Summer Block 3

Shape

Small steps

Step 1	Understand and use degrees
Step 2	Classify angles
Step 3	Measure angles
Step 4	Calculate angles around a point
Step 5	Calculate angles on a straight line
Step 6	Vertically opposite angles
Step 7	Angles in a triangle
Step 8	Angles in a triangle – special cases

Small steps

Step 9	Angles in quadrilaterals
Step 10	Regular polygons
Step 11	Irregular polygons
Step 12	Circles
Step 13	Draw shapes
Step 14	3-D shapes

Understand and use degrees

Notes and guidance

In this small step, children recap and build on learning from previous years. They should already be familiar with the idea that an angle is a measure of turn and be able to describe angles as acute or obtuse by comparing them to a right angle.

Year 5 children are introduced to degrees, including the degree symbol, as a unit of measure for turn. Children explore the fact that there are 360° in a full turn, and therefore 180° in half a turn, 90° in a quarter turn (or right angle) and 270° in a three-quarter turn. They use this knowledge and the language of clockwise and anticlockwise to describe turns, including in the context of compass directions and clocks.

Year 6 children should recognise other common angles, such as 45° being half a right angle, and apply this knowledge to describe turns.

Things to look out for

- Children may confuse the terms clockwise and anticlockwise.
- Children may find it trickier to identify angles that are not shown in a standard orientation, for example a three-quarter turn from north-east to north-west.

Key questions

- What does a full/half/quarter/three-quarter turn look like?
- What does "clockwise"/"anticlockwise" mean?
- If there are 360° in a full turn, how many degrees are there in a right angle/quarter turn/half turn/three-quarter turn?

Possible sentence stems

- There are _____° in a full turn, so there are _____° in a _____ turn.
- There are _____° in a right angle.
- Turning _____° _____ is the same as turning _____° _____

Single age small step links

- Understand and use degrees (Y5)

- N/A

National Curriculum links

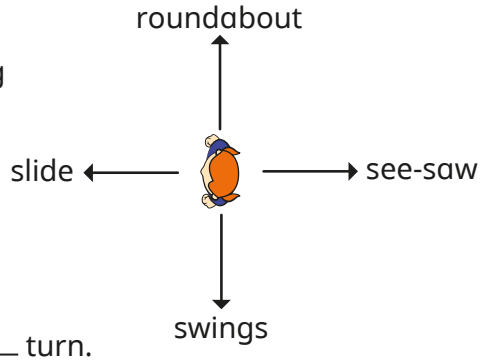
- Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles (Y5)

Understand and use degrees

Key learning

- Alex is facing the slide.

  She turns 360° and is facing the slide again.



  - Complete the sentences.

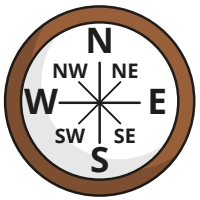
    There are 360° in a _____ turn.

    There are _____° in a half turn.

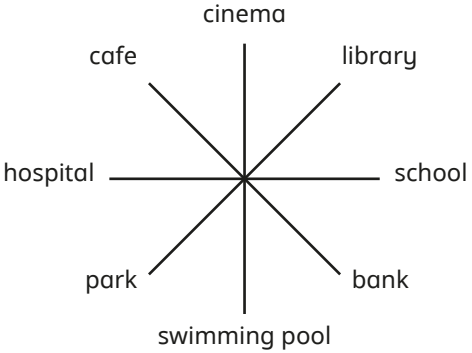
    There are _____° in a quarter turn.

  - Describe some turns to a partner and work out what Alex will be facing after each turn.

- Work out the angle of each turn in degrees.
  - east to north clockwise
  - east to north anticlockwise
  - south to west clockwise
  - north-east to south-west anticlockwise



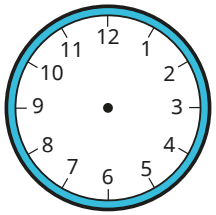
- Huan, Filip, Dani and Aisha are standing in the centre.
  - Work out what each child is facing after their turn.
    - Huan is facing the school and turns 90° clockwise.
    - Filip is facing the swimming pool and turns 270° anticlockwise.
    - Dani is facing the library and turns 180°.
    - Aisha is facing the cafe and turns 360°.
  - Explain why it does not matter whether Dani and Aisha turn clockwise or anticlockwise.



- The minute hand turns from the start time to the end time.

  Use the clock to help you complete the table.

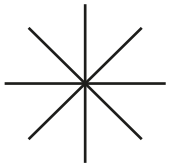
Start time	End time	Degrees
2 o'clock	quarter to 3	
3:10 pm	3:40 pm	
4:35 am		270°
	22:05	90°



Understand and use degrees

Reasoning and problem solving

Use the clues to label the diagram.



- Jack is standing in the middle of his bedroom.
- He is facing his sofa.
- He turns 180° and is facing the window.
- He then makes a 90° turn clockwise and is facing his computer.
- He turns another 90° clockwise, and then makes a $\frac{3}{4}$ turn anticlockwise.

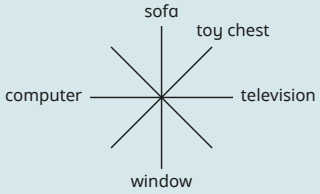
  He is now facing the television.

Compare diagrams with a partner.

His toy chest is between the sofa and the television.

Describe the turn from the sofa to the toy chest.

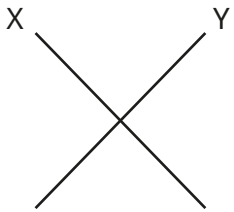
any rotation of:

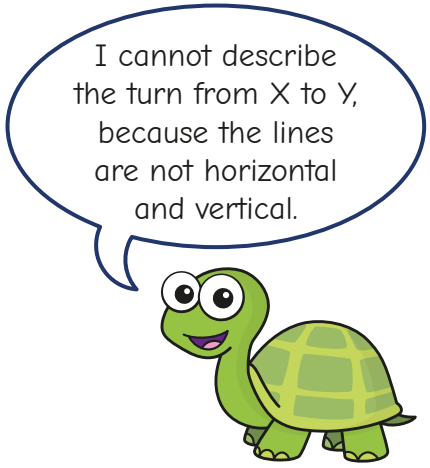


45° clockwise

or $\frac{1}{8}$ of a turn clockwise

or half of a quarter turn clockwise





Explain why Tiny is incorrect.

Describe the turn from X to Y in two different ways.

$\frac{1}{4}$ turn (or 90° turn) clockwise

$\frac{3}{4}$ turn (or 270° turn) anticlockwise

Classify angles

Notes and guidance

In this small step, children classify and estimate angles using their knowledge of right angles. Year 5 children are introduced to reflex angles.

Start by revisiting previous learning and classify angles as acute or obtuse based on whether an angle is less than or greater than a quarter turn (right angle). Children need to be able to visually classify angles as acute, obtuse or reflex by comparing them to right angles and straight lines. The use of angle finders, such as a right angle, may provide support. Children can then begin to classify angles numerically before drawing examples of each angle type and estimating the sizes of given angles.

Year 6 children explore estimating angles by comparing them to known fractions of a turn to increase the accuracy of their estimations. They should explore the idea of halfway between already known angles, for example 45° is half of a right angle and 135° is halfway between a right angle and a straight line. From here, they can start to estimate given angles by comparing them to these key amounts.

Things to look out for

- Children may need to turn the paper to help classify angles that are not presented horizontally or vertically.

Key questions

- What are the four types of angles?
- How many degrees are there in a right angle/on a straight line?
- If an angle is _____°, what type of angle is it?
- Is the angle less than or greater than a right angle?

Possible sentence stems

- Angles greater/less than _____° are called _____ angles.
- Angles greater than _____° but less than _____° are called _____ angles.

Single age small step links

- Classify angles (Y5)
- Estimate angles (Y5)
- Measure and classify angles (Y6)

National Curriculum links

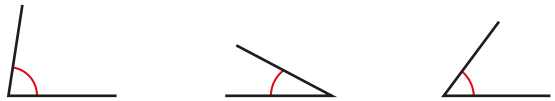
- Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles (Y5)
- Draw given angles, and measure them in degrees (°) (Y5)

Classify angles

Key learning

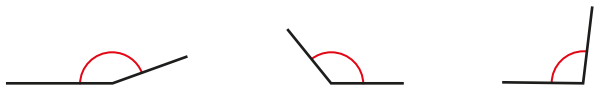
- Complete the sentences to describe the types of angles.

acute angles



Acute angles are less than _____°.

obtuse angles



Obtuse angles are greater than _____° but less than _____°.

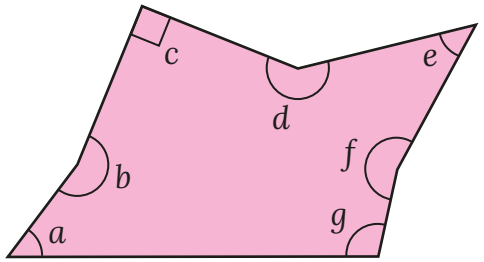
reflex angles

Reflex angles are greater than _____°.

- Draw and label two different diagrams that show each type of angle.

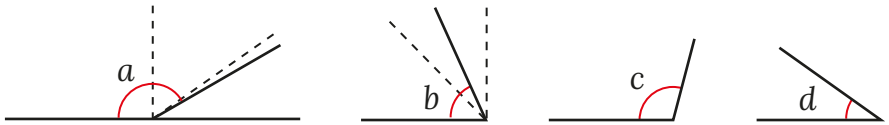
acute | obtuse | reflex

- Classify angles a to g as acute, obtuse, reflex or right angle.



Estimate the size of each angle.

- Match each angle to an appropriate estimate of its size.



50° | 110° | 89° | 142° | 68° | 96° | 130°

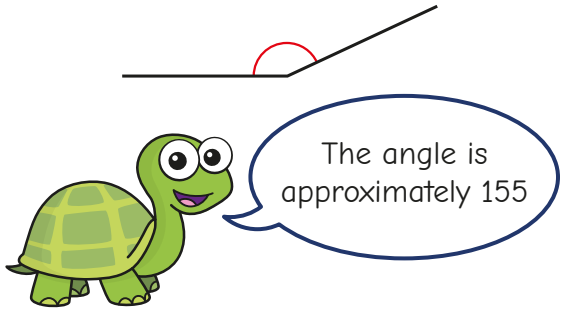
Compare answers with a partner.

- Draw angles that are approximately of each size.

