledge of angles to ensure they are reading from the correct scale.

Mathematical Talk

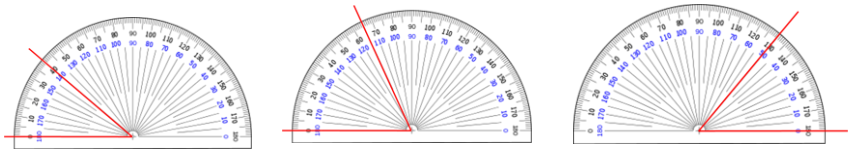
What do we measure angles in? How do we know an angle is acute?
Can we see where acute angles would be measured on the protractor? Where wouldn't they be measured?
Can we estimate the size of this angle? What is the size of the angles? What mistake might someone make?
Where will you place your protractor first? Is this the same as your partners?

Varied Fluency

1 Discuss how angles are measured using the protractor. Where can we see acute angles on the protractor? Why are there two sets of numbers?

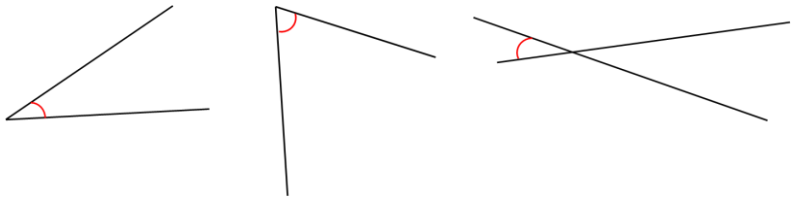


2 Read the angles shown on the protractor.



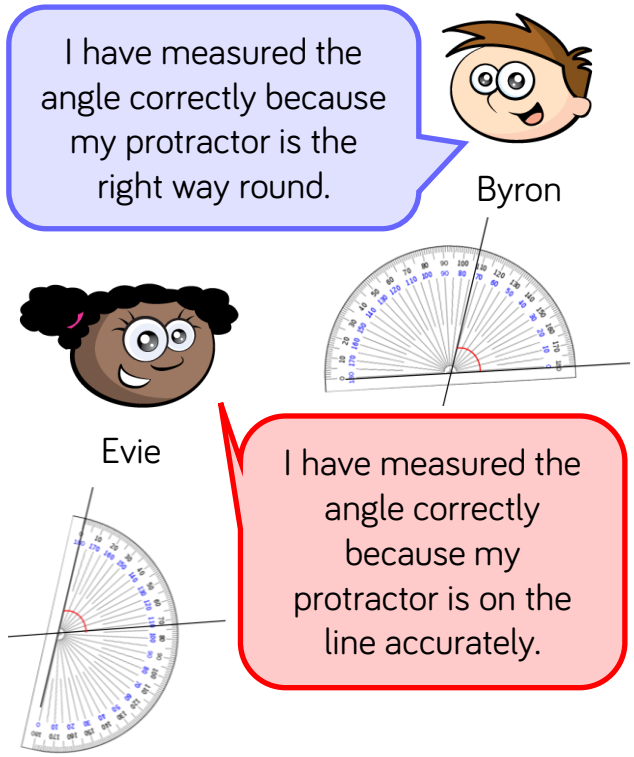
What's the same? What's different?

3 Estimate the size of the angles and then use a protractor to measure them to the nearest degree.



Measuring with a Protractor (1)

