Basic Identities:

\[ \sec x = \frac{1}{\cos x} \quad \tan x = \frac{\sin x}{\cos x} \]

Derivatives and Antiderivatives:

\[ \frac{d}{dx} \sin x = \cos x \quad \text{and} \quad \int \cos x \, dx = \sin x + C \]

\[ \frac{d}{dx} \cos x = -\sin x \quad \text{and} \quad \int \sin x \, dx = -\cos x + C \]

\[ \frac{d}{dx} \tan x = \sec^2 x \quad \text{and} \quad \int \sec^2 x \, dx = \tan x + C \]

\[ \frac{d}{dx} \sec x = \tan x \cdot \sec x \quad \text{and} \quad \int \tan x \cdot \sec x \, dx = \sec x + C \]

Identities:

\[ \cos^2 x + \sin^2 x = 1 \quad \text{and} \quad \cos^2 x = 1 - \sin^2 x \quad \text{and} \quad \sin^2 x = 1 - \cos^2 x \]

\[ \tan^2 x + 1 = \sec^2 x \quad \text{and} \quad \tan^2 x = \sec^2 x - 1 \]

The half angle Identities:

\[ \cos^2 \frac{x}{2} = \frac{1 + \cos 2x}{2} \quad \text{and} \quad \sin^2 \frac{x}{2} = \frac{1 - \cos 2x}{2} \]

Note: Try to memorize these identities. I will ask you about them in Quiz 5!

Examples for other angles:

\[ \cos^2 4x + \sin^2 4x = 1 \quad \text{and} \quad \cos^2 3x = 1 - \sin^2 3x \quad \text{and} \quad \sin^2 8x = 1 - \cos^2 8x \]

\[ \tan^2 2x + 1 = \sec^2 2x \quad \text{and} \quad \tan^2 6x = \sec^2 6x - 1 \]

\[ \cos^2 2x = \frac{1 + \cos 4x}{2} \quad \text{and} \quad \sin^2 3x = \frac{1 - \cos 6x}{2} \]

Use the above identities, and Lecture note 18 to evaluate the following integrals:

1. \( \int \sin^3 x \cdot \cos^3 x \, dx \)
2. \( \int \sin^2 2x \cdot \cos^2 2x \, dx \)
3. \( \int \tan^{10} x \cdot \sec^4 x \, dx \)
4. \( \int \tan^3 3x \cdot \sec^3 3x \, dx \).

Note: I will give you one of the above integrals in Quiz 5!