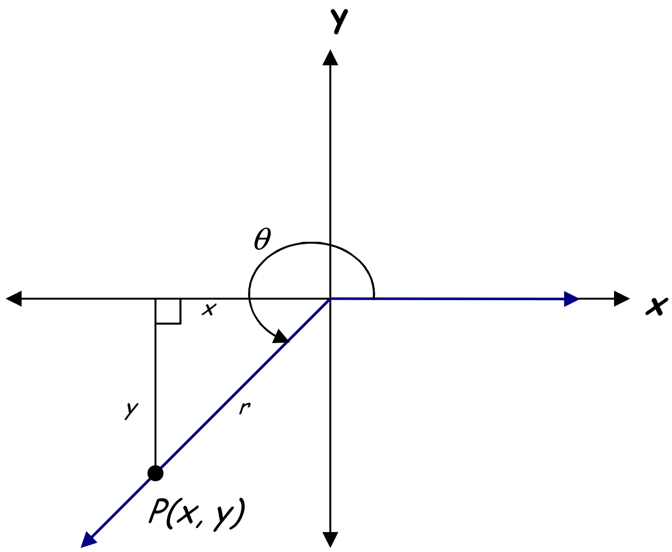
TRIGONOMETRIC FORMULAS

$\sin\theta = \frac{y}{r}$ $\csc\theta = \frac{r}{y}$, y not equal to 0 $\cos\theta = \frac{x}{r}$ $\sec\theta = \frac{r}{x}$, x not equal to 0

$\tan\theta = \frac{y}{x}$, x not equal to 0 $\cot\theta = \frac{x}{y}$, y not equal to 0



- THE RECIPROCAL IDENTITIES

$$\sin\theta = \frac{1}{\csc\theta} \qquad \cos\theta = \frac{1}{\sec\theta} \qquad \cot\theta = \frac{1}{\tan\theta}$$

$$\csc\theta = \frac{1}{\sin\theta} \qquad \sec\theta = \frac{1}{\cos\theta} \qquad \tan\theta = \frac{1}{\cot\theta}$$

- PYTHAGOREAN IDENTITIES

$$\sin^2\theta + \cos^2\theta = 1 \qquad \tan^2\theta + 1 = \sec^2\theta \qquad 1 + \cot^2\theta = \csc^2\theta$$

- QUOTIENT IDENTITIES

$$\frac{\sin\theta}{\cos\theta} = \tan\theta \qquad \frac{\cos\theta}{\sin\theta} = \cot\theta$$

- NEGATIVE ANGLE IDENTITIES

$$\sin(-\theta) = -\sin\theta \qquad \cos(-\theta) = \cos\theta \qquad \tan(-\theta) = -\tan\theta$$

- COFUNCTION IDENTITIES

$$\sin A = \cos(90^\circ - A) \qquad \csc A = \sec(90^\circ - A) \qquad \cos A = \sin(90^\circ - A)$$

$$\sec A = \csc(90^\circ - A) \qquad \tan A = \cot(90^\circ - A) \qquad \cot A = \tan(90^\circ - A)$$

- SUM AND DIFFERENCE IDENTITIES

$$\cos(A - B) = \cos A\cos B + \sin A\sin B \qquad \cos(A + B) = \cos A\cos B - \sin A\sin B$$

$$\sin(A - B) = \sin A\cos B - \cos A\sin B \qquad \sin(A + B) = \sin A\cos B + \cos A\sin B$$

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A\tan B} \qquad \tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A\tan B}$$

- DOUBLE-ANGLE IDENTITIES

$\cos 2A = \cos^2 A - \sin^2 A \quad \cos 2A = 1 - 2\sin^2 A \quad \cos 2A = 2\cos^2 A - 1$

$\sin 2A = 2\sin A\cos A \qquad \tan 2A = \dfrac{2\tan A}{1-\tan^2 A}$

- HALF-ANGLE IDENTITIES

$\cos\dfrac{A}{2} = \pm\sqrt{\dfrac{1+\cos A}{2}} \quad \sin\dfrac{A}{2} = \pm\sqrt{\dfrac{1-\cos A}{2}}$

$\tan\dfrac{A}{2} = \pm\sqrt{\dfrac{1-\cos A}{1+\cos A}} \quad \tan\dfrac{A}{2} = \dfrac{1-\cos A}{\sin A} \quad \tan\dfrac{A}{2} = \dfrac{\sin A}{1+\cos A}$

- PRODUCT-TO-SUM AND SUM-TO-PRODUCT IDENTITIES

$\cos A\cos B = \dfrac{1}{2}\left[\cos(A+B)+\cos(A-B)\right] \quad \sin A\sin B = \dfrac{1}{2}\left[\cos(A-B)-\cos(A+B)\right]$

$\sin A\cos B = \dfrac{1}{2}\left[\sin(A+B)+\sin(A-B)\right] \quad \cos A\sin B = \dfrac{1}{2}\left[\sin(A+B)-\sin(A-B)\right]$

$\sin A+\sin B = 2\sin\left(\dfrac{A+B}{2}\right)\cos\left(\dfrac{A-B}{2}\right) \quad \sin A-\sin B = 2\cos\left(\dfrac{A+B}{2}\right)\sin\left(\dfrac{A-B}{2}\right)$

$\cos A+\cos B = 2\cos\left(\dfrac{A+B}{2}\right)\cos\left(\dfrac{A-B}{2}\right) \quad \cos A-\cos B = -2\sin\left(\dfrac{A+B}{2}\right)\sin\left(\dfrac{A-B}{2}\right)$

- LAW OF SINES

$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

- LAW OF COSINES

$a^2 = b^2 + c^2 - 2bc\cos A \quad b^2 = a^2 + c^2 - 2ac\cos B \quad c^2 = a^2 + b^2 - 2ab\cos C$

- AREA OF A TRIANGLE

In any triangle *ABC*, the area λ is given by the following formulas:

$\lambda = \dfrac{1}{2}bc\sin A, \quad \lambda = \dfrac{1}{2}ab\sin C, \quad \lambda = \dfrac{1}{2}ac\sin B.$

- HERON'S AREA FORMULA

If a triangle has sides of lengths *a*, *b* and *c*, with semiperimeter $s = \dfrac{1}{2}(a+b+c)$, then the area of the triangle is $\lambda = \sqrt{s(s-a)(s-b)(s-c)}$