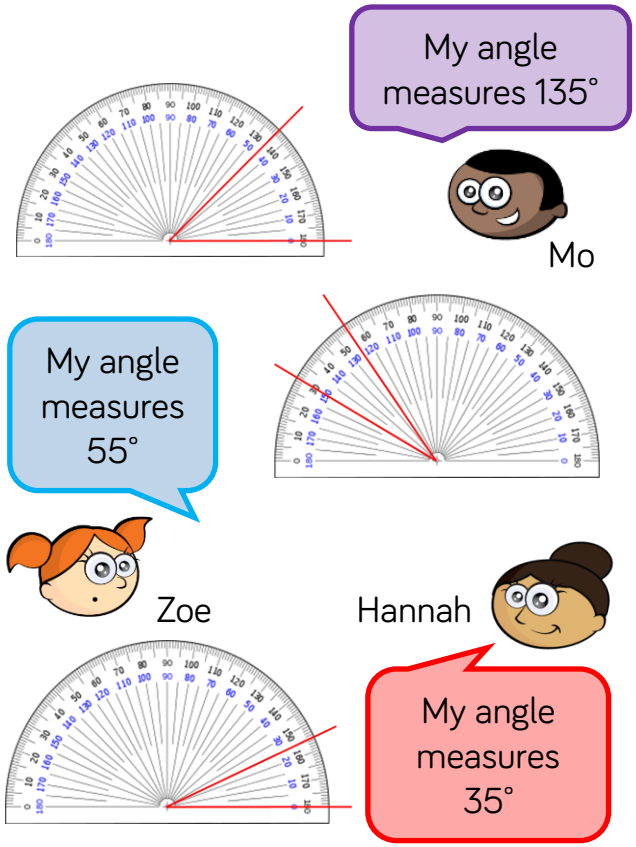
Reasoning and Problem Solving



Who do you agree with?
Explain why.

They are both correct. It doesn't matter which way the protractor is as long as it is placed on the angle correctly.

Three children are measuring angles.
Can you spot and explain their mistake?



Mo hasn't recognised his angle is acute so his measurement is wrong.

Zoe has not placed one of her lines on 0. Her angle measures 25°

Hannah has misread the scale. Her angle measures 25°

Measuring with a Protractor (2)

Notes and Guidance

Children develop their understanding of obtuse angles. They continue to use a protractor and focus on measuring obtuse angles.

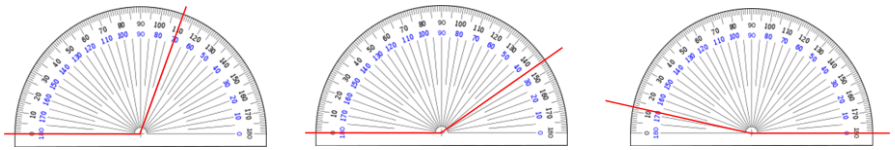
Children also make estimations and use their understanding of right angles and straight lines to help with estimating obtuse angles.

Mathematical Talk

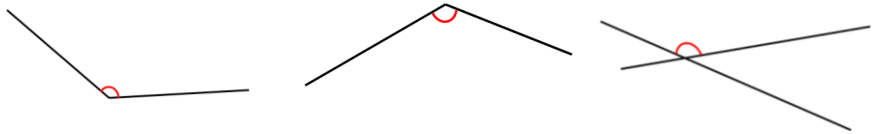
How do you know an angle is obtuse?
Can you see where obtuse angles would be measured on the protractor?
Can you estimate the size of this angle?
What is the size of the angles? What mistake might someone make?
Where will you place your protractor first? Is this the same as your partners?

Varied Fluency

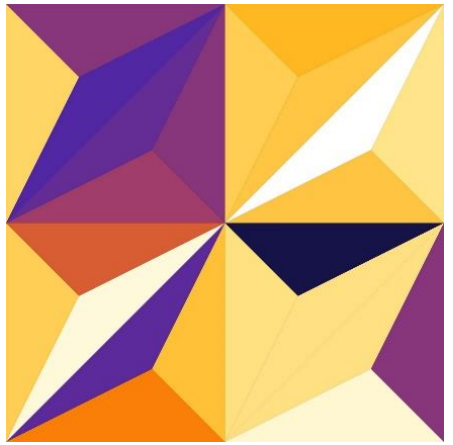
1 Read the angles on the protractor.



2 Estimate the size of the angles and then use a protractor to measure them to the nearest degree.



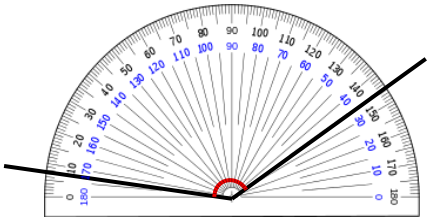
3 Identify obtuse angles in the image.
Can you estimate the size of the angles and measure them?



