Released March 2018

Year 6

Small Steps Guidance and Examples

Block 1 – Properties of Shapes

White Rose Maths

Year 6 – 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, Subtraction, Multiplication and Division				Fractions				Geometry- Position and Direction	Consolidation
Spring	Number- Decimals		Number- Percentages		Number- Algebra		Measurement Converting units	Measurement Perimeter, Area and Volume		Number- Ratio		Consolidation
Summer	Geometry- Properties of Shapes		Problem solving			Statistics		Investigations				Consolidation

Week 1 to 2 – Geometry: Properties of Shapes

Overview

Small Steps

- Measure with a protractor
- Introduce angles
- Calculate angles
- Vertically opposite angles
- Angles in a triangle
- Angles in a triangle – special cases
- Angles in a triangle – missing angles
- Angles in special quadrilaterals
- Angles in regular polygons
- Draw shapes accurately
- Nets of 3D shapes

NC Objectives

Draw 2-D shapes using given dimensions and
angles.
Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals and regular polygons.
Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles.

Measure with a Protractor

Notes and Guidance

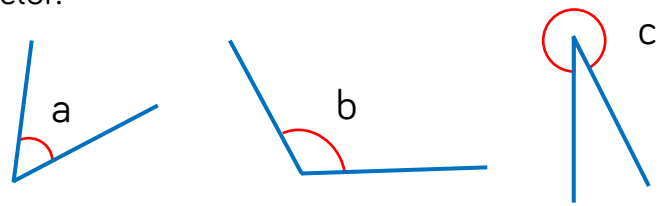
This step revises measuring angles using a protractor from year 5
Children recap how to line up the protractor accurately, and identify which side of the scale to read. They link this to their understanding of angle sizes.
Children read the measurement and practise measuring angles given in different orientations.
Angles are also related to compass points.

Mathematical Talk

Can we name and describe the 4 different types of angles? (right angle, obtuse, acute, reflex)
What unit do we measure angles in?
Does it matter which side of the protractor I use?
What mistakes could we make when measuring with a protractor?
How would I measure a reflex angle?
Look at a compass, what angles can we identify using the compass?

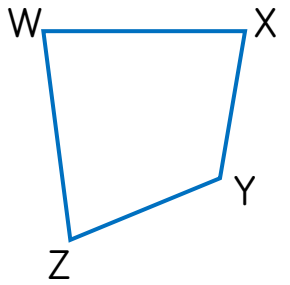
Varied Fluency

1 Identify the type of angle, and measure the angle using a protractor.



Angle ☐ is an ☐ angle. It measures ☐

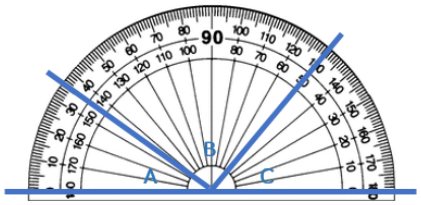
2 Estimate, then measure each of the angles in the quadrilateral.



W: ☐ X: ☐

Y: ☐ Z: ☐

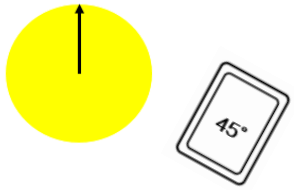
3 Work out the size of each angle.
Explain how you did it.



Measure with a Protractor

Reasoning and Problem Solving

Cut out a circle with a spinner in the centre.



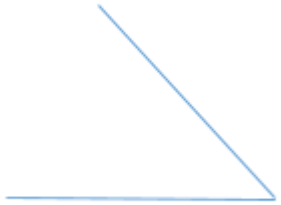
Put the arrow in the starting position as shown above. Turn over a flash card with an angle on.

Estimate the given angle by moving the spinner.

Check how close you are using a protractor.

Children could work in pairs and get a partner to check the accuracy of the angles made.

Alex measures this angle:



He says it is 130°

How do you know Alex is definitely wrong?
Explain what he has done wrong.

Alex is definitely wrong because 130° is an obtuse angle and the angle drawn is acute.
He has read the wrong scale on the protractor. He should have measured the angle to be 50°

Introduce Angles

Notes and Guidance

Children build on their understanding of degrees in a right angle and make connections to angles on a straight line and around a point.
Children should make links to whole, quarter, half and three-quarter turns and apply this in different contexts such as time and on a compass.

