

Summer Block 1

**Shape**

## Small steps

Step 1

Understand and use degrees

Step 2

Classify angles

Step 3

Estimate angles

Step 4

Measure angles up to  $180^\circ$

Step 5

Draw lines and angles accurately

Step 6

Calculate angles around a point

Step 7

Calculate angles on a straight line

Step 8

Lengths and angles in shapes



## Small steps

Step 9

Regular and irregular polygons

Step 10

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.

This step introduces degrees as a unit of measure for turn, including the degree symbol. Children explore the fact that there are  $360^\circ$  in a full turn, and therefore  $180^\circ$  in half a turn,  $90^\circ$  in a quarter turn (or right angle) and  $270^\circ$  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.

Children may begin to recognise other common angles, such as  $45^\circ$  being half a right angle, but there is no requirement to measure or explore more complex angles, such as  $67^\circ$  or  $241^\circ$ , at this point, as this is covered in later steps.

### 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  $\frac{3}{4}$  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?
- What is a right angle?  
How many right angles are there in a full turn?
- If there are  $360^\circ$  in a full turn, how many degrees are there in a right angle/quarter turn/half turn/three-quarter turn?
- If you are performing a full/half/quarter turn, does it matter if you turn clockwise or anticlockwise?

## Possible sentence stems

- There are \_\_\_\_\_ $^\circ$  in a full turn, so there are \_\_\_\_\_ $^\circ$  in a \_\_\_\_\_ turn.
- There are \_\_\_\_\_ $^\circ$  in a right angle.
- Turning \_\_\_\_\_ $^\circ$  \_\_\_\_\_ is the same as turning \_\_\_\_\_ $^\circ$  \_\_\_\_\_

## National Curriculum links

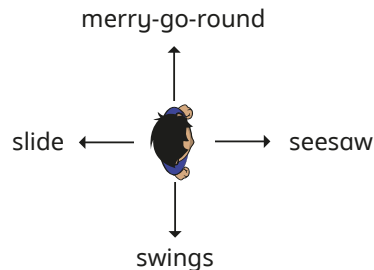
- Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles

# Understand and use degrees

## Key learning

- Amir is facing the seesaw.

He turns  $360^\circ$  and is facing the seesaw again.



Complete the sentences.

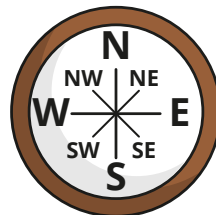
There are  $360^\circ$  in a \_\_\_\_\_ turn.

There are \_\_\_\_\_ $^\circ$  in a half turn.

There are \_\_\_\_\_ $^\circ$  in a quarter turn.

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

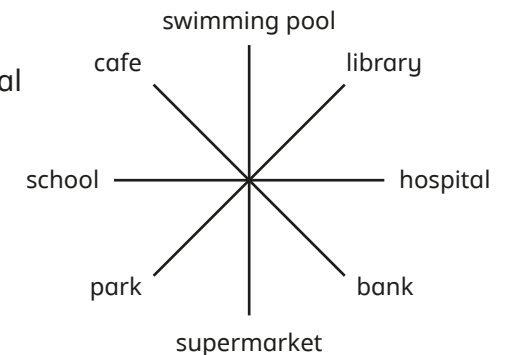
- Work out the angle of each turn in degrees.
  - north to west clockwise
  - north to west anticlockwise
  - east to north clockwise
  - north-west to south-east anticlockwise



- Aisha, Scott, Huan and Dani are standing in the centre.

- ▶ Work out what each child is facing after their turn.

- Aisha is facing the hospital and turns  $90^\circ$  clockwise.
- Scott is facing the supermarket and turns  $270^\circ$  anticlockwise.
- Huan is facing the cafe and turns  $180^\circ$ .
- Dani is facing the library and turns  $360^\circ$ .

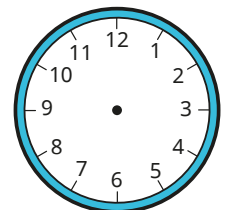


- ▶ Explain why it does not matter whether Huan and Dani turned clockwise or anticlockwise.

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

Use the clock to help you complete the table.

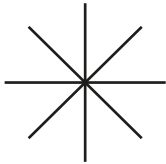
Start time	End time	Degrees
3 o'clock	quarter to 4	
4:10 pm	4:40 pm	
5:30 am		$270^\circ$
	21:05	$90^\circ$



# Understand and use degrees

## Reasoning and problem solving

Use the clues to label the diagram.



- Ron is standing in the middle of his bedroom.
- He is facing his bed.
- He turns  $180^\circ$  and is facing the door.
- He then makes a  $90^\circ$  turn clockwise and is facing his laptop.
- He turns another  $90^\circ$  clockwise, and then makes a  $\frac{3}{4}$  turn anticlockwise. He is now facing the mirror.

Compare diagrams with a partner.

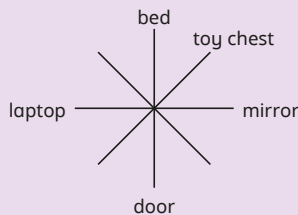


His toy chest is between the bed and the mirror.

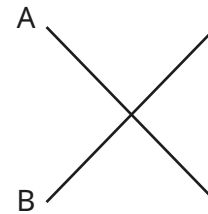
Describe the turn from the bed to the toy chest.



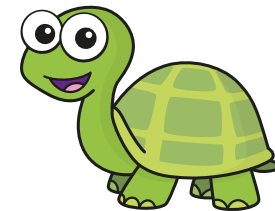
any rotation of:



- 45° clockwise
- or  $\frac{1}{8}$  of a turn clockwise
- or half of a quarter turn clockwise



I cannot describe the turn from A to B because the lines are not horizontal and vertical.



Explain why Tiny is incorrect.

Describe the turn from A to B in two different ways.



$\frac{3}{4}$  turn (or  $270^\circ$ ) turn clockwise

$\frac{1}{4}$  turn (or  $90^\circ$ ) turn anticlockwise

# Classify angles

## Notes and guidance

In this small step, children classify angles using knowledge of right angles from the previous step. In Year 4, children classified angles as acute or obtuse based on whether an angle was less than or greater than a quarter turn (right angle). They begin by revisiting this and are also introduced to reflex angles for the first time.

It is important that children are able to visually classify an angle as acute, obtuse or reflex by comparing them to right angles and straight lines. Use of angle finders, such as the right angle, may provide support. Once secure in this, children can then begin to look at classifying angles numerically. They should be able to state, for example, that  $23^\circ$  is an acute angle because it is less than  $90^\circ$ ,  $134^\circ$  is an obtuse angle because it is greater than  $90^\circ$  but less than  $180^\circ$ , and  $210^\circ$  is a reflex angle because it is greater than  $180^\circ$ .

As well as identifying and classifying angles, children should draw examples of each angle type.