Measuring with a Protractor (2)

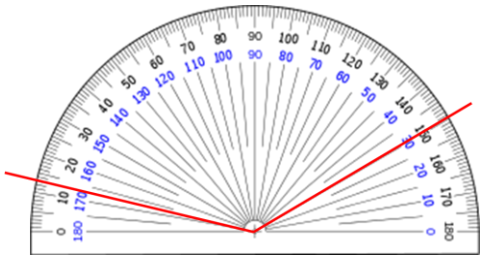
Reasoning and Problem Solving

Tamira is measuring an obtuse angle. What's her mistake?



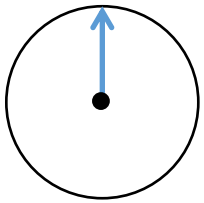
Tamira has not placed one of her lines on the 0 line.

How many ways can you find the value of the angle?



Children may subtract 150 – 13 = 137° Children may add up on the protractor as a number line e.g. +7 +100 +30 = 137 ° Discuss similarities and differences

Use a cut out of a circle and place a spinner in the centre.



- Point the arrow in the starting position above.
- Turn over a flash card with an angle on.
- Estimate the given angle by moving the spinner.
- Check how close you are with a protractor.

40° 72° 154°

Drawing Accurately

Notes and Guidance

Children draw lines to the nearest millimetre. They use a protractor to draw angles of a given size.

Children continue to develop their estimation skills whilst drawing and measuring lines and angles. They also continue to use precise language to describe the types of angles they are drawing.

Mathematical Talk

How many millimetres are in a centimetre?
Can we draw a line that measures ___?
Can you explain how to draw an angle?
If I want my angle to measure___, what will I do when drawing it?
How can I make this angle measure ___ but one of the lines have a length of ___?

Varied Fluency

1 Draw lines that measure:

4 cm and 5 mm	450 mm	4.5 cm

What's the same? What's different?

2 Draw:

- an angle that measures 45°
- an acute angle and an obtuse angle that is a multiple of 3 and 5
- an obtuse angle that has a factor of 4 and 6

Can your partner check you are accurate?

3 Draw:

- an acute angle that measures 56° with one line that measures 5.6 cm
- an obtuse angle that measures more than 130° but less than 140° with a line that measures 6.7 cm
- an obtuse angle that is equivalent to two 36° angles and with a line that has 49 mm

Can your partner check you are accurate?

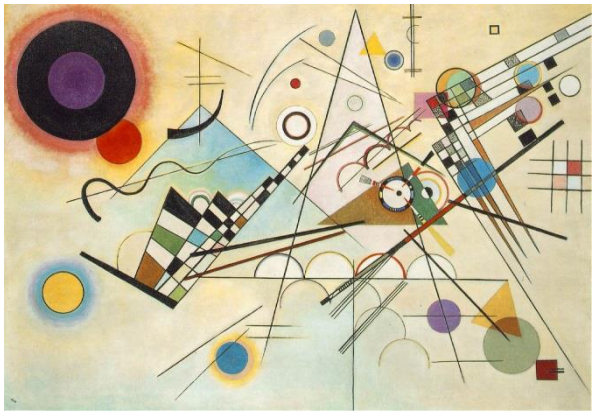
Drawing Accurately

Reasoning and Problem Solving

Draw a range of angles for a friend.
Estimate the angles to order them order from smallest to largest.
Then measure to check to see if they were correct.

Make a poster explaining how to draw an angle and measure it accurately with a protractor.
Include warnings against any possible mistakes that could be made when using a protractor.

Use Kadinsky's artwork to practice measuring lines and angles.



Create clues for your partner to work out which line or angle you have measured.

For example, my line is horizontal and has an obtuse angle of 110°

Angles on a Straight Line

Notes and Guidance

Children build on their understanding of degrees in a right angle and recognise two right angles are equivalent to a straight line.

