

Trigonometric Graphs

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Name: _____

Date: _____

At a glance

Exact trig values, the graphs of $y = \sin x$, $\cos x$ and $\tan x$, and solving trig equations from 0° to 360° .

1. Exact values
2. The graphs of sin, cos and tan
3. Solving trig equations

1. Exact values

☐ I revised this

- Learn the table — it is needed on the non-calculator paper.
- Memory aid: sin goes 0, $\frac{1}{2}$, $\frac{\sqrt{2}}{2}$, $\frac{\sqrt{3}}{2}$, 1 from 0° to 90° ; cos is the same list backwards.

	0°	30°	45°	60°	90°
sin	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0
tan	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	undefined

Worked example

Work out $4 \sin 30^\circ + \tan 45^\circ$.

1. $\sin 30^\circ = \frac{1}{2}$ and $\tan 45^\circ = 1$.
2. $4 \times \frac{1}{2} + 1$.

3

2. The graphs of sin, cos and tan

☐ I revised this

- $y = \sin x$: starts at 0, maximum 1 at 90° , 0 at 180° , minimum -1 at 270° , 0 at 360° .
- $y = \cos x$: starts at 1, 0 at 90° , -1 at 180° , 0 at 270° , 1 at 360° .
- $y = \tan x$: through $(0, 0)$, $(180^\circ, 0)$, $(360^\circ, 0)$; asymptotes at $x = 90^\circ$ and 270° ; repeats every 180° .
- $y = a \sin x$ stretches it vertically: maximum a , minimum $-a$.

x	0°	90°	180°	270°	360°
sin x	0	1	0	-1	0
cos x	1	0	-1	0	1
tan x	0	—	0	—	0

Worked example

State the maximum and minimum values of $y = 3 \cos x$ and where the maximum occurs ($0^\circ \leq x \leq 360^\circ$).

1. $\cos x$ is between -1 and 1 .

Maximum 3 at $x = 0^\circ$ and 360° ; minimum -3

3. Solving trig equations

☐ I revised this

- Rearrange to $\sin x = k$, $\cos x = k$ or $\tan x = k$ first.
- The calculator gives one angle; use the graph's symmetry for the others in 0° to 360° .

How to do it

1. Rearrange to trig function = number.
2. Use the inverse on the calculator to get x_1 .
3. Find the second solution from the table (add 360° to any negative angle first).
4. Check both are in the range.

Equation	Solutions in 0° – 360° (x_1 from the calculator)
$\sin x = k$	x_1 and $180^\circ - x_1$
$\cos x = k$	x_1 and $360^\circ - x_1$
$\tan x = k$	x_1 and $x_1 + 180^\circ$

Worked example

Solve $2 \sin x + 1 = 0$ for $0^\circ \leq x \leq 360^\circ$.

1. $\sin x = -0.5$.
2. Calculator: $x = -30^\circ$, outside the range.
3. Solutions: $180^\circ + 30^\circ = 210^\circ$ and $360^\circ - 30^\circ = 330^\circ$.

$x = 210^\circ$ or $x = 330^\circ$

Exam tip: Sketch the graph with the horizontal line $y = k$ to see how many solutions there are.

Common mistakes

Don't write	Write instead
$\times$ Giving only the calculator's answer	$\checkmark$ There are usually two answers in 0° – 360°
$\times$ $\sin x = -0.5 \rightarrow x = -30^\circ$	$\checkmark$ Negative angles are outside the range: use 210° and 330°
$\times$ Calculator in radians	$\checkmark$ Set it to degrees
$\times$ $\tan x = k \rightarrow x_1$ and $180^\circ - x_1$	$\checkmark$ $\tan$ repeats every 180° : x_1 and $x_1 + 180^\circ$

In the exam

- Learn the exact values — they appear on the non-calculator paper.
- Sketch the graph to check your second solution.
- Give angles to 1 decimal place unless they are exact.

My notes

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