Mathematical Talk

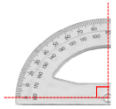
If there are 90 degrees in one right angle, how many are there in two? What about three?

How many degrees are there in a quarter/half turn?

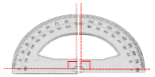
Between which two compass points can you see a right angle/half turn/$\frac{3}{4}$ turn?

Varied Fluency

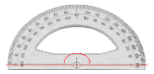
1



There are ☐ degrees in a right angle.



There are ☐ right angles on a straight line.



There are ☐ degrees on a straight line.

2 Complete the table.

Angle	Fraction of a turn	Degrees
Right angle	$\frac{1}{4}$	90°
Straight line		
Three right angles		
Full turn		

3 Use a compass to identify how many degrees there are between:

- North & South (going clockwise)
- South & East (going anti-clockwise)
- North-East and South-West (going clockwise)

Introduce Angles

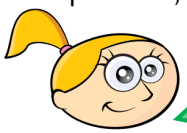
Reasoning and Problem Solving

Emma and Steph were asked how many degrees there are between North-West and South-West.

Emma said,

There are 90 degrees between NW and SW.

Steph said,



There are 270° between NW and SW.

Who do you agree with?
Explain why.

They are both correct. Emma measured anti-clockwise whereas Steph measured clockwise.

If it takes 60 minutes for the minute hand to travel all the way around the clock, how many degrees does the minute hand travel in:

- 7 minutes
- 12 minutes

How many minutes have passed if the minute hand has moved 162°?

360 ÷ 60 = 6 so the minute hand travels 6° per minute.
7 minutes: 42°
12 minutes: 72°

162° : 27 minutes

Always, sometimes, never.

W to S = 90 degrees
NE to SW = 180 degrees
E to SE in a clockwise direction > 90°

Sometimes
Always
Never

Calculate Angles

Notes and Guidance

Children apply their understanding of angles in a right angle, on a straight line and around a point to calculate missing angles.

They should also recognise how a right angle is identified on a triangle or diagram and use this to help them calculate the unknown angles.

Mathematical Talk

What do we know about a and b? How do we know this?
Which angle fact might you need to use when answering this question?
What does the word equal mean in this question? What does the tell us about the size of the angles?
What angles do we know? How can we use this to calculate unknown angles?

Varied Fluency

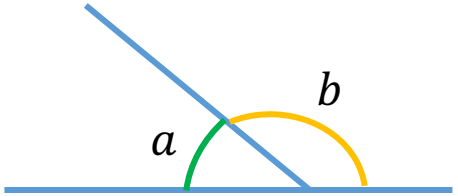
1

$a + b = \square$

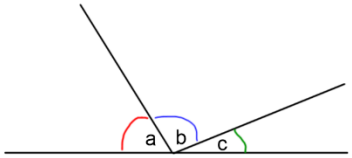
$b + a = \square$

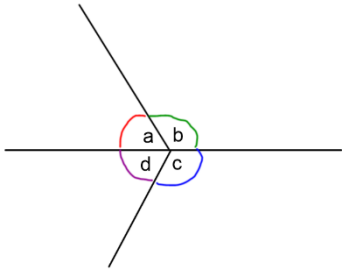
$\square - a = b$

$\square - b = a$

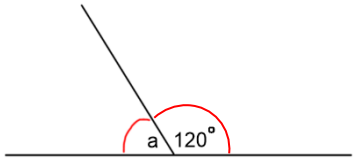


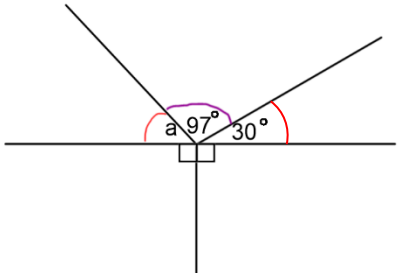
2 How many other sentences can you write from the images?





3 Calculate the missing angles.





Calculate Angles

Reasoning and Problem Solving

Five equal angles all meet around a point.

What is the size of each angle?

Explain how you know.

72° because
360 ÷ 5 = 72

Four angles lie on a straight line.

