

Unit 13

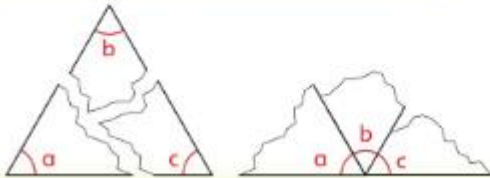
Geometry – properties of shapes



In this unit we will ...

- ✦ Measure angles and draw shapes accurately using a ruler and protractor
- ✦ Calculate unknown angles in shapes and on lines using angle facts
- ✦ Explore properties of polygons and circles
- ✦ Identify 3D shapes from 2D representations
- ✦ Draw multiple nets for a 3D shape

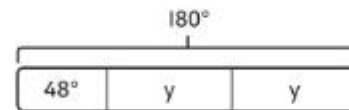
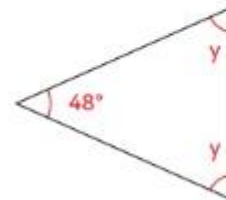
How can you use your knowledge of angles on a straight line to work out what the interior angles of a triangle add up to?



We will need some maths words. Which ones do you recognise? What do they mean?

degree angle obtuse acute reflex
right angle protractor triangle isosceles
equilateral scalene regular polygon quadrilateral
parallelogram kite rhombus trapezium diameter
radius circumference concentric perimeter
net pyramid tetrahedron cylinder prism
vertically opposite angles cuboid cube

We also need to be able to use bar models to calculate unknown angles. How can you work out the size of this angle without measuring?



Home learners – check out <https://whiterosemaths.com/homelearning/year-6/> Week 2 (not summer term) **Lesson 3 Measure with a protractor** for extra guidance

Measuring with a protractor

Discover



I measured these angles: 50° , 45° and 110° .



Jamilla

- 1 a) Match the angles to Jamilla's measurements.
- b) Max measured the angles and his measurements were 130° , 70° and 135° .
What mistake did he make?

Share

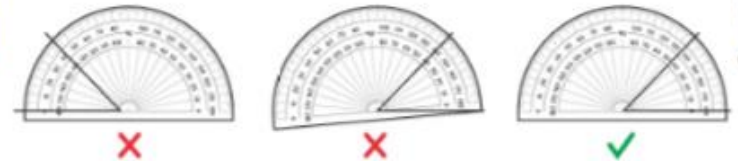
a)

I can see angle B is obtuse so this might be 110° .

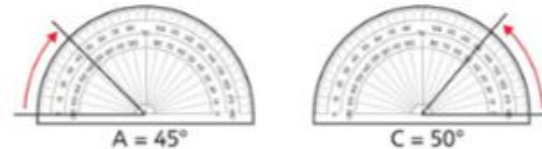
I will measure the other two angles using a protractor.



Step 1: Line up the base line and the crosshairs.



Step 2: Read the correct scale by following the turn.



- b) Max has read the wrong scale. He started from the wrong side.

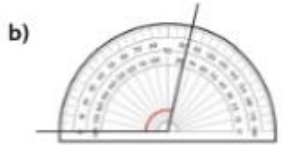


There are two scales on a protractor, to read angles that turn different ways.

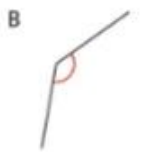
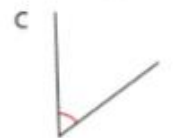
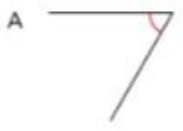


Think together

1 Complete the measurements below.



2 Rearrange these angles in order of size, starting with the smallest.

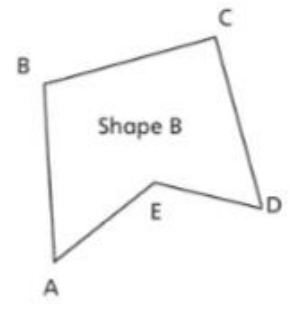
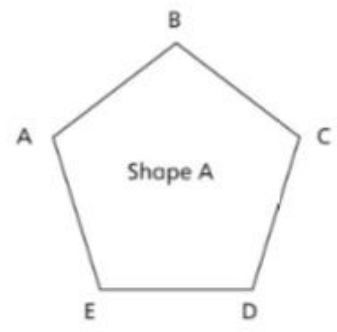


First, I will sort them into types of angle.

