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Introduction to Trigonmetry

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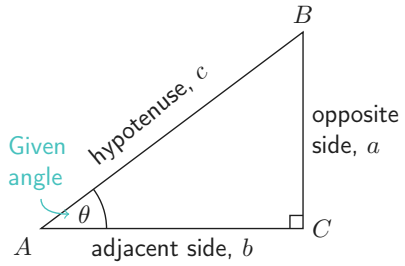
Overview

This presentation will cover:

- Trigonometric ratios
- Angle units
- Other trigonometric ratios

Right-angled Triangles



Recall: Pythagoras' Theorem:

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

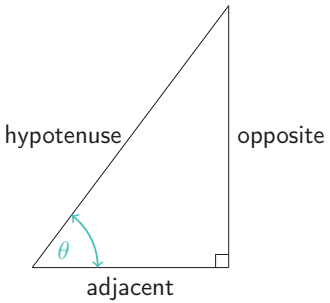
Note that:

- the sum of angles in any triangle is $180°$;
- side AC is **adjacent** to angle θ;
- side BC is **opposite** to angle θ;
- side AB, the **hypotenuse**, is opposite the right-angle.

Trigonometric ratios

Ratios are only defined for a right-angle triangle.

$$\text{sine } \theta \text{ or } \sin\theta = \frac{\text{opposite}}{\text{hypotenuse}},$$
$$\text{cosine } \theta \text{ or } \cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}},$$
$$\text{tangent } \theta \text{ or } \tan\theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{\sin\theta}{\cos\theta}.$$



Degrees, Radians, Grads

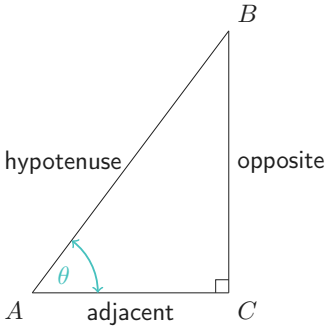
Angles are measured in:

- **Degrees:** Amount of turning so that a circle has $360°$
- **Radians:** Ratio of circular arc length to radius
- **Grads:** A metric degree, where 100 grads equals 90 degrees. It is sometimes referred to as a 'grade' or a 'gon'. Not used much in Australia.

Always check your calculator before completing trigonometric calculations

Other trigonometric ratios

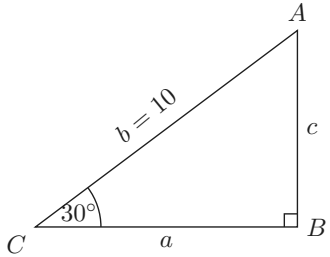
There are more ratios which can be used in Trigonometry (remember that ratios are only defined for right-angle triangles).



$$\begin{aligned}
\text{secant } \theta \text{ or } \sec\theta &= \frac{1}{\cos\theta} \\
&= \frac{\text{hypotenuse}}{\text{adjacent}}, \\
\text{cosecant } \theta \text{ or } \operatorname{cosec}\theta &= \frac{1}{\sin\theta} \\
&= \frac{\text{hypotenuse}}{\text{opposite}}, \\
\text{cotangent } \theta \text{ or } \cot\theta &= \frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta} \\
&= \frac{\text{adjacent}}{\text{opposite}}.
\end{aligned}$$

Example 1

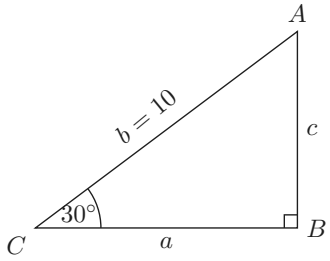
Find all the lengths of the given triangle. (Give answer to 2 decimal places.)



$$\begin{aligned}
\sin C &= \frac{\text{opposite}}{\text{hypothenuse}} \\
\sin 30° &= \frac{c}{10} \\
10 \times \sin 30° &= c \\
c &= 10 \times \sin 30° \\
c &= 5.
\end{aligned}$$

Example 1 (continued)

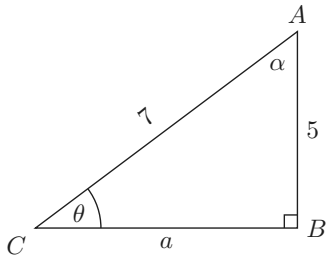
Find all the lengths of the given triangle. (Give answer to 2 decimal places.)



$$\begin{aligned} \cos C &= \frac{\text{adjacent}}{\text{hypothenuse}} \\ \cos 30^\circ &= \frac{a}{10} \\ 10 \times \cos 30^\circ &= a \\ a &= 10 \times \cos 30^\circ \\ a &\approx 8.66\,. \end{aligned}$$

Example 2

Find all the sides and angles of the given triangle. (Give answer to 2 decimal places.)



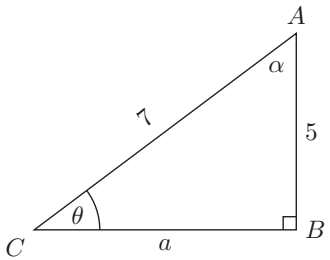
Firstly find the angle θ:

$$\begin{aligned} \sin\theta &= \frac{\text{opposite}}{\text{hypotenuse}} \\ \sin\theta &= \frac{5}{7} \\ \theta &= \sin^{-1}\left(\frac{5}{7}\right) \\ \theta &\approx 45.57^\circ\,. \end{aligned}$$

Note: $\sin^{-1}\left(\frac{5}{7}\right)$ means the angle whose sine is $\frac{5}{7}$.

Example 2 (continued)

Secondly, find the angle α:



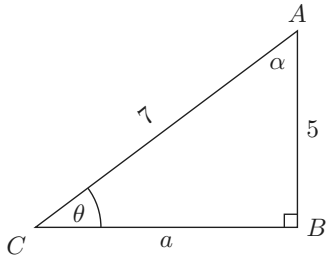
To find the angle $\angle CAB$, (or α), we use the fact that all angles in a triangle add up to 180°.

Recall that $\angle ABC$ is a right angle, which means that $\angle ABC = 90^\circ$.

Therefore,

$$\alpha \approx 180^\circ - 90^\circ - 45.58^\circ = 44.42^\circ\,.$$

Example 2 (continued)



To find side a, we could use Pythagoras' Theorem:

$$\begin{aligned} a^2 + 5^2 &= 7^2 \\ a^2 &= 7^2 - 5^2 \\ &= 24 \\ a &= \sqrt{24} \approx 4.90\,. \end{aligned}$$

Alternatively, you could use trigonometry.

Further help

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