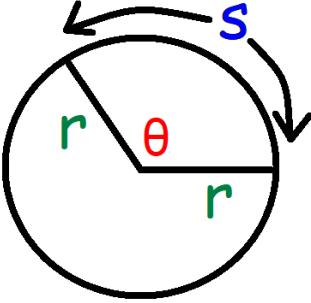
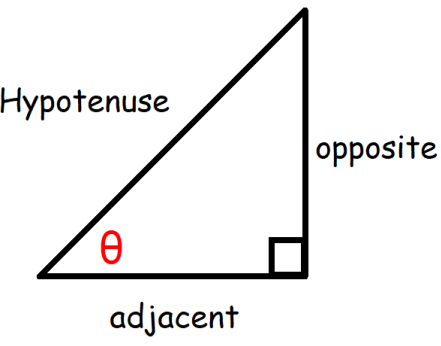
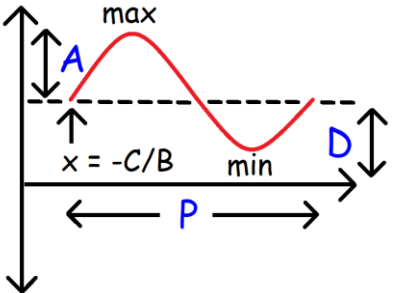
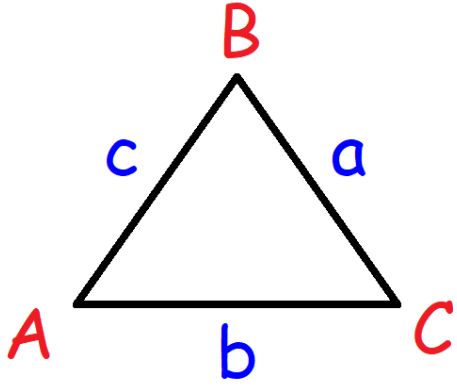


## Trigonometry Formula Sheet:

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p><b>Arc Length:</b></p> $s = \theta r \quad \theta \rightarrow \text{radians}$ <p><b>Area of a Sector:</b></p> $A = \frac{1}{2} \theta r^2 \quad \theta \rightarrow \text{radians}$ $A = \left( \frac{\theta}{360^\circ} \right) \pi r^2 \quad \theta \rightarrow \text{degrees}$                                                             |
|    | <p><b>Six Trig Functions: (SOH CAH TOA)</b></p> $\sin \theta = \frac{\text{opp}}{\text{hyp}} \quad \csc \theta = \frac{\text{hyp}}{\text{opp}}$ $\cos \theta = \frac{\text{adj}}{\text{hyp}} \quad \sec \theta = \frac{\text{hyp}}{\text{adj}}$ $\tan \theta = \frac{\text{opp}}{\text{adj}} \quad \cot \theta = \frac{\text{adj}}{\text{opp}}$ |
|  | <p><b>Graphing Trig Functions:</b></p> $y = A \sin(Bx + c) + D$ <p><b>Amplitude:</b> <math> A  = \frac{\text{max} - \text{min}}{2}</math>    <b>Period:</b> <math>P = \frac{2\pi}{B}</math></p> <p><b>Vertical Shift:</b> <math>D = \frac{\text{max} + \text{min}}{2}</math>    <b>Phase Shift:</b> <math>x = \frac{-C}{B}</math></p>           |
|  | <p><b>Law of Sines:</b></p> $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$ <p><b>Law of Cosines:</b></p> $c^2 = a^2 + b^2 - 2ab \cos C$ <p><b>Law of Tangents:</b></p> $\frac{a-b}{a+b} = \frac{\tan[1/2 (A-B)]}{\tan[1/2 (A+B)]}$                                                                                                    |

