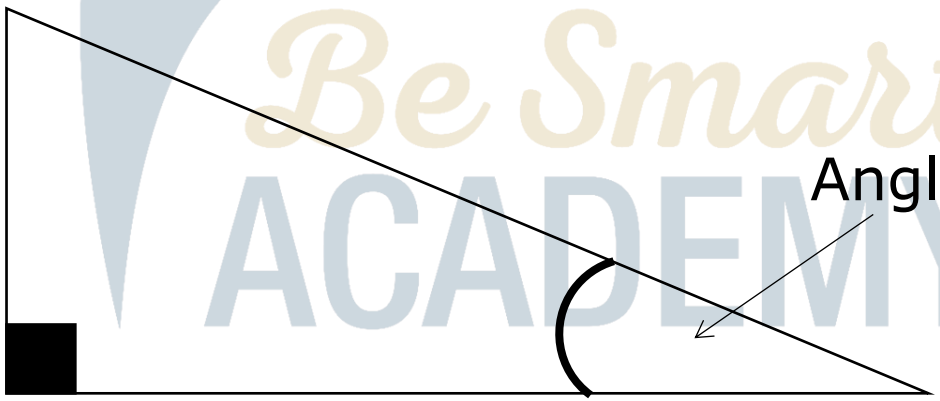
Trigonometry

Trigonometry is concerned with the connection between the **sides** and **angles** in any right angled triangle.

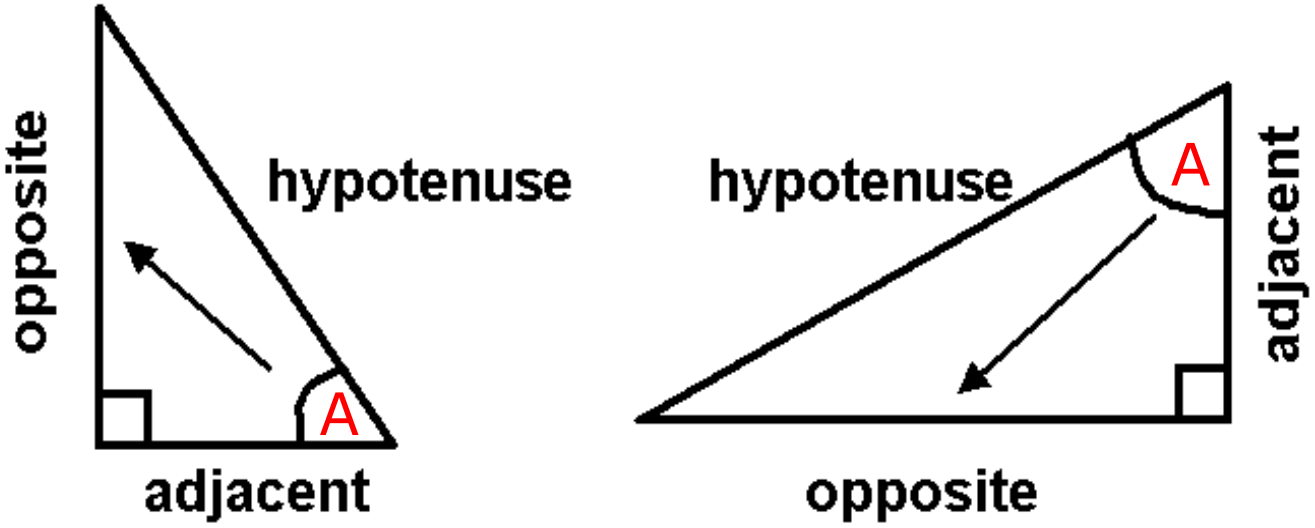


The sides of a right -angled triangle are given special names:

The hypotenuse, the opposite and the adjacent.

The hypotenuse is the longest side and is always opposite the right angle.

The opposite and adjacent sides refer to another angle, other than the 90°.