One angle is 81°

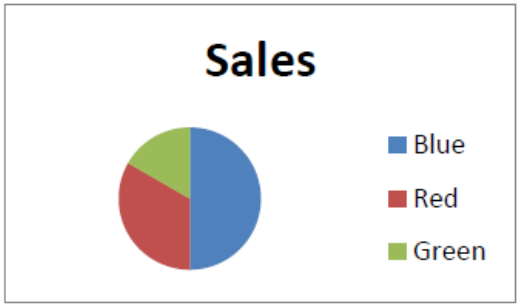
The other three angles are equal.

What size are the other three angles?

Draw a diagram to prove your answer.

33°

Here is a pie chart showing the colour of cars sold by a car dealer.



The number of blue cars sold is equal to the total number of red and green cars sold.

The number of red cars sold is twice the number of green cars sold.

Work out the inside angle of each section of the pie chart.

Blue: 180°
Red: 120°
Green: 60°

Vertically Opposite Angles

Notes and Guidance

Children recognise that vertically opposite angles are equal and use practical examples to prove this.

They continue to apply their understanding of angles on a straight line and around a point to calculate missing angles.

Mathematical Talk

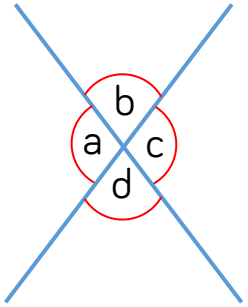
What sentences can we write about vertically opposite angles in relation to other angles?

How can we find the missing angle?

Is there more than one way to find this angle?

Varied Fluency

1 Take a piece of paper and draw a large 'X'.
Mark the angles on as shown.
Measure the angles you have drawn.
What do you notice about angles b and d?
What do you notice about angles a and c?
Is this always the case?
Investigate with other examples.



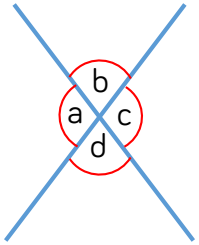
2 Complete.

$\square = \square$

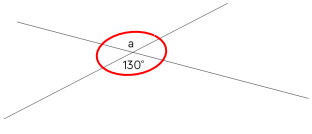
$\square + \square = 180°$

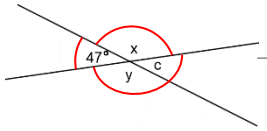
$\square = \square$

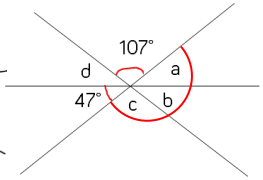
$\square + \square = 180°$



3 Find the missing angles.



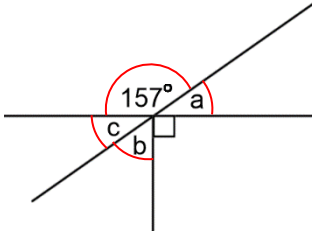




Is there more than one way to find them?

Vertically Opposite Angles

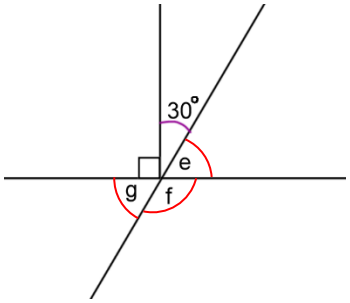
Reasoning and Problem Solving



Rachel says that it's not possible to calculate all of the missing angles.

Do you agree? Explain why.

I disagree because:
180 – 157 = 23
so a = 23°
because angles on a straight line add up to 180°
Angles a and c are equal because they are vertically opposite so
c = 23°
Then angles around a point add up to 360° so
b = 67°



Darren says that angle g is equal to 30° because vertically opposite angles are equal.

Do you agree? Explain your answer.
If you disagree, work out the value of g.

Darren is wrong because g is vertically opposite to e, not to 30° so g would actually be 60°

Angles in a Triangle (1)

Notes and Guidance

Children practically explore internal angles of a triangle and understand that the angles will add up to 180 degrees.

