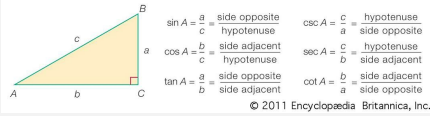


## Trigonometric Functions



## 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**

$$\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)} \quad \text{or} \quad \frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$$

(for finding sides) (for finding angles)

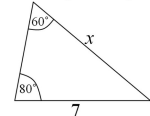
**Cosine Rule**

$$a^2 = b^2 + c^2 - 2bc \cos(A) \quad \text{or} \quad \cos(A) = \frac{b^2 + c^2 - a^2}{2bc}$$

(for finding sides) (for finding angles)

## 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:

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

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:

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

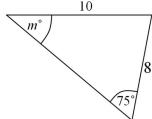
$$x = \frac{7}{\sin(60^\circ)} \times \sin(80^\circ)$$

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

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  $m^\circ$  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:

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

Subtract angles of depression by 90 degrees

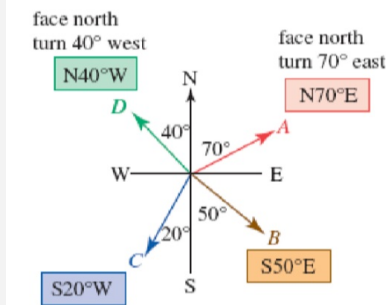
## Scale Factor

### Scale Factor

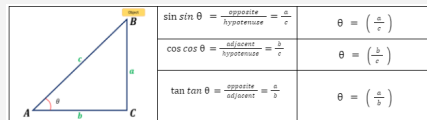
Scale factor is the ratio between the scale of a given original object and a new object, which is its representation but of a different size (bigger or smaller).

sf = larger figure dimensions ÷ smaller figure dimensions

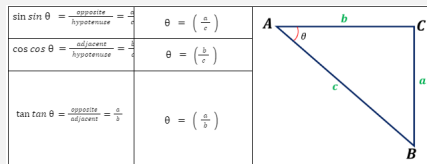
## true bearings



## angle of elevation example

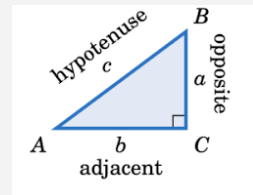


## angle of depression example



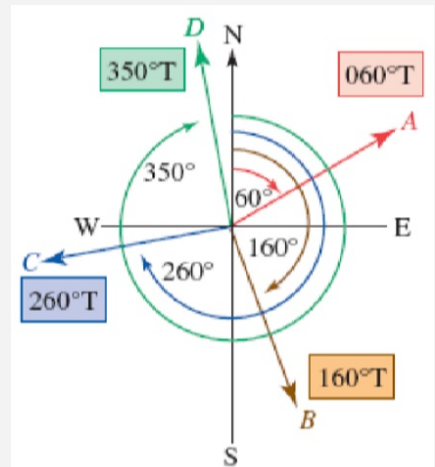
## Examples of Trigonometric functions

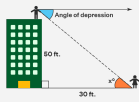
## Examples of inverse functions



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

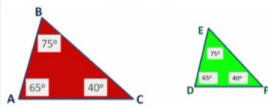
## conventional bearings





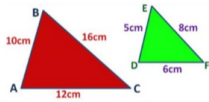
## Similarity Test for Similar Triangles

### AAA Rule



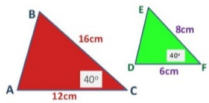
$\angle A = \angle D = 65^\circ$   
 $\angle B = \angle E = 75^\circ$   
 $\angle C = \angle F = 40^\circ$   
 $\triangle ABC \sim \triangle DEF$   
 by the AAA Rule.

### SSS Rule



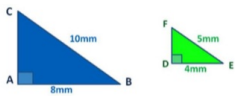
$\frac{AB}{DE} = \frac{10}{5} = 2$   
 $\frac{BC}{EF} = \frac{16}{8} = 2$   
 $\frac{AC}{DF} = \frac{12}{6} = 2$   
 $\triangle ABC \sim \triangle DEF$   
 by the SSS Rule.

### SAS Rule



$\frac{BC}{EF} = \frac{16}{8} = 2$   
 $\angle C = \angle F = 40^\circ$   
 $\frac{AC}{DF} = \frac{12}{6} = 2$   
 $\triangle ABC \sim \triangle DEF$   
 by the SAS Rule.

### RHS Rule



$\angle A = \angle D = 90^\circ$   
 $\frac{BC}{EF} = \frac{10}{5} = 2$   
 $\frac{AB}{DE} = \frac{8}{4} = 2$   
 $\triangle ABC \sim \triangle DEF$   
 by the RHS Rule.

## SINE

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



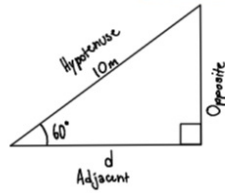
$$\sin 39^\circ = \frac{d}{30}$$

$$d = 30 \times \sin 39^\circ$$

$$d = 18.88 \text{ m}$$

## COSINE

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



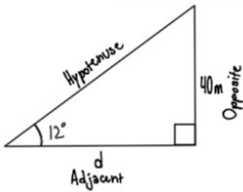
$$\cos 60^\circ = \frac{d}{10}$$

$$d = 10 \times \cos 60^\circ$$

$$d = 5 \text{ m}$$

## TANGENT

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



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

$$d = 40 \div \tan 12^\circ$$

$$d = 188.19 \text{ m}$$

By deathrobotpunch

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Page 1 of 2.

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