|                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reciprocal Identities:</b> $\cot \theta = \frac{1}{\tan \theta}$ $\csc \theta = \frac{1}{\sin \theta}$ $\sec \theta = \frac{1}{\cos \theta}$                                                                                                                                                                                                                                            | <b>Quotient Identities:</b> $\tan \theta = \frac{\sin \theta}{\cos \theta}$ $\cot \theta = \frac{\cos \theta}{\sin \theta}$                                                                                                                                                                                                                                                                        | <b>Pythagorean Identities:</b> $\sin^2 \theta + \cos^2 \theta = 1$ $1 + \tan^2 \theta = \sec^2 \theta$ $1 + \cot^2 \theta = \csc^2 \theta$                                                              |
| <b>Even-Odd Identities:</b> $\sin(-\theta) = -\sin \theta$ $\cos(-\theta) = \cos \theta$ $\tan(-\theta) = -\tan \theta$ $\csc(-\theta) = -\csc \theta$ $\sec(-\theta) = \sec \theta$ $\cot(-\theta) = -\cot \theta$                                                                                                                                                                        | <b>Co-function Identities:</b> $\cos(90^\circ - \theta) = \sin \theta$ $\sin(90^\circ - \theta) = \cos \theta$ $\tan(90^\circ - \theta) = \cot \theta$ $\cot(90^\circ - \theta) = \tan \theta$ $\sec(90^\circ - \theta) = \csc \theta$ $\csc(90^\circ - \theta) = \sec \theta$                                                                                                                     | <b>Power Reducing Formulas:</b> $\sin^2 \theta = \frac{1 - \cos 2\theta}{2}$ $\cos^2 \theta = \frac{1 + \cos 2\theta}{2}$ $\tan^2 \theta = \frac{1 - \cos 2\theta}{1 + \cos 2\theta}$                   |
| <b>Double Angle Formulas:</b> $\sin 2\theta = 2 \sin \theta \cos \theta$ $\sin 2\theta = \frac{2 \tan \theta}{1 + \tan^2 \theta}$ <hr/> $\cos 2\theta = \cos^2 \theta - \sin^2 \theta$ $\cos 2\theta = 2\cos^2 \theta - 1$ $\cos 2\theta = 1 - 2\sin^2 \theta$ $\cos 2\theta = \frac{1 - \tan^2 \theta}{1 + \tan^2 \theta}$ <hr/> $\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$ | <b>Half-Angle Formulas:</b> $\sin\left(\frac{\theta}{2}\right) = \pm \sqrt{\frac{1 - \cos \theta}{2}}$ <hr/> $\cos\left(\frac{\theta}{2}\right) = \pm \sqrt{\frac{1 + \cos \theta}{2}}$ <hr/> $\tan\left(\frac{\theta}{2}\right) = \frac{1 - \cos \theta}{2} = \frac{\sin \theta}{1 + \cos \theta}$ <hr/> $\tan\left(\frac{\theta}{2}\right) = \pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}}$ | <b>Triple Angle Formulas:</b> $\sin 3\theta = 3 \sin \theta - 4\sin^3 \theta$ $\cos 3\theta = 4\cos^3 \theta - 3 \cos \theta$ $\tan 3\theta = \frac{3 \tan \theta - \tan^3 \theta}{1 - 3\tan^2 \theta}$ |

**Sum and Difference Identities:**

$$\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta$$

$$\cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta$$

$$\tan(\alpha \pm \beta) = \frac{\tan \alpha \pm \tan \beta}{1 \mp \tan \alpha \tan \beta}$$

**Polar Equations:**

$$x = r \cos \theta \quad y = r \sin \theta$$

$$r = \sqrt{x^2 + y^2}$$

$$\theta = \tan^{-1} \left( \frac{y}{x} \right)$$

**Sum-to-Product Formulas:**

$$\sin \alpha + \sin \beta = 2 \sin \left( \frac{\alpha + \beta}{2} \right) \cos \left( \frac{\alpha - \beta}{2} \right)$$

$$\sin \alpha - \sin \beta = 2 \sin \left( \frac{\alpha - \beta}{2} \right) \cos \left( \frac{\alpha + \beta}{2} \right)$$

$$\cos \alpha + \cos \beta = 2 \cos \left( \frac{\alpha + \beta}{2} \right) \cos \left( \frac{\alpha - \beta}{2} \right)$$

$$\cos \alpha - \cos \beta = -2 \sin \left( \frac{\alpha + \beta}{2} \right) \sin \left( \frac{\alpha - \beta}{2} \right)$$

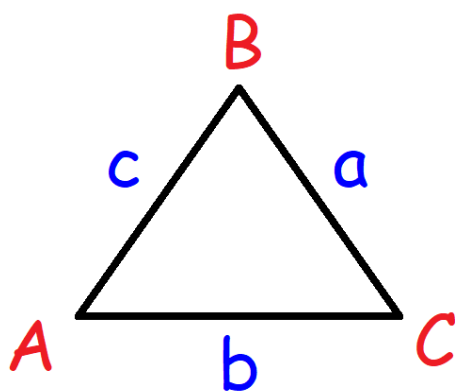
**Product-to-Sum Formulas:**

$$\sin \alpha \sin \beta = \frac{1}{2} [\cos(\alpha - \beta) - \cos(\alpha + \beta)]$$

$$\cos \alpha \cos \beta = \frac{1}{2} [\cos(\alpha - \beta) + \cos(\alpha + \beta)]$$

$$\sin \alpha \cos \beta = \frac{1}{2} [\sin(\alpha + \beta) + \sin(\alpha - \beta)]$$

$$\cos \alpha \sin \beta = \frac{1}{2} [\sin(\alpha + \beta) - \sin(\alpha - \beta)]$$