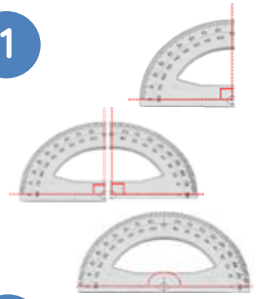
Once children understand a straight line is 180 degrees, they use this to calculate missing angles on straight lines.
Part whole and bar models may be used to represent missing angles.

Mathematical Talk

How many degrees are there in a right angle? How many will there be in two right angles?
If we place two right angles together, what do we notice?
How can we calculate the missing angles?
What will our calculation be?
Is there more than one way to calculate the missing angle?

Varied Fluency

1

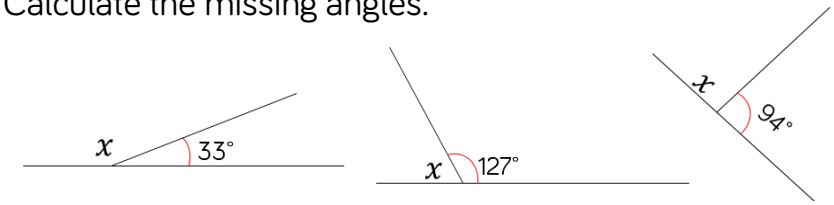


There are _____degrees in a right angle.

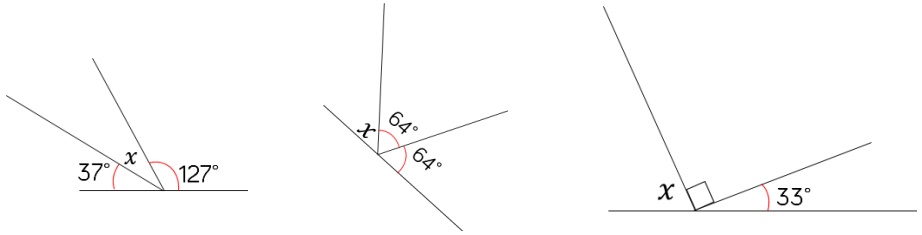
There are _____right angles on a straight line.

There are _____degrees on a straight line.

2 Calculate the missing angles.



3 Calculate the missing angles.

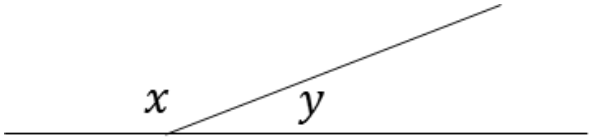


Can you find more than one way to calculate the missing angles?

Angles on a Straight Line

Reasoning and Problem Solving

Here are two angles.



Use the clues to calculate what the missing angles could be worth.

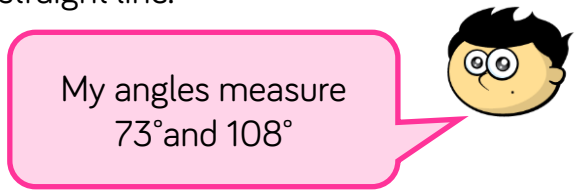
Angle x is larger than 130°
Angle y is a prime number between 40 and 50

$y = 41°$, $x = 139°$

$y = 43°$, $x = 137°$

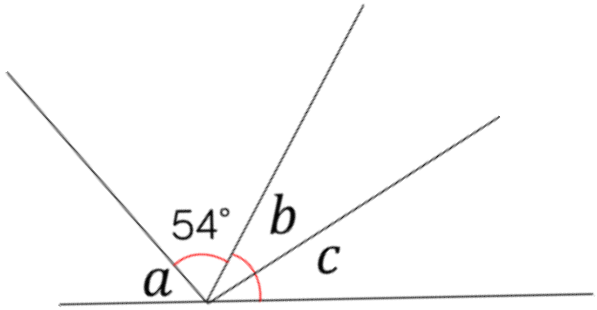
$y = 47°$, $x = 133°$

Bradley is measuring two angles on a straight line.



Explain why Bradley's angles must be wrong.