I will turn the page to help me place the protractor accurately.



3 Measure all of the interior angles of these shapes.



I think one is a regular shape. I will check by measuring.



I wonder how to measure the angle at vertex E. First I will decide which is the interior angle.



Drawing shapes accurately

Discover



I am going to make a logo.

Logo Design

Step 1:
Draw a 12 cm square.

Step 2:
Join the midpoints of each side.

Step 3:
Repeat step 2 twice.

- 1 a) Complete step 1 on blank paper.
- b) Complete steps 2 and 3. Measure the new lengths of each shape you draw.

Share

I am going to use a ruler, a protractor and a sharp pencil.

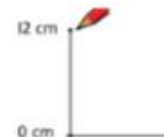
a) i) Draw 12 cm precisely.



ii) Mark the 90° angle.



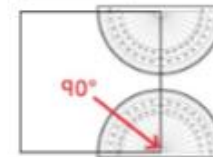
iii) Join the two dots and extend the line.



iv) Mark the next 90° angle.

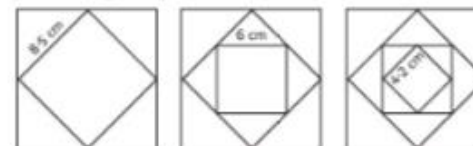


v) Continue until you have drawn all the sides.



The square should have four right angles and all sides should measure 12 cm. Remember to check the final angle is correct.

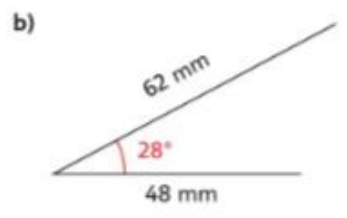
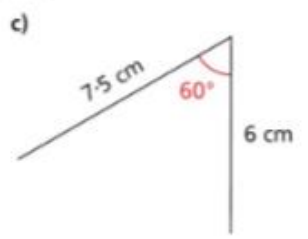
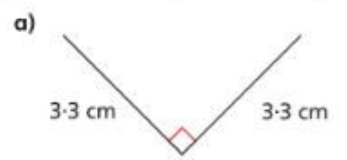
b) Each new shape should form a square, with the following measurements.



Discuss with your carer and then complete the lesson in your book 6C p9

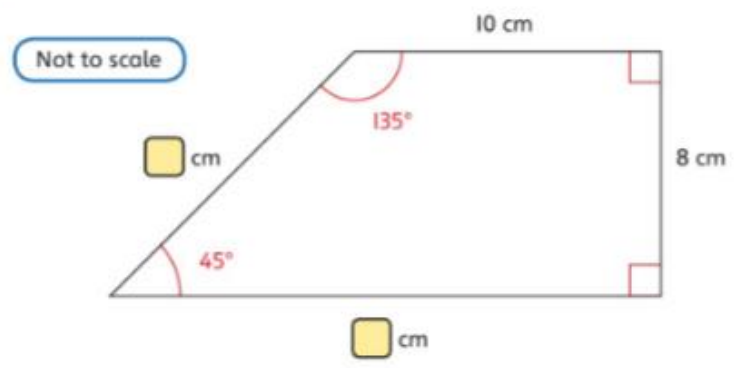
Think together

1 Draw these angles accurately, including lengths to the nearest mm or cm.



Not to scale

2 Draw the quadrilateral accurately then measure the missing lengths.



3 On each grid below, parts of parallelograms have been drawn. Describe how to complete each parallelogram.

a)

Two sides of a parallelogram.

b)

Two sides of a parallelogram.

