

## Math Formulas: Trigonometry Identities

### Right-Triangle Definitions

1.  $\sin \alpha = \text{Opposite} / \text{Hypotenuse}$
2.  $\cos \alpha = \text{Adjacent} / \text{Hypotenuse}$
3.  $\tan \alpha = \text{Opposite} / \text{Adjacent}$
4.  $\text{Cosec } \alpha = 1 / \sin \alpha = \text{Hypotenuse} / \text{Opposite}$
5.  $\text{Sec } \alpha = 1 / \cos \alpha = \text{Hypotenuse} / \text{Adjacent}$
6.  $\text{Cot } \alpha = 1 / \tan \alpha = \text{Adjacent} / \text{Opposite}$

### Reduction Formulas

7.  $\sin(-x) = -\sin(x)$
8.  $\cos(-x) = \cos(x)$
9.  $\sin(\pi/2 - x) = \cos(x)$
10.  $\cos(\pi/2 - x) = \sin(x)$
11.  $\sin(\pi/2 + x) = \cos(x)$
12.  $\cos(\pi/2 + x) = -\sin(x)$
13.  $\sin(\pi - x) = \sin(x)$
14.  $\cos(\pi - x) = -\cos(x)$
15.  $\sin(\pi + x) = -\sin(x)$
16.  $\cos(\pi + x) = -\cos(x)$

### Basic Identities

17.  $\sin^2 x + \cos^2 x = 1$
18.  $\tan^2 x + 1 = 1/\cos^2 x$
19.  $\cot^2 x + 1 = 1/\sin^2 x$

## Sum and Difference Formulas

$$20. \sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \sin \beta \cdot \cos \alpha$$

$$21. \sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \sin \beta \cdot \cos \alpha$$

$$22. \cos(\alpha + \beta) = \cos \alpha \cdot \cos \beta - \sin \alpha \cdot \sin \beta$$

$$23. \cos(\alpha - \beta) = \cos \alpha \cdot \cos \beta + \sin \alpha \cdot \sin \beta$$

$$24. \tan(\alpha + \beta) = \frac{\tan \alpha + \tan \beta}{1 - \tan \alpha \cdot \tan \beta}$$

$$25. \tan(\alpha - \beta) = \frac{\tan \alpha - \tan \beta}{1 + \tan \alpha \cdot \tan \beta}$$

## Double Angle and Half Angle Formulas

$$26. \sin(2\alpha) = 2 \cdot \sin \alpha \cdot \cos \alpha$$

$$27. \cos(2\alpha) = \cos^2 \alpha - \sin^2 \alpha$$

$$28. \tan(2\alpha) = \frac{2 \tan \alpha}{1 - \tan^2 \alpha}$$

## Other formulas

$$\cos^2 A + \sin^2 A = 1$$

$$\sec^2 A - \tan^2 A = 1$$

$$\operatorname{cosec}^2 A - \cot^2 A = 1$$

$$\sin 2A = 2 \sin A \cos A$$

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

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos A \cos B = \frac{\cos(A + B) + \cos(A - B)}{2}$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin A \sin B = \frac{\cos(A - B) - \cos(A + B)}{2}$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$\sin A \cos B = \frac{\sin(A + B) + \sin(A - B)}{2}$$

$$\sin A + \sin B = 2 \sin \frac{A + B}{2} \cos \frac{A - B}{2}$$

$$\cos^2 A = \frac{1 + \cos 2A}{2}$$

$$\sin A - \sin B = 2 \cos \frac{A + B}{2} \sin \frac{A - B}{2}$$

$$\sin^2 A = \frac{1 - \cos 2A}{2}$$

$$\cos A + \cos B = 2 \cos \frac{A + B}{2} \cos \frac{A - B}{2}$$

$$\cos^3 A = \frac{3 \cos A + \cos 3A}{4}$$

$$\cos A - \cos B = -2 \sin \frac{A + B}{2} \sin \frac{A - B}{2}$$

$$\sin^3 A = \frac{3 \sin A - \sin 3A}{4}$$