50° | 95° | 250° | 178°

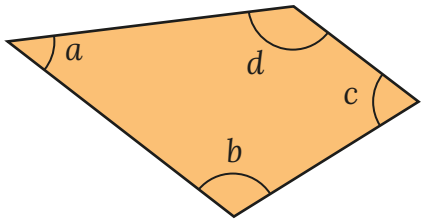
Classify angles

Reasoning and problem solving



What mistake has Tiny made?

Tiny has forgotten to give the unit of measure: degrees or °.



Is the statement true or false?

angle a + angle b < angle c + angle d

Use estimates to explain your answer.

True

Approximate sizes of angles are:

$a = 45°$, $b = 110°$, $c = 70°$, $d = 135°$

$45 + 110 < 70 + 135$

Are the statements always true, sometimes true or never true?

Subtracting an acute angle from a reflex angle leaves an obtuse angle.

Two obtuse angles added together make a reflex angle.

Subtracting an obtuse angle from a reflex angle leaves an acute angle.

Two acute angles added together make an obtuse angle.

Draw examples to support your answers.

sometimes true

always true

sometimes true

sometimes true

Measure angles

Notes and guidance

In this small step, children use a protractor to measure angles.

Children read the sizes of angles, where a protractor is shown over the top of the angle in the correct position. They then position protractors for themselves in order to measure angles. Model the steps to successfully using a protractor: make sure that the zero line of the protractor is on one of the lines of the angle; position the centre point of the protractor on the vertex; read the correct scale. Children count up from the zero line to get to the correct angle. Encourage them to classify and estimate the size of the angle before measuring, so that they are more likely to read the correct scale. For example, if an angle is acute, then it must be less than 90°. Year 5 children only measure angles up to 180°.

Year 6 children could be challenged to consider how to measure reflex angles.

Things to look out for

- Children may place the protractor in the incorrect place.
- Children may read the incorrect scale on the protractor.
- Children may require support when measuring reflex angles with a 180° protractor.

Key questions

- Where should you put the protractor to measure an angle?
- Which scale will you use when reading the protractor?
- How does moving the paper help you to measure some angles?
- How can you use a protractor to measure a reflex angle?

Possible sentence stems

- The angle is an _____ angle, so the number of degrees must be more/less than _____
- A/an _____ angle is between _____ and _____ degrees.

Single age small step links

- Measure angles up to 180° (Y5)
- Estimate angles (Y5)
- Measure and classify angles (Y6)

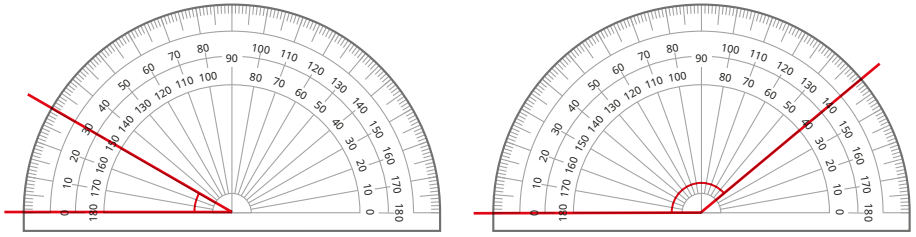
National Curriculum links

- Draw given angles, and measure them in degrees (°) (Y5)
- Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles (Y6)

Measure angles

Key learning

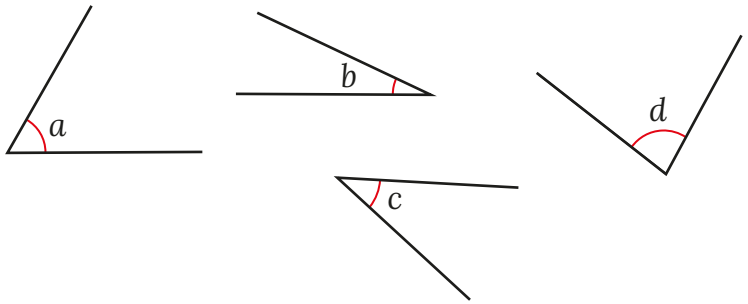
- Is each angle acute or obtuse?



What is the size of each angle?

- Is each angle acute or obtuse?

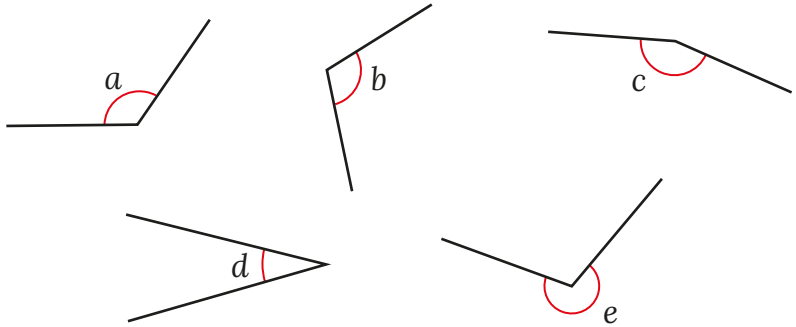
Estimate the size of each angle.



Measure each angle with a protractor.

How close were your estimates to the actual measurements?

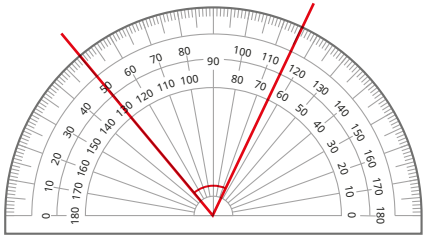
- Use a protractor to measure the angles, then complete the sentences for each one.



Angle _____ is _____ °.

It is a/an _____ angle.

- What is the size of this angle?



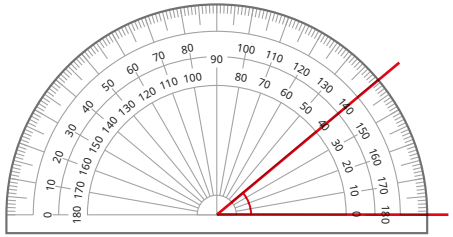
How did you work out your answer?

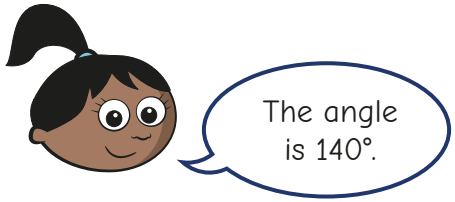
How else could you measure the angle?

Measure angles

Reasoning and problem solving

Sam is measuring angles.





Is Sam correct?

Explain your answer.

What has Sam done correctly?

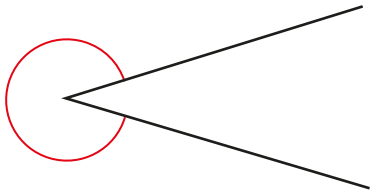
What has Sam got wrong?

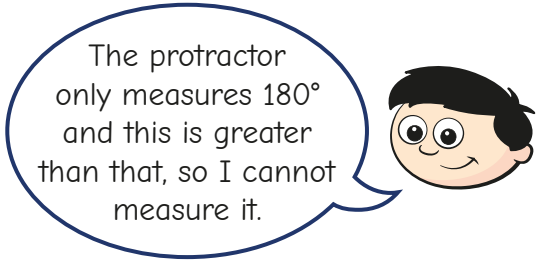
No

Sam has used the wrong scale.

The angle is 40°, not 140°.

Dexter is trying to measure the size of this reflex angle.





Is Dexter correct?

Explain your answer.

No

Calculate angles around a point

Notes and guidance

In this small step, children calculate angles based on given information, rather than using a protractor to measure them.

Recap prior learning that a full turn is 360° and model this with a child turning through 360°. Children use a protractor to measure angles around a point to see that they total 360°. Any slight differences will be due to human error and should be discussed. Children then work out unknown angles using the knowledge that all the angles sum to 360°. They should explore both methods: subtracting each known part from the whole in turn; and adding the known parts together and subtracting this from the whole.

Children should recognise that if they know that the angles around a point are equal, 360 can be divided by the number of angles to find the size of one of the angles.

Things to look out for

- Children may use a protractor to measure an unknown angle, rather than calculating from the given information.
- Children may not see or understand the notation for a right angle and exclude this from any calculations.

Key questions

- How many right angles are there in a full turn?
- If you know the size of three out of four angles around a point, how can you work out the fourth angle?
- If all the angles around a point are equal in size, how can you work out the size of each one?

Possible sentence stems

- Angles around a point sum to _____°.
- The total of angle _____ and angle _____ is _____°.
- To find angle _____, I subtract _____ from _____

Single age small step links

- Calculate angles around a point (Y5)
- Calculate angles (Y6)

National Curriculum links

- Identify angles at a point and 1 whole turn (total 360°) (Y5)
- Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles (Y6)

Calculate angles around a point

Key learning

- Mo faces in one direction.

  He then does a full turn and ends up facing the same direction.

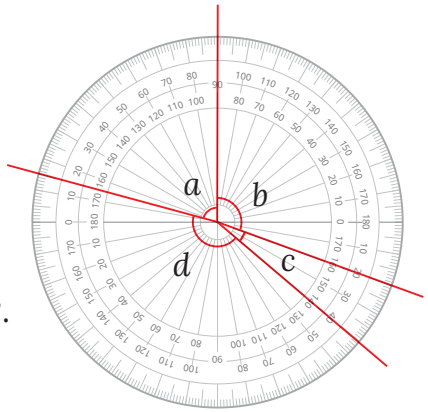
  Discuss with a partner how many right angles Mo has turned.

- Measure the angles.

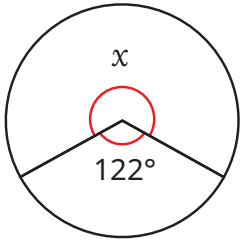
  a = _____° c = _____°

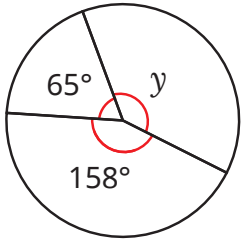
  b = _____° d = _____°

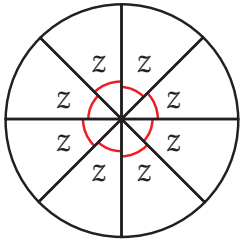
  The sum of all four angles = _____°.



- Work out the unknown angles.