The Trigonometric Functions we will be looking at

SINE

COSINE

TANGENT

The Trigonometric Functions

SINE

COSINE

TANGENT

Greek Letter

θ

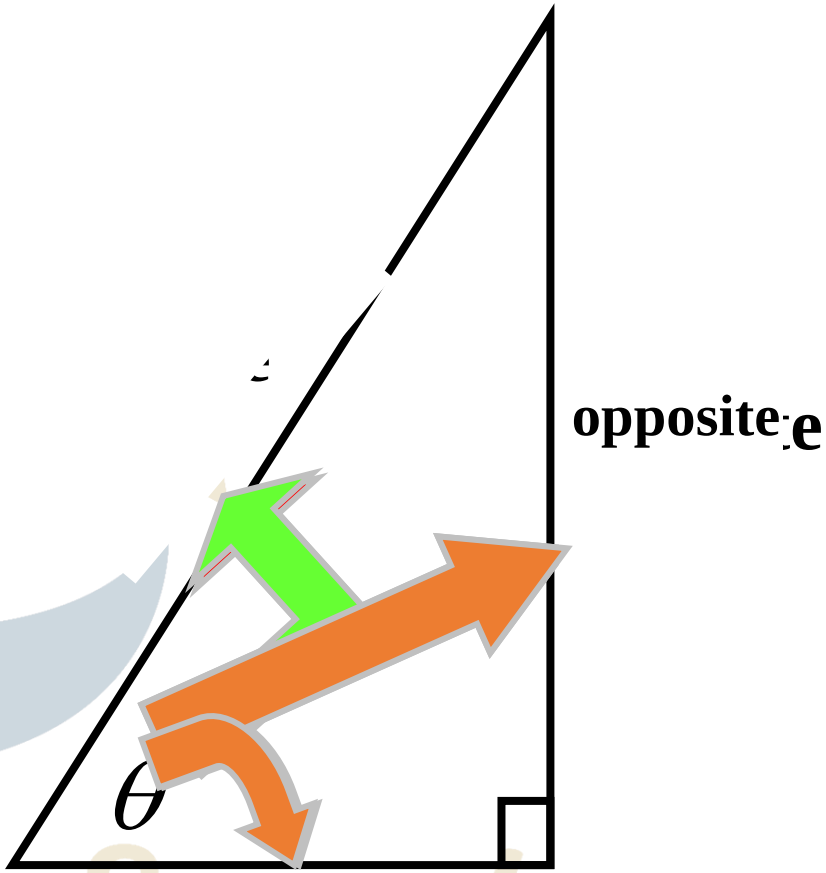
Prounounced "theta"

Represents an unknown angle

$$Sin\,\theta = \frac{Opp}{Hyp}$$

$$Cos\,\theta = \frac{Adj}{Hyp}$$

$$Tan\,\theta = \frac{Opp}{Adj}$$



Using trigonometry on the calculator

All individual angles have different sine, cosine and tangent ratios (or decimal values).

Scientific calculators store information about every angle.

We need to be able to access this information in the correct manner.

Finding the ratios

The simplest form of question is finding the decimal value of the ratio of a given angle.

Find:

sin 32 =

sin	32	=	0.5514

Using ratios to find angles

We have just found that a scientific calculator holds the ratio information for sine (sin), cosine (cos) and tangent (tan) for all angles.

It can also be used in reverse, finding an angle from a ratio.

To do this we use the $\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$ function keys.

Example:

1. sin x = 0.1115 find angle x.

$\boxed{\sin^{-1}}$ 0.1115 $\boxed{=}$

($\boxed{\text{shift}}$ $\boxed{\sin}$)

$x = \sin^{-1}(0.1115)$

$x = 6.4^{o}$

2. cos x = 0.8988 find angle x

$\boxed{\cos^{-1}}$ 0.8988 $\boxed{=}$

($\boxed{\text{shift}}$ $\boxed{\cos}$)

$x = \cos^{-1}(0.8988)$

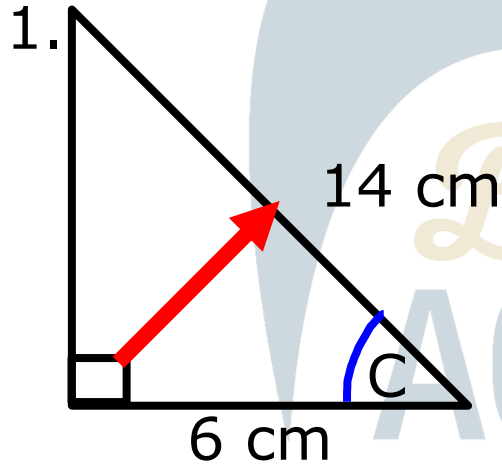
$x = 26^{o}$

Finding an angle from a triangle

To find a missing angle from a right-angled triangle we need to know two of the sides of the triangle.

