

Lesson 2: Trigonometry in engineering and manufacturing

Trigonometry worksheet 2 - Answers

Trigonometry

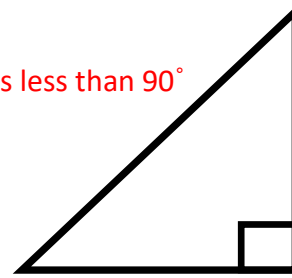
The purpose of this session is to apply knowledge gained from our previous session - right-angled triangles and trigonometry. Please apply the knowledge you developed during that session to answer the following questions.

Starter activity

- i) What is the difference between an acute angle and a right angle?
- ii) What are the three sides of a right-angled triangle called?
- iii) State the three functions for calculating the ratio of the sides of a right-angled triangle and express them mathematically.

Acute angle is less than 90°

Hyp-opp-adj



Sine (sin)	= <u>Opposite</u>
	Hypotenuse
Cosine (cos)	= <u>Adjacent</u>
	Hypotenuse
Tangent (tan)	= <u>Opposite</u>
	Adjacent

We can use those functions to calculate triangle's angles and the lengths of its sides.

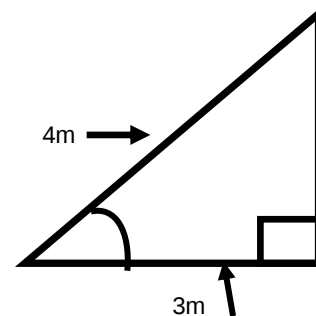
Example

To calculate the angle ϕ

$$\text{Cosine (cos)} = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\text{Cosine } \phi = \frac{3}{4} = 0.75$$

$$\text{Cosine}^{-1} \phi = 41.41^\circ$$



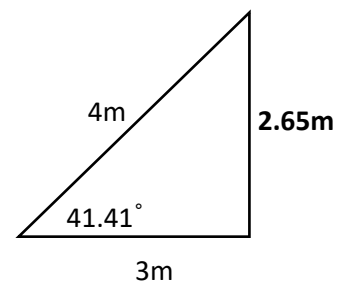
Example

$$\text{Tangent (tan)} = \frac{\text{Opposite}}{\text{Adjacent}}$$

$$\text{Tan} \times \text{adjacent} = \text{opposite}$$

$$\text{Tan } 41.41^\circ = 0.88$$

$$0.88 \times 3 = \mathbf{2.65}$$



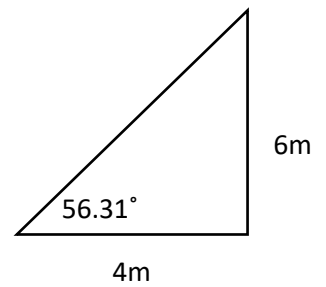
Example

$$\text{Tangent (tan)} = \frac{\text{Opposite}}{\text{Adjacent}}$$

$$\text{Tan} = \frac{6}{4}$$

$$\text{Tan} = 1.5$$

$$\text{Tan}^{-1} 1.5 = 56.31^\circ$$



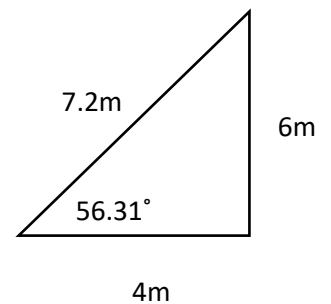
Example

$$\text{Cosine (cos)} = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\text{Hypotenuse} = \frac{\text{Adjacent}}{\text{Cos } 56.31^\circ}$$

$$\text{Hypotenuse} = \frac{4}{0.55}$$

$$\text{Hypotenuse} = \mathbf{7.2m}$$



Activity 1

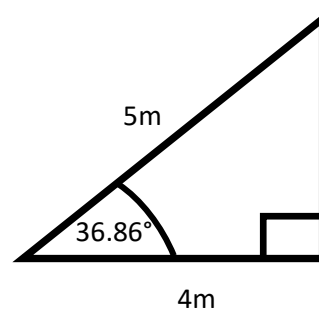
Use trigonometry to calculate the length of the third side.

$$\text{Tangent (tan)} = \frac{\text{Opposite}}{\text{Adjacent}}$$

$$\text{Tan} \times \text{adjacent} = \text{opposite}$$

$$\text{Tan } 36.86^\circ = 0.75$$

$$0.75 \times 4 = \mathbf{3m}$$



Calculate the length of the third side and the angle.

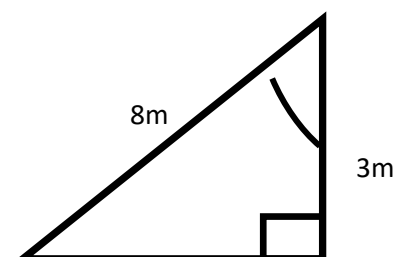
$$\cos = \frac{\text{Adjacent}}{\text{Hypotenuse}} = \frac{3}{8} = 0.375$$

$$\cos^{-1} 0.375 = 67.98^\circ$$

$$\text{Tan} \times \text{adjacent} = \text{opposite}$$

$$\text{Tan } 67.98^\circ = 2.47$$

$$2.47 \times 3 = \mathbf{7.41m}$$



Calculate the length of the third side and the angle.