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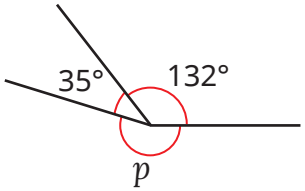
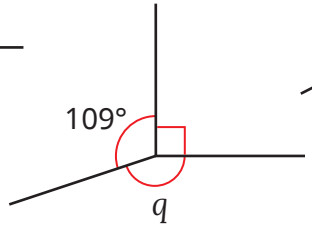
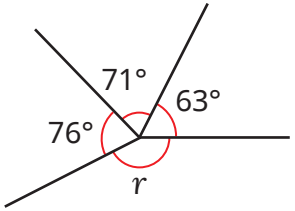


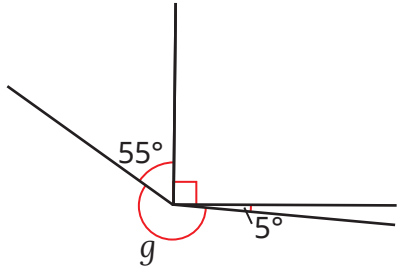




- Use the fact that angles around a point sum to 360° to work out the size of angle g.

  What do you notice?

  Compare methods with a partner.



- There are three angles around a point.

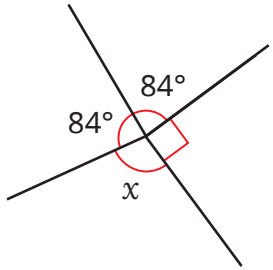
  Angle m is double the size of angle n.

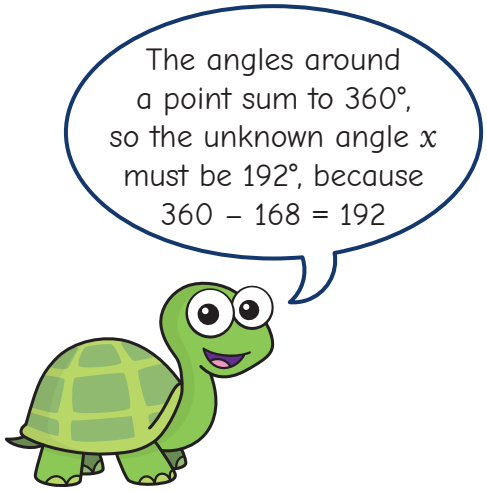
  Angle o is the same size as the total of angles m and n.

  What are the sizes of angles m, n and o?

Calculate angles around a point

Reasoning and problem solving





Is Tiny correct?

Explain your answer.

No

Are the statements always true, sometimes true or never true?

If there are four angles around a point, they could all be acute.	never true
If there are three angles around a point, they will all be obtuse.	sometimes true
If there are five equal angles around a point, they will all be acute.	always true
If three of the angles around a point are right angles, any remaining angles will be acute.	sometimes true

Give reasons for your answers.

Calculate angles on a straight line

Notes and guidance

In this small step, children see that the total of the angles on a straight line is half the total of the angles around a point.

Children should recognise that a half turn is the same as a straight line, meaning that adjacent angles on a straight line sum to 180°. Looking at a protractor will reinforce this point, as children will see that the 0° to 180° line is a straight line.

Once children are secure in the understanding that both a half turn and a straight line are equal to 180°, they move on to working out unknown angles on a straight line. As with the previous step, children should explore both methods of calculation: the whole (180°) subtract each part; or add the parts first, then subtract from the whole.

Finally, children use division to work out equal angles when they know that the total is 180°.

Things to look out for

- Children may use a protractor to measure unknown angles, rather than calculating from the given information.
- Children may make errors when using mental strategies of subtraction, for example 90 – 75 = 25

Key questions

- How many right angles are there in a half turn?
- What do angles on a straight line sum to?
- How can you work out an unknown angle on a straight line if you know the size of the other angle/angles?

Possible sentence stems

- Angles on a straight line sum to _____°
- The total of angle _____ and angle _____ is _____°.
- To find angle _____, I subtract _____ from _____

Single age small step links

- Calculate angles on a straight line (Y5)
- Calculate angles (Y6)

National Curriculum links

- Identify: angles at a point and 1 whole turn (total 360°); angles at a point on a straight line and half a turn (total 180°) (Y5)
- Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles (Y6)

Calculate angles on a straight line

Key learning

- Kim faces in one direction.

  She then turns around to face the opposite direction.

  - How many right angles has Kim turned?
  - Complete the sentences.

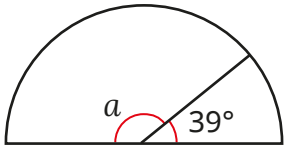
    $\frac{1}{4}$ of a full turn = _____ right angle = _____°

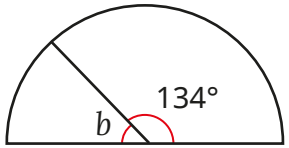
    There are _____ right angles on a straight line.

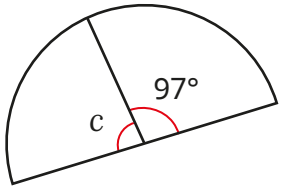
    1 half turn = _____ right angles = _____°

    There are _____° on a straight line.

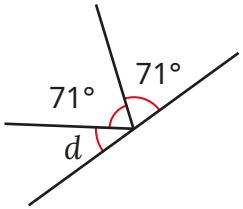
- Work out the unknown angles.

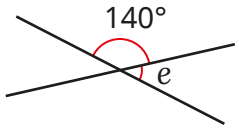






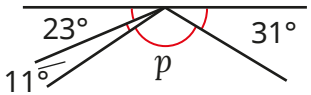
- Work out the unknown angles.

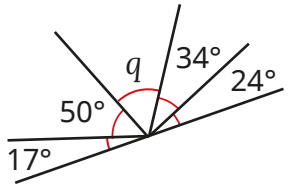


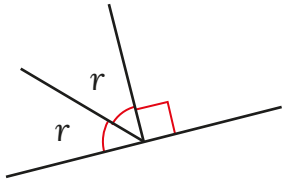


Is there more than one way to work out each angle?

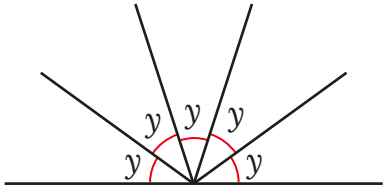
- Work out the unknown angles.





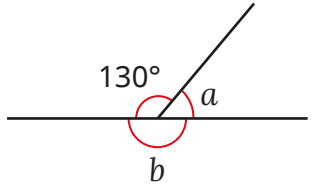


- The five angles are on a straight line.



Work out the size of each angle.

- Here are three angles on a straight line.

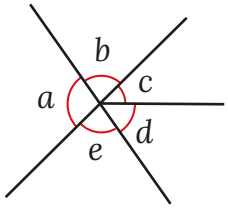


Which of the statements are true?

$a < b$	$a + 130° = b$	$b - a = 130°$
a is half the size of 130°.		$a + b = 130°$

Calculate angles on a straight line

Reasoning and problem solving



$a + b + c + d + e = 360°$

$a + e = 180°$

Write some different number sentences about this diagram.

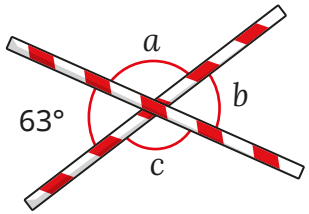
multiple possible answers, e.g.

$b + c + d = a + e$

$360° - a - e = 180°$

Two straws are on a table.

Work out the three unknown angles.

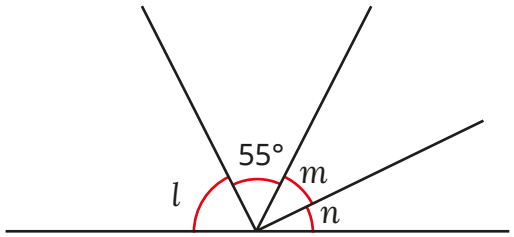


$a = 117°$

$b = 63°$

$c = 117°$

The angles are on a straight line.



- Angle l is 8° greater than the size of the given angle.
- Angle m is 10° greater than angle n.

Work out the sizes of the angles.

Create your own straight-line problem for a partner.

$l = 63°$

$m = 36°$

$n = 26°$

Vertically opposite angles

Notes and guidance

In this small step, children learn that vertically opposite angles are equal.

Begin by showing what vertically opposite angles are. By drawing two straight lines that intersect at a point, four angles are created. Through investigation, children see that there are two pairs of equal angles. They need to understand that vertically opposite angles are formed when two straight lines cross, and if either of the lines is not straight, then the angles formed are not vertically opposite. Secure this understanding by comparing vertically opposite angles to pairs of angles around a point that are opposite each other, but not formed by two straight lines intersecting.

Once Year 6 children are confident with their understanding that opposite angles are equal, they can use this fact alongside the rules they already know to work out unknown angles.

Things to look out for

- Children may think that vertically opposite angles must be vertical in relation to each other, rather than sharing a common vertex.

Key questions

- What are vertically opposite angles?
- What number sentences can you write about vertically opposite angles?
- How can you find the size of the unknown angle? Is there more than one way?
- What is the difference between vertically opposite angles and two angles around a point that are opposite each other?

Possible sentence stems

- Vertically opposite angles are _____
- If angle _____ is _____°, then angle _____ is also _____°.
- Angles _____ and _____ are equal, because ...

Single age small step links

- N/A
- Vertically opposite angles (Y6)

National Curriculum links

- Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles (Y6)

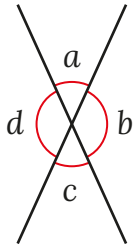
Vertically opposite angles

Key learning

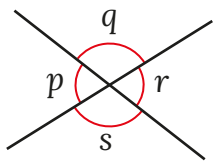
- Take a piece of paper and draw a large "X".
  - Mark the angles as shown.
  - Measure each angle.
  - What do you notice about angles a and c?

    What do you notice about angles b and d?

    Is this always the case? Draw other "X" shapes to investigate.



- Use the letters from the diagram to complete the statements.



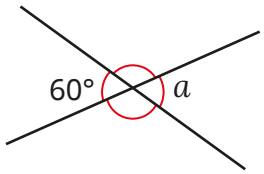
_____ = _____

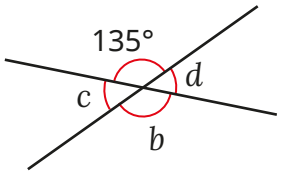
_____ + _____ = 180°

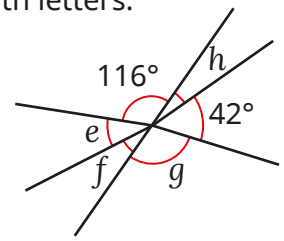
_____ = _____

_____ + _____ = 180°

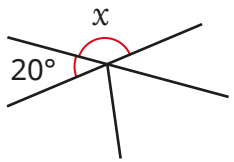
- Work out the sizes of the angles marked with letters.

