# 3-3 Day 2

1. Using the fact that $\dfrac{d}{dx}[\sin x] = \cos x$ and the geometric relationship between $f(x) = \sin x$ and $g(x) = \cos x$, explain why

$$\frac{d}{dx}[\cos x] = -\sin x.$$

2. Show $\dfrac{d}{dx}[\tan x] = \sec^2 x$ using the Quotient Rule and the derivatives of sine and cosine.

**Derivatives of Trigonometric Functions:**

- $\frac{d}{dx}(\sin x) =$ _____
- $\frac{d}{dx}(\cos x) =$ _____
- $\frac{d}{dx}(\tan x) =$ _____
- $\frac{d}{dx}(\csc x) =$ _____
- $\frac{d}{dx}(\sec x) =$ _____
- $\frac{d}{dx}(\cot x) =$ _____

3. Find the derivatives of each of the following:

   (a) $y = e^x(\tan x - \sec x)$

   (b) $g(\theta) = \frac{\sin\theta}{\cos\theta+1}$

4. For what values of $t$ does the graph of $f(t) = t + 2\cos t$ have a horizontal tangent?

5. An elastic band is hung on a hook and a mass is hung on the lower end of the band. When the mass is pulled down 2 cm past its rest position and then released, it vibrates vertically. The equation of motion is

$$s = 2\cos t + 3\sin t, \text{ for } t \geq 0,$$

   where $s$ is measured in centimeters and $t$ is measured in seconds. (We are taking the positive direction to be downward.)

   (a) Find $s(0)$, $s'(0)$, and $s''(0)$ including units.

   (b) What do your answers from part (a) tell you about the mass? Do your answers make sense?