His angles total more than 180° He must have measured incorrectly.



- The total of angle b and c are the same as angle a
- Angle a is 9° more than the size of the given angle.
- Angle b is 11° more than angle c

What are the angles worth?

Create your own straight line problem like this one for your partner.

$a = 63°$

$b = 37°$

$c = 26°$

Angles around a Point

Notes and Guidance

Children build on their understanding of degrees in a right angle and recognise four right angles are equivalent to a full turn or around a point.

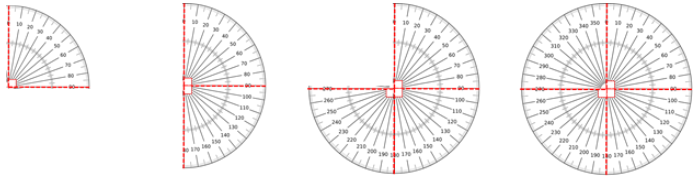
Once children understand angles around a point total 360 degrees, they use this to calculate missing angles.

Mathematical Talk

How many right angles are there in 1/4, 1/2, 3/4 or a full turn?
If you know a half turn/full turn is 180/360 degrees, how can this help you calculate the missing angle?
Can you estimate to help us? Will the angle be an acute or obtuse angle? How do you know?
What is the most efficient way to calculate the missing angle?

Varied Fluency

1 Complete the sentences.



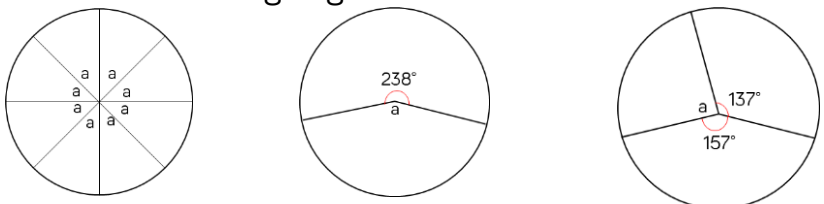
$\frac{1}{4}$ of a turn = 1 right angle = 90°

$\frac{1}{2}$ of a turn = __ right angles = _____°

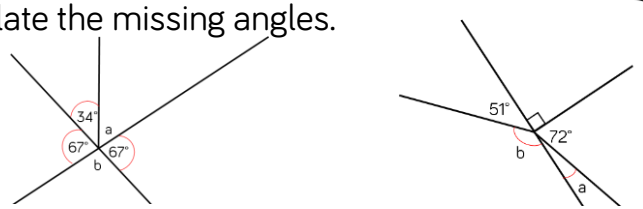
— of a turn = 3 right angles = _____°

A full turn = __ right angles = _____

2 Calculate the missing angles.

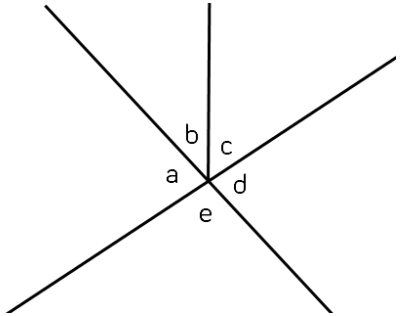


3 Calculate the missing angles.



Angles around a Point

Reasoning and Problem Solving



a + b + c + d + e = 360°

What other sentences can you record?

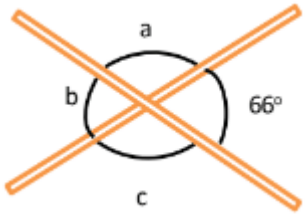
Various answers e.g.

a + b + c = e + d

360° - e – d = 180

Etc.

Two match sticks are on a table. Without measuring, find the three missing angles.



Children use knowledge of angles on a straight line

For example,

a = 180 – 66

a = 114°

The code for the lock is 50, 25, 75, 0, 50

Write instructions of the turns in degrees that you must do to open the lock.

Can you create your own combination for your partner to record instructions?

Various responses. Encourage children to use accurate mathematical language including:

Degrees

Clockwise

Anti-clockwise

Etc.