### Things to look out for

- Children may find it more challenging to classify angles that are close to  $90^\circ$  or  $180^\circ$ .
- Children may need to turn the paper to help classify angles that are not presented horizontally or vertically.

## Key questions

- What does a right angle look like?
- What does the angle on a straight line look like?
- How many degrees are there in a right angle/on a straight line?
- Is the drawn angle less than or greater than a right angle?
- What does “acute”/“obtuse” mean?
- Can an angle be greater than  $180^\circ$ ? What do you call an angle such as this?
- If an angle is \_\_\_\_\_ degrees, what type of angle is it?

## Possible sentence stems

- Angles less than \_\_\_\_\_ $^\circ$  are called \_\_\_\_\_ angles.
- Angles greater than \_\_\_\_\_ $^\circ$  but less than \_\_\_\_\_ $^\circ$  are called \_\_\_\_\_ angles.
- Angles greater than \_\_\_\_\_ $^\circ$  are called \_\_\_\_\_ angles.

## National Curriculum links

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

# Classify angles

## Key learning

- Here is a right angle and a straight line.

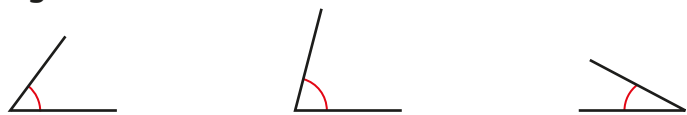


How many degrees are there in a right angle?

How many degrees are there on a straight line?

- 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

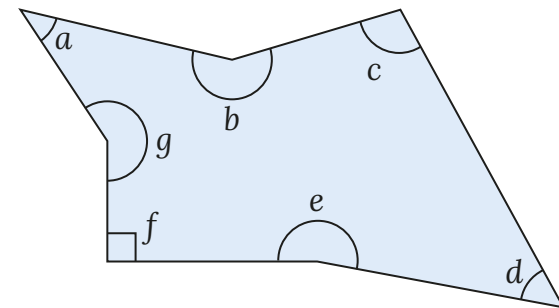


Reflex angles are greater than \_\_\_\_\_°.

- 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.



- Sort the angles into acute, obtuse and reflex.

23°	123°	91°	359°	99°
190°	19°	181°	89°	165°

- Draw a triangle and a quadrilateral.

For each shape, label the angles as acute, obtuse, reflex or right angle.

Compare diagrams with a partner.



# Classify angles

## Reasoning and problem solving

Angle  $a$  is the smallest and angle  $c$  is the greatest.

**Sam**

Angle  $x$  is the smallest and angle  $z$  is the greatest.

**Jack**

Do you agree with Sam and Jack?  
Explain your reasoning.

No

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

Two acute angles added together make an obtuse angle.

Two obtuse angles added together make a reflex angle.

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

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

Draw examples to support your answers.

sometimes true  
 always true  
 sometimes true  
 sometimes true

# Estimate angles

## Notes and guidance

In this small step, children estimate the sizes of angles based on knowledge of what right angles and angles on a straight line look like and measure in degrees.

Children should already be able to look at an angle and identify whether it is acute, obtuse or reflex, and they now progress to estimating the size of the angle. To begin with, it is important to explore the idea of halfway between already known angles, for example  $45^\circ$  is half of a right angle and  $135^\circ$  is halfway between a right angle and a straight line. From here, children can start to estimate given angles by comparing them to these key amounts. For example  $80^\circ$  is greater than half a right angle but less than a right angle and is closer to  $90^\circ$  than  $45^\circ$ . As well as estimating the sizes of given angles, children start to draw angles approximately of a given size.

### Things to look out for

- Children may find angles that are not given in standard orientations more difficult to estimate.
- Children may want to find exact measurements rather than estimates, and may need support to realise that different answers are acceptable.

## Key questions

- What does a right angle/straight line look like?
- How many degrees are there in a right angle/on a straight line?
- What angle is halfway between  $0^\circ$  and  $90^\circ/90^\circ$  and  $180^\circ$ ?
- Is the angle acute, obtuse or reflex? How do you know?
- Is the angle closer to  $0^\circ$  or  $90^\circ/90^\circ$  or  $180^\circ$ ?
- Is the angle closer to  $45^\circ$  or  $90^\circ/90^\circ$  or  $135^\circ$ ?

## Possible sentence stems

- Angles less than \_\_\_\_\_ $^\circ$  are called \_\_\_\_\_ angles.
- Angles greater than \_\_\_\_\_ $^\circ$  but less than \_\_\_\_\_ $^\circ$  are called \_\_\_\_\_ angles.
- Angles greater than \_\_\_\_\_ $^\circ$  are called \_\_\_\_\_ angles.
- The angle is a \_\_\_\_\_ angle, so it must be ...
- The angle is closer to \_\_\_\_\_ than \_\_\_\_\_, so it could be \_\_\_\_\_ $^\circ$ .

## National Curriculum links

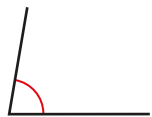
- Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles

# Estimate angles

## Key learning

- Which is the most appropriate estimate for the size of each angle?

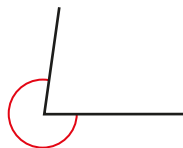
Explain your reasons to a partner.



80° or 110°



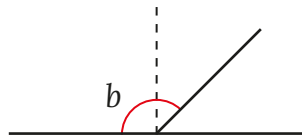
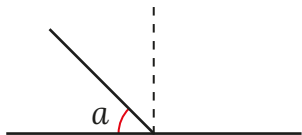
165° or 185°



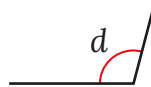
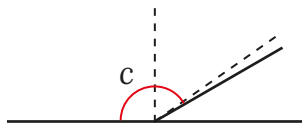
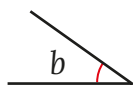
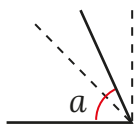
249° or 278°

- The diagonal lines cut the right angles in half.

What are the sizes of angles  $a$  and  $b$ ?



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



150°

35°

89°

65°

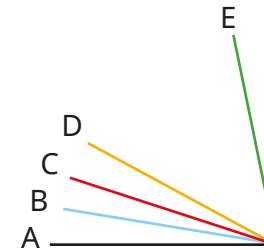
105°

170°

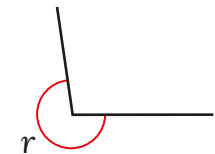
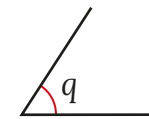
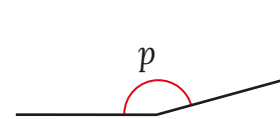
95°

Compare answers with a partner.

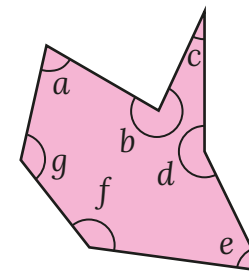
- Estimate the size of the angle formed by each line from line A.