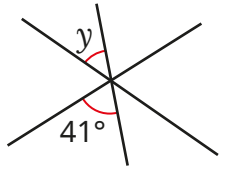


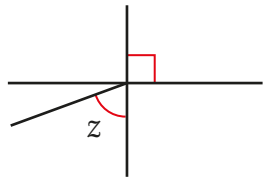




- Each diagram has been drawn using three straight lines.





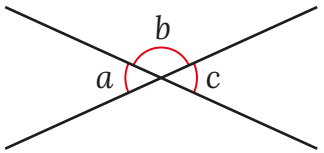


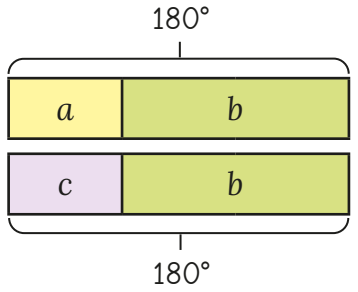
Which of the angle(s) marked with letters can you work out?

Which angle(s) can you not work out?

Talk about it with a partner.

- Ron has drawn a bar model to show the sizes of the angles.



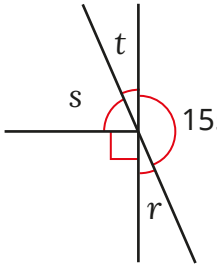


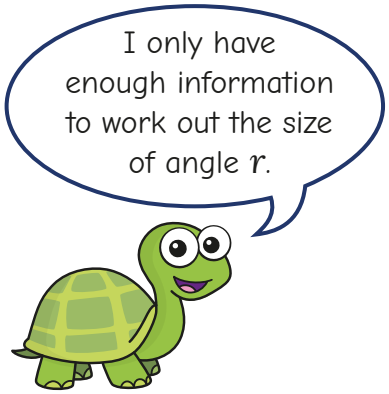
Explain how Ron's bar model shows that vertically opposite angles are equal.

Vertically opposite angles

Reasoning and problem solving

The diagram has been drawn using three straight lines.





Is Tiny correct?

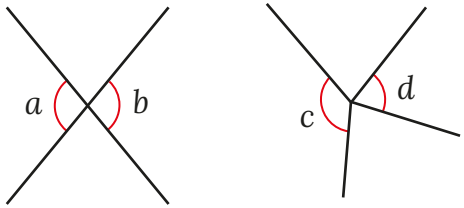
Explain your answer.

No

$r = 25°$

$s = 65°$

$t = 25°$



Are the statements true or false?

Angles a and b are equal.

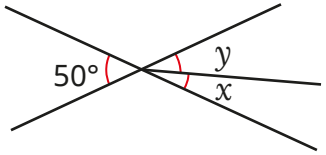
Angles c and d are equal.

Explain your answers.

True

False

Three straight lines are drawn.



y is one and a half times greater than x.

Work out the size of angle x.

$x = 20°$

Angles in a triangle

Notes and guidance

In this small step, children learn that the interior angles of a triangle always sum to 180°.

Ask children to measure each angle of a triangle and add them together, for a number of different triangles, in order to identify the rule. Discuss the possibility of small measuring inaccuracies causing the total to be slightly different from 180°.

When the rule is established, children work out unknown angles in triangles. They should see each angle as a "part" and 180° as the "whole". The three parts add to make the whole. They can work out one of the unknown parts by subtracting each of the known parts from the whole, or adding the known parts together before subtracting from the whole. This step is a good opportunity to revisit mental and written calculation methods, as well as using inverse operations to check answers.

Year 6 children should be able to solve increasingly complex unknown angle questions by thinking about angles in different types of triangles, as well as in right angles, on a straight line and around a point.

Things to look out for

- Children may measure unknown angles with a protractor, rather than working them out based on given facts.

Key questions

- What do the interior angles of a triangle sum to?
- If you know the size of two interior angles in a triangle, how can you work out the third angle?
- Could you work out the unknown angle in a different way?

Possible sentence stems

- The angles in a _____ add up to _____°.
- The whole (180°) subtract the parts _____° and _____° gives the unknown angle, _____°.

Single age small step links

- Lengths and angles in shapes (Y5)

- Angles in a triangle (Y6)
- Angles in a triangle – missing angles (Y6)

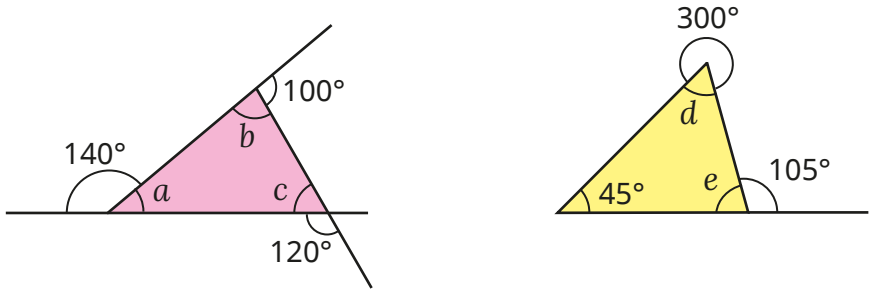
National Curriculum links

- Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals and regular polygons (Y6)

Angles in a triangle

Key learning

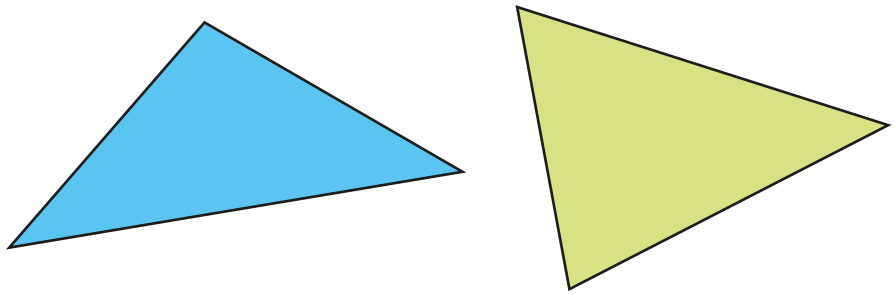
- Work out the unknown angles in the triangles.



What do you notice about the angles in each triangle?

What rules did you use to work out the unknown angles?

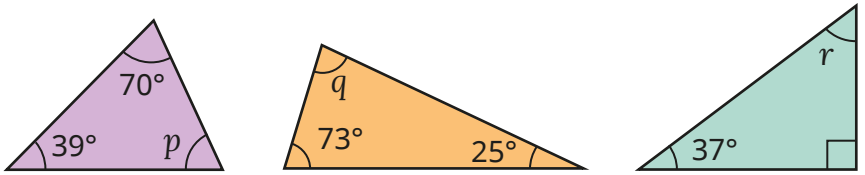
- Use a protractor to measure the angles in each triangle.



What is the sum of the angles in each triangle?

What do you notice?

- Calculate the sizes of the angles marked with letters.



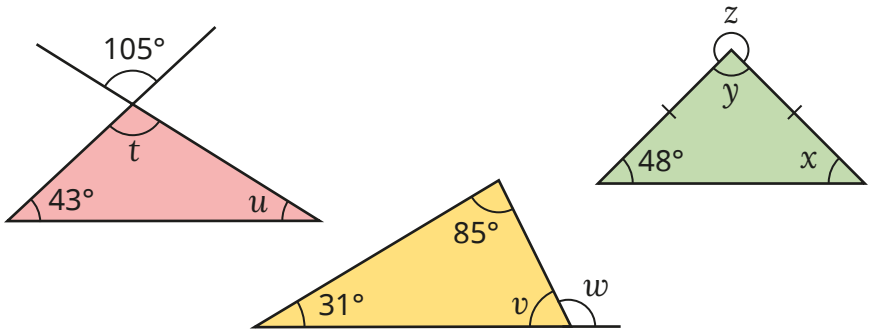
- The first angle in a triangle is 21°.

The second angle is three times the size of the first angle.

What is the size of the third angle?

- Work out the sizes of the angles marked with letters.

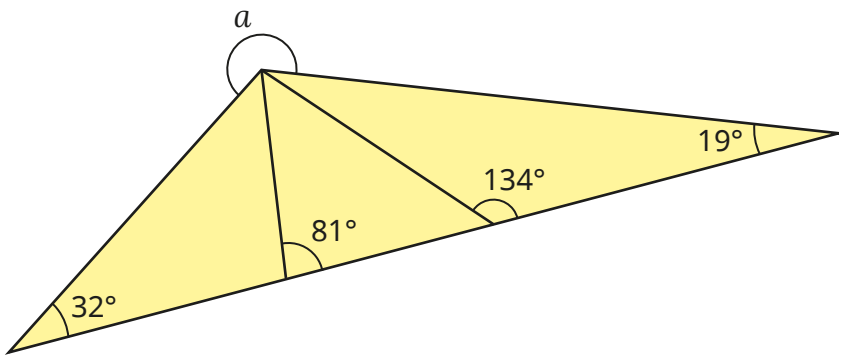
Explain each step in your workings.



Angles in a triangle

Reasoning and problem solving

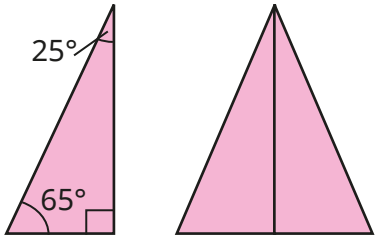
Work out the size of the reflex angle a.

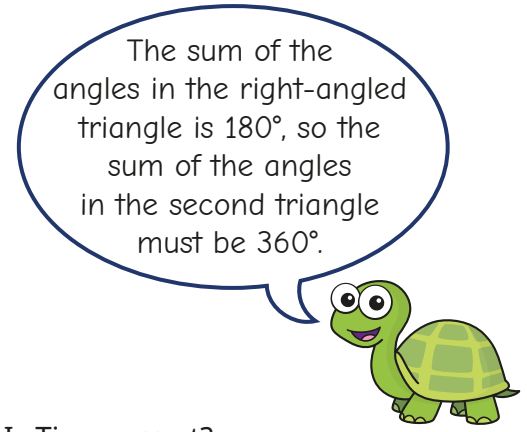


What other angles can you work out?