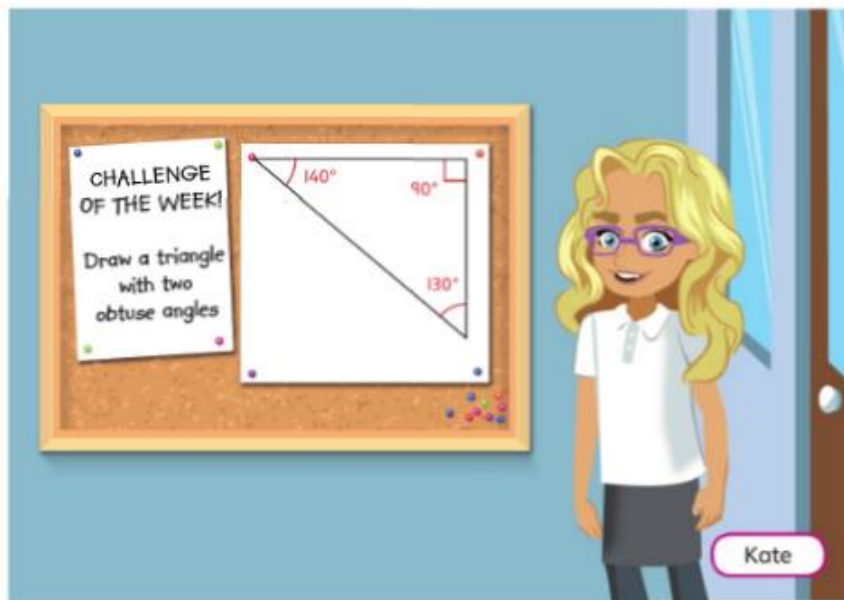
c)

One side of a parallelogram.

Check out the video on <https://whiterosemaths.com/homelearning/year-6/>
Summer Term Week 1 Lesson 3 Angles in a triangle for extra guidance

Angles in triangles 1

Discover



Kate

- 1 a) Attempt the Challenge of the Week. Explain what you discover.
- b) What do you think of Kate's solution? Has she solved the challenge?

Share

a)

My turn to have a go!
 First, I draw one side.



Now I draw an obtuse angle.



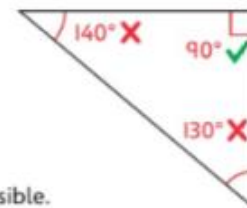
Now I draw a second obtuse angle.

The lines can never meet, so you cannot draw a triangle with two obtuse angles.



It is impossible to draw a triangle with two obtuse angles.

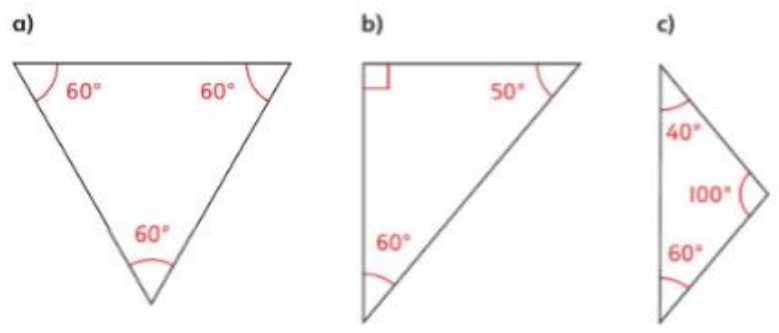
- b) Kate's solution is incorrect. The right angle is correct, but both of the other angles are acute, so they cannot be 130° and 140° .



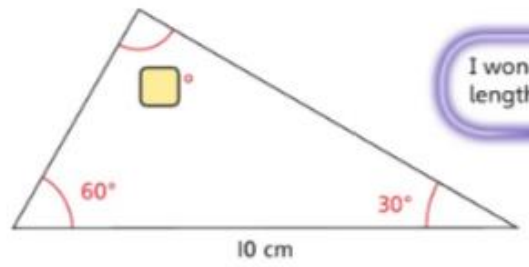
Kate has **not** solved the challenge; it is impossible.

