

Trigonometric Identities

I. Pythagorean Identities

- A. $\sin^2 \theta + \cos^2 \theta = 1$
- B. $\tan^2 \theta + 1 = \sec^2 \theta$
- C. $\cot^2 \theta + 1 = \csc^2 \theta$

II. Sum and Difference of Angles Identities

- A. $\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$
- B. $\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$
- C. $\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$
- D. $\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$
- E. $\tan(\alpha + \beta) = \frac{\tan \alpha + \tan \beta}{1 - \tan \alpha \tan \beta}$
- F. $\tan(\alpha - \beta) = \frac{\tan \alpha - \tan \beta}{1 + \tan \alpha \tan \beta}$

III. Double Angle Identities

- A. $\sin(2\theta) = 2 \sin \theta \cos \theta$
- B. $\cos(2\theta) = \cos^2 \theta - \sin^2 \theta$
 $= 2 \cos^2 \theta - 1$
 $= 1 - 2 \sin^2 \theta$
- C. $\tan(2\theta) = \frac{2 \tan \theta}{1 - \tan^2 \theta}$

IV. Half Angle Identities

- A. $\sin \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{2}}$
- B. $\cos \frac{\theta}{2} = \pm \sqrt{\frac{1 + \cos \theta}{2}}$
- C. $\tan \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}}$