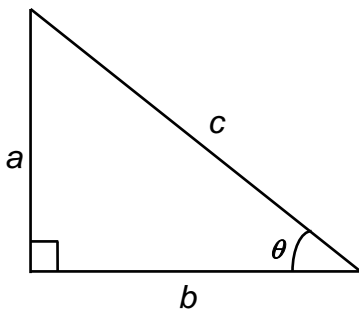


Factsheet: Trigonometric Identities

For right-angled triangles



$$\sin \theta = \frac{a}{c}$$

$$\cos \theta = \frac{b}{c}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{a}{b}$$

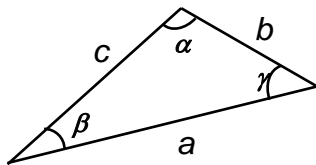
$$\csc \theta = \frac{1}{\sin \theta} = \frac{c}{a}$$

$$\sec \theta = \frac{1}{\cos \theta} = \frac{c}{b}$$

$$\cot \theta = \frac{1}{\tan \theta} = \frac{b}{a}$$

Pythagoras' theorem: $c^2 = a^2 + b^2$

For any triangle



Sine rule:

$$\frac{a}{\sin \alpha} = \frac{b}{\sin \beta} = \frac{c}{\sin \gamma}$$

Cosine rule:

$$a^2 = b^2 + c^2 - 2bc \cos \alpha$$

$$b^2 = a^2 + c^2 - 2ac \cos \beta$$

$$c^2 = a^2 + b^2 - 2ab \cos \gamma$$

Trigonometric identities

Sum-difference formulas: $\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta$

$$\cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta$$

$$\tan(\alpha \pm \beta) = \frac{\tan \alpha \pm \tan \beta}{1 \mp \tan \alpha \tan \beta}$$

Trigonometric identities continued

Product-to-sum formulas:

$$2 \sin \alpha \cos \beta = \sin(\alpha + \beta) + \sin(\alpha - \beta)$$
$$2 \cos \alpha \cos \beta = \cos(\alpha - \beta) + \cos(\alpha + \beta)$$
$$2 \sin \alpha \sin \beta = \cos(\alpha - \beta) - \cos(\alpha + \beta)$$

Pythagorean identities:

$$\sin^2 \alpha + \cos^2 \alpha = 1$$
$$1 + \cot^2 \alpha = \csc^2 \alpha$$
$$1 + \tan^2 \alpha = \sec^2 \alpha$$

Double angle formulas:

$$\sin 2\alpha = 2 \sin \alpha \cos \alpha$$
$$\begin{aligned} \cos 2\alpha &= \cos^2 \alpha - \sin^2 \alpha \\ &= 2 \cos^2 \alpha - 1 \\ &= 1 - 2 \sin^2 \alpha \end{aligned}$$
$$\tan 2\alpha = \frac{2 \tan \alpha}{1 - \tan^2 \alpha}$$

Want to know more?

If you have any further questions about this topic you can make an appointment to see a **Learning Enhancement Tutor** in the **Student Support Service**, as well as speaking to your lecturer or adviser.

- 📞 Call: 01603 592761
- 💻 Ask: ask.let@uea.ac.uk
- 🖱️ Click: <https://portal.uea.ac.uk/student-support-service/learning-enhancement>

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