$a = 231°$

A triangle is made by combining two right-angled triangles.





Is Tiny correct?

Explain your answer.

No

Angles in a triangle – special cases

Notes and guidance

In previous years, children learnt to classify triangles as equilateral, isosceles or scalene, based on the lengths of their sides. They also know that a right-angled triangle has one angle of 90°. In this small step, they extend this learning to include the angles of triangles. Using their knowledge of angles in specific triangles, as well as the total of the angles, children work out unknown angles in different types of triangles.

Starting with equilateral triangles, where all the angles are equal, children learn that each angle must be 180° ÷ 3 = 60°. They then investigate isosceles triangles, learning that not only do isosceles triangles have two equal sides, but they also have two equal angles. Children need to identify which two angles are equal in order to find the sizes of unknown angles in the triangles. They may need reminding of hatch mark notation to show that sides of shapes are equal in length.

Year 6 children should progress to solving increasingly complex unknown angle questions, using the angle facts from earlier in this block.

Things to look out for

- Children may need support to work out intermediate angles when the required angle cannot be found in one step.

Key questions

- What do you know about the sides/angles of an equilateral triangle?
- What are the properties of an isosceles triangle?
- If you know the size of one angle in an isosceles triangle, how can you calculate the sizes of the other two angles?

Possible sentence stems

- In an equilateral triangle, all three angles are _____°.
- In an isosceles triangle, two _____ are equal and two _____ are equal.

Single age small step links

- Lengths and angles in shapes (Y5)

- Angles in a triangle – missing angles (Y6)
- Angles in a triangle – special cases (Y6)

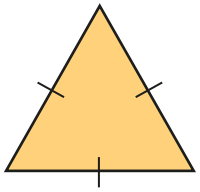
National Curriculum links

- Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals and regular polygons (Y6)

Angles in a triangle – special cases

Key learning

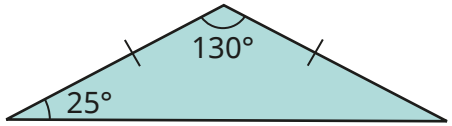
- In an equilateral triangle, all three angles are equal.



What is the size of each angle in an equilateral triangle?

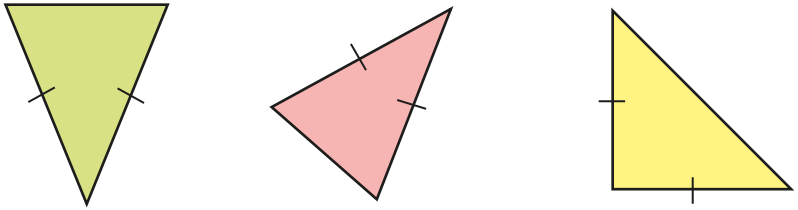
How do you know?

- Work out the unknown angle in the isosceles triangle.

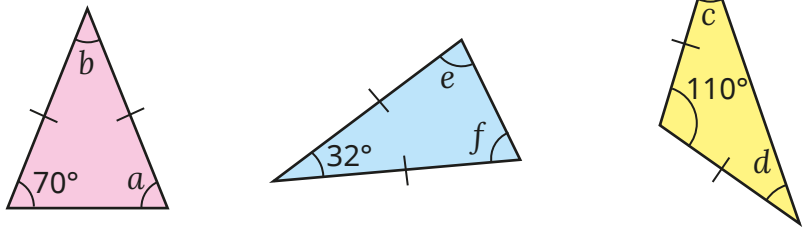


What do you notice?

- Identify which angles will be equal in each isosceles triangle.



- Here are three isosceles triangles.



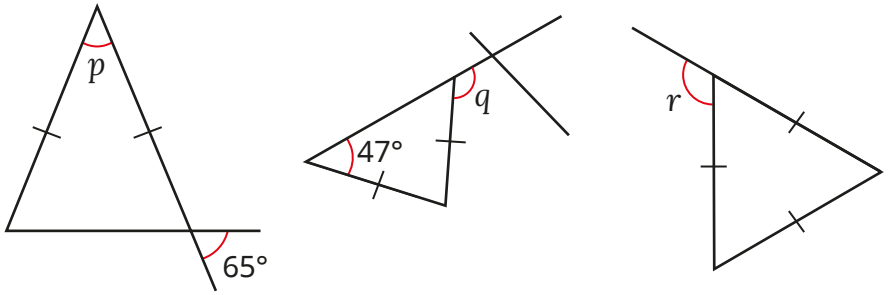
Work out the sizes of the angles marked with letters.

- One of the angles in an isosceles triangle is 28°.

What could the sizes of the other two angles be?

Find more than one possible answer.

- Discuss with a partner how you could work out the sizes of each of the angles marked with letters.

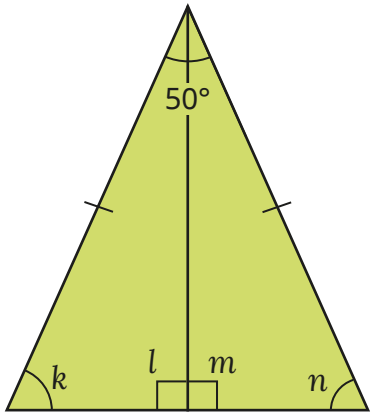


Angles in a triangle – special cases

Reasoning and problem solving

How many sentences can you write to express the relationships between the angles in the triangles?

One has been done for you.



$50° + k + n = 180°$

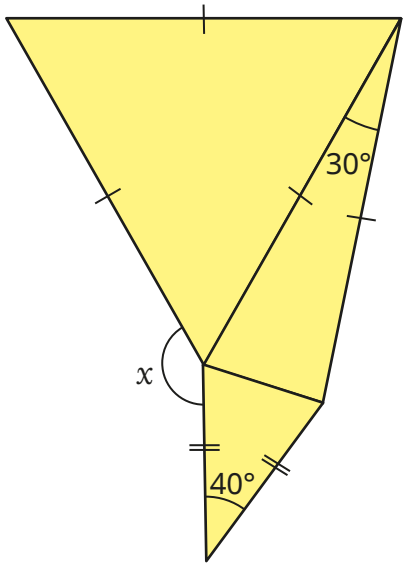
multiple possible answers, e.g.

$25° + k + l = 180°$

$25° + m + n = 180°$

$k = n$

The shape is made from two isosceles triangles and an equilateral triangle.



Work out the size of angle x.

$x = 155°$

Angles in quadrilaterals

Notes and guidance

In previous years, children explored the properties of different quadrilaterals and they should be familiar with the words "trapezium", "rhombus", "square", "rectangle", "parallelogram" and "kite". They learnt about the equal and parallel sides in quadrilaterals, as well as which ones have right angles. In this small step, that learning is extended to include the properties of the angles in these quadrilaterals.

For a square and a rectangle, the fact that the angles add up to 360° can be worked out quickly. For other quadrilaterals, children can investigate by measuring the angles with a protractor. Show that, as any quadrilateral can be split into two triangles, the sum of the interior angles is twice that of a triangle and compare this with the totals found by measuring.

Give Year 6 children the opportunity to explore the relationships between angles in a rhombus and a parallelogram, where opposite angles are equal.

Things to look out for

- Children may incorrectly identify equal sides and/or angles.
- Children may try to use 180° instead of 360° as the sum of the angles in a quadrilateral.

Key questions

- In what ways can quadrilaterals be different from one another?
- What is the sum of the interior angles in a quadrilateral?
- What is the same/different about a rhombus and a square?

Possible sentence stems

- The sum of the interior angles in any quadrilateral is _____°.
- A parallelogram has two pairs of equal _____ and two pairs of equal _____

Single age small step links

- Lengths and angles in shapes (Y5)
- Angles in a quadrilateral (Y6)

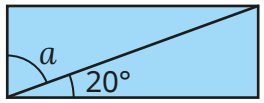
National Curriculum links

- Use the properties of rectangles to deduce related facts and find missing lengths and angles (Y5)
- Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals and regular polygons (Y6)

Angles in quadrilaterals

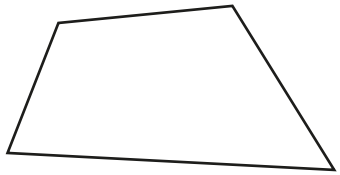
Key learning

- A rectangle has been split into two triangles.



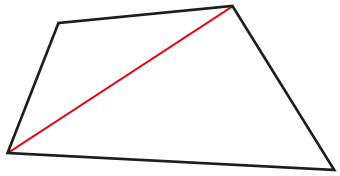
  - Work out the size of angle a.
  - What other unknown angles can you work out in the rectangle?

- Measure the angles of the quadrilateral.



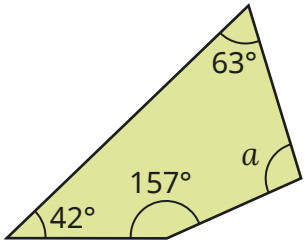
What is the sum of all four angles?

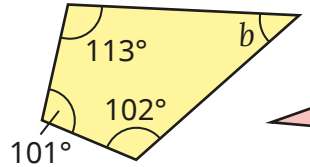
Scott draws a line on the quadrilateral to prove that the angles in any quadrilateral add up to 360°.

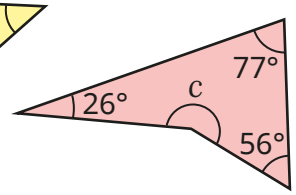


Explain Scott's reasoning.

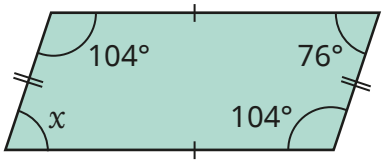
- Work out the unknown angles in the quadrilaterals.





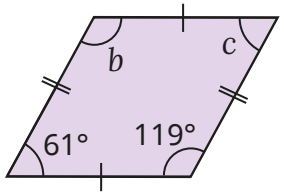


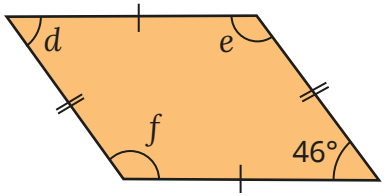
- Work out the size of angle x in the parallelogram.



What do you notice about the opposite angles in a parallelogram?

Use this to work out the angles marked with letters in the parallelograms.





Angles in quadrilaterals

Reasoning and problem solving

Tiny draws a quadrilateral with four equal sides.

