Mathematical Formulae

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1 Trigonometry

1.1 Addition/Difference Formulae:

$$sin(A+B) = sinA\,cosB + cosA\,sinB$$
$$sin(A-B) = sinA\,cosB - cosA\,sinB$$

$$cos(A+B) = cosA\,cosB - sinA\,sinB$$
$$cos(A-B) = cosA\,cosB + sinA\,sinB$$

$$tan(A+B) = \frac{tanA + tanB}{1 - tanA\,tanB}$$
$$tan(A-B) = \frac{tanA - tanB}{1 + tanA\,tanB}$$
$$cot(A+B) = \frac{cotA\,cotB - 1}{cotB + cotA}$$
$$cot(A-B) = \frac{cotA\,cotB + 1}{cotB - cotA}$$
$$sinC + sinD = 2\,sin\left(\frac{C+D}{2}\right) cos\left(\frac{C-D}{2}\right)$$
$$sinC - sinD = 2\,cos\left(\frac{C+D}{2}\right) sin\left(\frac{C-D}{2}\right)$$
$$cosC + cosD = 2\,cos\left(\frac{C+D}{2}\right) cos\left(\frac{C-D}{2}\right)$$
$$cosC - cosD = 2\,sin\left(\frac{C+D}{2}\right) cos\left(\frac{D-C}{2}\right)$$

1.1.1 Special Cases:

$$tan\left(\frac{\pi}{4} + \theta\right) = \frac{1 + tan\theta}{1 - tan\theta}$$
$$tan\left(\frac{\pi}{4} - \theta\right) = \frac{1 - tan\theta}{1 + tan\theta}$$

1.2 Product Formulae:

$$2\,sinA\,cosB = sin(A+B) + sin(A-B)$$
$$2\,cosA\,sinB = sin(A+B) - sin(A-B)$$
$$2\,cosA\,cosB = cos(A+B) + cos(A-B)$$
$$2\,sinA\,sinB = cos(A-B) - cos(A+B)$$
$$sin^2A - sin^2B = sin(A+B)\,sin(A-B)$$
$$cos^2A - sin^2B = cos(A+B)\,cos(A-B)$$

1.3 Double Angle Formulae:

$$sin\,2\theta = 2\,sin\theta\,cos\theta$$
$$sin\,2\theta = \frac{2\,tan\theta}{1 + tan^2\theta}$$

$$cos\,2\theta = cos^2\theta - sin^2\theta$$
$$cos\,2\theta = 2\,cos^2\theta - 1$$
$$cos\,2\theta = 1 - 2\,sin^2\theta$$
$$cos\,2\theta = \frac{1 - tan^2\theta}{1 + tan^2\theta}$$

$$tan\,2\theta = \frac{2\,tan\theta}{1 - tan^2\theta}$$

1.4 Triple Angle Formulae:

$$sin\,3\theta = 3\,sin\theta - 4\,sin^3\theta$$
$$cos\,3\theta = 4\,cos^3\theta - 3\,cos\theta$$
$$tan\,3\theta = \frac{3\,tan\theta - tan^3\theta}{1 - 3\,tan^2\theta}$$

1.5 Miscellaneous:

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

	0	30	45	60	90
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞

1.5.1 Identities:

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