Lengths and Angles in Shapes

Notes and Guidance

Children look at angles in squares and rectangles on a grid. They use what they know to reason from known angles, such as 90 degrees in the corner of a rectangle. Children use the square grids to reason about length and angles, for example half a right angle is 45 degrees.
Children should be confident in understanding parallel lines and right angles in relation to squares and rectangles. They also calculate missing lengths from given sides.

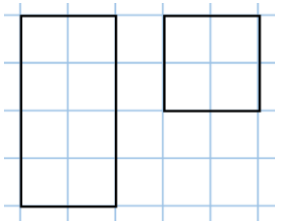
Mathematical Talk

Look at the rectangle and square, where can you see parallel lines? How many right angles do they have?
What can you say about the lengths?
If I fold the square in half diagonally, what will the angles be worth?

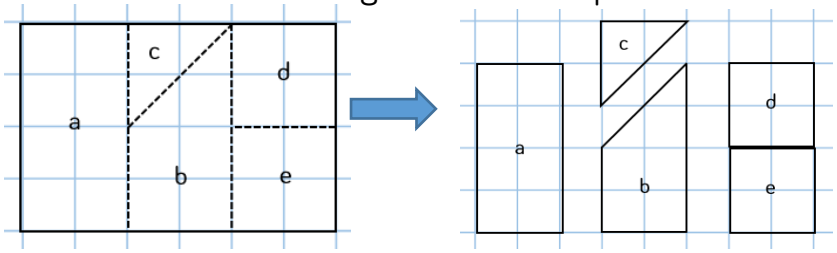
Using what you know about squares and rectangles, how can you calculate the size of the angles?
How can you find the missing lengths?

Varied Fluency

1 Look at the square and the rectangle.
What's the same? What's different?

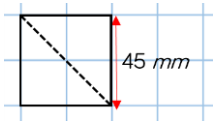


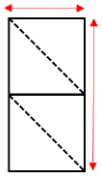
2 Calculate the size of the angles in each shape.



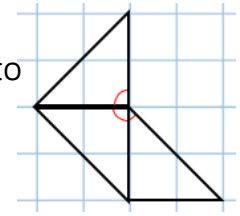
What's the same? What's different?

3 Here is a square.





Use the square to calculate the missing lengths.

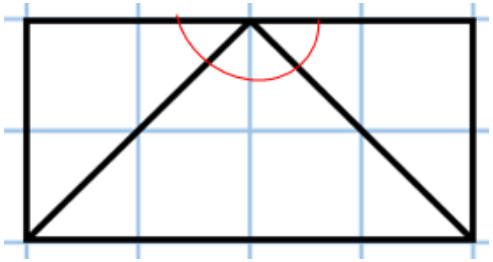


Use the square to calculate the missing angles.

Lengths and Angles in Shapes

Reasoning and Problem Solving

Helena is calculating the missing angles in the shape.



She says,

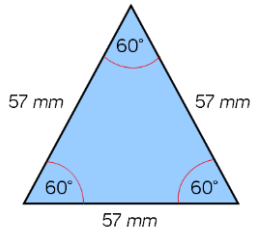
> The missing angles are worth 60 because 180 ÷ 3 = 60

Do you agree?
Explain why.

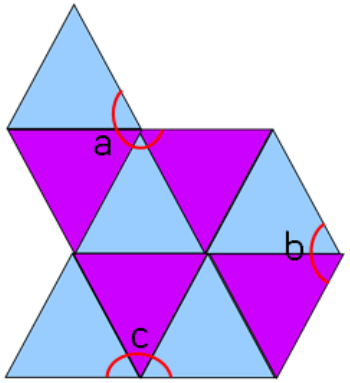
Helena is wrong. The angles are not equal.

The angles will be worth 45°, 90° and 45°because the line shows a square being split in half diagonally. This means 90° has been divided by 2

Alek has this triangle.



He makes this composite shape using identical triangles to the one above.



- Calculate the perimeter of the shape.
- Calculate the missing angles.