Think together

1 Which angles have been measured incorrectly?



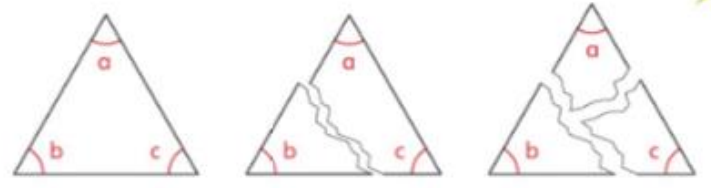
2 Draw this triangle accurately and measure the third angle.



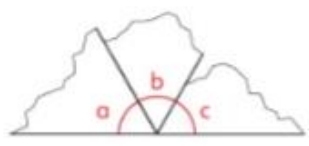
I wonder why only one side length has been given.



3 Max has a paper triangle. He labels each angle then tears off each corner.



He lines up all of the angles at a point.



They join to form a straight line.
I wonder what happens if I change the order.

a) Now draw some triangles and cut them out.



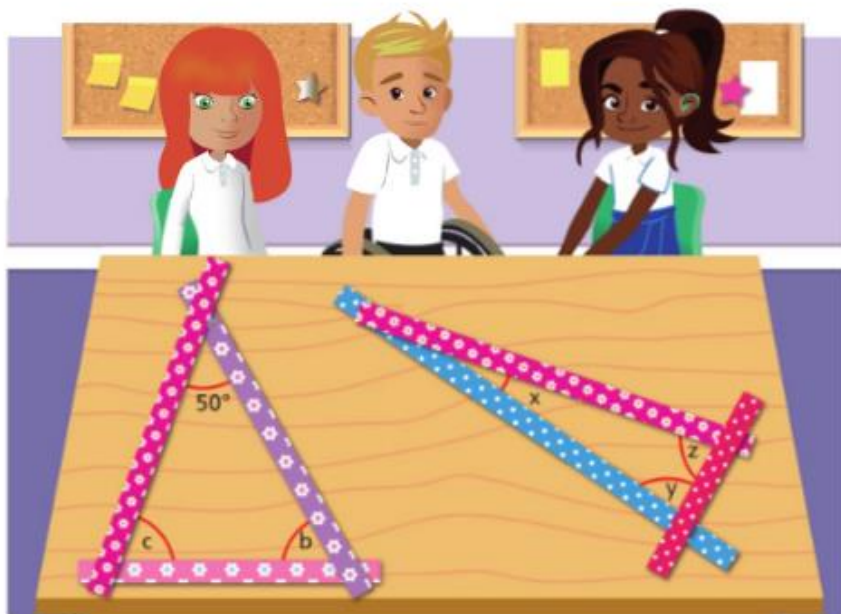
Tear off the angles and place them together like Max did. Do they always form a straight line? What happens if you change the order of the angles?

b) What can we say about the angles in a triangle?

Check out the video on <https://whiterosemaths.com/homelearning/year-6/> **Summer Term Week 1 Lesson 4 Angles in a triangle – missing angles** for extra guidance

Angles in triangles 2

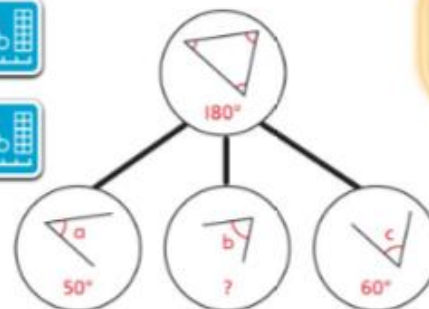
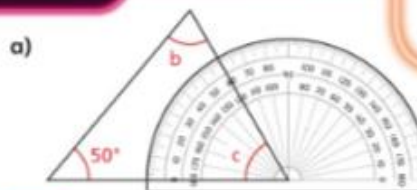
Discover



- 1** a) Find the size of angles b and c in degrees.
- b) Measure angles x and y and use these measurements to work out angle z.

