Important Trigonometric Identities

You are expected to know the following trigonometric formulas. Do not expect them to be given to you on an exam. These identities will be reviewed as they are needed throughout the term.

Quotient & Reciprocal Identities

- \( \tan \theta = \frac{\sin \theta}{\cos \theta} \)
- \( \cot \theta = \frac{\cos \theta}{\sin \theta} \)
- \( \sec \theta = \frac{1}{\cos \theta} \)
- \( \csc \theta = \frac{1}{\sin \theta} \)

Pythagorean Identities

- \( \sin^2 \theta + \cos^2 \theta = 1 \)
- \( \tan^2 \theta + 1 = \sec^2 \theta \) (This is simply \( \sin^2 \theta + \cos^2 \theta = 1 \) divided through by \( \cos^2 \theta \))
- \( 1 + \cot^2 \theta = \csc^2 \theta \) (This is simply \( \sin^2 \theta + \cos^2 \theta = 1 \) divided through by \( \sin^2 \theta \))

Double-Angle Identities

- \( \sin (2\theta) = 2 \sin \theta \cos \theta \)
- \( \cos (2\theta) = \cos^2 \theta - \sin^2 \theta = 1 - 2 \sin^2 \theta = 2 \cos^2 \theta - 1 \)
- \( \sin^2 \theta = \frac{1}{2} (1 - \cos 2\theta) \) (This is simply \( \cos (2\theta) = 1 - 2 \sin^2 \theta \) solved for \( \sin^2 \theta \))
- \( \cos^2 \theta = \frac{1}{2} (1 + \cos 2\theta) \) (This is simply \( \cos (2\theta) = 2 \cos^2 \theta - 1 \) solved for \( \cos^2 \theta \))
**Sum/Difference Formulas**

- \( \sin (A + B) = \sin A \cos B + \cos A \sin B \)
- \( \sin (A - B) = \sin A \cos B - \cos A \sin B \)
  
  This is simply the formula for \( \sin [A + (-B)] \)
- \( \cos (A + B) = \cos A \cos B - \sin A \sin B \)
- \( \cos (A - B) = \cos A \cos B + \sin A \sin B \)
  
  This is simply the formula for \( \cos [A + (-B)] \)

The following formulas immediately follow from the sum/difference formulas:

- \( \sin A \cos B = \frac{1}{2} \left[ \sin (A - B) + \sin (A + B) \right] \)
- \( \cos A \cos B = \frac{1}{2} \left[ \cos (A - B) + \cos (A + B) \right] \)
- \( \sin A \sin B = \frac{1}{2} \left[ \cos (A - B) - \cos (A + B) \right] \)

**NOTE:** The double angle identities (above) also follow from the sum/difference formulas with the fact that \( 2 \theta = \theta + \theta \).