**Area of a Triangle:**

$$A = \frac{1}{2} ab \sin C$$

**Heron's Formula:**

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$s = \frac{1}{2} (a + b + c)$$

## Common Trigonometric Values:

| Degrees:    | Radians:         | $\sin \theta$        | $\cos \theta$        | $\csc \theta$         | $\sec \theta$         | $\tan \theta$        | $\cot \theta$        |
|-------------|------------------|----------------------|----------------------|-----------------------|-----------------------|----------------------|----------------------|
| <b>0°</b>   | <b>0</b>         | 0                    | 1                    | Undefined             | 1                     | 0                    | Undefined            |
| <b>30°</b>  | $\frac{\pi}{6}$  | $\frac{1}{2}$        | $\frac{\sqrt{3}}{2}$ | 2                     | $\frac{2\sqrt{3}}{3}$ | $\frac{\sqrt{3}}{3}$ | $\sqrt{3}$           |
| <b>45°</b>  | $\frac{\pi}{4}$  | $\frac{\sqrt{2}}{2}$ | $\frac{\sqrt{2}}{2}$ | $\sqrt{2}$            | $\sqrt{2}$            | 1                    | 1                    |
| <b>60°</b>  | $\frac{\pi}{3}$  | $\frac{\sqrt{3}}{2}$ | $\frac{1}{2}$        | $\frac{2\sqrt{3}}{3}$ | 2                     | $\sqrt{3}$           | $\frac{\sqrt{3}}{3}$ |
| <b>90°</b>  | $\frac{\pi}{2}$  | 1                    | 0                    | 1                     | Undefined             | Undefined            | 0                    |
| <b>180°</b> | $\pi$            | 0                    | -1                   | Undefined             | -1                    | 0                    | Undefined            |
| <b>270°</b> | $\frac{3\pi}{2}$ | -1                   | 0                    | -1                    | Undefined             | Undefined            | 0                    |
| <b>360°</b> | $2\pi$           | 0                    | 1                    | Undefined             | 1                     | 0                    | Undefined            |

## Common Inverse Trigonometric Values:

| $x$                   | $\sin^{-1}(x)$               | $\cos^{-1}(x)$               | $\tan^{-1}(x)$               |
|-----------------------|------------------------------|------------------------------|------------------------------|
| $-\sqrt{3}$           | $N/A$                        | $N/A$                        | $-60^\circ = -\frac{\pi}{3}$ |
| $-1$                  | $-90^\circ = -\frac{\pi}{2}$ | $180^\circ = \pi$            | $-45^\circ = -\frac{\pi}{4}$ |
| $-\frac{\sqrt{3}}{2}$ | $-60^\circ = -\frac{\pi}{3}$ | $150^\circ = \frac{5\pi}{6}$ |                              |
| $-\frac{\sqrt{2}}{2}$ | $-45^\circ = -\frac{\pi}{4}$ | $135^\circ = \frac{3\pi}{4}$ |                              |
| $-\frac{\sqrt{3}}{3}$ |                              |                              | $-30^\circ = -\frac{\pi}{6}$ |
| $-\frac{1}{2}$        | $-30^\circ = -\frac{\pi}{6}$ | $120^\circ = \frac{2\pi}{3}$ |                              |
| $0$                   | $0^\circ$                    | $90^\circ = \frac{\pi}{2}$   | $0^\circ$                    |
| $\frac{1}{2}$         | $30^\circ = \frac{\pi}{6}$   | $60^\circ = \frac{\pi}{3}$   |                              |
| $\frac{\sqrt{3}}{3}$  |                              |                              | $30^\circ = \frac{\pi}{6}$   |
| $\frac{\sqrt{2}}{2}$  | $45^\circ = \frac{\pi}{4}$   | $45^\circ = \frac{\pi}{4}$   |                              |
| $\frac{\sqrt{3}}{2}$  | $60^\circ = \frac{\pi}{3}$   | $30^\circ = \frac{\pi}{6}$   |                              |
| $1$                   | $90^\circ = \frac{\pi}{2}$   | $0^\circ$                    | $45^\circ = \frac{\pi}{4}$   |
| $\sqrt{3}$            | $N/A$                        | $N/A$                        | $60^\circ = \frac{\pi}{3}$   |