- Estimate the sizes of the angles.



- Estimate the size of each angle in the shape.



- Draw angles that are approximately of each size.

40°

85°

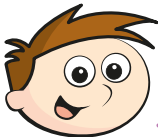
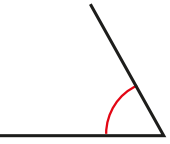
110°

165°

240°

# Estimate angles

## Reasoning and problem solving



The angle is approximately 60

What mistake has Teddy made?

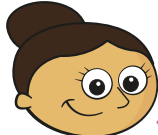
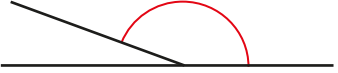
Teddy has forgotten to give the unit of measure: degrees or °.

Use the clues to draw an approximate diagram of the angle described.

- The angle is obtuse.
- The size of the angle is a cube number.





angle of approximately 125°

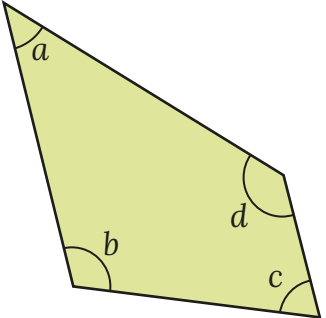



The angle is approximately 10°.

Do you agree with Dora?  
Explain your reasons.




No



Is the statement true or false?

angle  $a$  + angle  $b$  > angle  $c$  + angle  $d$

Use estimates to explain your answer.



False

approximate sizes of angles are:  
 $a = 45^\circ$ ,  $b = 110^\circ$ ,  
 $c = 70^\circ$ ,  $d = 135^\circ$

$45 + 110 < 70 + 135$

# Measure angles up to $180^\circ$

## Notes and guidance

In this small step, children use a protractor to measure angles up to  $180^\circ$ .

It is important to begin by recapping the concept of estimating angles. Children then read the sizes of angles, where a protractor is shown over the top of the angle, so they know that the protractor is already in the correct position.

Children should then be given protractors to position 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 to determine what size the angle is. Children count up from the zero line to get to the correct angle. By estimating the size of the angle before measuring, they are less likely to read the wrong scale.

For this step, children do not measure angles greater than  $180^\circ$ .

### Things to look out for

- Children may place the protractor in the incorrect place.
- Children may read the incorrect scale on the protractor.

## Key questions

- What is an angle?
- What unit do you use to measure an angle?
- What can you use to measure the size of an angle?
- How can you tell the difference between an acute angle and an obtuse angle?
- Where should you put the protractor when measuring an angle?
- Which scale will you use when reading the protractor?
- How does moving the paper help you to measure some angles?

## Possible sentence stems

- The angle is less than \_\_\_\_\_ $^\circ$ , so it is an \_\_\_\_\_ angle.
- The angle is greater than \_\_\_\_\_ $^\circ$ , so it is an \_\_\_\_\_ angle.
- The angle is an \_\_\_\_\_ angle, so the number of degrees must be more/less than \_\_\_\_\_

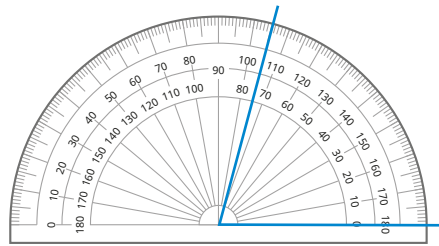
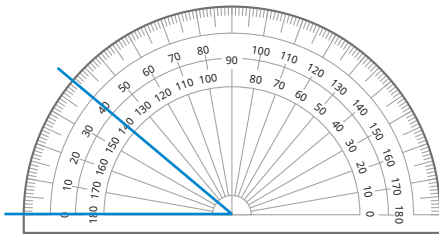
### National Curriculum links

- Draw given angles, and measure them in degrees ( $^\circ$ )

# Measure angles up to 180°

## Key learning

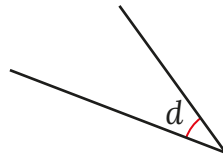
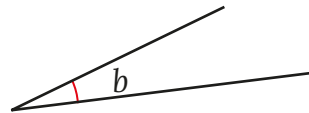
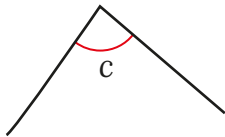
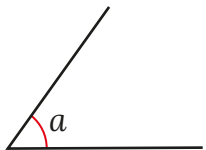
- Is each angle acute or obtuse?



What is the size of each angle?

What is the same and what is different about the angles?

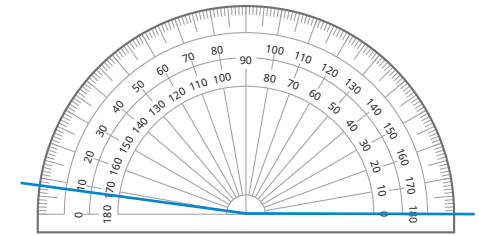
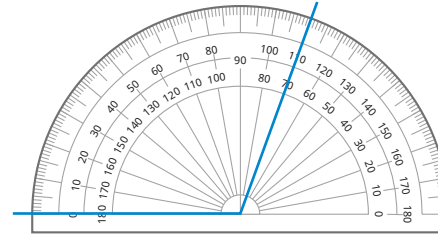
- Is each angle acute or obtuse?  
Estimate the size of each angle.



Measure each angle with a protractor.

How close were your estimates to the actual measurements?

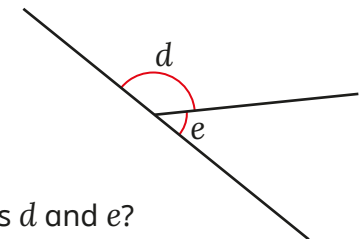
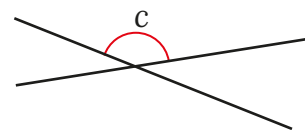
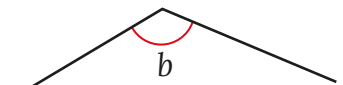
- Is each angle acute or obtuse?



What is the size of each angle?

What is the same and what is different about the angles?


- Is each angle acute or obtuse?  
Estimate the sizes of the angles.  
Then measure them with a protractor.



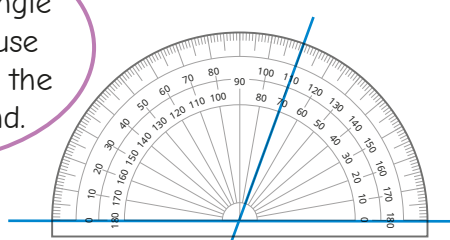
What do you notice about angles *d* and *e*?


