

## Useful Trigonometric Formulas

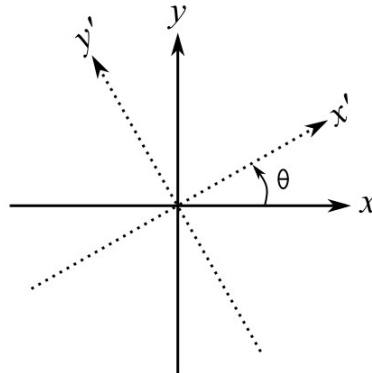
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1.  $\cos(\alpha+\beta) = \cos\alpha \cos\beta - \sin\alpha \sin\beta$
2.  $\cos(\alpha-\beta) = \cos\alpha \cos\beta + \sin\alpha \sin\beta$
3.  $\sin(\alpha+\beta) = \sin\alpha \cos\beta + \cos\alpha \sin\beta$
4.  $\sin(\alpha-\beta) = \sin\alpha \cos\beta - \cos\alpha \sin\beta$
5.  $\tan(\alpha+\beta) = (\tan\alpha + \tan\beta) / (1 - \tan\alpha \tan\beta)$
6.  $2 \cos\alpha \cos\beta = \cos(\alpha+\beta) + \cos(\alpha-\beta)$
7.  $2 \cos\alpha \sin\beta = \sin(\alpha+\beta) - \sin(\alpha-\beta)$
8.  $2 \sin\alpha \sin\beta = -\cos(\alpha+\beta) + \cos(\alpha-\beta)$
9.  $2 \sin\alpha \cos\beta = \sin(\alpha+\beta) + \sin(\alpha-\beta)$
10.  $\sin 2\theta = 2 \sin\theta \cos\theta$
11.  $\cos 2\theta = \cos^2\theta - \sin^2\theta = 1 - 2\sin^2\theta = 2\cos^2\theta - 1$
12.  $\sin^2\theta + \cos^2\theta = 1$
13.  $\sin\theta = \frac{\sqrt{1-\cos 2\theta}}{2}$ ;  $\cos\theta = \frac{\sqrt{1+\cos 2\theta}}{2}$
14.  $\cos 0 = 1$ ;  $\cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}$ ;  $\cos \frac{\pi}{4} = \frac{\sqrt{2}}{2}$ ;  $\cos \frac{\pi}{3} = \frac{1}{2}$ ;  $\cos \frac{\pi}{2} = 0$
15.  $\sin 0 = 0$ ;  $\sin \frac{\pi}{6} = \frac{1}{2}$ ;  $\sin \frac{\pi}{4} = \frac{\sqrt{2}}{2}$ ;  $\sin \frac{\pi}{3} = \frac{\sqrt{3}}{2}$ ;  $\sin \frac{\pi}{2} = 1$

16. Rotation of coordinates:

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x' \\ y' \end{bmatrix}$$



17. Euler's formula

$$e^{j\omega} = \cos\omega + j\sin\omega$$

$$\cos\omega = \frac{e^{j\omega} + e^{-j\omega}}{2}; \quad \sin\omega = \frac{e^{j\omega} - e^{-j\omega}}{2j}$$

Euler's number:

$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \frac{1}{1} + \frac{1}{1} + \frac{1}{1 \cdot 2} + \frac{1}{1 \cdot 2 \cdot 3} + \dots = 2.71828$$

