Helping Your Child with Trigonometry

Measurement & Space · Year 7 to Year 10 · Australian Curriculum Mathematics

Trigonometry is the study of the relationships between the angles and sides of triangles. It is one of the most useful topics in mathematics — used by engineers, architects, surveyors, pilots, and game designers. Your child first learns the three basic trigonometric ratios (**sine**, **cosine**, **tangent**) in Year 9, then applies them to practical real-world problems in Year 10 — including angles of elevation and depression, direction and bearings, and 3D situations.

Year	What your child learns	What this looks like at home
Year 7	**Prior knowledge — angle types and angle sum (AC9M7M05)** **This shaded section shows earlier learning your child draws on.** **angle** — the amount of turn between two lines, measured in degrees (°) **right angle** — exactly 90°; appears at corners of squares and rectangles **acute angle** — less than 90° **obtuse angle** — between 90° and 180° **Angles in a triangle add to 180°** e.g. 90° + 40° + 50° = 180°	**'What type of angle is 45°?'** (Acute — less than 90°) **'A triangle has angles 90° and 35°. What is the third angle?'** (180 − 90 − 35 = 55°) **Identify right angles in buildings, furniture, and roads.**
Year 8	**Pythagoras' theorem — the foundation for trigonometry (AC9M8M06)** **This shaded section shows earlier learning your child draws on.** **Pythagoras' theorem: $a^2 + b^2 = c^2$ (introduced Year 8)** **hypotenuse** — the longest side of a right-angled triangle, opposite the right angle Your child is comfortable naming the sides of a right-angled triangle and measuring angles — the key skills trigonometry builds on in Year 9.	**'A right-angled triangle has legs 3 m and 4 m. What is the length of the hypotenuse?'** ($a^2 + b^2 = c^2$: $3^2 + 4^2 = 25$, c = 5 m) **Check a corner is a true right angle using the 3-4-5 rule.**
Year 9	**SOH CAH TOA — the three basic trigonometric ratios (AC9M9SP01)** **For a right-angled triangle with a given angle (θ — 'theta'):** **Opposite (O)** — the side across from the angle **Adjacent (A)** — the side next to the angle (not the hypotenuse) **Hypotenuse (H)** — the longest side, opposite the right angle **SOH:** $\sin(\theta) = \frac{\text{Opposite}}{\text{Hypotenuse}}$ **CAH:** $\cos(\theta) = \frac{\text{Adjacent}}{\text{Hypotenuse}}$ **TOA:** $\tan(\theta) = \frac{\text{Opposite}}{\text{Adjacent}}$ To find an angle when you know two sides, use the inverse: $\theta = \sin^{-1}(\frac{O}{H})$ | $\theta = \cos^{-1}(\frac{A}{H})$ | $\theta = \tan^{-1}(\frac{O}{A})$	**'What does SOH CAH TOA stand for?'** (Sine=$\frac{Opp}{Hyp}$, Cosine=$\frac{Adj}{Hyp}$, Tangent=$\frac{Opp}{Adj}$) **'A ramp rises 3 m over a run of 4 m. What angle does it make?'** $\tan(\theta) = \frac{3}{4} \rightarrow \theta = \tan^{-1}(0.75) \approx 36.9°$ **'A 10 m ladder leans at 60°. How high up the wall does it reach?'** $\sin(60°) = \frac{h}{10} \rightarrow h = 10 \times \sin(60°) \approx 8.66$ m
Year 10	**Practical applications — elevation, depression, direction and 3D (AC9M10M03)** **Still right-angled triangles** — just applied to real-world situations: **angle of elevation** — the angle you look **UP** from horizontal to see something above you (along your line of sight) **angle of depression** — the angle you look **DOWN** from horizontal to see something below you (along your line of sight) **looking up (elevation) ; looking down (depression)** **bearing** — direction measured clockwise from North: **e.g. a bearing of 060° means a direction 60° clockwise from North | use trig to find how far N and E** **3D problems** — apply trig in two steps: e.g. find a horizontal distance first, then use it as one side of a new triangle	**'From the top of a 30 m cliff, the angle of depression to a boat is 20°. How far is the boat from the cliff?'** $\tan(20°) = \frac{30}{d} \rightarrow d = \frac{30}{\tan(20°)} \approx 82.4$ m **'A plane is 5,000 m high. The angle of elevation from the ground is 15°. How far horizontally is the plane?'** $\tan(15°) = \frac{5000}{d} \rightarrow d \approx 18{,}660$ m **'A ship sails on bearing 040° for 60 km. How far north has it travelled?'** ($\cos(40°) \times 60 \approx 45.96$ km)

★ SOH CAH TOA — the memory trick that unlocks trigonometry

	Ratio	Formula	When to use it
SOH	**Sine**	$\sin(\theta) = \frac{\text{Opp}}{\text{Hyp}}$	Use when you know the opposite and hypotenuse, or want to find the angle from those sides
CAH	**Cosine**	$\cos(\theta) = \frac{\text{Adj}}{\text{Hyp}}$	Use when you know the adjacent and hypotenuse, or want to find the angle from those sides
TOA	**Tangent**	$\tan(\theta) = \frac{\text{Opp}}{\text{Adj}}$	Use when you know the opposite and adjacent (no hypotenuse needed), e.g. a slope or ramp

Memory aid: *"Some Old Hens Can Always Hide Their Old Age" — S,O,H / C,A,H / T,O,A. Make up your own sentence using the letters S, O, H, C, A, H, T, O, A.*

Using a calculator: *make sure it is set to DEGREES (not radians). To find an angle: use the* $\sin^{-1}$, $\cos^{-1}$, *or* $\tan^{-1}$ *button (sometimes labelled arcsin, arccos, arctan or SHIFT + sin/cos/tan).*

Helping at Home — Trigonometry

Worked examples and questions to ask · Year 7 to Year 10

How it works — worked examples

Year 9 — Finding a missing side (SOH)

A 10 m ladder leans against a wall at an angle of 60° to the ground. How high up the wall does it reach?

