

MATH 1060 Trigonometry

Exam 2

Formula Sheet

Pythagorean Identities

$$\begin{aligned}\sin^2 \theta + \cos^2 \theta &= 1 & 1 + \cot^2 \theta &= \csc^2 \theta \\ \tan^2 \theta + 1 &= \sec^2 \theta\end{aligned}$$

Even-Odd Identities

$$\begin{aligned}\sin(-\theta) &= -\sin \theta & \csc(-\theta) &= -\csc \theta \\ \cos(-\theta) &= \cos(\theta) & \sec(-\theta) &= \sec(\theta) \\ \tan(-\theta) &= -\tan(\theta) & \cot(-\theta) &= -\cot(\theta)\end{aligned}$$

Reciprocal Identities

$$\begin{aligned}\sin \theta &= \frac{1}{\csc \theta} & \csc \theta &= \frac{1}{\sin \theta} \\ \cos \theta &= \frac{1}{\sec \theta} & \sec \theta &= \frac{1}{\cos \theta} \\ \tan \theta &= \frac{1}{\cot \theta} & \cot \theta &= \frac{1}{\tan \theta}\end{aligned}$$

Quotient Identities

$$\tan \theta = \frac{\sin \theta}{\cos \theta} \quad \cot \theta = \frac{\cos \theta}{\sin \theta}$$

Sum and Difference Formulas

$$\begin{aligned}\sin(\alpha + \beta) &= \sin(\alpha) \cos(\beta) + \cos(\alpha) \sin(\beta) \\ \sin(\alpha - \beta) &= \sin(\alpha) \cos(\beta) - \cos(\alpha) \sin(\beta) \\ \cos(\alpha + \beta) &= \cos(\alpha) \cos(\beta) - \sin(\alpha) \sin(\beta) \\ \cos(\alpha - \beta) &= \cos(\alpha) \cos(\beta) + \sin(\alpha) \sin(\beta) \\ \tan(\alpha + \beta) &= \frac{\tan(\alpha) + \tan(\beta)}{1 - \tan(\alpha) \tan(\beta)} \\ \tan(\alpha - \beta) &= \frac{\tan(\alpha) - \tan(\beta)}{1 + \tan(\alpha) \tan(\beta)}\end{aligned}$$

Double-Angle Identities

$$\begin{aligned}\sin(2\theta) &= 2 \sin \theta \cos \theta \\ \cos(2\theta) &= \cos^2 \theta - \sin^2 \theta \\ &= 1 - 2 \sin^2 \theta \\ &= 2 \cos^2 \theta - 1 \\ \tan(2\theta) &= \frac{2 \tan \theta}{1 - \tan^2 \theta}\end{aligned}$$

Half-Angle Identities

$$\begin{aligned}\sin\left(\frac{\theta}{2}\right) &= \pm \sqrt{\frac{1 - \cos \theta}{2}} \\ \cos\left(\frac{\theta}{2}\right) &= \pm \sqrt{\frac{1 + \cos \theta}{2}} \\ \tan\left(\frac{\theta}{2}\right) &= \pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}} \\ &= \frac{\sin \theta}{1 + \cos \theta} \\ &= \frac{1 - \cos \theta}{\sin \theta}\end{aligned}$$

Reduction (Power-Reducing) Identities

$$\begin{aligned}\sin^2 \theta &= \frac{1 - \cos(2\theta)}{2} \\ \cos^2 \theta &= \frac{1 + \cos(2\theta)}{2} \\ \tan^2 \theta &= \frac{1 - \cos(2\theta)}{1 + \cos(2\theta)}\end{aligned}$$

Law of Sines

$$\frac{\sin \alpha}{a} = \frac{\sin \beta}{b} = \frac{\sin \gamma}{c}$$

Law of Cosines

$$\begin{aligned}a^2 &= c^2 + b^2 - 2cb \cos(\alpha) \\ b^2 &= c^2 + a^2 - 2ca \cos(\beta) \\ c^2 &= a^2 + b^2 - 2ab \cos(\gamma)\end{aligned}$$

Law of Sines Ambiguous Case:

- No Triangle: $a < h$.
- One Triangle: $a \geq b$.
- Two Triangles: $h < a < b$.
- One Triangle: $a = h$.

Some Cofunction Identities

$$\begin{aligned}\sin(t) &= \cos\left(\frac{\pi}{2} - t\right) \\ \cos(t) &= \sin\left(\frac{\pi}{2} - t\right)\end{aligned}$$