Can you use your own triangle, square or rectangle to make a similar problem?

Perimeter =
57 × 10 = 570 mm

a = 60 × 4

a = 240°

b = 60 × 2

b = 120°

c = 60 × 3

c = 180°

Regular & Irregular Polygons

Notes and Guidance

Children distinguish between regular and irregular polygons. Once children are confident with regular and irregular polygons, they can reason about angles and lengths of a polygon based on the properties of the shape.

Children should explore the properties of different quadrilaterals and recognise the difference between them.

Mathematical Talk

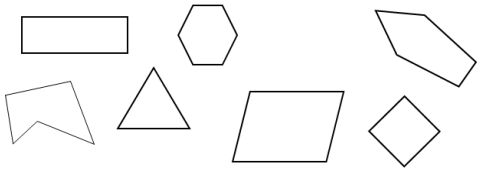
What is a polygon? Can you name a shape which isn't a polygon?
What makes a polygon irregular or regular?

What do regular polygons have in common?

If I have a shape with ____ sides and ____ lengths, what is the name of my polygon? If my angles are equal/not equal will it be regular or irregular?

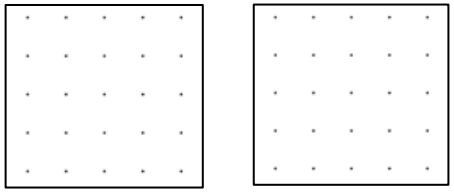
Varied Fluency

1 Sort the shapes in to irregular and regular polygons.

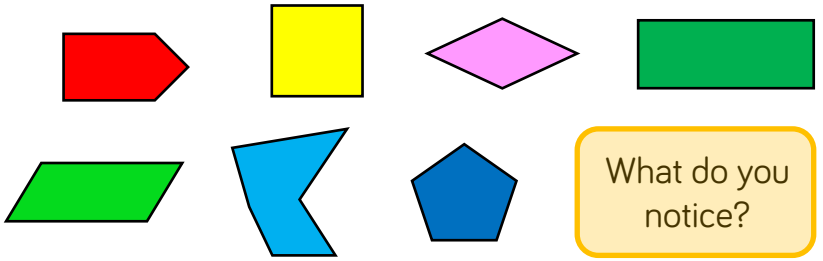


What's the same? What's different?

2 Draw a regular polygon and an irregular polygon on the grids.



3 Look at the 2D shapes. Decide whether the shape is a regular or irregular polygon. Measure the angles in each one.



Regular & Irregular Polygons

Reasoning and Problem Solving

Decide which statements are true, sometimes true or false.

- A regular polygon has equal sides but not equal angles.
- A triangle is a regular polygon.
- A rhombus and square are regular polygons.
- The number of angles is the same as the number of sides in any polygon.

Prove it!

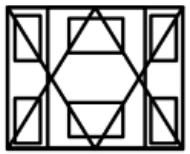
False– equal sides and equal angles

Sometimes true – the triangle must have equal sides and equal angles

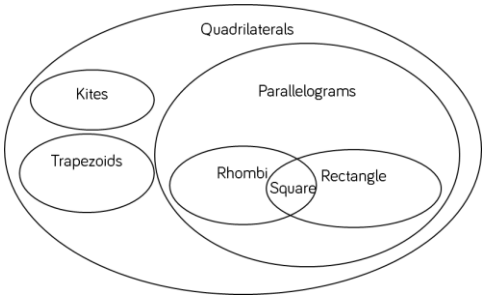
Sometimes true – rhombus has two different angles so is not regular

True

How many regular and irregular polygons can you find in this picture?



Cut out lots of different regular and irregular shapes. Ask children to work in pairs and sort them into groups. Once they have sorted them, can they find a different way to sort them again? Children could use Venn diagrams and Carroll diagrams to deepen their understanding, for example:



	Regular polygon	Irregular polygon
Has right angles		
Doesn't have any right angles		

Multiple responses

Reasoning about 3D Shapes

Notes and Guidance

Children identify 3D shapes, including cubes and cuboids, from 2D shapes. They should have a secure understanding of language associated with the properties of 3D shapes, for example, faces, curved surfaces, vertices etc.