# Measure angles up to $180^\circ$

## Reasoning and problem solving

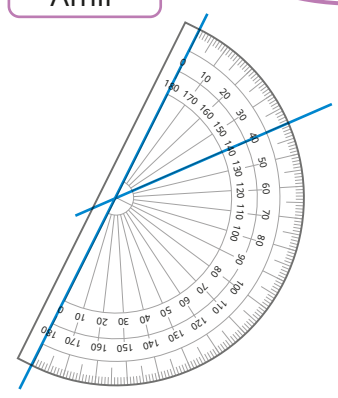
 I have measured the angle correctly, because my protractor is the right way round.

**Amir**



 I have measured the angle correctly, because my protractor is on the line accurately.

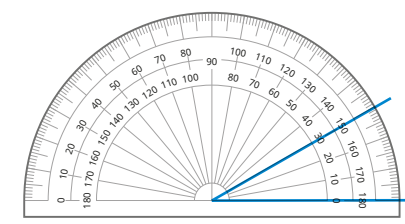
**Whitney**

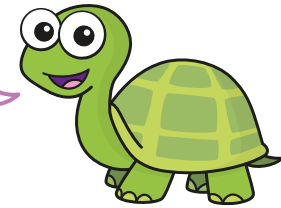


Who do you agree with?  
Explain your answer.

They are both correct.

Tiny is measuring angles.



 The angle is  $150^\circ$ .

Do you agree with Tiny?  
Explain your answer.

What steps for measuring an angle has Tiny done correctly?  
What steps has Tiny got wrong?

No  
Tiny has used the wrong scale.  
The angle is  $30^\circ$ , not  $150^\circ$ .

# Draw lines and angles accurately

## Notes and guidance

In this small step, children draw lines and angles accurately and use what they have learnt about shapes to construct shapes.

Children begin by drawing straight lines of given lengths, in both centimetres and millimetres. Ensure that children are measuring using the correct scale, for example centimetres, not inches.

Model 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. Encourage children to label any angles that they draw. Once comfortable with drawing given lines and angles, they can explore drawing whole shapes accurately from a given description.

This step is a good opportunity to revisit the properties of different triangles and quadrilaterals.

### Things to look out for

- When using a ruler, children may start their line at the edge rather than at zero on the scale.
- Children may use the wrong scale on the ruler.
- Children may use the wrong scale on the protractor.

## Key questions

- What are the steps to draw a straight line of a given length with a ruler?
- Are you drawing the line in millimetres, centimetres or inches?
- How can you use a protractor to draw a given angle accurately?
- Where on the line should you place the protractor?
- Is the angle you want to draw acute or obtuse?
- Which scale on the protractor should you use? Why?
- How can you accurately draw a polygon if you know the measurements?
- What are the features of a rhombus/isosceles triangle?

## Possible sentence stems

- When drawing an angle of \_\_\_\_\_ degrees, I know it will be greater/smaller than a right angle, so I will use the inner/outer scale.

### National Curriculum links

- Draw given angles, and measure them in degrees (°)



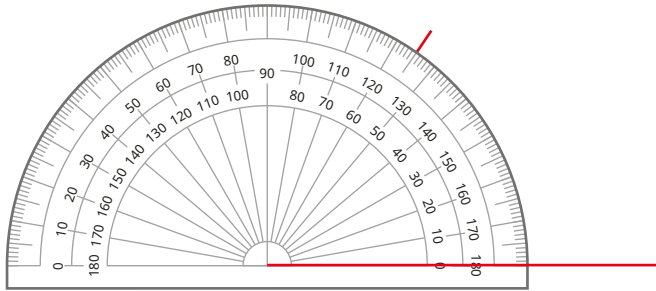
# Draw lines and angles accurately

## Key learning

- Use a ruler to accurately draw the lines.



- Aisha is asked to draw an angle. She draws a horizontal line, then puts the protractor on the line. She then makes a mark.



What size angle is Aisha drawing?

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

Draw a horizontal line for each one.



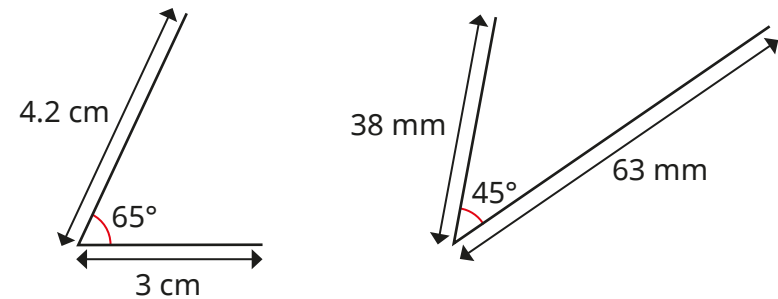
- Accurately draw and label a square that has a perimeter of 22 cm.

- Draw a straight line and label the ends A and B.

Draw an angle of  $140^\circ$  from point A.

Draw an angle of  $40^\circ$  from point B.

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

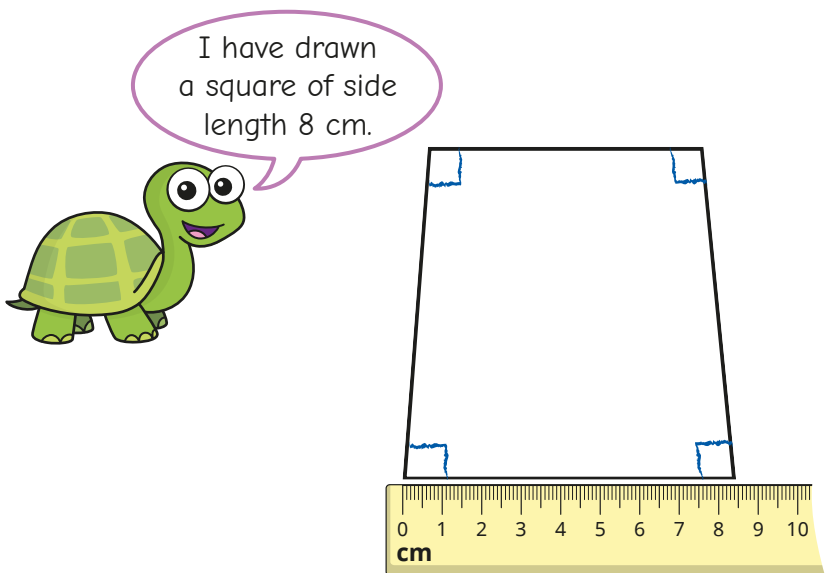


- Use a ruler and protractor to accurately draw and label:
  - an angle of  $50^\circ$  with the arms of the angle 50 mm long
  - an isosceles triangle that has a base of 4 cm and angles of  $70^\circ$
  - a rhombus with sides of 35 mm, one pair of  $50^\circ$  angles and one pair of  $130^\circ$  angles

# Draw lines and angles accurately

## Reasoning and problem solving

I have drawn a square of side length 8 cm.



What mistakes has Tiny made?

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

All angles should be  $90^\circ$  and all lengths should be exactly 8 cm.

Mo and Kim are drawing an angle of  $200^\circ$ .