Label sides	Hyp = 10 m (ladder), angle = 60°, need: Opposite (height)
Choose ratio	We have H and need O → use SOH: $\sin(\theta) = \frac{O}{H}$
Substitute	$\sin(60°) = \frac{h}{10}$ → $h = 10 \times \sin(60°)$
Calculate	**$h = 10 \times 0.866 = 8.66$ m (ladder reaches 8.66 m up the wall)**

Year 9 — Finding a missing angle (TOA)

A ramp rises 4 m over a horizontal distance of 10 m. What angle does the ramp make with the ground?

Label sides	Opposite = 4 m (rise), Adjacent = 10 m (run), angle = ?
Choose ratio	We have O and A → use TOA: $\tan(\theta) = \frac{O}{A}$
Substitute	$\tan(\theta) = \frac{4}{10} = 0.4$
Find angle	**$\theta = \tan^{-1}(0.4) \approx 21.8°$ (the ramp makes about a 22° angle)**

Year 10 — Angle of depression

A lifeguard sits on a 4 m tall tower. They look down at a swimmer at an angle of depression of 18°. How far is the swimmer from the base of the tower?

Draw it	The angle of depression from the tower top = 18°. Height = 4 m (Opposite). Distance = d (Adjacent).
Choose ratio	We have O and need A → use TOA: $\tan(\theta) = \frac{O}{A}$
Substitute	$\tan(18°) = \frac{4}{d}$ → $d = \frac{4}{\tan(18°)}$
Calculate	**$d = \frac{4}{0.3249} \approx 12.3$ m (the swimmer is about 12 m from the tower)**

Questions to ask your child

You don't need to solve these. Ask them and let your child explain their thinking!

7 Year 7

→ What is a right angle? Show me one in the room.
→ Angles in a triangle add to how many degrees?
→ A triangle has angles 90° and 47°. What is the third angle?
→ What is the difference between an acute and an obtuse angle?

8 Year 8

→ What does 'hypotenuse' mean in a right-angled triangle?
→ A right-angled triangle has legs 6 cm and 8 cm. What is the hypotenuse? (10 cm)
→ Which side of a right-angled triangle is always the longest?

9 Year 9

→ What does SOH CAH TOA stand for?
→ A right-angled triangle has hypotenuse 15 m and one angle of 30°. Find the opposite side.
→ The opposite side is 7 cm and adjacent is 7 cm. What is the angle? ($\tan^{-1}(1) = 45°$)
→ A person stands 50 m from a building. The angle up to the top is 40°. How tall is the building?
→ A ship sails 12 km north, then 9 km east. What angle does its path make with north?
→ What angle does a 1 in 5 slope make with the horizontal?

10 Year 10

→ What is the difference between an angle of elevation and an angle of depression?
→ From the top of a 40 m building, the angle of depression to a car is 32°. How far is the car from the building? ($d = \frac{40}{\tan(32°)} \approx 64$ m)
→ A ship sails on a bearing of 050° for 80 km. How far north has it travelled? ($\cos(50°) \times 80 \approx 51.4$ km)
→ A 10 m ramp rises to a platform 2.5 m high. What is the angle of elevation of the ramp?

Things to try at home

Year 7: Look for right angles, acute angles, and obtuse angles around the house. Use a protractor to check your guess.	**Year 7:** Draw a triangle and measure all three angles with a protractor. Do they add up to 180°?
Year 8: Find a right-angled object (a book, a table corner). Measure two sides and use Pythagoras' theorem to predict the third.	**Year 8:** Practise naming the sides of a right-angled triangle: which one is the hypotenuse? Which are the legs?
Year 9: Ladder problem: lean something against the wall. Measure the angle and the length. Calculate the height it reaches.	**Year 9:** Shadow problem: on a sunny day, measure your shadow length and your height. Calculate the angle of the sun.
Year 10: Angle of elevation: stand back from a tall tree or building. Measure the angle to the top with a phone inclinometer app and your distance. Calculate the height!	**Year 10:** Bearing walk: step 20 paces on a bearing of 060°, then 15 paces north. How far east and north are you from your start? Use trig to calculate.

Key words to learn together

trigonometry: the study of relationships between angles and sides in triangles	**SOH CAH TOA:** memory tool: sin=$\frac{\text{Opp}}{\text{Hyp}}$, cos=$\frac{\text{Adj}}{\text{Hyp}}$, tan=$\frac{\text{Opp}}{\text{Adj}}$
sine (sin): ratio of the opposite side to the hypotenuse: $\sin(\theta) = \frac{O}{H}$	**cosine (cos):** ratio of the adjacent side to the hypotenuse: $\cos(\theta) = \frac{A}{H}$
tangent (tan): ratio of the opposite side to the adjacent side: $\tan(\theta) = \frac{O}{A}$	**opposite:** the side across from the angle of interest
adjacent: the side next to the angle of interest (not the hypotenuse)	**hypotenuse:** the longest side — opposite the right angle
angle of elevation: the angle measured upward from horizontal to look at something above you along your line of sight.	**angle of depression:** the angle measured downward from horizontal to look at something below you along your line of sight.
inverse trig ($\sin^{-1}$): finds the angle given the ratio: $\sin^{-1}(0.5) = 30°$	**bearing:** direction measured clockwise from North — e.g. 045° means NE, 180° means South
3D trigonometry: applying trig in two steps — find one side, then use it in a new triangle	

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