We can then choose the appropriate ratio, sin, cos or tan and use the calculator to identify the angle from the decimal value of the ratio.

1.

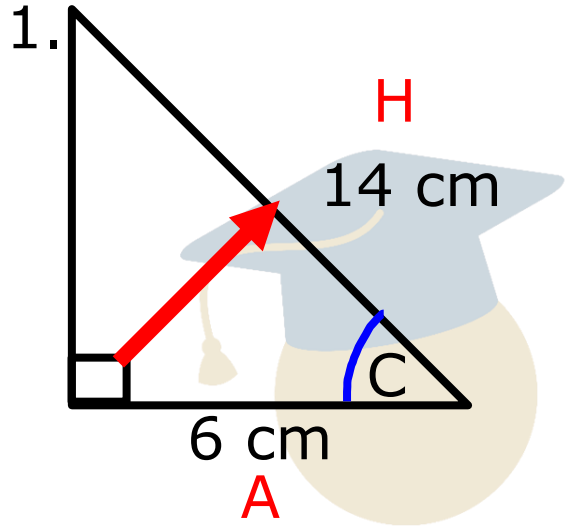


Find angle C

a) Identify/label the names of the sides.

b) Choose the ratio that contains BOTH of the letters.

1.



We have been given the adjacent and hypotenuse so we use COSINE:

$$\text{Cos A} = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\text{Cos A} = \frac{a}{h}$$

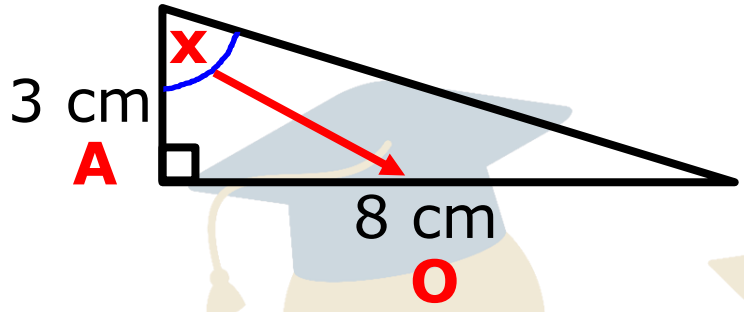
$$\text{Cos C} = \frac{6}{14}$$

$$\text{Cos C} = 0.4286$$

$$C = \cos^{-1}(0.4286)$$

$$C = 64.6^{o}$$

2. Find angle x



Given adj and opp need to use tan:

$$\text{Tan A} = \frac{\text{opposite}}{\text{adjacent}}$$

$$\text{Tan A} = \frac{o}{a}$$

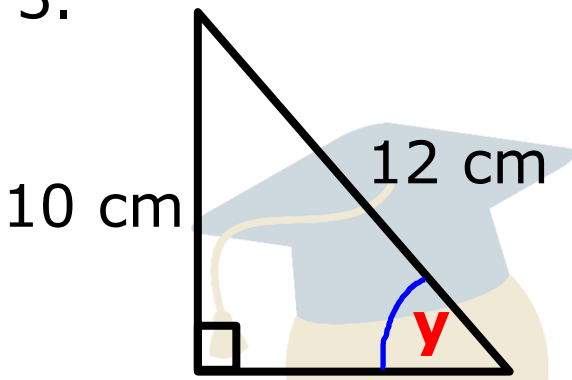
$$\text{Tan } x = \frac{8}{3}$$

$$\text{Tan } x = 2.6667$$

$$x = \tan^{-1}(2.6667)$$

$$x = 69.4^{o}$$

3.



Given opp and hyp need to use sin:

$$\text{Sin A} = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\sin A = \frac{o}{h}$$

$$\sin x = \frac{10}{12}$$

$$\sin x = 0.8333$$

$$x = \sin^{-1}(0.8333)$$

$$x = 56.4^{o}$$

Finding a side from a triangle

To find a missing side from a right-angled triangle we need to know one angle and one other side.