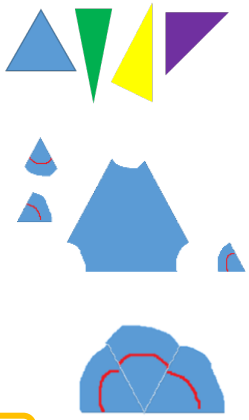
Children should apply their understanding that angles on a straight line add up to 180 degrees.

Mathematical Talk

What's the same and what's different about the four triangle types?
What do the three internal angles add up to? Would this work for all triangles?
What does this tell us about the internal angles of a triangle?
Does the type of triangle change anything?
Does the size of the triangle matter?

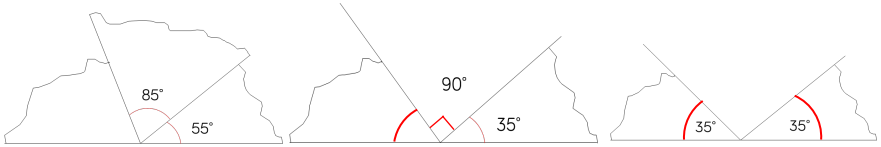
Varied Fluency

1 Using different coloured paper of card, make an equilateral, isosceles, scalene and right-angled triangle.
Use your protractor to measure each internal angle, then add them up. What do you notice?
Now take any of the triangles and cut the corners off.
Arrange the corners to make a straight line.

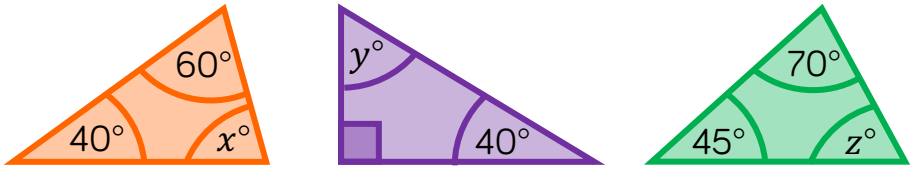


The internal angles of a triangle add up to ☐

2 Find the missing angles and state the type of triangle.



3 Find the missing angles.



Angles in a Triangle (1)

Reasoning and Problem Solving

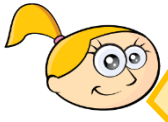
Mo says,

My triangle has two 90° angles.

Can Mo be right? Prove it.

Mo can't be right because these two angles would add up to 180 degrees, and the third angle can't be 0 degrees.

Kate says,



My triangle is a scalene triangle. One angle is obtuse. One of the angles measures 56° The obtuse angle is three times the smallest angle.

Find each of the angles in the triangle.

The angles of Kate's triangle are 56°, 93° and 31°

True or False?

A triangle can never have 3 acute angles.

False
Children could find multiple examples to show this.

Angles in a Triangle (2)

Notes and Guidance

Children are introduced to conventional markings for equal lengths. They concentrate on angles in right-angled triangles and isosceles triangles.

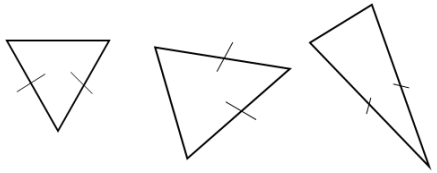
Children use their understanding of the properties of triangles to reason about angles.

Mathematical Talk

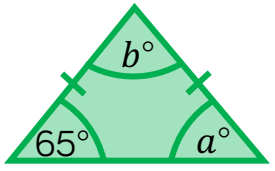
How can we identify sides which are the same length on a triangle?
How does this effect the angles in an isosceles triangle?
If you know this angle in an isosceles triangle, what else do you know?
Can you have an isosceles right-angled triangle?

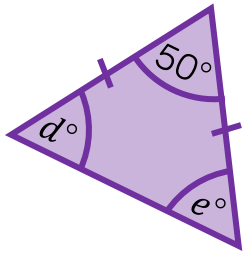
Varied Fluency

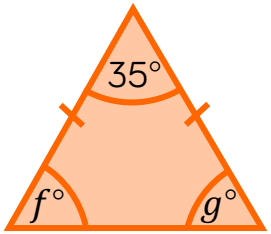
1 Identify which angles will be identical in the isosceles triangles.