I am going to draw a straight line, then measure and draw  $20^\circ$  from one end of the line.

Mo

I am going to measure and draw an angle of  $160^\circ$ .

Kim

Talk to a partner about how both strategies will create an angle of  $200^\circ$ .

Use both strategies to draw an angle of  $200^\circ$ .

accurately drawn diagrams of  $200^\circ$  angles

# Calculate angles around a point

## Notes and guidance

In this small step, children move on to calculating angles based on given information, rather than always using a protractor to measure angles. When looking at drawings of angles, distinguish between those that are and are not to scale, and discuss why a protractor is or is not useful in that context.

Recap prior learning that a full turn is  $360^\circ$  and model this with a child turning through  $360^\circ$ . Children use a protractor to measure angles around a point to see that they add up to  $360^\circ$ . Any slight differences will be due to human error and should be discussed. Children then calculate missing angles using the knowledge that all the angles sum to  $360^\circ$ . They can either subtract each known angle from the total of  $360^\circ$ , or add the known angles first and then subtract this total from  $360^\circ$ . Children should also 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 a missing 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

- What is a full turn?
- How many right angles are there in a full turn?
- How many degrees are there in a full turn?
- If you know three out of four angles around a point, how can you work out the fourth angle?
- Do you need to add or subtract to find the unknown angle? How do you know?
- If all the angles around a point are equal in size, how can you work out the size of each one?

## Possible sentence stems

- A full turn is \_\_\_\_\_ degrees and is made up of \_\_\_\_\_ right angles.
- Angles around a point sum to \_\_\_\_\_ $^\circ$ .
- The missing angle is \_\_\_\_\_ $^\circ$  subtract the total of \_\_\_\_\_ $^\circ$ , \_\_\_\_\_ $^\circ$  and \_\_\_\_\_ $^\circ$ .

## National Curriculum links

- Identify angles at a point and 1 whole turn (total  $360^\circ$ )

# Calculate angles around a point

## Key learning

- Eva faces in one direction.

She then does a complete turn and ends up facing the same direction.

- ▶ Discuss with a partner how many right angles Eva has turned.

- ▶ Complete the sentences.

1 complete turn = \_\_\_\_\_ right angles = \_\_\_\_\_°

$\frac{1}{2}$  of a complete turn = \_\_\_\_\_ right angles = \_\_\_\_\_°

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

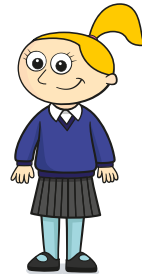
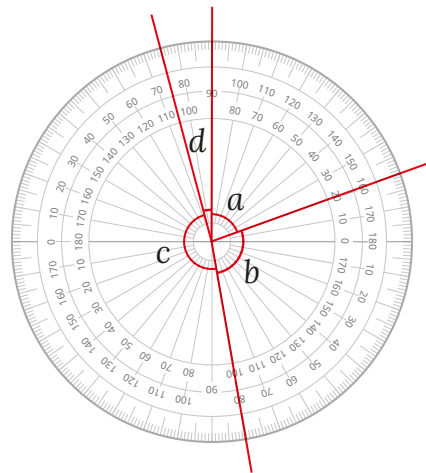
$\frac{3}{4}$  of a complete turn = \_\_\_\_\_ right angles = \_\_\_\_\_°

- Measure the angles.

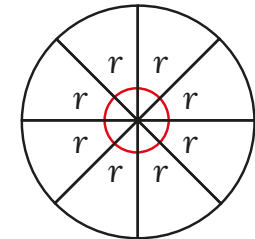
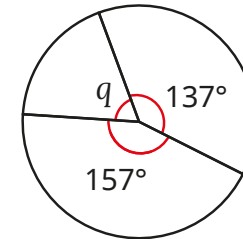
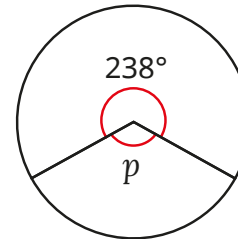
$a = \text{_____}^\circ$        $b = \text{_____}^\circ$

$c = \text{_____}^\circ$        $d = \text{_____}^\circ$

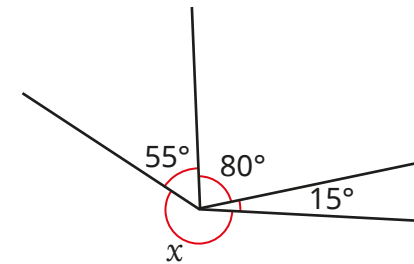
The sum of all four angles = \_\_\_\_\_°



- Work out the missing angles.



- Use the fact that angles around a point add up to 360° to work out the size of the angle marked x.

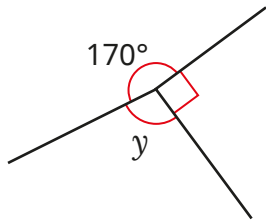


Compare methods with a partner.

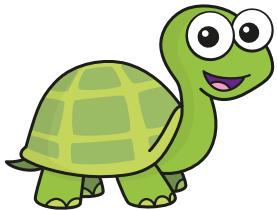
- There are three angles around a point.  
Angle  $a$  is half the size of angle  $b$ .  
Angle  $c$  is the same size as the total of angles  $a$  and  $b$ .  
What are the sizes of angles  $a$ ,  $b$  and  $c$ ?

# Calculate angles around a point

## Reasoning and problem solving



The angles around a point add up to  $360^\circ$ , so the missing angle  $y$  must be  $190^\circ$ , because  $360 - 170 = 190$



Do you agree with Tiny?  
Explain your answer.

No

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

If three of the angles around a point are right angles, any remaining angles will be acute.

If there are only three angles around a point, they must all be obtuse.

If there are only five equal angles around a point, they will all be acute.

If there are four angles around a point, they could all be acute.

Give reasons for your answers.

sometimes true  
sometimes true  
always true  
never true

# 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  $180^\circ$ . Looking at a protractor will reinforce this point, as children will see that the  $0^\circ$  to  $180^\circ$  line is a straight line.

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

Finally, children use division to work out equal angles knowing that the total is  $180^\circ$ , for example five equal angles on a straight line will all be  $36^\circ$ , because  $180 \div 5 = 36$

## Things to look out for

- Children may use a protractor to measure missing angles, rather than calculating from the given information.
- Children may confuse this step with the previous one and think that  $360^\circ$  is the whole rather than  $180^\circ$ .

## Key questions

- How many right angles are there in a half turn?
- How many degrees are there in a half turn?
- How can you work out a missing angle on a straight line if you know the size of the other angle/angles?
- What strategies can you use to work out missing angles?
- Do you need to add or subtract to find the unknown angle? Why?
- If there is more than one missing angle but they are equal, how can division help you to work them out?

