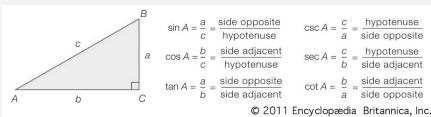


Trigonometric Functions



pythagoras's theorem

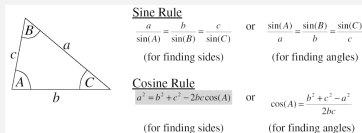
$$c^2 = a^2 + b^2 \quad c = \sqrt{a^2 + b^2}$$

$$a^2 = c^2 - b^2 \quad a = \sqrt{c^2 - b^2}$$

$$b^2 = c^2 - a^2 \quad b = \sqrt{c^2 - a^2}$$

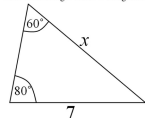
c is the hypotenuse whereas a and b can be switched interchangeably

Sine and cosine rule



Sine rule finding side example

Work out the length of x in the diagram below:



Step 1 Start by writing out the Sine Rule formula for finding sides:

$$\frac{a}{\sin(A)} = \frac{b}{\sin(B)}$$

Step 2 Fill in the values you know, and the unknown length:

$$\frac{x}{\sin(80^\circ)} = \frac{7}{\sin(60^\circ)}$$

Remember that each fraction in the Sine Rule formula should contain a side and its opposite angle.

Step 3 Solve the resulting equation to find the unknown side, giving your answer to 3 significant figures:

$$\frac{x}{\sin(80^\circ)} = \frac{7}{\sin(60^\circ)} \quad (\text{multiply by } \sin(80^\circ) \text{ on both sides})$$

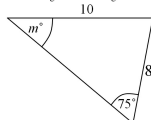
$$x = \frac{7}{\sin(60^\circ)} \times \sin(80^\circ)$$

$$x = 7.96 \text{ (accurate to 3 significant figures)}$$

Note that you should try and keep full accuracy until the end of your calculation to avoid errors.

Sine rule Finding Angles example

Work out angle m° in the diagram below:



Step 1 Start by writing out the Sine Rule formula for finding angles:

$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b}$$

Step 2 Fill in the values you know, and the unknown angle:

$$\frac{\sin(m^\circ)}{8} = \frac{\sin(75^\circ)}{10}$$

Remember that each fraction in the Sine Rule formula should contain a side and its opposite angle.

Step 3 Solve the resulting equation to find the sine of the unknown angle:

$$\frac{\sin(m^\circ)}{8} = \frac{\sin(75^\circ)}{10} \quad (\text{multiply by 8 on both sides})$$

$$\sin(m^\circ) = \frac{\sin(75^\circ)}{10} \times 8$$

$$\sin(m^\circ) = 0.773 \text{ (3 significant figures)}$$

Step 4 Use the inverse-sine function ($\sin^{-1}$) to find the angle:

$$m^\circ = \sin^{-1}(0.773) = 50.6^\circ \text{ (3sf)}$$

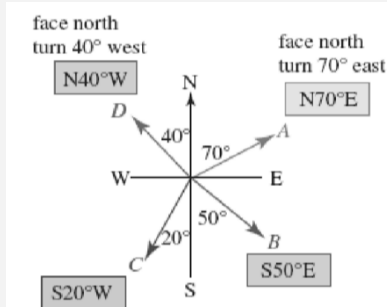
Scale Factor

Scale Factor

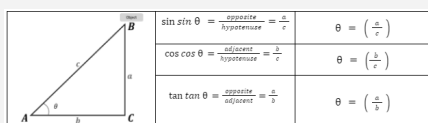
Scale factor is the ratio between the scale of a given original object and a new object, which is its representation but of a different size (bigger or smaller).

