Section 2.5
Derivatives of Trig Functions
MATH 1190

- **Derivative of the trig functions: MEMORIZE!!**
  - $\frac{d}{dx}\sin x = \cos x$
  - $\frac{d}{dx}\cos x = -\sin x$
  - $\frac{d}{dx}\tan x = \sec^2 x$
  - $\frac{d}{dx}\sec x = \sec x \tan x$
  - $\frac{d}{dx}\csc x = -\csc x \cot x$
  - $\frac{d}{dx}\cot x = -\csc^2 x$
- Example: Find y' if
$$y = x^2 \cot x - \frac{1}{x^2}$$
First rewrite
$$y = x^2 \cot x - x^{-2}$$
Then using the product rule and trig derivatives on the first term and power rule on the second term, we have
$$y' = x^2 \frac{d}{dx}(\cot x) + \cot x \frac{d}{dx}(x^2) + 2x^{-3} = x^2(-\csc^2 x) + \cot x(2x) + 2x^{-3} = -x^2 \csc^2 x + 2x \cot x + \frac{2}{x^3}$$
- Example: Find $\frac{ds}{dt}$ if
$$s = \frac{\sin t}{1 - \cos t}$$
Using the quotient rule, we have
$$\begin{aligned} s'(t) &= \frac{(1-\cos t)\frac{d}{dt}(\sin t) - \sin t \frac{d}{dt}(1-\cos t)}{(1-\cos t)^2} \\ &= \frac{(1-\cos t)(\cos t) - \sin t \sin t}{(1-\cos t)^2} \\ &= \frac{\cos t - \cos^2 t - \sin^2 t}{(1-\cos t)^2} \\ &= \frac{\cos t - (\cos^2 t + \sin^2 t)}{(1-\cos t)^2} \\ &= \frac{\cos t - 1}{(1-\cos t)^2} \\ &= \frac{-(1-\cos t)}{(1-\cos t)^2} \\ &= \frac{-1}{1-\cos t} \end{aligned}$$
- **Group Work - Worksheet Part I**