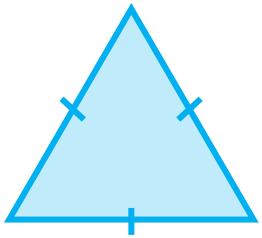
2 Use the given angle to calculate the missing angles in the isosceles triangles.







3 Here is an equilateral triangle.



What will the size of each angle be?
How do you know?
Will this be the same for all equilateral triangles?
Explain your answer.

Angles in a Triangle (2)

Reasoning and Problem Solving

I have an isosceles triangle.
One angle measures 42 degrees.

What could the other angles measure?

The angles could be:
42°, 42°, 96°
or
42°, 69°, 69°

Shania

My angles are 70°, 70° and 40°

Harrison

My angles are 45°, 45° and 90°

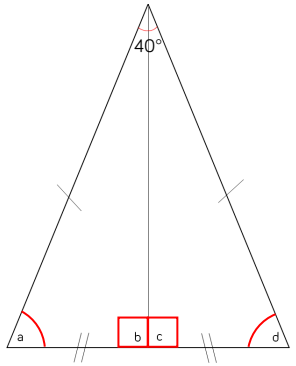
Lucy

My angles are 60°, 60° and 60°

What type of triangle is each person describing?
Explain how you know.

Shania is describing an isosceles triangle.
Harrison is describing an isosceles right-angled triangle.
Lucy is describing an equilateral triangle.

How many sentences can you write to express the relationships between the angles in the triangles?
One has been done for you.



$40° + a + d = 180°$

Possible responses:
$20° + a + b = 180°$
$20° + c + d = 180°$
$b = 90°$
$c = 90°$
$b = c$
$a = d$

etc.

Children could also work out the value of each angle.

Angles in a Triangle (3)

Notes and Guidance

Children build on prior learning to make links and recognise key features of specific triangle types and think about how they can use this to solve missing angle problems.
They should also link in their earlier learning of angles on a straight line, angles around a point and vertically opposite angles.

Mathematical Talk

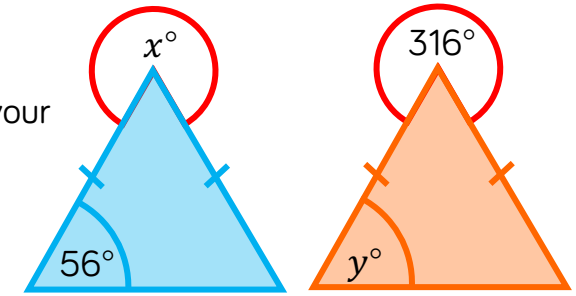
Try to estimate the angles before calculating them.

Can we identify the type of triangle? How will this help us calculate the missing angle?

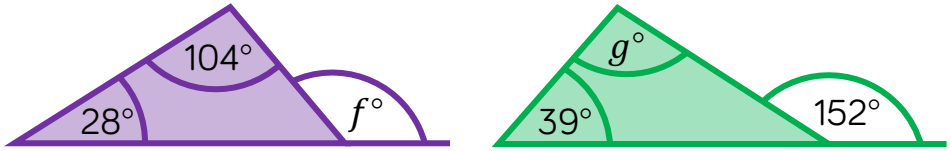
How do you know the answer has got to be less than 90 degrees?

Varied Fluency

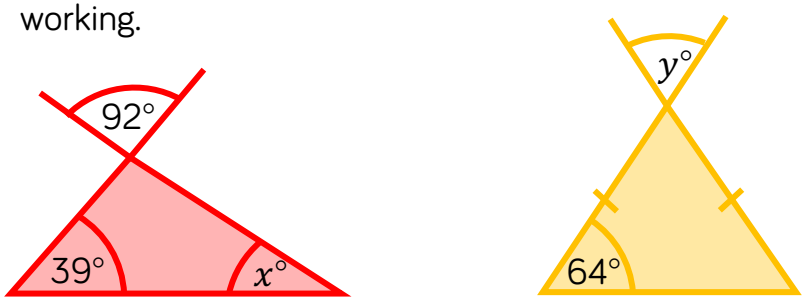
1 Calculate the missing angles.
Explain each step of your working.