Is Tiny correct?

Explain your answer.

No

Nijah draws a quadrilateral with exactly two right angles.

What types of quadrilaterals could she have drawn?

Is it possible to draw a quadrilateral with exactly three right angles?

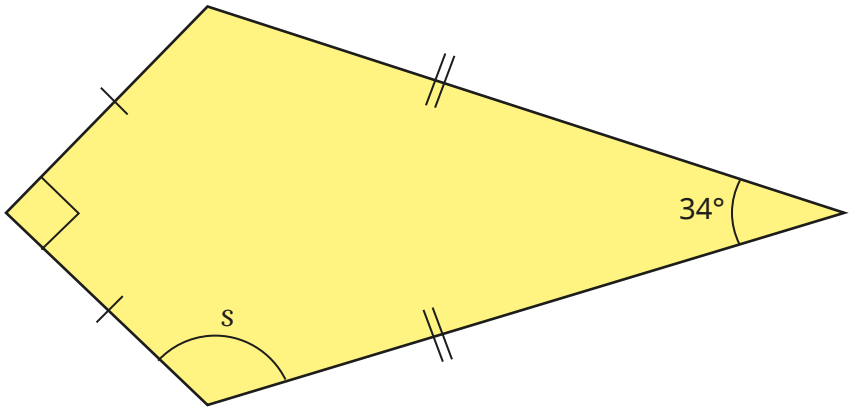
Explain your answer.

kite or trapezium

No

3 right angles sum to 270°, so the 4th angle must be 360° – 270° = 90°.

Here is a kite.



Work out the size of angle s.

Talk to a partner about how you worked it out.

$s = 118°$

Regular polygons

Notes and guidance

In this small step, children explore regular polygons. It is important to discuss with children that the words "polygon" and "shape" are not interchangeable. A polygon refers to a 2-D, fully enclosed shape formed from straight lines.

Explore what a regular polygon is, allowing children to see that not only do all sides have to be the same length, but the angles must also be equal. A good example is the difference between a square and a rectangle: while the angles are all equal, the sides are not. Year 5 children should be secure with their understanding of a regular polygon, before exploring the sum of the interior angles in polygons.

Year 6 children should focus on angles in regular polygons. They explore how many triangles polygons can be split into using one vertex of the polygon. They learn that the number of triangles is two fewer than the number of sides. Multiplying the number of triangles by 180° gives the sum of the interior angles, which they can use to find the interior angle of a regular polygon.

Things to look out for

- Children may draw too many triangles by drawing lines from more than one vertex of the polygon.

Key questions

- What are the features of a regular polygon?
- If the sum of the interior angles in each triangle is 180°, how can you work out the sum of the interior angles in the polygon?

Possible sentence stems

- In a regular polygon, all angles are _____ and all sides are _____

Single age small step links

- Lengths and angles in shapes (Y5)
- Regular and irregular polygons (Y5)

- Angles in polygons (Y6)

National Curriculum links

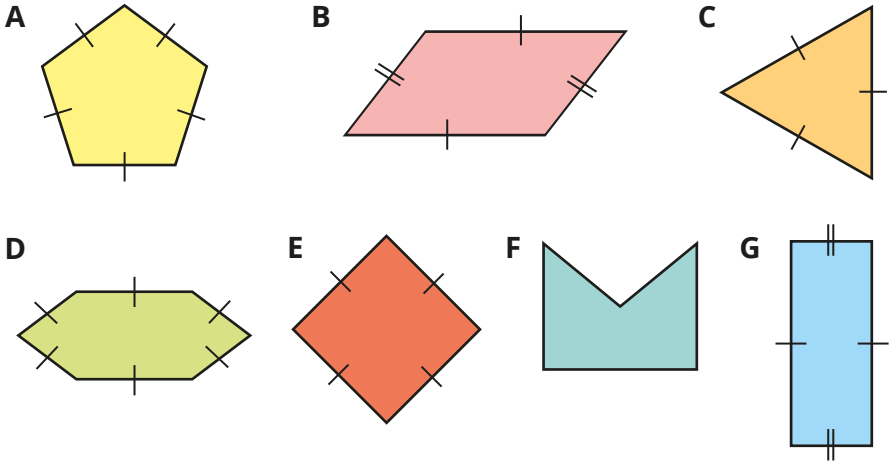
- Distinguish between regular and irregular polygons based on reasoning about equal sides and angles (Y5)
- Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals and regular polygons (Y6)

Regular polygons

Key learning

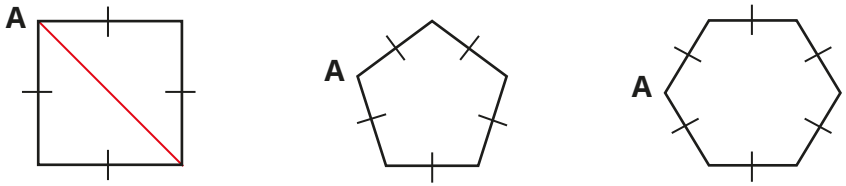
- In a regular polygon, all angles are equal and all sides are equal.

  Which of the polygons are regular?



- Brett splits a square into two triangles by drawing lines from vertex A.

  Use Brett's method to split the other regular shapes into triangles.



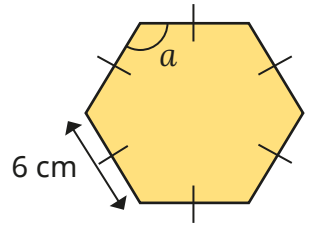
- Rosie can make two triangles from a quadrilateral.

  She then knows that the sum of the interior angles in a quadrilateral must be 360°.

  Use Rosie's method to complete the table.

Shape	Number of sides	Number of triangles	180 × number of triangles	Sum of interior angles
square	4	2	180 × 2	360°
pentagon	5	3		
hexagon				
heptagon				
octagon				

- Here is a regular hexagon.



  - What is the perimeter of the hexagon?

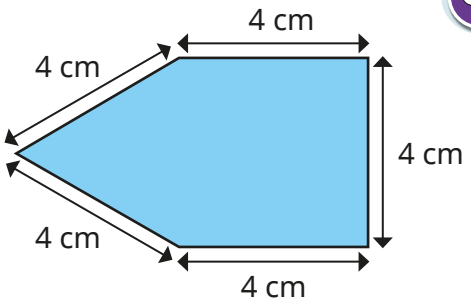
    How do you know?
  - What is the sum of the interior angles of the hexagon?

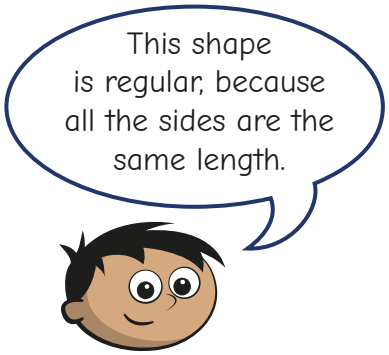
    How do you know?
  - What is the size of angle a?

    How do you know?

Regular polygons

Reasoning and problem solving



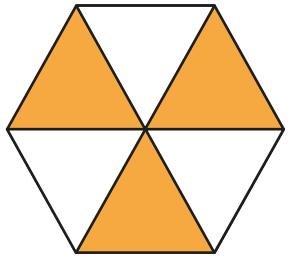


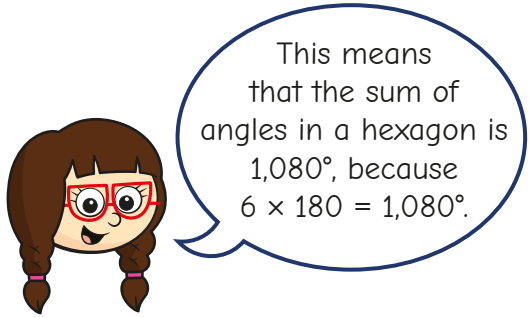
Is Amir correct?

Explain your answer.

No

Jo draws six triangles inside a hexagon.





Is Jo correct?

Explain your answer.

No

Jo's total includes the angles at the centre of the hexagon, not just those at the vertices.

Irregular polygons

Notes and guidance

In this small step, children explore irregular polygons. A polygon refers to a 2-D, fully enclosed shape formed from straight lines.

Explore what an irregular polygon is. A good example is the difference between a square and a rectangle: while the angles are all equal, the sides are not, therefore a rectangle is an irregular polygon. Year 5 children should be secure with their understanding of irregular polygons, before exploring the interior angles in polygons with five sides.

Year 6 children should focus on angles in irregular polygons. They should establish that the method of dividing a polygon into triangles can also be applied to irregular polygons. The angle sum of an irregular polygon is the same as a regular polygon with the same number of sides.

Things to look out for

- Children may think that a polygon with equal angles but different length sides, or with equal length sides and different angles, is regular.
- Children may draw too many triangles by drawing lines from more than one vertex of the polygon.

Key questions

- What is the difference between a regular and an irregular polygon?
- If the sum of the interior angles in each triangle is 180°, how can you work out the sum of the interior angles in the polygon?

Possible sentence stems

- In an irregular polygon, all angles may not be _____ and all sides may not be _____

Single age small step links

- Lengths and angles in shapes (Y5)
- Regular and irregular polygons (Y5)

- Angles in polygons (Y6)

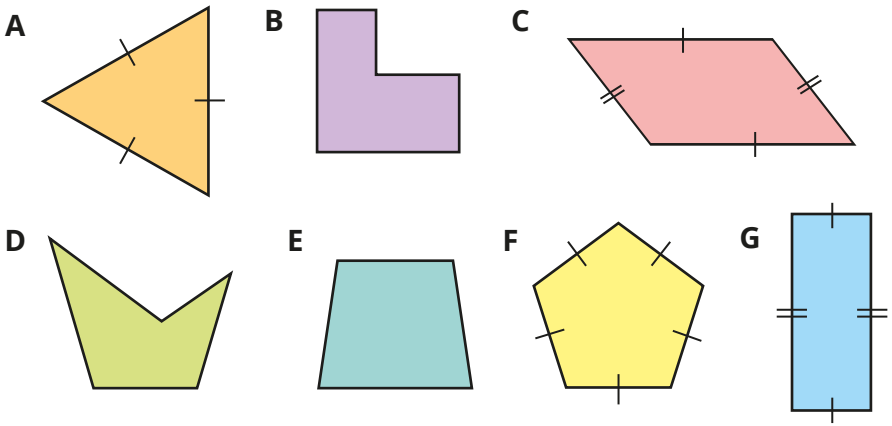
National Curriculum links

- Distinguish between regular and irregular polygons based on reasoning about equal sides and angles (Y5)
- Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals and regular polygons (Y6)

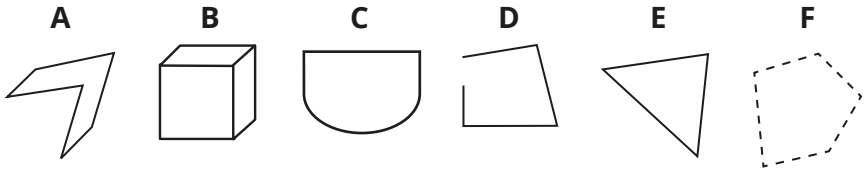
Irregular polygons

Key learning

- Sort the shapes into regular and irregular polygons.