Share

The angles in a triangle add up to 180°. If you know any two angles, you can calculate the third.



Angle c is 60°.
Now I can calculate the final missing angle, angle b.

Method 1

$$180 - 50 = 130$$

$$130 - 60 = 70$$

Angle b must be 70°.

Method 2

$$50 + 60 = 110$$

$$180 - 110 = 70$$

Angle b must be 70°.

- b) Measure angles x and y, then calculate angle z.



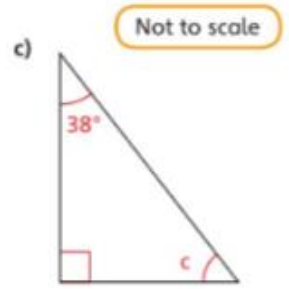
$$15 + 85 = 100$$

$$180 - 100 = 80$$

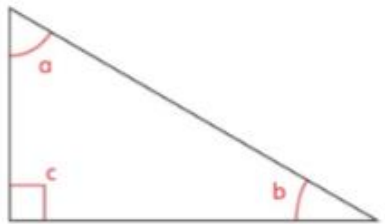
Angle x is 15°. Angle y is 85°.
Angle z must be 80°.

Think together

1 Calculate the missing angles.



2 Calculate the missing angles.
 Angle a is twice as large as angle b.
 Angle c is three times as large as angle b.



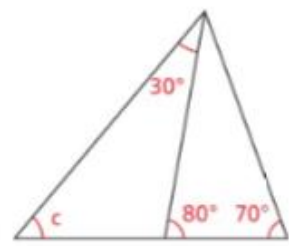
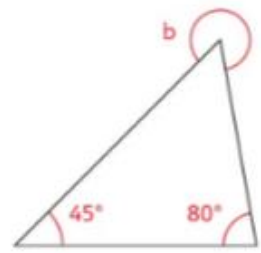
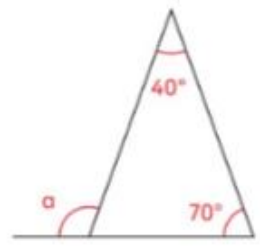
I will use trial and error. I will make a guess, then see if I have to adjust it.



I will draw a bar model to compare the sizes of the three angles.



3 a) Calculate angles a, b and c.



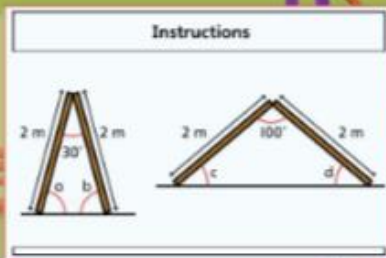
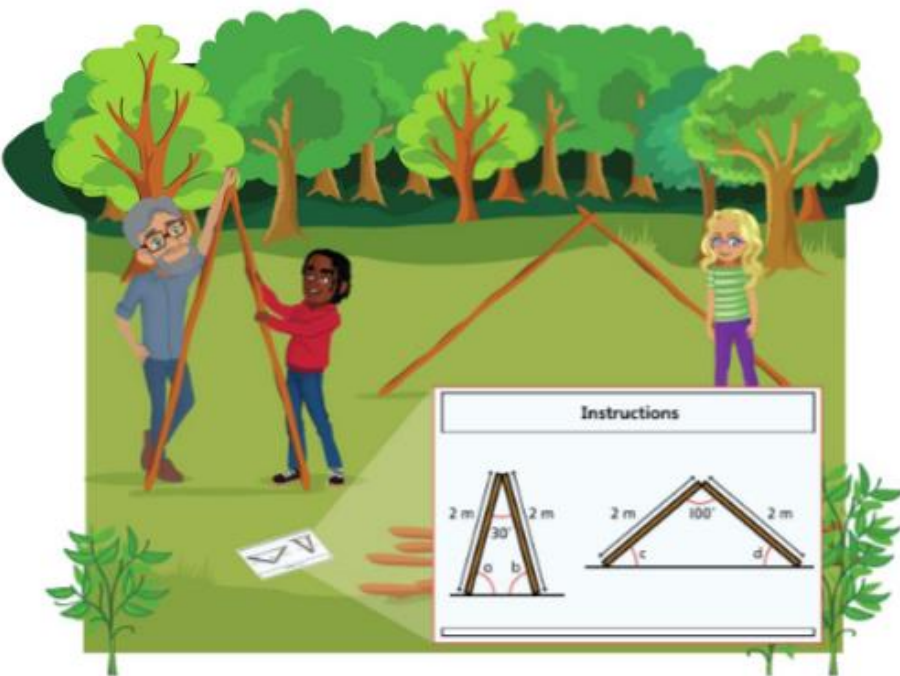
This needs a chain of reasoning. There are multiple steps to solve the problems.



