Geometry and Measurement

Coordinate Geometry

Slope $= \frac{y_2 - y_1}{x_2 - x_1}$

Distance [2D] $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ [3D] $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$

Midpoint [2D] $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ [3D] $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2}\right)$

Polar Coordinates

In polar form, each coordinate pair is written as (r, θ)

To convert from polar to Cartesian (xy) coordinates:

$x = r \cos \theta$

$y = r \sin \theta$

Transformation

For $k > 0$:

$f(x) + k \rightarrow$ function is translated k units upward

$f(x) - k \rightarrow$ function is translated k units downward

$f(x + k) \rightarrow$ function is translated k units to the left

$f(x - k) \rightarrow$ function is translated k units to the right

$-f(x) \rightarrow$ function is reflected along the x-axis (upside-down flip)

$f(-x) \rightarrow$ function is reflected along the y-axis (left-right flip)

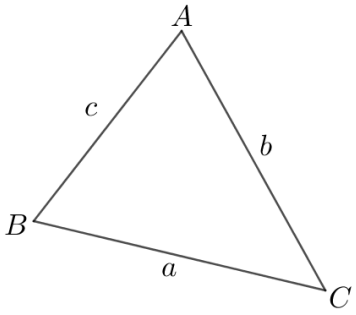
Degree vs. Radian

Degree to Radian: $x° \times \frac{\pi}{180°} =$ radian

Radian to Degree: $x \times \frac{180°}{\pi} =$ degree

Trigonometry for Non-Right-Angle Triangle

Let A, B, and C be the angles of a triangle, and a, b, and c be the corresponding sides.



Law of sine: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Law of cosine: $c^2 = a^2 + b^2 - 2ab\cos C$

$$\text{or } \cos C = \frac{a^2+b^2-c^2}{2ab}$$

Area of triangle $= \frac{1}{2}ab\sin C$

Trigonometric Identities

$\tan\theta = \frac{\sin\theta}{\cos\theta}$ / $\cot\theta = \frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta}$

$\csc\theta = \frac{1}{\sin\theta}$ / $\sec\theta = \frac{1}{\cos\theta}$

$\sin^2\theta + \cos^2\theta = 1$ / $\sin^2\theta = 1 - \cos^2\theta$ / $\cos^2\theta = 1 - \sin^2\theta$

$1 + \tan^2\theta = \sec^2\theta$ / $1 + \cot^2\theta = \csc^2\theta$

$\sin 2\theta = 2\sin\theta\cos\theta$

$\cos 2\theta = \cos^2\theta - \sin^2\theta = 2\cos^2\theta - 1 = 1 - 2\sin^2\theta$