- Which of the shapes are irregular polygons?



How do you know?

Explain why each of the other shapes is not an irregular polygon.

- Draw a regular polygon and an irregular polygon.

Compare shapes with a partner.

What is the same and what is different about your shapes?

- Max draws a shape with five straight lines.

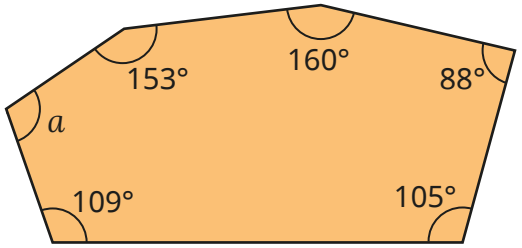
There are five angles in Max's shape.

Each angle is 108°.

Is Max's shape regular or irregular, or is it impossible to tell?

Explain your answer.

- Work out the size of angle a.



Explain your reasoning.

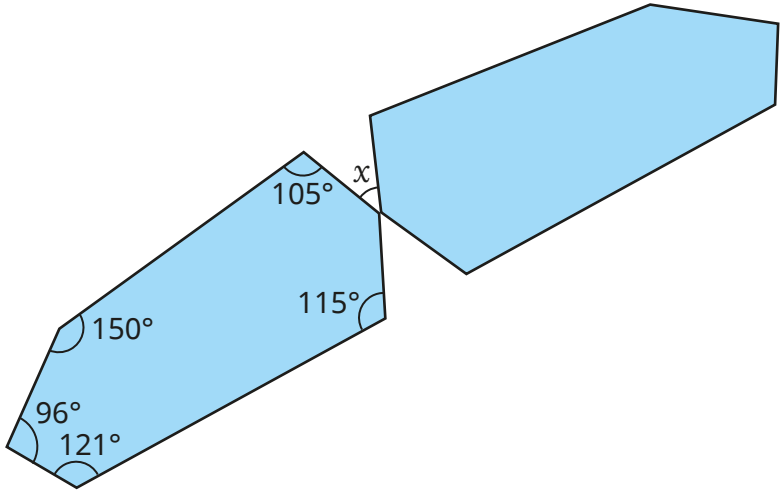
Irregular polygons

Reasoning and problem solving

Are the statements always true, sometimes true or never true?

An irregular polygon has equal sides, but not equal angles.	sometimes true
A rhombus is an irregular polygon.	sometimes true
An irregular polygon has equal angles, but not equal sides.	sometimes true
A scalene triangle is an irregular polygon.	always true

Here are two identical irregular hexagons.



Work out the size of angle x.

$x = 47°$

Circles

Notes and guidance

In this small step, children develop their knowledge of circles to include "radius", "diameter" and "circumference".

Children need to understand the importance of the centre of a circle: it is the point that is an equal distance from every part of the edge of the circle. They then move on to looking at the connection between the radius and the diameter. It is important that they realise that both of these are related to the centre. Showing examples and non-examples of radii and diameters will help to reinforce this understanding.

Year 5 children should focus on illustrating and naming parts of circles, including the radius, diameter and circumference, and be challenged to explore the relationship between the radius and diameter. Year 6 children should build on this and begin to explore and apply formulae showing the relationship between the radius and diameter. At this stage, they do not need to be able to calculate the circumference.

Things to look out for

- Children may confuse the terms "radius" and "diameter".
- Children may think that a diameter is any line across a circle, even if it does not go through the centre.

Key questions

- What does "radius"/"diameter"/"circumference" mean?
- What is the relationship between the radius and the diameter of a circle?
- What point must the diameter of a circle go through?
- If you know the diameter/radius of a circle, how can you calculate its radius/diameter?

Possible sentence stems

- The radius/diameter of a circle is _____ the size of the diameter/radius of the circle.
- All the points on the circumference of a circle are an _____ distance from the _____

Single age small step links

- N/A

- Circles (Y6)

National Curriculum links

- Illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius (Y6)

Circles

Key learning

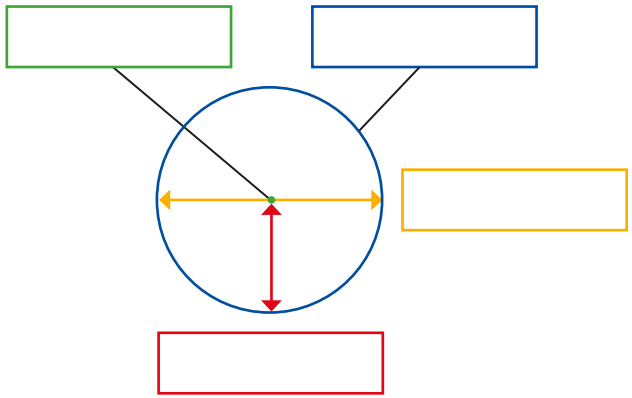
- Use the labels to complete the diagram.

radius

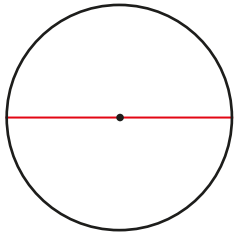
diameter

centre

circumference



- Esther has drawn a 6 cm straight line through the centre of the circle.



  - What is the name of the line that Esther has drawn?
  - Explain to a partner how Esther can use this line to help her find the radius of the circle.

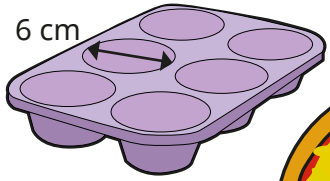
- Complete the table.

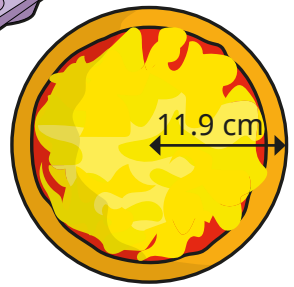
Radius	Diameter
24 cm	
	41 mm
2.75 m	
	97 cm
	11.56 cm

- Find the radius and the diameter for each object.

24 mm

6 cm





The radius is _____

The diameter is _____

I know this because ...

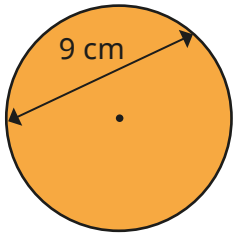
- If the radius of a circle is r and the diameter is d, which formula shows the relationship between the radius and diameter of the circle?

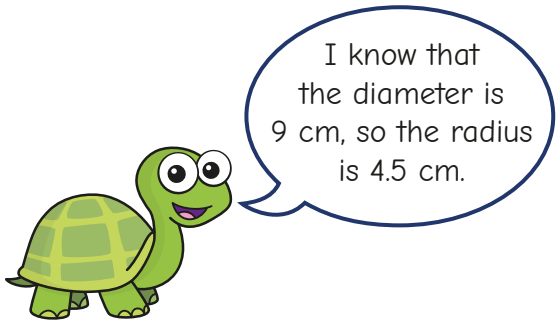
$2d = r$ | $2r = d$ | $d + 2 = r$ | $r + 2 = d$

Circles

Reasoning and problem solving

Tiny is trying to find the radius of the circle.





Is Tiny correct?

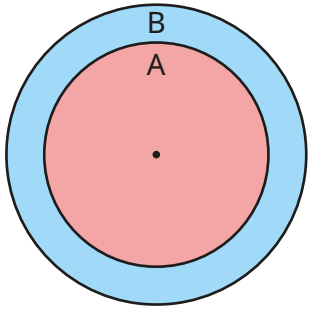
Explain your answer.

No

The diameter needs to pass through the centre of the circle and this line does not.

Circle A is drawn on top of circle B.

The diameter of circle A is $\frac{4}{5}$ the diameter of circle B.



If the diameter of circle B is 20 cm, what is the diameter of circle A?

If the diameter of circle A is 20 cm, what is the diameter of circle B?

If the radius of circle B is 10 cm, what is the radius of circle A?

If the radius of circle A is 10 cm, what is the diameter of circle B?

16 cm

25 cm

8 cm

25 cm

Draw shapes

Notes and guidance

In this small step, children use skills learnt in this block to draw lines, angles and shapes accurately, using given dimensions.

Recap how to use a protractor to draw a given angle. Instruct children to draw a straight line, then to move the protractor so that the zero line is on the line they have drawn, and the centre of the protractor is on the end of the line. They then mark the angle, remove the protractor and draw another line.

Year 5 children first draw straight lines of given lengths and then use a protractor to draw and label given angles. Once comfortable with drawing lines and angles, they can explore drawing whole shapes accurately from a description.

Year 6 children begin by drawing simple shapes such as rectangles and right-angled triangles where the base and height are given. This could be extended to shapes where the perimeter and some of the sides are known. Children then use a protractor to produce an accurate drawing of a shape with known angles, using their understanding of the properties of quadrilaterals and triangles to draw these accurately.

Things to look out for

- Children may use the wrong scale on the ruler or protractor.

Key questions

- What tools can you use to help you draw a shape accurately?
- What do you know about the shape that will help you to draw it accurately?
- How can you accurately draw a polygon if you know the measurements?

Possible sentence stems

- If an angle is _____ than 90°, I need to use the _____ scale on the protractor.
- If the perimeter of the rectangle is _____ cm and one side is _____ cm, then the other sides must be _____ cm, _____ cm and _____ cm.