2 Calculate the missing angles. Explain each step of your working.



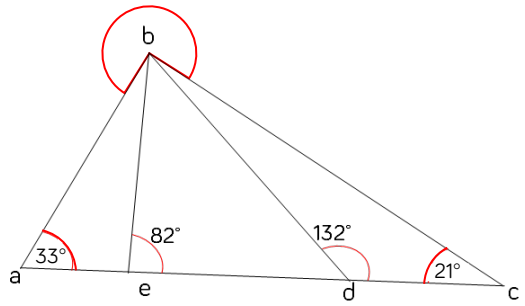
3 Calculate the missing angles. Explain each step of your working.



Angles in a Triangle (3)

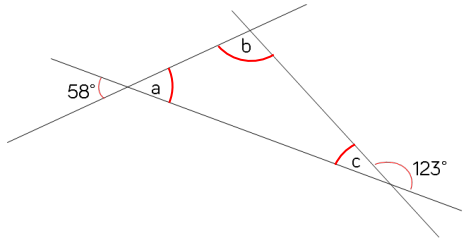
Reasoning and Problem Solving

Calculate the size of angle b



234°

Can you calculate the angles inside the triangle?



Give reasons for all of your answers.

a is 58 degrees because vertically opposite angles are equal.
c is 57 degrees because angles on a straight line add up to 180 degrees.
b is 65 degrees because angles in a triangle add up to 180 degrees.

Angles in Quadrilaterals

Notes and Guidance

Children use their knowledge of shape properties to explore internal angles in a parallelogram, rhombus, trapezium etc.

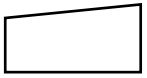
Children need to have a secure understanding of the relationship between a rectangle and a parallelogram, and a square and a rhombus.

Mathematical Talk

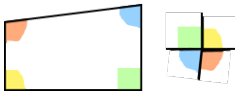
What is the same and different between a rectangle and a parallelogram? What do you notice about the opposite angles in a parallelogram?
What is the same and different between a square and a rhombus? What do you notice about the opposite angles in a rhombus?
What is the difference between a trapezium and an isosceles trapezium?
If you know 3 of the internal angles, how could you work out the fourth angle?

Varied Fluency

1 Take two quadrilaterals.



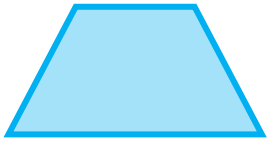
For the first quadrilateral, measure the internal angles using a protractor.

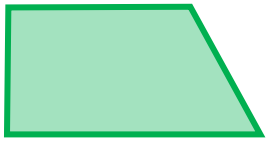


For the second, tear the corners off and place them together.

What's the same? What's different? Is this the case for other quadrilaterals?

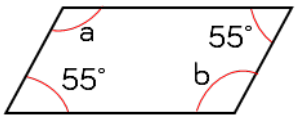
2 Here are two trapeziums. What's the same? What's different?

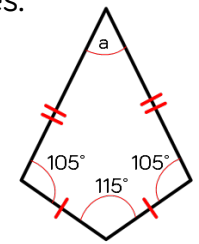


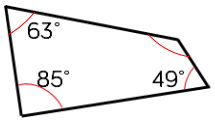


Can you draw a different trapezium?
Measure the internal angles of each one. What do you notice?

3 Calculate the missing angles.



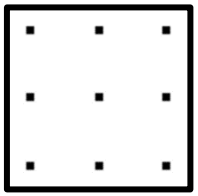




Angles in Quadrilaterals

Reasoning and Problem Solving

How many quadrilaterals can you make on the geoboard?



Identify the different quadrilaterals.

What do you notice about the angles in certain quadrilaterals?

If your geoboard was 4 × 4, would you be able to make any different quadrilaterals?

There are lots of different quadrilaterals children could draw. They should notice that opposite angles in a parallelogram and rhombus are equal. They should also identify that a kite has a pair of equal angles, and some kites have a right angle. On a larger grid, they could draw a trapezium without a right angle.

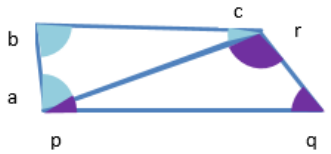
Adam says,

All quadrilaterals have at least one right angle.

Draw two different shapes to prove Adam wrong. Measure and mark on the angles.

Examples:
Trapezium (without a right angle)
Rhombus
Parallelogram

This quadrilateral is split into two triangles.



