

$$3) \frac{7}{3m} = 6 - \frac{5}{m}$$

$$\frac{7}{3m} = 6 - \frac{5}{m} \times \frac{3}{3} \quad \text{make into } \frac{1}{3m} \text{'s}$$

$$\frac{7}{3m} = 6 - \frac{15}{3m} \quad \times 3m \text{ both sides}$$

$$7 = 18m - 15$$

$$22 = 18m$$

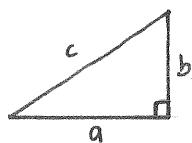
$$m = \frac{22}{18} \text{ or } 1.2$$

## Right Angled Trigonometry and Pythagoras

In a right angled triangle, the hypotenuse is the side opposite the right angle. It is the longest side.

### Finding the Hypotenuse

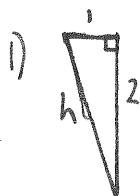
Use Pythagora's relation, for a right angled triangle



$$a^2 + b^2 = c^2$$

$$c^2 = a^2 + b^2$$

Examples:

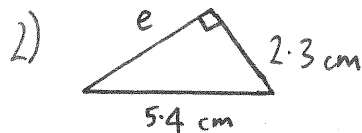


$$h^2 = 1^2 + 2^2$$

$$h^2 = 5$$

$$h = \sqrt{5} \text{ exact}$$

$$h = 2.24 \text{ (2 dp) rounded}$$



$$5.4^2 = e^2 + 2.3^2$$

$$e^2 = 5.4^2 - 2.3^2$$

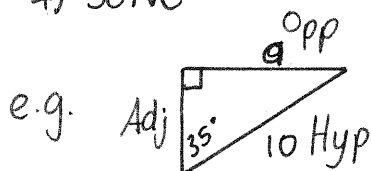
$$e^2 = 23.87$$

$$e = \sqrt{23.87}$$

$$e = 4.9 \text{ cm (1 dp)}$$

## Summary of Steps

- 1) Label sides of triangle (Hyp., Opp., Adj.)
- 2) Use SOHCAHTOA to decide which trig ratio to use.
- 3) Write the trig ratio with information from the problem.
- 4) Solve



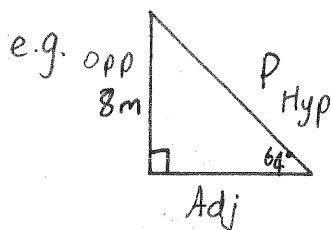
SOHCAHTOA

$$\sin 35 = \frac{a}{10}$$

$$a = 10 \sin 35$$

$$a = 5.74 \text{ (2 dp)}$$

If the unknown is the denominator you will need to divide by the trig ratio.



SOHCAHTOA

$$\sin 64 = \frac{8}{p}$$

$$p \sin 64 = 8$$

$$p = \frac{8}{\sin 64}$$

$$p = 8.9 \text{ m (1 dp)}$$

## Finding an angle

If we have the value of any of the trigonometric ratios of sine, cosine or tangent then we can find the corresponding angle.

### Examples

1)  $\sin \theta = 0.89$

$$\theta = \sin^{-1} 0.89$$

$$\theta = 62.9^\circ \text{ (1 d.p.)}_{\sin^{-1}}$$

on calculator  $\boxed{\text{shift}} \boxed{\sin} 0.89 \boxed{=}$

2)  $\tan \alpha = \frac{4.9}{5.9}$

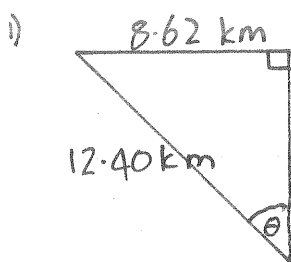
$$\alpha = \tan^{-1} \left( \frac{4.9}{5.9} \right)$$

$$\alpha = 39.7^\circ \text{ (1 d.p.)}_{\tan^{-1}}$$

on calculator  $\boxed{\text{shift}} \boxed{\tan} \boxed{(} 4.9 \div 5.9 \boxed{)} \boxed{=}$

## Finding an angle in a triangle

### Examples



$$\sin \theta = \frac{8.62}{12.40}$$

$$\theta = \sin^{-1} \left( \frac{8.62}{12.40} \right)$$

$$\theta = 44.0^\circ \text{ (1 d.p.)}_{\sin^{-1}}$$

on calculator  $\boxed{\text{shift}} \boxed{\sin} \boxed{(} 8.62 \div 12.40 \boxed{)} \boxed{=}$

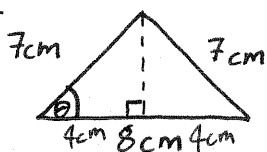
# Applications

- Steps:
- Draw a diagram & label
  - Decide which trig ratio is required using SOH CAH TOA
  - Write the trig ratio with values and symbols from the problem.
  - Solve, stating units and rounding.

