

RECITATION: 3-4 TO 3-4 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:

- $\frac{d}{dx} b^x$
- $\frac{d}{dx} \sin^{-1} x$

- $\frac{d}{dx} \cos^{-1} x$

- $\frac{d}{dx} \tan^{-1} x$

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

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

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

Example 1: Differentiate the following functions.

(a) $f(x) = e^{-x} \cos x$

(b) $f(t) = \frac{\cot t}{e^{2t}}$

Example 2: If $f(x) = \sec x$, find $f''(\pi/4)$.

Example 3: Differentiate the following functions.

(a) $f(x) = \cos(x^2)$

(b) $f(x) = \sin^4(5x)$

Example 4: Differentiate the following functions.

(a) $y = 2^{x \tan x}$

(b) $f(x) = \frac{1}{(1+\tan x)^2}$

Example 5: Find the 50th derivative of $y = \cos(2x)$.

Example 6: Given $x^2 - 4xy + y^2 = 4$ find dy/dx .

Example 7: Find an equation of the tangent line to $\sin(x + y) = 2x - 2y$ at the point (π, π) .

Example 8: Differentiate the following functions.

(a) $y = \tan^{-1}(5x^3)$

(b) $g(x) = \arccos(\sqrt{x})$

Example 9: Differentiate $y = x \sin^{-1} x + \sqrt{1 - x^2}$

Example 10: Differentiate the following functions. Simplify.

(a) $f(x) = -3x^4 + \sqrt{x^5} + \pi^3 + e^7$

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

Example 11: Find y'' if $x^2 + y^2 = 1$.

Example 12: Determine where the tangent line to $y = x + 2 \cos x$ is horizontal.