

28 GEOMETRY AND MEASURES: USING TRIGONOMETRY

LEARNING OBJECTIVES

- Know and use the formulae for the trigonometry ratios, and apply them to work out angles and lengths in right-angled triangles in 2-D and 3-D figures

SPECIFICATION LINKS

- G1, G20

STARTER ACTIVITY

- Rearranging an equation; 5 minutes; page 180**

This activity is a precursor to rearranging the trigonometric ratios. Encourage the student to think about the triangle that relates the three values in the equation. If necessary, write the equation using a formula triangle.

MAIN ACTIVITIES

- Calculating missing lengths; 20 minutes; page 181**

Model how to work out missing lengths in a right-angled triangle using trigonometry. You may wish to invent a mnemonic to help the student remember SOHCAHTOA, such as Studying On Holiday Can Always Have Two Obvious Advantages. When completing question 2, introduce the student to the terms 'angle of elevation' and 'angle of depression'.

- Calculating missing angles; 20 minutes; page 182**

Model how to work out missing angles in a right-angled triangle. Emphasise that the system is very similar to working out the lengths of sides.

PLENARY ACTIVITY

- Flow charts; 5 minutes**

Ask the student to design a flow chart to show how to calculate:

- a missing side in a right-angled triangle
- a missing angle in a right-angled triangle.

HOMEWORK ACTIVITY

- Using trigonometry to solve problems; 30 minutes; page 183**

Full instructions are given on the activity sheet.

SUPPORT IDEA

- Calculating missing lengths** If the student can identify which trigonometric ratio to use, but struggles to rearrange it, it might help to display SOHCAHTOA in three formula triangles like this:

O	A	O
S H	C H	T A

They can then cover the side they wish to calculate in the relevant triangle and see what calculation they need to do.

EXTENSION IDEA

- Calculating missing lengths; Calculating missing angles** Sketch a cuboid and challenge the student to work out the lengths of sides, diagonals and angles, given set values of side lengths or angles.

PROGRESS AND OBSERVATIONS

STARTER ACTIVITY: REARRANGING AN EQUATION

TIMING: 5 MINS

LEARNING OBJECTIVES

- Rearrange a simple equation to make a given variable the subject

EQUIPMENT

none

We know that $4 = \frac{12}{3}$.

This equation can be rearranged to give: $4 \times 3 = 12$ or $3 = \frac{12}{4}$.

1. Use this method to make x the subject of each of these equations.

a) $a = \frac{x}{b}$

.....

b) $a = \frac{b}{x}$

.....



MAIN ACTIVITY: CALCULATING MISSING LENGTHS

TIMING: 20 MINS

LEARNING OBJECTIVES

- Know and use the formulae for the trigonometric ratios, and apply them to work out lengths in right-angled triangles in 2-D and 3-D figures

EQUIPMENT

- scientific calculator
- ruler
- protractor

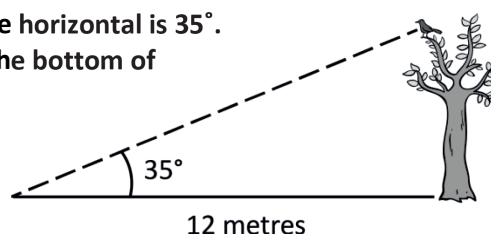


- Draw any right-angled triangle in the space below. Measure one angle and one side and mark them on the triangle. Use trigonometry to calculate the length of the other two sides. Repeat.



- A man is watching a bird in a tree. The angle of elevation from the horizontal is 35° . He is watching the bird from the ground 12 m horizontally from the bottom of the tree.

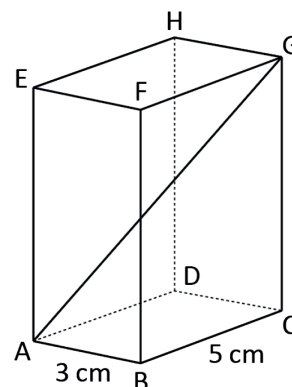
How far up the tree is the bird?
Give your answer to the nearest 10 cm.



Remember, angle of elevation means looking up, and angle of depression means looking down.



- In the cuboid shown, $AB = 3$ cm and $BC = 5$ cm. Given that the line AG makes an angle of 50° with the horizontal, calculate the height of the cuboid.