Use your knowledge of angles in a triangle to find the total of angles in a quadrilateral.

Try splitting other quadrilaterals into triangles too. What do you notice?

Children should find that angles in any quadrilateral will always add up to 360 degrees.

Angles in Polygons

Notes and Guidance

Children use their knowledge of shape properties to explore interior angles in regular polygons.

Children explore how they can split shapes into triangles to work out the sum of the angles in regular polygons.

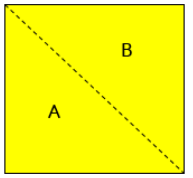
They use their knowledge of angles on a straight line being 180° to calculate exterior angles.

Mathematical Talk

What does it mean if a polygon is regular? What does it mean if a polygon is irregular?
What do the sum of angles in a triangle always equal?
How can we use this to work out the interior angles of regular polygons?
Can we spot a pattern in the table? What predictions can we make?

Varied Fluency

1 Draw a square and split it into 2 triangles.
What do the angles of triangle A add up to?
What do the angles of triangle B add up to?
So what is the sum of angles in a quadrilateral?



2 Use the same method to complete the table.

Shape	Number of sides	Number of triangles	180 × number of triangles	Sum of internal angles
Square	4	2	180 × 2	360°
Pentagon	5	3	180 × 3	540°
Hexagon				
Heptagon				

What do you notice?

Can you predict the angle sum of any other polygon?

Angles in Polygons

Reasoning and Problem Solving

Use the clues to work out who has which shape and the sum of the interior angles.

Tabitha

My polygon is made up of 5 triangles.

The sum of my angles is more than 540° but less than 900°

Jonah

Harriett

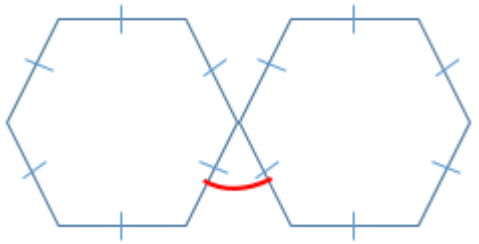
The sum of my angles is equivalent to the sum of angles in 3 triangles.

Tabitha:
Heptagon – 900°

Jonah:
Hexagon – 720°

Harriett:
Pentagon – 540°

Here are two regular hexagons.



The interior angles of a hexagon add up to 720°
Use this fact to find the missing angle in this diagram.

60°

Drawing Shapes Accurately

Notes and Guidance

Children begin by drawing shapes accurately on different grids, moving on to using a protractor on plain paper.

Children use their knowledge of properties of shapes and angles, as well as converting between different units of measure.

Mathematical Talk

What do you know about the shapes which will help you draw them?

How can we ensure our measurements are accurate?

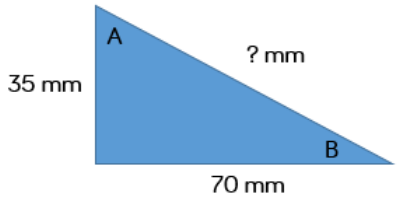
How would you draw a triangle on a plain piece of paper using a protractor?

Varied Fluency

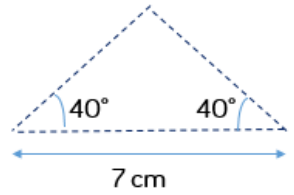
1 On a piece of squared paper, accurately draw the shapes.

- A square with perimeter 16 cm
- A rectangle with an area of 20 cm^2
- A right-angled triangle with a height of 8 cm and a base of 6 cm
- A parallelogram with sides AB & DC 3 cm apart, and AD & BC 5 cm apart.

2 Draw the triangle accurately on squared paper to work out the missing length, and measure the size of angles A and B.



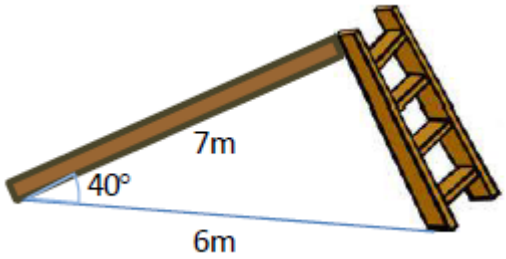
3 Hannah has been asked to draw this triangle on plain paper using a protractor.
Create a step by step plan to show how she would do this.