sf = larger figure dimensions ÷ smaller figure dimensions

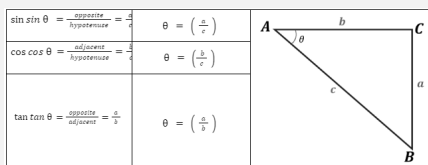
true bearings



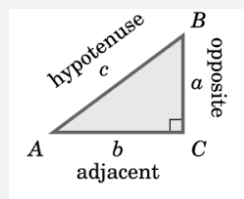
angle of elevation example



angle of depression example



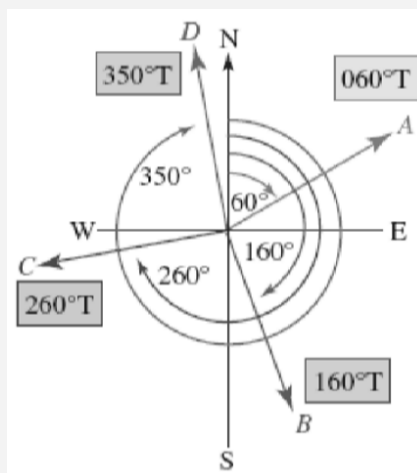
Examples of inverse functions



to solve A: $\sin^{-1}(a/c)$ or $\cos^{-1}(\text{adjacent/hypotenuse})$ or $\tan^{-1}(a/b)$

to solve B: $\sin^{-1}(b/c)$ $\cos^{-1}(a/c)$ $\tan^{-1}(b/a)$

conventional bearings

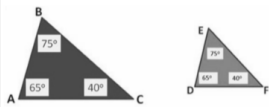


Subtract angles of depression by 90 degrees



Similarity Test for Similar Triangles

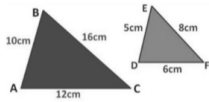
AAA Rule



$$\begin{aligned}\angle A &= \angle D = 65^\circ \\ \angle B &= \angle E = 75^\circ \\ \angle C &= \angle F = 40^\circ\end{aligned}$$

$\triangle ABC \sim \triangle DEF$
by the AAA Rule.

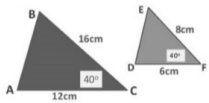
SSS Rule



$$\begin{aligned}\frac{AB}{DE} &= \frac{10}{5} = 2 \\ \frac{BC}{EF} &= \frac{16}{8} = 2 \\ \frac{AC}{DF} &= \frac{12}{6} = 2\end{aligned}$$

$\triangle ABC \sim \triangle DEF$
by the SSS Rule.

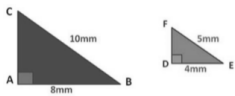
SAS Rule



$$\begin{aligned}\frac{BC}{EF} &= \frac{16}{8} = 2 \\ \angle C &= \angle F = 40^\circ \\ \frac{AC}{DF} &= \frac{12}{6} = 2\end{aligned}$$

$\triangle ABC \sim \triangle DEF$
by the SAS Rule.

RHS Rule

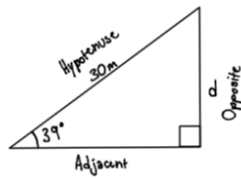


$$\begin{aligned}\angle A &= \angle D = 90^\circ \\ \frac{BC}{EF} &= \frac{10}{5} = 2 \\ \frac{AB}{DE} &= \frac{8}{4} = 2\end{aligned}$$

$\triangle ABC \sim \triangle DEF$
by the RHS Rule.

SINE

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

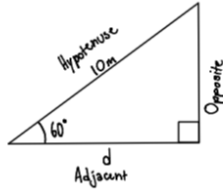


$$\sin 39^\circ = \frac{d}{30}$$

$$\begin{aligned}d &= 30 \times \sin 39^\circ \\ d &= 18.88\text{m}\end{aligned}$$

COSINE

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

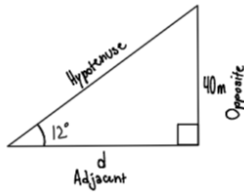


$$\cos 60^\circ = \frac{d}{10}$$

$$\begin{aligned}d &= 10 \times \cos 60^\circ \\ d &= 5\text{m}\end{aligned}$$

TANGENT

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$



$$\tan 12^\circ = \frac{40}{d}$$

$$\begin{aligned}d &= 40 \div \tan 12^\circ \\ d &= 188.19\text{m}\end{aligned}$$



By deathrobotpunch

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