b) Now create your own angle puzzles like the ones above.

Angles in triangles 3

Discover



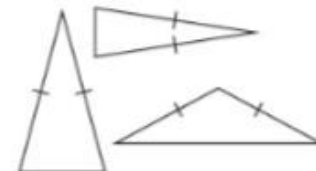
- 1 a) Kate and Ebo use equal lengths of wood to form these triangle frames. Find the angles a, b, c and d.
- b) They form a new triangle frame with the two equal lengths. One of the angles is 80°. What could the other two angles be?

Share

- a) The two lengths are equal, so they form isosceles triangles.



To show equal lengths on a mathematical diagram, we use small marks like this.



In an isosceles triangle, two sides and two angles are equal.

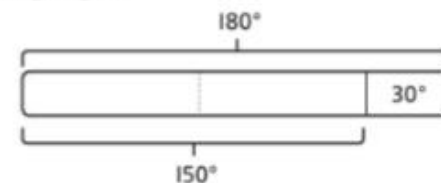
Use this to calculate both missing angles:



$$180 - 30 = 150$$

$$150 \div 2 = 75$$

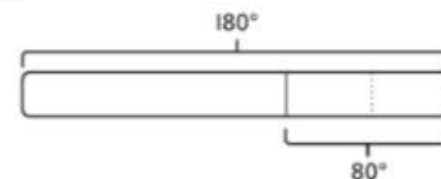
Angles a and b both equal 75°.



$$180 - 100 = 80$$

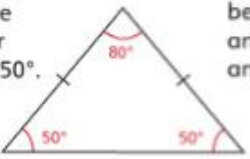
$$\frac{1}{2} \text{ of } 80 \text{ is } 40$$

Angles c and d both equal 40°.




b) There are two solutions.

The 80° angle could be the angle between the equal sides. The other two angles would be 50° .



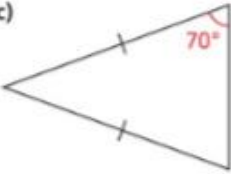


The 80° angle could be one of the equal angles. The other angle would be 20° .



Think together

1 Calculate the two missing angles in each triangle below.

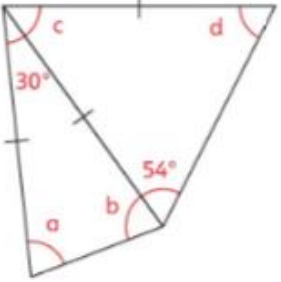
a)  b)  c) 

I only need to know one angle in an isosceles triangle to be able to calculate the others.


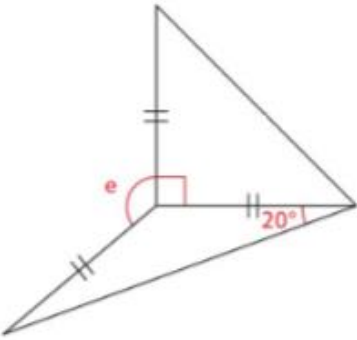


2 Use a ruler to draw an isosceles triangle with two sides of length 75 mm. Measure one angle then calculate both of the other angles.

3 Calculate angles a to f.



There seems to be two different triangles joined together.

I am not told any angles in this diagram. I wonder how I can work some out.