Drawing Shapes Accurately

Reasoning and Problem Solving

Mr Harrison is designing a slide for the playground.

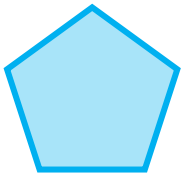


Use a scale of 1 cm to represent 1 m.

Draw the scale diagram and use this to find out how long Mr Harrison needs the ladder to be.

Children will have to use the scale to give their answer in m once they have measured it in cm.

The interior angles of a pentagon add up to 540°
Use this fact to work out what one angle in a regular pentagon would be.



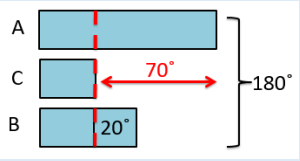
Accurately draw a regular pentagon with side length 5 cm.

108°

Kate has drawn a scalene triangle.
Angle A is the biggest angle.
Angle B is 20° larger than angle C.
Angle C is the smallest angle, and it is 70° smaller than angle A.

Use a bar model to help you calculate the size of each angle, then construct Kate's triangle.

Is there more than one way to do this?



Angle A: 100°
Angle B: 50°
Angle C: 30°
These angles would work with different side lengths.

Nets of 3D Shapes

Notes and Guidance

Children use their knowledge of 2D and 3D shape properties to identify three-dimensional shapes from their nets.

Children need to recognise that a net is a two-dimensional figure that can be folded to create a three-dimensional shape.

They use measuring tools and conventional markings to draw nets of shapes accurately.

Mathematical Talk

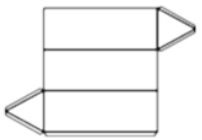
What two-dimensional shapes can you see in three-dimensional shapes?

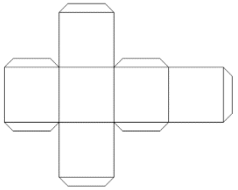
What is a **net**? What shape will this net make? How do you know? What shape won't it make?

If we make this net, what would happen if we were not accurate with our measuring?

Varied Fluency

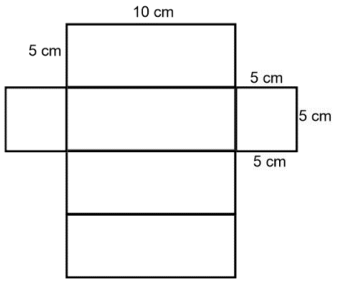
1 Which three-dimensional shapes can be made from these nets?



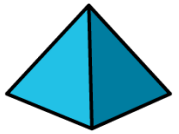


Identify and describe the faces of each shape.

2 Accurately draw this net.
Cut, fold and stick to create a cuboid.



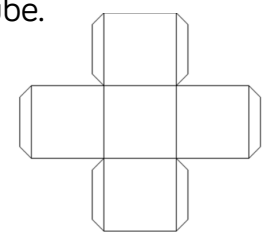
3 Draw the nets of these three-dimensional shapes.



Nets of 3D Shapes

Reasoning and Problem Solving

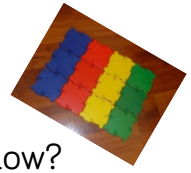
Sally thinks that this net will fold to create a cube.



Do you agree with Sally?
Explain your answer.

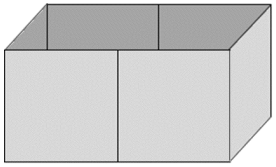
Sally is incorrect because a cube has 6 faces, this would only have 5

Use Polydron to investigate how many different nets can be made for a cube.



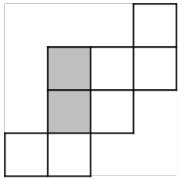
Is there a rule you need to follow?
Can you spot an arrangement that won't work before you build it?
How do you know why it will or won't work?
Can you record your investigation systematically?

Here is an open box.

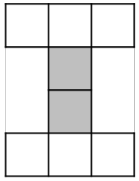


Which of the nets will fold together to make the box?
The grey squares show the base.

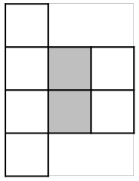
A



B



C



A and C