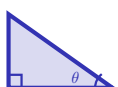


## Trigonometry

IGCSE Mathematics • Topic 6

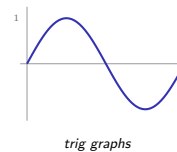
IGCSE Mathematics



Trigonometry

### What we will cover

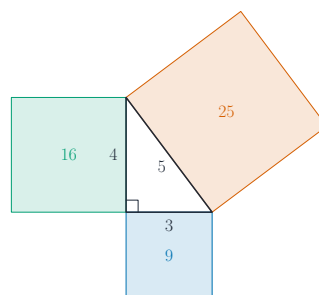
- 1 Pythagoras' theorem
- 2 SOH-CAH-TOA
- 3 Elevation & depression
- 4 Exact values
- 5 Trig graphs
- 6 Sine & cosine rules



# 1 Right-angled triangles

Trigonometry  
Right-angled triangles

### Pythagoras' theorem



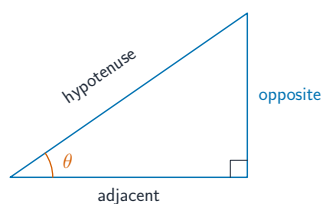
$$a^2 + b^2 = c^2.$$

Use it to find a missing side.

$$b^2 = 13^2 - 5^2 = 169 - 25 = 144, \quad b =$$

Trigonometry  
Right-angled triangles

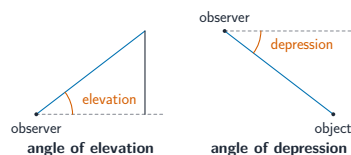
### SOH-CAH-TOA



- $y = \sin x$  is a wave starting at 0, peaking at  $90^\circ$ , back to 0 at  $180^\circ$ , down to  $-1$  at  $270^\circ$ .
- $y = \cos x$  is the same wave but starting at 1.
- $y = \tan x$  rises steeply and repeats every  $180^\circ$ .

Trigonometry  
Right-angled triangles

### Elevation and depression



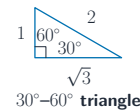
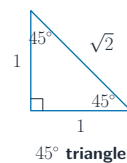
The **angle of elevation** 仰角 looks **up**; the **angle of depression** 俯角 looks **down**.  
Tower:  $50 \tan 40^\circ = 42.0$  m.

## 2 Values and graphs

Trigonometry  
Values and graphs

### Exact values

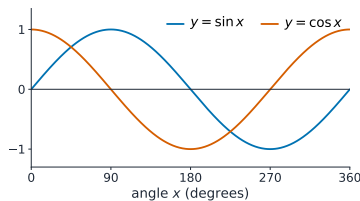
|     | 30°                  | 45°                  | 60°                  |
|-----|----------------------|----------------------|----------------------|
| sin | $\frac{1}{2}$        | $\frac{\sqrt{2}}{2}$ | $\frac{\sqrt{3}}{2}$ |
| cos | $\frac{\sqrt{3}}{2}$ | $\frac{\sqrt{2}}{2}$ | $\frac{1}{2}$        |
| tan | $\frac{1}{\sqrt{3}}$ | 1                    | $\sqrt{3}$           |



- $y = \sin x$  is a wave starting at 0, peaking at 90°, back to 0 at 180°, down to -1 at 270°.
- $y = \cos x$  is the same wave but starting at 1.
- $y = \tan x$  rises steeply and repeats every 180°.

Trigonometry  
Values and graphs

### Trig graphs

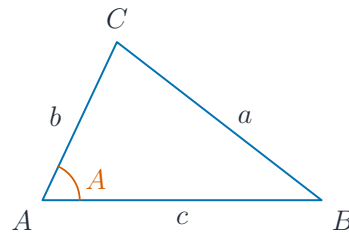


$y = \sin x$  &  $y = \cos x$  are waves between -1 & 1.

A trig equation has several answers in 0–360° – use the wave's symmetry.  $\sin x = \frac{\sqrt{3}}{2} \Rightarrow x = 60^\circ$  or  $120^\circ$ .

Trigonometry  
Values and graphs

### Sine and cosine rules



- $y = \sin x$  is a wave starting at 0, peaking at 90°, back to 0 at 180°, down to -1 at 270°.
- $y = \cos x$  is the same wave but starting at 1.
- $y = \tan x$  rises steeply and repeats every 180°.

## 3 Recap

Trigonometry  
Recap

### Worked example – Pythagoras

A right-angled triangle has hypotenuse 13 cm and one short side 5 cm. Find the other short side.

- $a^2 + b^2 = c^2$ , where  $c$  is the hypotenuse (opposite the right angle).
- $5^2 + b^2 = 13^2$
- $25 + b^2 = 169 \Rightarrow b^2 = 144$
- $b = \sqrt{144} = 12$  cm

Finding a shorter side means **subtract**; finding the hypotenuse means **add**. Check: the hypotenuse must be the **longest** side.

## Topic 6 – key takeaways

### 1 Pythagoras

$a^2 + b^2 = c^2$  for a right triangle

### 2 Ratios

SOH-CAH-TOA; inverse to find an angle

### 3 Graphs

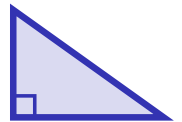
sine & cosine waves; many solutions

### 4 Any triangle

the sine rule & the cosine rule

## Check yourself

- 1 What is the hypotenuse?
- 2 Which ratio is opp over adj?
- 3 What is  $\sin 30^\circ$  exactly?
- 4 Which rule works for a non-right triangle?



**Answers** 1. the longest side, opposite the right angle 2. tangent 3.  $\frac{1}{2}$  4. the sine or cosine rule