

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 & Year 8	Prior knowledge — angles and right-angled triangles 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. $90^\circ + 40^\circ + 50^\circ = 180^\circ$ Pythagoras' theorem: $a^2 + b^2 = c^2$ (introduced Year 8) Your child is comfortable naming triangle sides and measuring angles.	'What type of angle is 45°?' (Acute — less than 90°) 'A triangle has angles 90° and 35°. What is the third angle?' ($180 - 90 - 35 = 55^\circ$) Identify right angles in buildings, furniture, and roads.
Year 9	SOH CAH TOA — the three basic trigonometric ratios 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: $\sin(\theta) = \text{Opposite} \div \text{Hypotenuse}$ CAH: $\cos(\theta) = \text{Adjacent} \div \text{Hypotenuse}$ TOA: $\tan(\theta) = \text{Opposite} \div \text{Adjacent}$ To find an angle when you know two sides, use the inverse: $\theta = \sin^{-1}(O/H)$ $\theta = \cos^{-1}(A/H)$ $\theta = \tan^{-1}(O/A)$	'What does SOH CAH TOA stand for?' (Sine=Opp/Hyp, Cosine=Adj/Hyp, Tangent=Opp/Adj) 'A ramp rises 3 m over a run of 4 m. What angle does it make?' $\tan(\theta) = \frac{3}{4} \rightarrow \theta = \tan^{-1}(0.75) \approx 36.9^\circ$ 'A 10 m ladder leans at 60°. How high up the wall does it reach?' $\sin(60^\circ) = h/10 \rightarrow h = 10 \times \sin(60^\circ) \approx 8.66 \text{ m}$
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 angle of depression — the angle you look DOWN from horizontal to see something below you e.g. looking up at a plane: $\tan(\text{elevation}) = \text{height} \div \text{horizontal distance}$ e.g. looking down from a cliff: $\tan(\text{depression}) = \text{height} \div \text{distance to boat}$ bearing — direction measured clockwise from North: N060°E means 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?' $\tan(20^\circ) = 30 \div d \rightarrow d = 30 \div \tan(20^\circ) \approx 82.4 \text{ m}$ 'A plane is 5,000 m high. The angle of elevation from the ground is 15°. How far horizontally is the plane?' $\tan(15^\circ) = 5000 \div d \rightarrow d \approx 18,660 \text{ m}$ 'A ship sails on bearing 040° for 60 km. How far north has it travelled?' ($\cos(40^\circ) \times 60 \approx 45.96 \text{ km}$)

★ SOH CAH TOA — the memory trick that unlocks trigonometry

	Ratio	Formula	When to use it
SOH	Sine	$\sin(\theta) = \text{Opp} \div \text{Hyp}$	Use when you know the opposite and hypotenuse, or want to find the angle from those sides
CAH	Cosine	$\cos(\theta) = \text{Adj} \div \text{Hyp}$	Use when you know the adjacent and hypotenuse, or want to find the angle from those sides
TOA	Tangent	$\tan(\theta) = \text{Opp} \div \text{Adj}$	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 $\rightarrow$ use SOH: $\sin(\theta) = O/H$
Substitute	$\sin(60^\circ) = h/10 \rightarrow h = 10 \times \sin(60^\circ)$
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 $\rightarrow$ use TOA: $\tan(\theta) = O/A$
Substitute	$\tan(\theta) = \frac{4}{10} = 0.4$
Find angle	$\theta = \tan^{-1}(0.4) \approx 21.8^\circ$ (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 $\rightarrow$ use TOA: $\tan(\theta) = O/A$
Substitute	$\tan(18^\circ) = 4 \div d \rightarrow d = 4 \div \tan(18^\circ)$
Calculate	$d = 4 \div 0.3249 \approx 12.3$ 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!

7-8 Year 7 & 8

- $\rightarrow$ What is a right angle? Show me one in the room.
- $\rightarrow$ Angles in a triangle add to how many degrees?
- $\rightarrow$ A triangle has angles 90° and 47° . What is the third angle?
- $\rightarrow$ What does 'hypotenuse' mean in a right-angled triangle?

9 Year 9

- $\rightarrow$ What does SOH CAH TOA stand for?
- $\rightarrow$ A right-angled triangle has hypotenuse 15 m and one angle of 30° . Find the opposite side.
- $\rightarrow$ The opposite side is 7 cm and adjacent is 7 cm. What is the angle? ($\tan^{-1}(1) = 45^\circ$)
- $\rightarrow$ A 6 m ramp makes a 20° angle with the ground. How high does it rise?

9 Year 9 — angles

- $\rightarrow$ A person stands 50 m from a building. The angle up to the top is 40° . How tall is the building?
- $\rightarrow$ Find the angle of elevation if you are 30 m from a 20 m tall tree.
- $\rightarrow$ A ship sails 12 km north, then 9 km east. What angle does its path make with north?
- $\rightarrow$ What angle does a 1 in 5 slope make with the horizontal?

10 Year 10

- $\rightarrow$ What is the difference between an angle of elevation and an angle of depression?
- $\rightarrow$ 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? ($d = 40 \div \tan(32^\circ) \approx 64$ m)
- $\rightarrow$ A ship sails on a bearing of 050° for 80 km. How far north has it travelled? ($\cos(50^\circ) \times 80 \approx 51.4$ km)
- $\rightarrow$ 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 7-8: Look for right angles and other angles at home. Use a protractor to measure them and name the type.	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 9: Find a ramp (driveway, wheelchair access). Estimate the rise and run. Calculate the angle it makes.
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: $\sin = \text{Opp}/\text{Hyp}$, $\cos = \text{Adj}/\text{Hyp}$, $\tan = \text{Opp}/\text{Adj}$
sine (sin): ratio of the opposite side to the hypotenuse: $\sin(\theta) = O/H$	cosine (cos): ratio of the adjacent side to the hypotenuse: $\cos(\theta) = A/H$
tangent (tan): ratio of the opposite side to the adjacent side: $\tan(\theta) = O/A$	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	angle of depression: the angle measured downward from horizontal to look at something below you
inverse trig ($\sin^{-1}$): finds the angle given the ratio: $\sin^{-1}(0.5) = 30^\circ$	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	