

# RECITATION: 3-1 TO 3-3 REVIEW OF BASIC DIFFERENTIATION

**Disclaimer:** On this worksheet “Simplify” is short for “simplify your answer by combining like terms, factoring out any common factors and finding a common denominator, if necessary.”

State the derivatives of the following functions:

- $\frac{d}{dx} x^n$

- $\frac{d}{dx} e^x$

- $\frac{d}{dx} \sin x$

- $\frac{d}{dx} \cos x$

- $\frac{d}{dx} \tan x$

- $\frac{d}{dx} \sec x$

- $\frac{d}{dx} \csc x$

- $\frac{d}{dx} \cot x$

Suppose  $f$  and  $g$  are differentiable functions. State the derivatives of the following functions. What rules are these?

- $\frac{d}{dx} (f(x)g(x))$

- $\frac{d}{dx} \left( \frac{f(x)}{g(x)} \right)$

**Example 1:** Find the derivative of the following functions.

a)  $y = \frac{1}{2}x^6 - 3x^4 + x$

b)  $f(t) = 2 - \frac{2}{3}t + \tan x$

**Example 2:** Find the derivative of the following functions.

a)  $y = \pi^2 + \ln 2 + e^5$

b)  $f(x) = \sqrt[5]{x} + 4\sqrt{x^5} + \cot x$

**Example 3:** Find the derivative of the following functions.

a)  $y = 5e^x + 3 \cos x + \sec x$

b)  $y = 5 + 2 \sin x + \sqrt{x}$

**Example 4:** Find the derivative of the following functions. Simplify.

a)  $h(x) = (x^2 + 3)(x - 5)$

b)  $y = \frac{x^3 - 2x + 6}{x^2}$

**Example 5:** For what values of  $x$  does the graph of  $f(x) = 2x^3 + 3x^2 - 12x + 1$  has a horizontal tangent?

**Example 6:** Find the derivative of the following functions. Simplify.

a)  $y = \frac{x + 1}{x^3 + x - 2}$

b)  $f(x) = x^3 \cos x$

**Example 7:** Suppose  $f(2) = -3$ ,  $g(2) = 4$ ,  $f'(2) = -2$ , and  $g'(2) = 7$ . Find  $h'(2)$  if  $h(x) = \frac{g(x)}{2 + f(x)}$ .

**Example 8:** For what values of  $x$  does  $f(x) = x + 2 \sin x$  have a horizontal tangent? (Hint: There are an infinite number of them. Don't give just one.)

**Example 9:** Differentiate  $f(\theta) = \theta \cos \theta \sin \theta$

**Example 10:** Find an equation of the tangent line to  $y = x + \tan x$  at  $(\pi, \pi)$ . Give your answer in slope-intercept form.