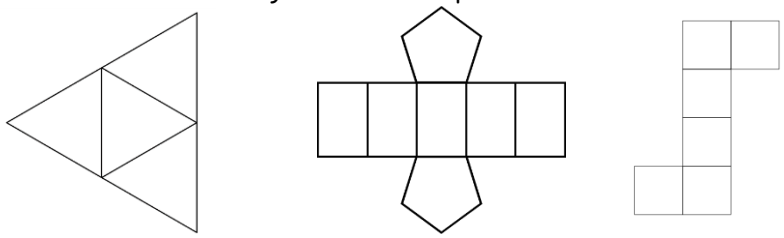
Children also look at properties of 3D shapes from 2D projections, including shadows and elevations.

Mathematical Talk

What's the difference between a face and a curved surface? Can you identify 3D solids which would have curved surfaces and which couldn't?
What faces can we see in the net? What shape will this make? Can it make more than one shape?
Which face will be opposite this face? Why?
Can we spot a pattern between the number of faces and the number of vertices a prism or pyramid has?

Varied Fluency

1 Look at the different nets. Describe the2D shapes used to make them and identify the 3D shape.

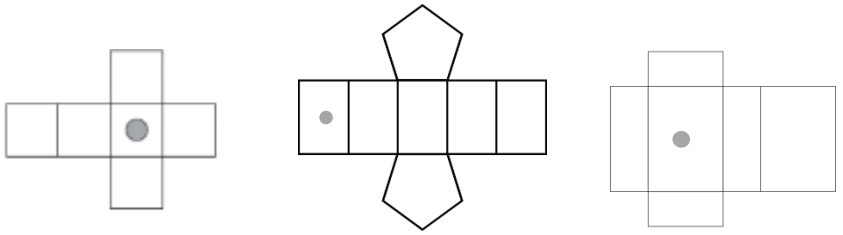


2 Use equipment, such as Polydron, or 2D shapes to build the 3D solids being described.

- My faces are made up of a square and four triangles.
- My faces are made up of rectangles and triangles.

Can the descriptions make more than one shape?

3 Draw another dot on the nets so they have a dot on the opposite face when the 3D shape is constructed.



Reasoning about 3D Shapes

Reasoning and Problem Solving

Albie says,

If two 3D shapes have the same number of edges, then they also have the same number of vertices.

Do you agree?
Explain why.

No. If the 3D shape is a prism then there will be more vertices than edges.

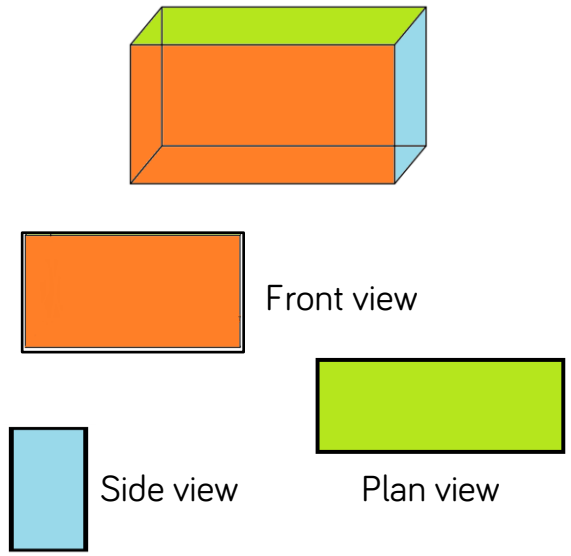
Children could investigate this and look for a pattern.

Create cubes and cuboids by using multilink.
Can you draw these on isometric paper?
Which part is difficult?
Would it be harder if you had to draw something other than squares or rectangles?

Multiple responses.

Using different 3D solids, can you represent them from different views? Can your partner work out which representation goes with which solid?

For example,



Children may explore a certain view for a prism and discover that it could always look like a cuboid or cube due to the rectilinear faces.