## Possible sentence stems

- Angles on a straight line sum to \_\_\_\_\_ $^\circ$ .
- The missing angle is \_\_\_\_\_ $^\circ$  subtract \_\_\_\_\_ $^\circ$ , \_\_\_\_\_ $^\circ$  and \_\_\_\_\_ $^\circ$ .

## National Curriculum links

- Identify: angles at a point and 1 whole turn (total  $360^\circ$ ); angles at a point on a straight line and half a turn (total  $180^\circ$ )

# Calculate angles on a straight line

## Key learning

- Jack faces in one direction.

He then turns around to face the opposite direction.

- ▶ How many right angles has Jack turned?

- ▶ Complete the sentences.

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

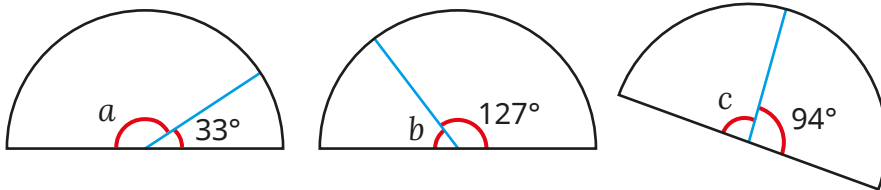
There are \_\_\_\_\_ right angles in a straight line.

1 half turn = \_\_\_\_\_ right angles = \_\_\_\_\_°

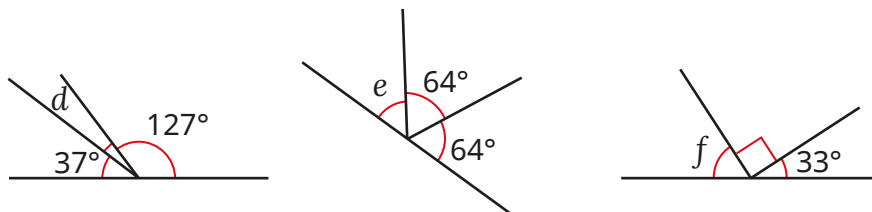
There are \_\_\_\_\_° in a straight line.



- Work out the missing angles.

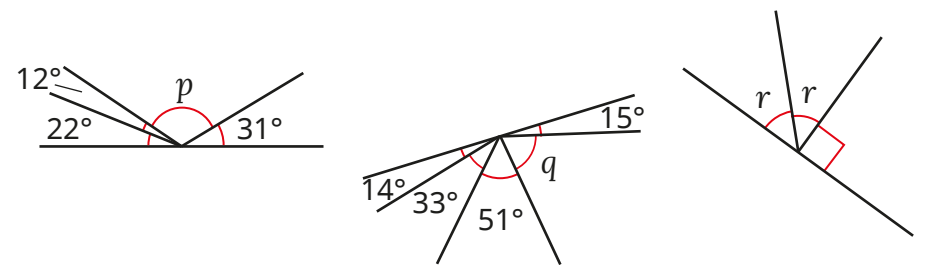


- Work out the missing angles.

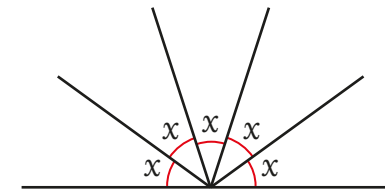


Is there more than one way to work out each angle?

- Work out the missing angles.



- The five angles are on a straight line.



Work out the size of each angle.

- There are three angles on a straight line.

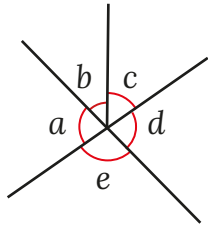
Angle *a* is half the size of angle *b*.

Angle *c* is the same size as the total of angles *a* and *b*.

Work out the sizes of the angles.

# Calculate angles on a straight line

## Reasoning and problem solving



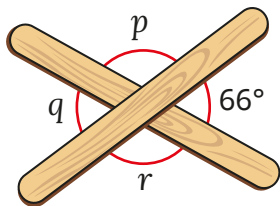
$$a + b + c + d + e = 360^\circ$$

$$d + e = 180^\circ$$

Write some number sentences about this diagram.

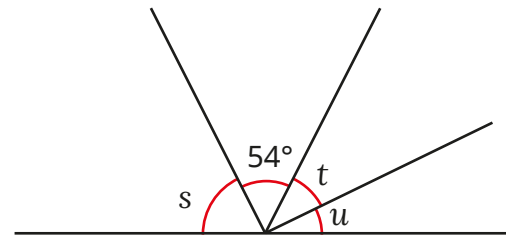
multiple possible answers, e.g.  
 $a + b + c = d + e$   
 $360^\circ - e - d = 180^\circ$

Two lolly sticks are on a table.  
 Work out the three missing angles.



$p = 114^\circ$   
 $q = 66^\circ$   
 $r = 114^\circ$

The angles are on a straight line.



- Angle  $s$  is  $9^\circ$  greater than the size of the given angle.
- Angle  $t$  is  $11^\circ$  greater than angle  $u$ .

Work out the sizes of the angles.

Create your own straight-line problem for a partner.

$s = 63^\circ$   
 $t = 37^\circ$   
 $u = 26^\circ$



# Lengths and angles in shapes

## Notes and guidance

In this small step, children explore different strategies for calculating missing lengths and angles in shapes.

Start by recapping what perimeter is and how to calculate it, so that children can use this to work out missing lengths. Once children are confident at calculating the perimeter of a rectangle, move on to the perimeter of compound shapes composed of multiple rectangles. Encourage them to explore the fact that the area is multiplied by the number of rectangles used, but the same relationship is not true for the perimeter.

Using what they have learnt in previous steps, children can work out missing angles within shapes, both on a straight line and around a point. The rule that angles in a triangle sum to  $180^\circ$  is not covered formally until Year 6

### Things to look out for

- Children may use a ruler or a protractor to measure a length or an angle, rather than calculating from the given information.
- Children may assume that angles that look similar are equal in size.

## Key questions

- What is the perimeter of the shape?
- If two of these shapes are joined together, does the perimeter double?
- What is the perimeter of the compound shape?
- If you know the size of angle  $x$  in the shape, how can you work out the sizes of other angles in the shape?
- If the perimeter of the shape is \_\_\_\_\_, what is the length of the line marked \_\_\_\_\_?

## Possible sentence stems

- Angles on a straight line sum to \_\_\_\_\_ $^\circ$ .
- Angles around a point sum to \_\_\_\_\_ $^\circ$ .
- If the perimeter is \_\_\_\_\_ cm and the sides I know sum to \_\_\_\_\_ cm, then the missing side is \_\_\_\_\_ cm.

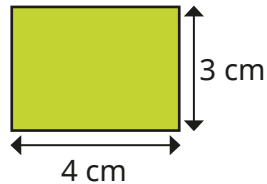
## National Curriculum links

- Identify: angles at a point and 1 whole turn (total  $360^\circ$ ); angles at a point on a straight line and half a turn (total  $180^\circ$ )
- Use the properties of rectangles to deduce related facts and find missing lengths and angles

# Lengths and angles in shapes

## Key learning

- A rectangle measures 4 cm by 3 cm.



