Math 1110: **Derivative Rules** Sept 17 (Mon)

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1. Objectives.

- correctly use the differentiation rules presented in the section (derivative of a constant, power rule, constant multiple rule, sum rule, natural exponential rule, product rule, quotient rule)

2. Derivative rules.

If you did not go over the derivative rules in the pre-class work, write them down here.

Let c and n be real numbers, and u and v be differentiable functions.

- Derivative of a constant function

- Power rule

- Derivative of a constant multiple

- Derivative sum rule

- Derivative of the natural exponential function

- Derivative product rule

- Derivative quotient rule

3. Practice applying rules.

Using the differentiation rules, compute the derivatives of the following functions:

(a) $f(x) = 3x^4 - 2x^3 + 2x - 5$

(b) $f(x) = ax^3 + bx^2 + cx + d$ where a, b, c and d are constants

(c) $f(x) = \dfrac{x-2}{x+2}$

(d) $f(t) = \dfrac{3t+1}{t^2+t-2}$

(e) $f(x) = 2x^3e^x$

(f) Suppose u and v are differentiable functions of x and that

$$u(1) = 2, \quad u'(1) = 0, \quad v(1) = 5, \quad v'(1) = -1.$$

Find the values of the folowing derivatives at $x = 1$:

(i) $\dfrac{d}{dx}(uv)$ (ii) $\dfrac{d}{dx}\left(\dfrac{u}{v}\right)$ (iii) $\dfrac{d}{dx}\left(\dfrac{v}{u}\right)$ (iv) $\dfrac{d}{dx}(7v - 2u)$.

4. More on quotient rule.

For each pair of functions, find the derivative of the functions by using quotient rule for one function and another method for the other.

(a) $f(t) = \dfrac{t^3 + 5t^2 - 2t}{t}$ and $g(t) = \dfrac{t}{t^3 + 5t^2 - 2t}$

(b) $f(x) = \dfrac{3}{x^4}$ and $g(x) = \dfrac{x^2 + x + 1}{\sqrt{x}}$

(c) Based on the calculation you have done, when is it easier *not* to use the quotient rule?

5. More on product rule.

The goal of this exercise is to see why $(f(x)g(x))' \neq f'(x)g'(x)$.

(a) A friend of yours claims (contrary to what the textbook says) that the product rule *is* $(f(x)g(x))' = f'(x)g'(x)$. You want to show him that his claim is wrong. If you compute the derivative of $f(x) = x^2$ using your friend's differentiation rule, what do you get?

(b) The product rule can be summarized pictorially as: