Closing Tues: HW 9.5

Closing Thurs: HW 9.6, HW 9.7(1)

Monday is a holiday (no class, no MSC)!

9.5/9.6 Product, Quotient, Chain rules

Consider the three functions:

$$y = (x^5 + 4x + 7)(x^4 + 2x)$$

$$y = \frac{x^4 + 5x}{x^7 - x^2}$$

$$y = (4x^2 - 3x)^{10}$$

PRODUCT RULE: $\frac{d}{dx}(f(x)g(x)) = f(x)g'(x) + f'(x)g(x).$

QUOTIENT RULE:

$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)f'(x) - f(x)g'(x)}{g(x)^2}$$

You try: Differentiate

1. $y = x^2(x^3 + 1)$

2. $y = \dfrac{5}{x^3}$

3. $y = (x^2 + 3x)(\sqrt{x} - 5x^3)$

4. $y = \dfrac{x^5}{3x^3 - x^5}$

CHAIN RULE:

$$\frac{d}{dx}(f(g(x))) = f'\big(g(x)\big)g'(x)$$

All Rules:

$$\frac{d}{dx}(f(x)+g(x)) = f'(x)+g'(x).$$

$$\frac{d}{dx}\big(cf(x)\big) = cf'(x).$$

$$\frac{d}{dx}(x^n) = n\,x^{n-1}.$$

$$\frac{d}{dx}(f(x)g(x)) = f(x)g'(x)+f'(x)g(x).$$

$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)f'(x)-f(x)g'(x)}{g(x)^2}$$

$$\frac{d}{dx}(f(g(x))) = f'\big(g(x)\big)g'(x)$$

Equations for Tangent lines

Recall:

All the points (x, y) on a given line can be described by an equation of the form

$$y = m(x - x_0) + y_0$$

where

$$m = \text{slope of the line}$$
$$(x_0, y_0) = \text{any point on the line}$$

Review Question:

Find the equation of the line that has slope 8 and goes through (3, 7).

Since f'(x) is the slope of the tangent line, we can use it to get the equation for the tangent line.

Example: Let

$$f(x) = \frac{x^3 + 3}{2x - 1}$$

Find the equation for the tangent line at $x = 1$.