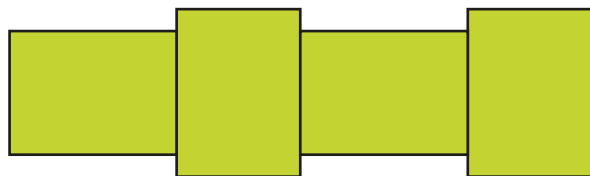
- ▶ Calculate the area and perimeter of the rectangle.

This compound shape is made from three of the rectangles.



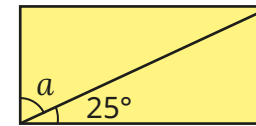
- ▶ Calculate the area and perimeter of the compound shape.
- ▶ What do you notice about the changes in area and perimeter from the first shape to the second? Why do you think this is?

This compound shape is made from four of the rectangles.



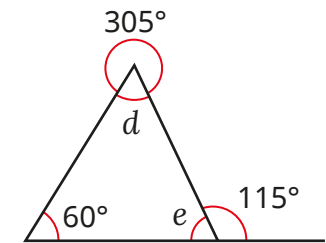
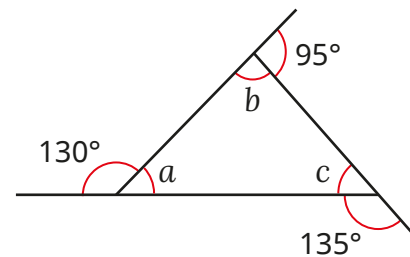
- ▶ Calculate the area and perimeter of the compound shape.
- Which was easier to work out?

- A rectangle has been split into two triangles.



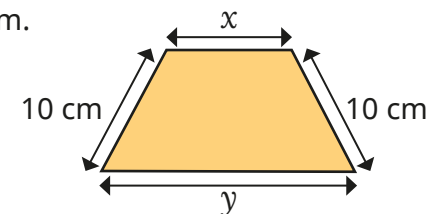
- ▶ Work out the size of angle  $a$ .
- ▶ What other missing angles can you calculate in the rectangle?

- Work out the angles in the triangles.



What do you notice about the angles of each triangle?

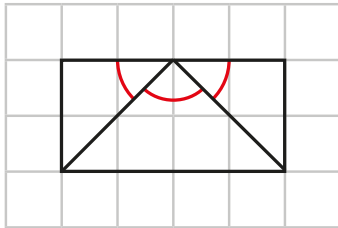
- The perimeter of the trapezium is 44 cm.
- Side  $y$  is twice the length of side  $x$ .
- Calculate the length of side  $y$ .



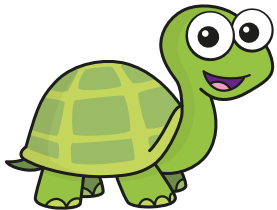
# Lengths and angles in shapes

## Reasoning and problem solving

Tiny is working out angles.



The missing angles are all  $60^\circ$ , because  $180 \div 3 = 60$

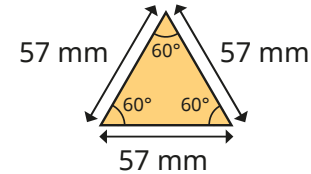


Do you agree with Tiny?  
Explain your answer.

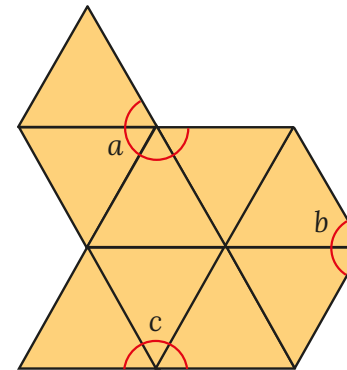


No

The lengths and interior angles of a triangular sticker are shown.



Some of these stickers are used to make this compound shape.



Work out the perimeter of the compound shape.

Work out the sizes of the angles marked with letters.

513 mm

$a = 240^\circ$

$b = 120^\circ$

$c = 180^\circ$

# Regular and irregular polygons

## Notes and guidance

In this small step, children explore regular and irregular 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. Show examples and non-examples of polygons to help with this understanding.

Move on to 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. Ensure that children understand that equal sides are indicated by hatch marks.

Once children are confident at identifying regular and irregular polygons, ask them to calculate the perimeter of regular shapes when given the length of one side. They may also explore finding the length of each side of a regular polygon when given the perimeter.

## Things to look out for

- Children may not identify polygons correctly.
- Children may think that a polygon with equal angles but different length sides, or with equal length sides and different angles, is regular.

## Key questions

- What is a polygon?
- What are the features of a polygon?
- Can a polygon have a curved side?
- How can you measure the perimeter of a polygon?
- What is a regular polygon?
- Is a shape with all equal sides always a regular polygon?
- How do you know that the shape is regular/irregular?

## Possible sentence stems

- In a regular polygon, all angles are \_\_\_\_\_ and all sides are \_\_\_\_\_
- In a regular polygon, if one side is \_\_\_\_\_ then the perimeter can be found by ...

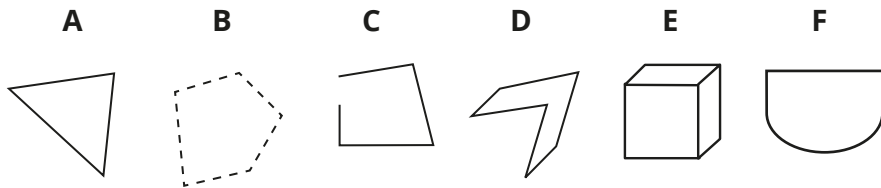
## National Curriculum links

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

# Regular and irregular polygons

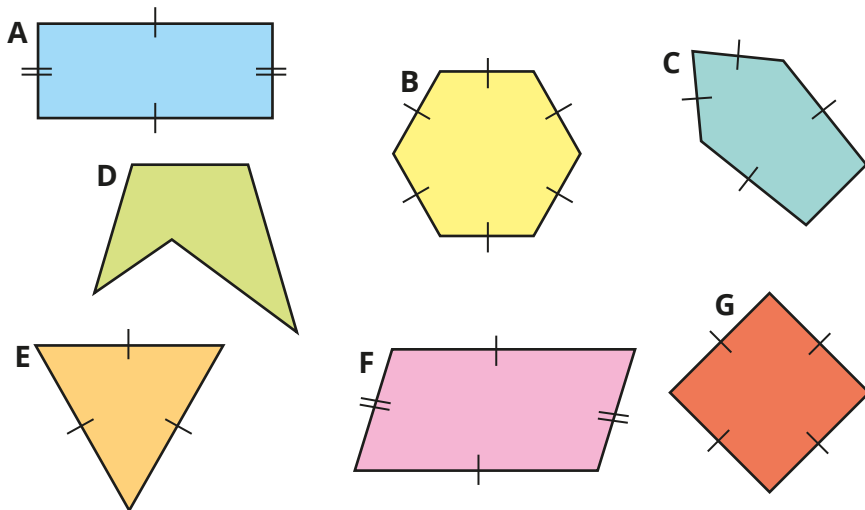
## Key learning

- Which of the shapes are polygons?