## Examples:

- 1) An isosceles triangle has sides 7cm, 7cm and 8cm. Find the base angle correct to 4 s.f.

## Solution:

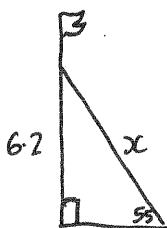


$$\cos \theta = \frac{4}{7}$$

$$\theta = \cos^{-1}\left(\frac{4}{7}\right)$$

$$\theta = 55.15^\circ \text{ (4 s.f.)}$$

- 2) A flagpole is supported by 4 metal braces, each of which makes an angle of  $55^\circ$  with the ground and meets the pole 6.2 m above the ground. Find the total length of metal braces.



$$\sin 55 = \frac{6.2}{x}$$

$$x \sin 55 = 6.2$$

$$x = \frac{6.2}{\sin 55}$$

$$x = 7.568 \dots$$

$$\text{Total length} = 4x$$

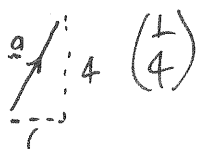
$$\text{Total} = 30.3 \text{ m (1 dp)}$$

## Vectors

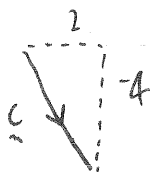
A vector is a quantity that has magnitude and direction. In general  $\begin{pmatrix} x \\ y \end{pmatrix}$  is the vector where  $x$  is the horizontal step &  $y$  is the vertical step.

Examples Draw the vectors  $\begin{pmatrix} 1 \\ 4 \end{pmatrix}$ ,

$\begin{pmatrix} 0 \\ 3 \end{pmatrix}$  and  $\begin{pmatrix} 2 \\ -4 \end{pmatrix}$



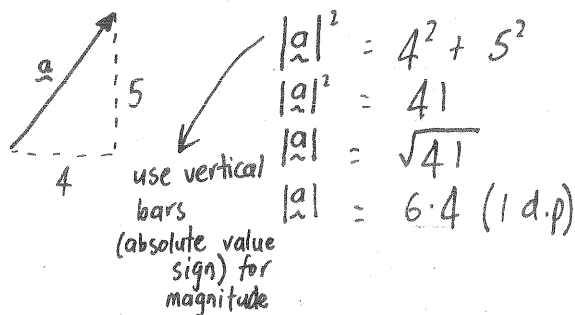
$\underline{b} \uparrow \begin{pmatrix} 0 \\ 3 \end{pmatrix}$



Point vectors are written bold or with a line underneath.

We can use pythagoras to find the magnitude or length of a vector.

eg. Find magnitude of  $\begin{pmatrix} 4 \\ 5 \end{pmatrix}$

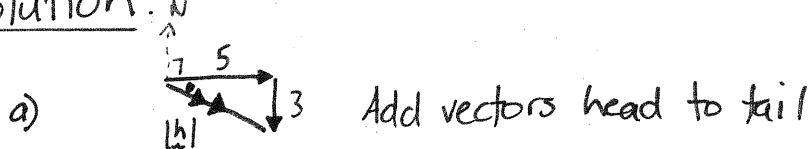


## Practical Applications

Example: Heta swims across the river at 5 km/hr. The river flows downstream at 3 km/hr. If Heta heads out directly from the bank, find

- his actual speed
- his actual direction

Solution:



$$|h|^2 = 3^2 + 5^2$$

$$|h|^2 = 34$$

$$|h| = \sqrt{34}$$

$$|h| = 5.8 \text{ (1 d.p.)}$$

b) Need to find  $\theta$  (use given, rather than derived information)

$$\tan \theta = \frac{3}{5}$$

$$\theta = \tan^{-1}\left(\frac{3}{5}\right)$$

$$\theta = 30.96^\circ \text{ (2 d.p.)}$$

As a bearing, angle is

$$\text{bearing} = 90 + 30.96^\circ$$

$$\text{bearing is } 120.96^\circ$$

Recall Bearing is given by a 3 digit number measured clockwise from North.