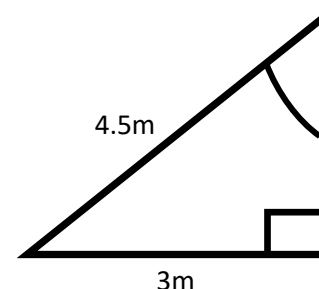
$$\sin = \frac{\text{Opposite}}{\text{Hypotenuse}} = \frac{3}{4.5} = 0.66666$$

$$\sin^{-1} 0.66666 = 41.81$$

$$\text{adjacent} = \cos \times \text{hyp}$$

$$\cos 41.81 = 0.75$$

$$4.5 \times 0.75 = \mathbf{3.37m}$$

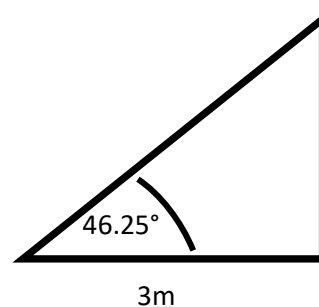


Calculate the length of the hypotenuse.

$$\cos = \frac{\text{Adjacent}}{\text{Hypotenuse}} =$$

$$\text{Adjacent} / \cos = \text{Hypotenuse}$$

$$3 / \cos 46.25^\circ = \mathbf{4.33m}$$



Activity 2

Download a clinometer app to your phone. If you cannot download an app, find another learner who can.

Pick a spot away from your table and measure the:

- i) distance to the base of the table
- ii) height of the table
- iii) the angle of elevation to the table, using your clinometer.

Calculate the length of the third side (the hypotenuse).

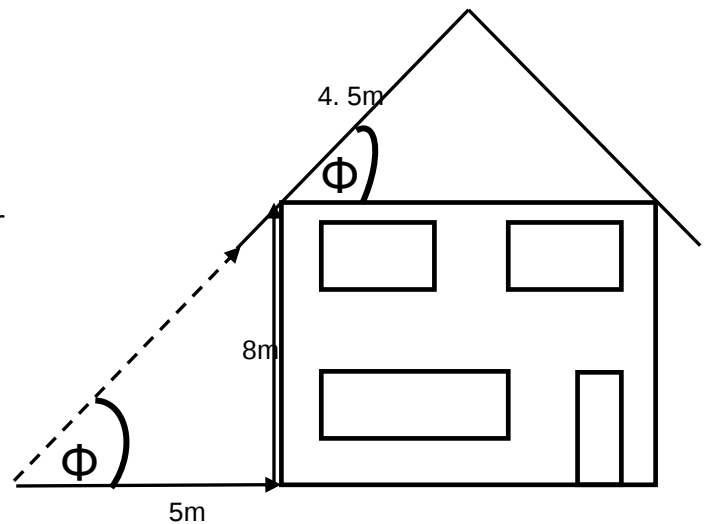
Do this for three surfaces / items / the ceiling in the room.



Activity 3

A housebuilder is building several domestic properties. An engineering company has been tasked with manufacturing the rafting brackets for the roof (part A).

Calculate the angle the brackets should be manufactured at for the required pitch of the roof.



$$\text{Tangent (tan)} = \frac{\text{Opposite}}{\text{Adjacent}}$$

$$8/5 = 1.6$$

$$\tan^{-1} 1.6 = 57.99^\circ$$

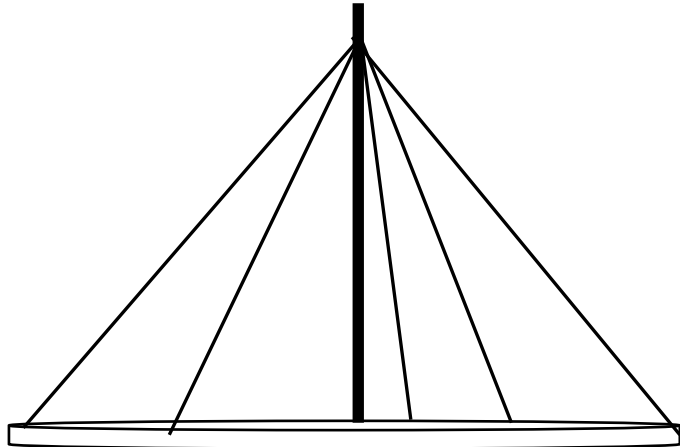
Plenary

Kew Gardens has a design for a Christmas tree light. It stands 11.8m tall on a circular base. The pitch angle for the wires is 20° .

Search on the internet for:

“Maypole Christmas tree lights”.

Now produce a labelled scale diagram.



PRODUCED BY



Hertford Regional College has produced this resource on behalf of the Education and Training Foundation

FUNDED BY



This programme is funded by the Department for Education