4.4 TRIGONOMETRY

A. LABELLING TRIANGLES

Trigonometry is a branch of mathematics that enables us to determine the measures of lengths and angles to great accuracy. In this section, we will only consider the results obtained from using right angled triangles. In doing so, we can identify the side lengths of such triangles by specific names.

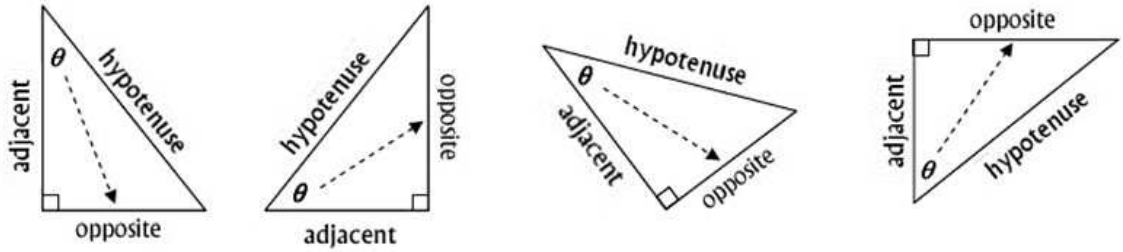
The three sides of a triangle can be labelled as the hypotenuse, opposite or adjacent sides.

As we saw with the Pythagorean Theorem, the ***hypotenuse*** is the longest side of the triangle and is opposite the 90° angle.

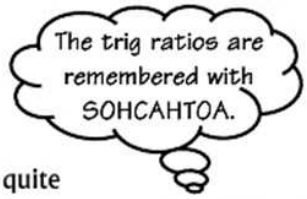
For a given angle θ (pronounced "theta"), the ***opposite*** side is opposite the angle θ.

The remaining third side is ***adjacent*** or alongside the angle θ that is not the hypotenuse.

For example,



Thus, $\sin\theta = \frac{\text{opp}}{\text{hyp}}$, $\cos\theta = \frac{\text{adj}}{\text{hyp}}$, $\tan\theta = \frac{\text{opp}}{\text{adj}}$

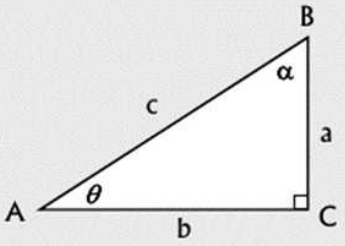


These three formulae are referred to as the ***trigonometric ratios***, and will prove quite useful for finding missing side and angle measures for right angled triangles.

EXAMPLE 8

For the following triangle determine:

a. $\sin\theta$ b. $\cos\alpha$ c. $\tan\theta$ d. $\sin\alpha$



Solution

a. $\sin\theta = \frac{\text{opp}}{\text{hyp}} = \frac{a}{c}$

b. $\cos\alpha = \frac{\text{adj}}{\text{hyp}} = \frac{a}{c}$

c. $\tan\theta = \frac{\text{opp}}{\text{adj}} = \frac{a}{b}$

d. $\sin\alpha = \frac{\text{opp}}{\text{hyp}} = \frac{b}{c}$

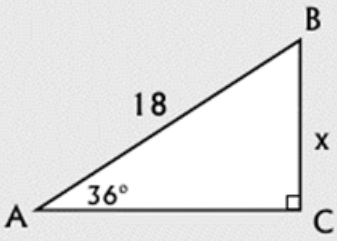
D. FINDING SIDES USING TRIGONOMETRY

In a right angled triangle, if we are given an angle (other than the 90°) and a side we can use trigonometry to determine the missing sides. To do so, follow the steps as outlined below:

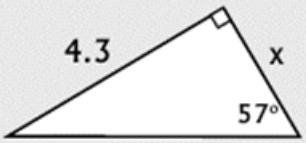
EXAMPLE 9

Determine the value of x in each triangle.

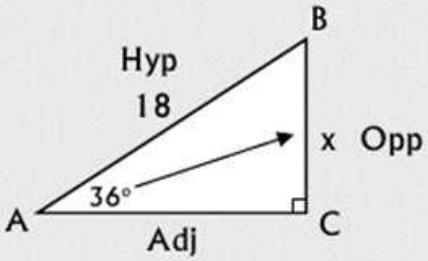
a.

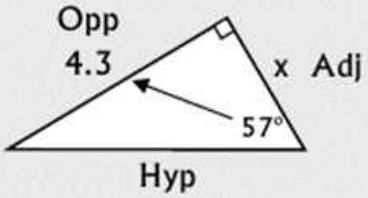


b.



Solution





a. $\sin\theta = \frac{opp}{hyp}$

$\sin 36° = \frac{x}{18}$

$x = 18 \sin 36°$

$x \approx 10.6$

b. $\tan\theta = \frac{opp}{adj}$

$\tan 57° = \frac{4.3}{x}$

$x = \frac{4.3}{\tan 57°}$

$x \approx 2.8$

E. FINDING ANGLES USING TRIGONOMETRY

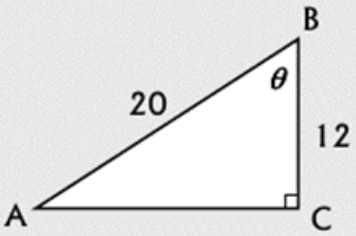
In a right angled triangle, if we are given any two sides we can use trigonometry to determine the missing angles. To do so, follow the steps as outlined below:

NOTE: Make sure to check that your calculator [MODE] is set on DEGREES.

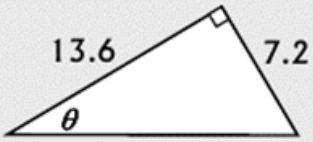
EXAMPLE 10

Determine the value of θ in each triangle.

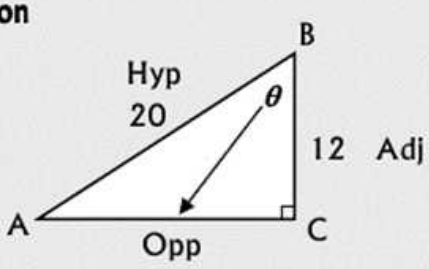
a.

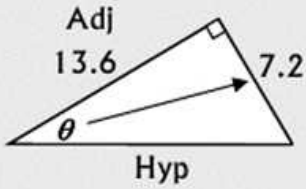


b.



Solution





To find θ on the calculator, press
[2nd] [COS]
0.6

a. $\cos\theta = \frac{adj}{hyp}$

$\cos\theta = \frac{12}{20}$

$\cos\theta = 0.6$

$\theta = \cos^{-1}(0.6)$

$\theta \approx 53°$

b. $\tan\theta = \frac{opp}{adj}$

$\tan\theta = \frac{7.2}{13.6}$

$\tan\theta \approx 0.5294$

$\theta = \tan^{-1}(0.5294)$

$\theta \approx 28°$

To find θ on the calculator, press
[2nd] [TAN]
0.5294