How do you know?

- In a regular polygon, all angles are equal and all sides are equal. Sort the shapes into regular and irregular polygons.



- Draw a regular polygon and an irregular polygon. Compare shapes with a partner. What is the same and what is different about your two shapes?
- Brett draws a regular triangle. Each side is 6 cm. What is the perimeter of Brett's triangle?
- Nijah draws a regular hexagon. Each side is 12 cm. What is the perimeter of Nijah's hexagon?
- Teddy draws a shape with four straight lines. There are four right angles in Teddy's shape. Is Teddy's shape regular, irregular or is it impossible to tell? Explain your answer.
- The perimeter of a regular pentagon is 60 mm. What is the length of each side?

# Regular and irregular polygons

## Reasoning and problem solving

5 cm

5 cm

5 cm

5 cm

5 cm

This shape is regular, because all the sides are the same length.

Do you agree with Tiny?  
Explain your answer.

No

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

A regular polygon has equal sides, but not equal angles.

A triangle is a regular polygon.

A rhombus is a regular polygon.

In any polygon, the number of angles is the same as the number of sides.

Explain your answers.

never true  
sometimes true  
sometimes true  
always true

# 3-D shapes

## Notes and guidance

In this small step, children start by recapping the names of 3-D shapes, and then move on to their properties. Seeing models of 3-D shapes will help to remind children of the differences between faces, edges and vertices. Identifying the 2-D shapes on the faces of the 3-D shapes allows children to compare shapes and will provide a basis for their learning of nets in Year 6

Children also 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.

Finally, children look at drawings of compound 3-D shapes made up of two or three simple 3-D shapes and identify which 3-D shapes were used to make the shape.

## 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

- What is the mathematical name for this 3-D shape?
- How many faces/edges/vertices are there on this 3-D shape?
- What 3-D shape is shown by this 2-D representation?
- How can you tell how many faces/edges/vertices there are on this 3-D shape when they are not all visible?
- What 2-D shapes can you see on the faces of the 3-D shape?
- What 3-D shapes is this compound shape made up of?

## Possible sentence stems

- This shape has \_\_\_\_\_ faces, \_\_\_\_\_ edges and \_\_\_\_\_ vertices.
- This shape is made up of a \_\_\_\_\_ and a \_\_\_\_\_

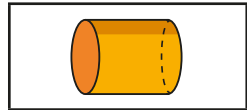
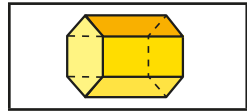
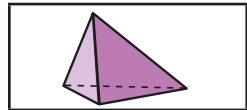
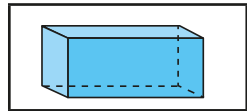
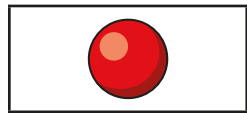
## National Curriculum links

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

# 3-D shapes

## Key learning

- Match the 3-D shapes to their names.



cuboid

triangular-based pyramid

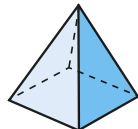
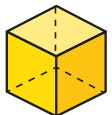
cone

sphere

hexagonal prism

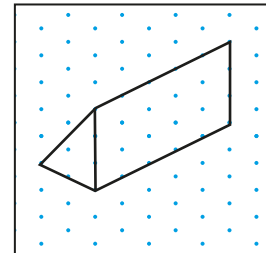
cylinder

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

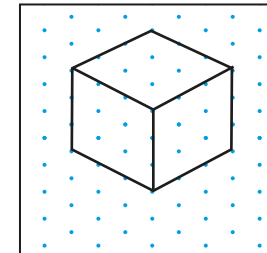


- Sam, Tommy and Ron have each drawn a 3-D shape on isometric paper.

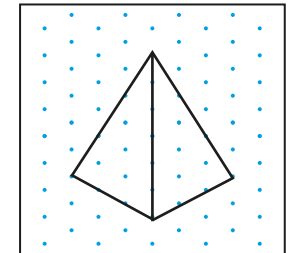
Sam



Tommy



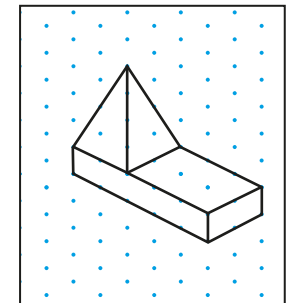
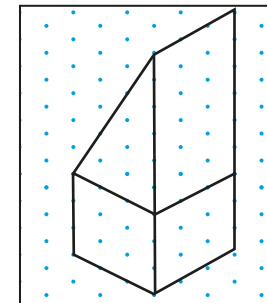
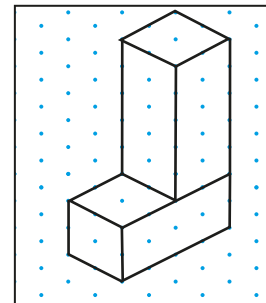
Ron



What 3-D shapes have they drawn? Is there more than one answer?

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

- Alex draws compound shapes made from other 3-D shapes.



What shapes has Alex used?

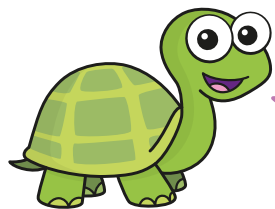
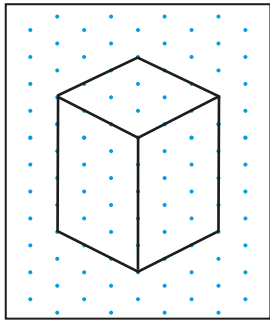
How many faces are there on each of Alex's shapes?



# 3-D shapes

## Reasoning and problem solving

Huan has drawn this shape on isometric paper.



Huan has drawn a cube.

Do you agree with Tiny?  
Explain your answer.

No

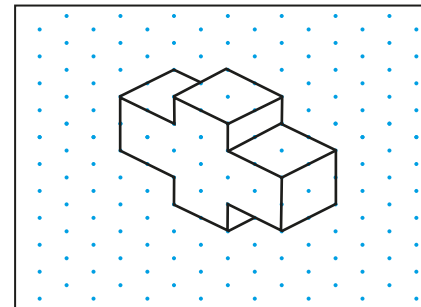
A cube has 6 faces and 12 edges. This means any 3-D shape has twice as many edges as faces.



Do you agree with Ron?  
Explain your answer.

No

How many faces does the shape have?



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