Single age small step links

- Draw lines and angles accurately (Y5)
- Draw shapes accurately (Y6)

National Curriculum links

- Draw given angles, and measure them in degrees (°) (Y5)
- Draw 2-D shapes using given dimensions and angles (Y6)

Draw shapes

White Rose MATHS

Key learning

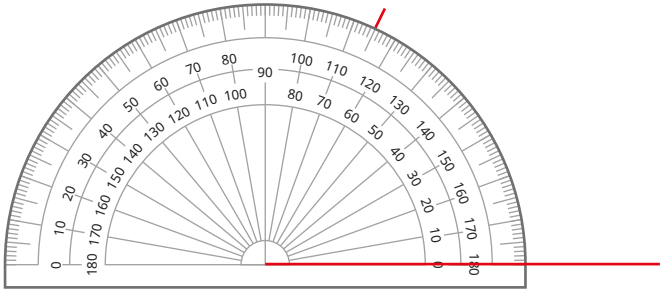
- Use a ruler to accurately draw the lines.

11 cm	5.5 cm	85 mm	110 mm

- Tommy is asked to draw an angle.

  He draws a horizontal line, then puts the protractor on the line.

  He then makes a mark.



  What size angle is Tommy drawing?

- Use a protractor to accurately draw and label the angles.

  Draw a horizontal line for each one.

55°	10°	135°	161°

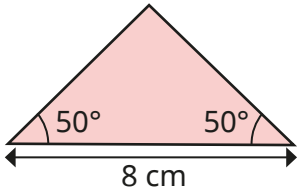
- Accurately draw and label a square that has a perimeter of 24 cm.

- The sides of a right-angled triangle are 4.5 cm, 6 cm and 7.5 cm.

  Draw the triangle and measure the sizes of its angles.

  Label the triangle with as much information as you can.

- Write a step-by-step plan to draw the triangle.



  Use your plan to make an accurate drawing of the triangle.

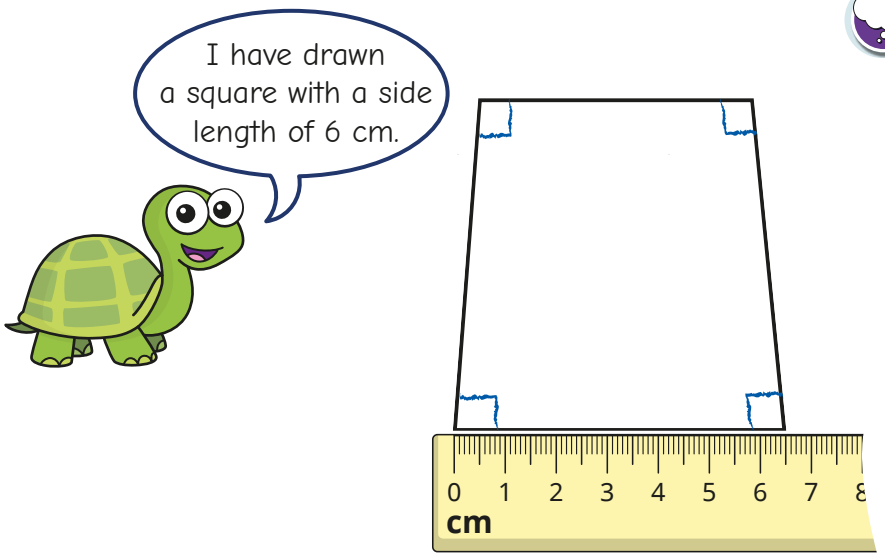
- Use a ruler and a protractor to draw each shape.

  Label the information that is given to you on the shape, as well as any equal or parallel lines.

  - a right-angled triangle with one angle of 37°
  - a parallelogram with two angles of 30° and two sides of 5 cm
  - an equilateral triangle with a perimeter of 18 cm
  - an irregular pentagon with a perimeter of 65 cm and three interior right angles

Draw shapes

Reasoning and problem solving

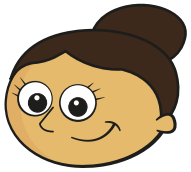


What mistakes has Tiny made?

Tiny has not drawn the side lengths or measured the angle sizes accurately.

All angles should be 90° and all lengths should be exactly 6 cm.

Dora has drawn a scalene triangle.



- Angle x is the greatest angle.
- Angle y is 20° greater than angle z.
- Angle z is 70° smaller than angle x.

Use a bar model to help you work out the size of each angle.

Then draw Dora's triangle.

Is there more than one way to draw the triangle?

$x = 100°$

$y = 50°$

$z = 30°$

These angles work with different side lengths.

3-D shapes

Notes and guidance

In this small step, children recap the names of 3-D shapes, and then move on to learning about their properties: faces, edges and vertices.

Year 5 children look at 2-D drawings of 3-D shapes on isometric paper, identifying the 3-D shape as well as its properties. By counting the dots on each side, they can identify equal lengths that can be used to tell the difference between, for example, a cube and a cuboid.

Year 6 children consider the nets of 3-D shapes. They can explore this practically, starting with nets of a cube and investigating which arrangements will and will not fold to make a cube. They then progress to other 3-D shapes and what 2-D shapes are needed to make their nets. Again, they first need to explore this with cut-out nets, which will help them to become more adept at visualising how nets fold up. They can then work from a 3-D shape to decide how the net will look.

Things to look out for

- Children may only count the faces, vertices and edges that they can see on the 2-D representation.
- Children may confuse some 3-D shapes, such as triangular-based pyramids and triangular prisms.

Key questions

- How many faces/edges/vertices are there on this 3-D shape?
- What 2-D shapes are needed to create the net of a _____?
- Which two faces of the 3-D shape made from this net will be opposite each other?

Possible sentence stems

- This shape has _____ faces, _____ edges and _____ vertices.
- I know that this net will make a _____ because ...

Single age small step links

- 3-D shapes (Y5)
- Nets of 3-D shapes (Y6)

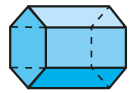
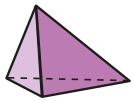
National Curriculum links

- Identify 3-D shapes, including cubes and other cuboids, from 2-D representations (Y5)
- Recognise, describe and build simple 3-D shapes, including making nets (Y6)

3-D shapes

Key learning

- Match the 3-D shapes to their names.

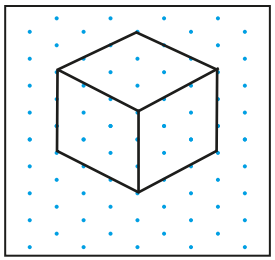
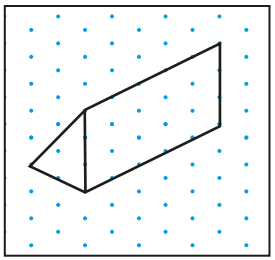
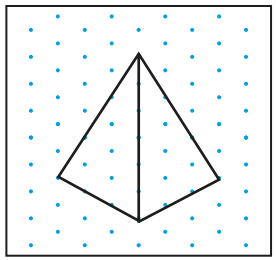
sphere

hexagonal prism

triangular-based pyramid

cone

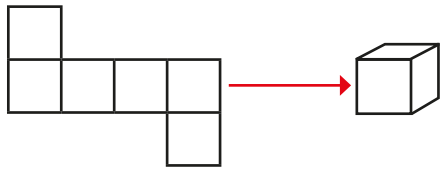
- Here are three 3-D shapes drawn on isometric paper.

What 3-D shapes are they? Is there more than one possible answer?

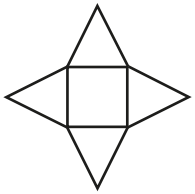
How many faces, edges and vertices does each shape have?

- The net of a cube is made up of six squares.

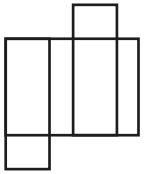


Here are some more nets.

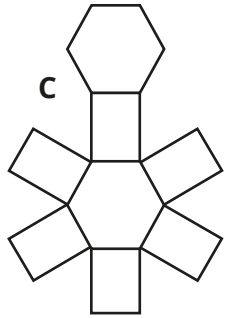
A



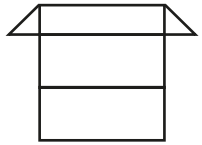
B



C

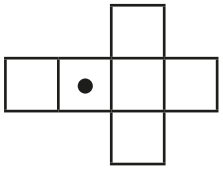
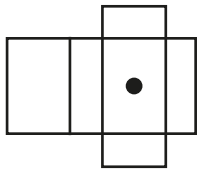
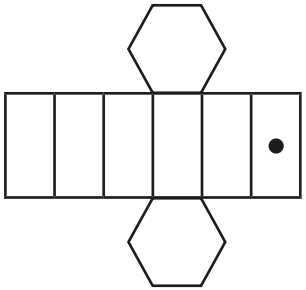


D



  - Which 3-D shapes will the nets make?
  - What 2-D shapes is each net made up of?

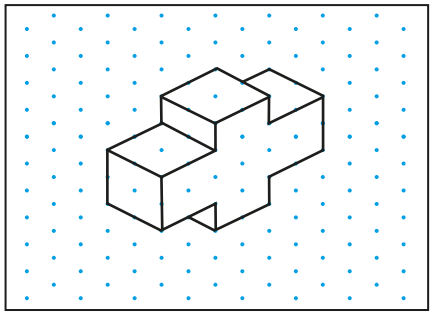
- Draw another dot on each net so that the dots are on opposite faces when the net is folded to make the 3-D shape.

3-D shapes

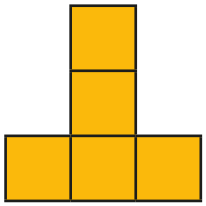
Reasoning and problem solving

How many faces does the shape have?



14

Tiny draws a net that will make a cube.



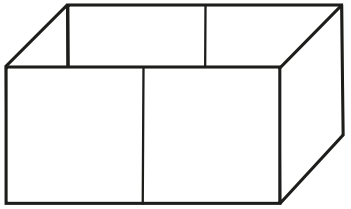
Is Tiny correct?

Explain your answer.

No

A cube has six faces, but the net only has five.

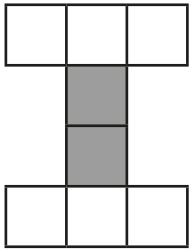
Here is an open box.



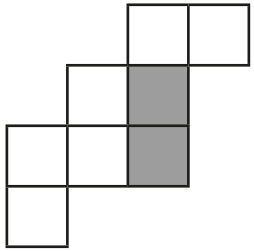
Which nets will fold to make the box?

The grey squares show the base.

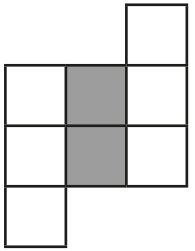
A



B



C



A and C