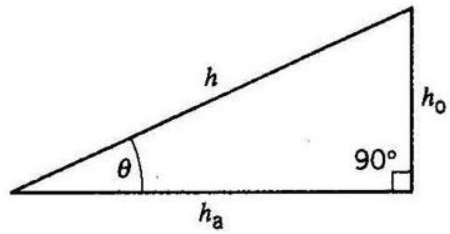
TRIGONOMETRY

Consider a right angle triangle.



We have then the following definitions:

$$cos(\theta) = \frac{Side\ Adjacent\ to\ \theta}{Hypotenuse} = \frac{h_a}{h}$$
$$sin(\theta) = \frac{Side\ Opposite\ to\ \theta}{Hypotenuse} = \frac{h_o}{h}$$
$$tan(\theta) = \frac{Side\ Opposite\ to\ \theta}{Side\ Adjacent\ to\ \theta} = \frac{h_o}{h_a}$$

Notes:

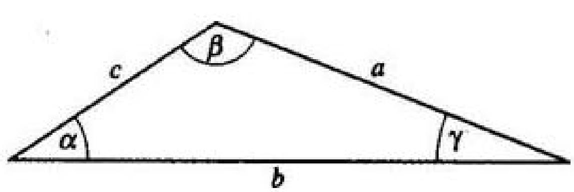
1. Each of the trigonometric function is the ratio of two length, and hence is dimensionless.
2. Pythagorean Theorem:

$$\boxed{h^2 = {h_o}^2 + {h_a}^2}$$

3. Often the values of the two sides of the triangle are available and the value of the angle is the unknown. In such situation we use the inverse trigonometric functions.

$$\theta = cos^{-1}(\frac{Side\ Adjacent\ to\ \theta}{Hypotenuse})$$
$$\theta = sin^{-1}(\frac{Side\ Opposite\ to\ \theta}{Hypotenuse})$$
$$\theta = tan^{-1}(\frac{Side\ Opposite\ to\ \theta}{Side\ Adjacent\ to\ \theta})$$

0.1 General triangle:



1. Sum of the angles:

$$\alpha + \beta + \gamma = 180^o$$

2. law of sines:

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

3. law of cosines:

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

0.2 Other trigonometric identities:

$$sin(-\theta) = -sin(\theta)$$

$$cos(-\theta) = cos(\theta)$$

$$tan(-\theta) = -tan(\theta)$$

$$sin(\theta)/cos(\theta) = tan(\theta)$$

$$sin^2(\theta) + cos^2(\theta) = 1$$

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

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