Note: If

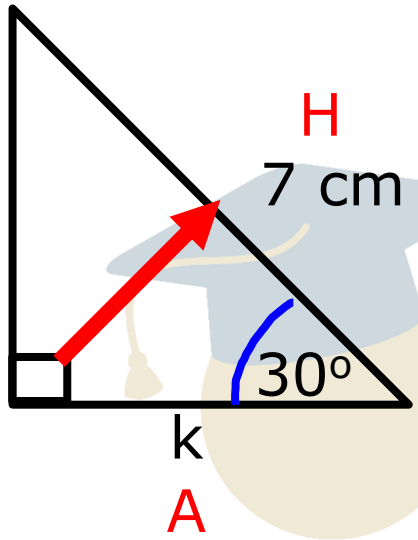
$$\text{Cos}45 = \frac{x}{13}$$

To leave x on its own we need to move the ÷ 13.

It becomes a "times" when it moves.

$$\text{Cos}45 \times 13 = x$$

4.



We have been given the adj and hyp so we use COSINE:

$$\text{Cos A} = \frac{\text{adjacent}}{\text{hypotenuse}}$$

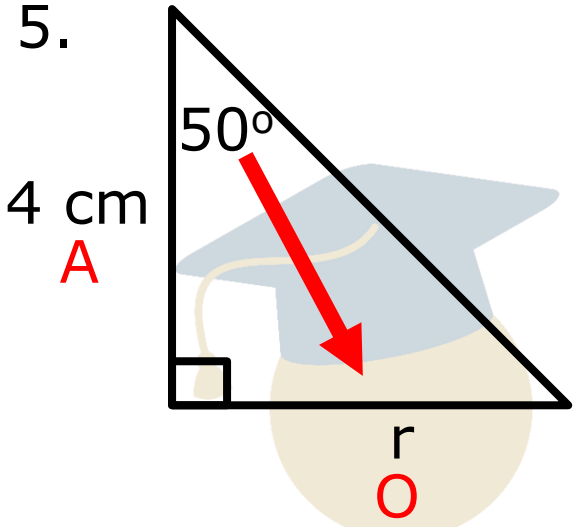
$$\text{Cos A} = \frac{a}{h}$$

$$\text{Cos } 30 = \frac{k}{7}$$

$$\text{Cos } 30 \times 7 = k$$

$$6.1 \text{ cm} = k$$

5.



We have been given the opp and adj so we use TAN:

$$\text{Tan A} = \frac{\text{opposite}}{\text{adjacent}}$$

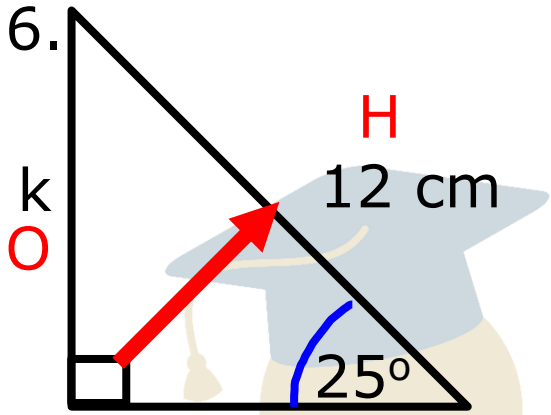
$$\text{Tan A} = \frac{o}{a}$$

$$\text{Tan } 50 = \frac{r}{4}$$

$$\text{Tan } 50 \times 4 = r$$

$$4.8 \text{ cm} = r$$

6.



We have been given the opp and hyp so we use SINE:

$$\text{Sin A} = \frac{\textbf{opposite}}{\textbf{hypotenuse}}$$

$$\sin A = \frac{o}{h}$$

$$\sin 25 = \frac{k}{12}$$

$$\text{Sin } 25 \times 12 = k$$

$$5.1 \text{ cm} = k$$

Finding a side from a triangle

There are occasions when the unknown letter is on the bottom of the fraction after substituting.

$$\text{Cos}45 = \frac{13}{u}$$

Move the u term to the other side.

It becomes a “times” when it moves.

$$\text{Cos}45 \times u = 13$$

To leave u on its own, move the cos 45 to other side, it becomes a divide.