MAIN ACTIVITY: CALCULATING MISSING ANGLES

TIMING: 20 MINS

LEARNING OBJECTIVES

- Know and use the formulae for the trigonometric ratios, and apply them to work out angles in right-angled triangles in 2-D and 3-D figures

EQUIPMENT

- scientific calculator
- protractor

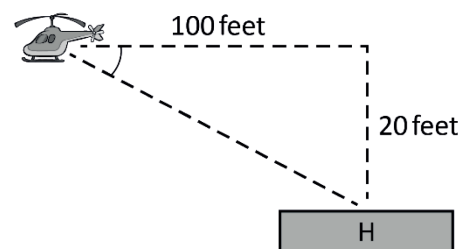
- Draw any right-angled triangle in the space below. Measure the length of the sides and mark them on the triangle.



Use trigonometry to calculate the size of one (non-right-angled) angle. Check your answer by measuring the angle. Repeat, using different pairs of sides to calculate the angles.

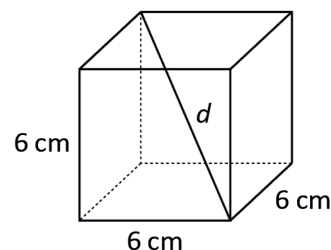
- A helicopter is hovering, waiting to land. It is 20 feet above ground level and 100 feet horizontally from the landing point.

Calculate the angle of depression from the helicopter to the landing point.



- A cube has sides of length 6 cm.

Work out the angle between the base of the cube and the diagonal (d).



HOMEWORK ACTIVITY: USING TRIGONOMETRY TO SOLVE PROBLEMS

TIMING: 30 MINS

LEARNING OBJECTIVES

- Know and use the formulae for the trigonometric ratios and apply them to work out angles and lengths in right-angled triangles in 2-D figures

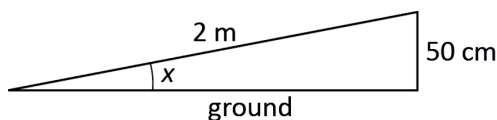
EQUIPMENT

- scientific calculator

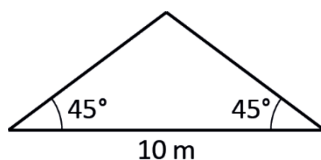
Give your answers to these questions to 1 decimal place.



1. A ramp is 2 m long. The step is 50 cm high. Work out the angle that the ramp is to the horizontal.



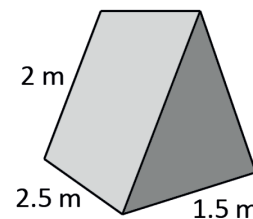
2. A roof is designed so that the angle of the slope with the horizontal is 45° . Work out the lengths of the sloping sides of the roof.



3. Prove that the area of an equilateral triangle with sides of length 1 cm is $\frac{\sqrt{3}}{4}$.



4. A tent is the shape of a triangular prism. The base measures 1.5 m by 2.5 m, and the sloping height measures 2 m.



- a) Calculate the area of fabric used to make the tent. Give your answer to the nearest 0.1 m^2 . The base of the tent is made from the same fabric as the sides.



- b) Calculate the angle that the sloping sides make with the ground. Give your answer to the nearest degree.

28 ANSWERS

STARTER ACTIVITY: REARRANGING AN EQUATION

1. a) $a \times b = x$

b) $x = \frac{b}{a}$

MAIN ACTIVITY: CALCULATING MISSING LENGTHS

1. Check the student's drawings.

2. 8.4 m

3. 6.9 cm

MAIN ACTIVITY: CALCULATING MISSING ANGLES

1. Check the student's drawings.

2. 11.3°

3. 35.3°

HOMEWORK ACTIVITY: USING TRIGONOMETRY TO SOLVE PROBLEMS

1. 14.5°

2. both sides = 7.07 m

3. Check the student's proof.

4. a) 16.5 m^2

b) 68°

GLOSSARY

Angle of elevation

The angle formed between the horizontal and a straight line, which makes an angle above the horizontal

Angle of depression

The angle formed between the horizontal and a straight line, which makes an angle below the horizontal