

DO NOW

Find the derivative of:

$$f(x) = 2x^5 - 3x^4 + x^3 + 7x^2 - 8x + 25$$

$$f'(x) = 10x^4 - 12x^3 + 3x^2 + 14x - 8$$

Page 1

3.2 Basic Differentiation Rules - Day 2

Review Rules:

$$\frac{d}{dx}[c] = 0$$

$$\frac{d}{dx}[x^n] = n x^{n-1}$$

$$\frac{d}{dx}[c(f(x))] = c(f'(x))$$

$$\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$$

Page 2

Derivatives of Sine and Cosine Function

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

Proof of sine rule:

$$\begin{aligned} \lim_{\Delta x \rightarrow 0} \frac{f(x+\Delta x) - f(x)}{\Delta x} \\ \lim_{\Delta x \rightarrow 0} \frac{\sin(x+\Delta x) - \sin x}{\Delta x} \\ \lim_{\Delta x \rightarrow 0} \frac{\sin x \cos \Delta x + \cos x \sin \Delta x - \sin x}{\Delta x} \\ \lim_{\Delta x \rightarrow 0} \frac{\cos x \sin \Delta x}{\Delta x} + \frac{-\sin x + \sin x \cos \Delta x}{\Delta x} \\ \lim_{\Delta x \rightarrow 0} \cos x \cdot \left(\frac{\sin \Delta x}{\Delta x} \right) - \sin x \cdot \left(\frac{1 - \cos \Delta x}{\Delta x} \right) \\ \cos x \cdot \left(\lim_{\Delta x \rightarrow 0} \frac{\sin \Delta x}{\Delta x} \right) - \sin x \cdot \lim_{\Delta x \rightarrow 0} \left(\frac{1 - \cos \Delta x}{\Delta x} \right) \\ \cos x \cdot 1 - \sin x \cdot 0 \\ \cos x \end{aligned}$$

Page 3

Examples:

$$1. y = x^3 + 2 \sin x \\ y' = 3x^2 + 2 \cos x$$

$$2. y = x^2 - \frac{\cos x}{2} \\ y' = 2x - \frac{1}{2}(-\sin x) \\ y' = 2x + \frac{\sin x}{2}$$

Page 4

Derivative of the Natural Exponential Function

$$\frac{d}{dx}[e^x] = e^x \quad \text{It is its own derivative.}$$

Examples: Find the derivative.

$$3. f(x) = 7e^x$$

$$f'(x) = 7e^x$$

$$4. g(x) = 5x^2 - 3e^x$$

$$g'(x) = 10x - 3e^x$$

$$5. y = \sin x - e^x$$

$$y' = \cos x - e^x$$

Page 5

Examples: Find the derivative.

$$6. h(t) = 3t(5t^2 - 2t) \\ h(t) = 15t^3 - 6t^2 \\ h'(t) = 45t^2 - 12t$$

$$7. f(x) = \frac{2x^3 - 3x^2 - 4x}{x^2} \\ f(x) = 2x - 3 - \frac{4}{x} \\ f'(x) = 2 + 4x^{-2} \\ f'(x) = 2 + \frac{4}{x^2} \\ f'(x) = \frac{2x^2 + 4}{x^2}$$

Page 6

HOMEWORK

pg 136; 3 - 24, 26, 28, 30, 39 - 52