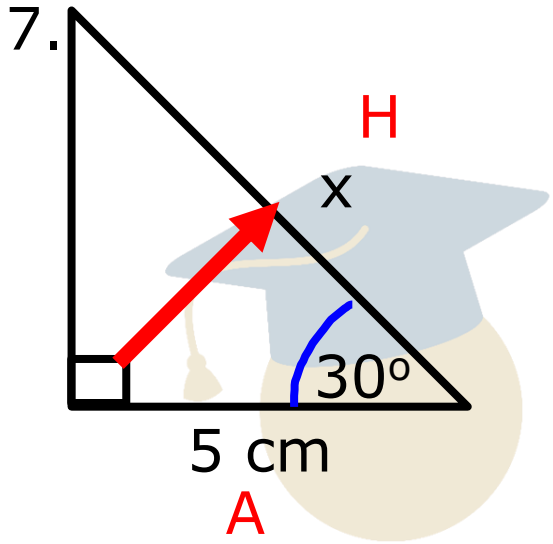
$$u = \frac{13}{\text{Cos } 45}$$

When the unknown letter is on the bottom of the fraction we can simply swap it with the trig (sin A, cos A, or tan A) value.

$$\text{Cos}45 = \frac{13}{u}$$

$$u = \frac{13}{\text{Cos } 45}$$

7.



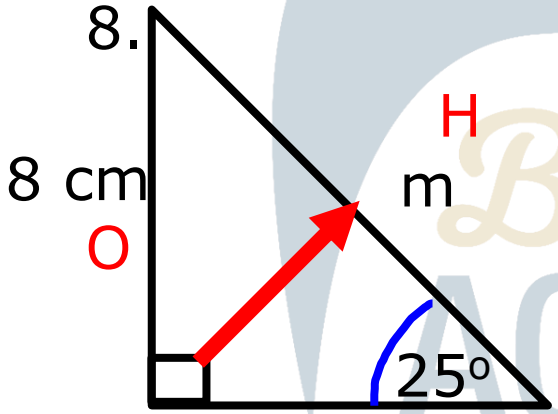
$$\text{Cos A} = \frac{a}{h}$$

$$\text{Cos } 30 = \frac{5}{x}$$

$$x = \frac{5}{\cos 30}$$

$$x = 5.8 \text{ cm}$$

8.



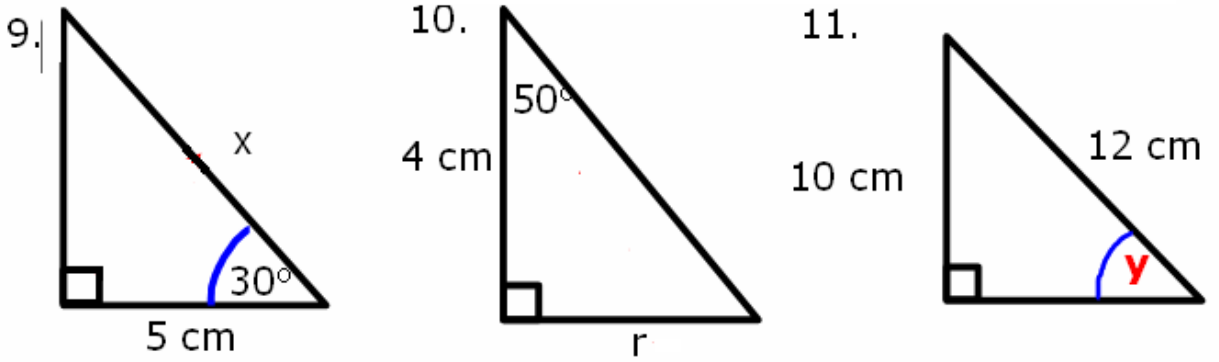
$$\sin A = \frac{o}{h}$$

$$\sin 25 = \frac{8}{m}$$

$$m = \frac{8}{\sin 25}$$

$$m = 18.9 \text{ cm}$$

Your turn (Round answers to the nearest tenth)



sin 30 = 0.5 sin 50 = 0.766

cos 30 = 0.866 cos 50 = 0.6428

tan 30 = 0.5774 tan 50 = 0.1.1917