

Notesheet. Sections 3.1 and 3.2 (Derivatives, cont.)

Math 1210

Theorem 1. Using our limit laws and the definition of the derivative, we define the following additional rules on derivatives for functions $f(x)$ and $g(x)$, as well as real number c .

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

Challenge 2. The demand function for JM's desk lamps is given by

$$p(x) = -0.1x^2 - 0.4x + 35$$

where x is the quantity of lamps demanded in thousands and $p(x)$ is the price of a lamp in dollars. What is $p'(x)$? What is the rate of change of the unit price when the quantity demanded is 10,000 lamps ($x = 10$)? What is the price of a lamp at that level of demand?

Challenge 3. Let $f(x) = x^n$ and $g(x) = x^m$. What is $\frac{d}{dx}[f(x)g(x)]$?

Definition 4. We define the product rule for derivatives to be

Challenge 5. Let $f(x) = (5x^2 + 1)(2\sqrt{x} - 1)$. What is $f'(x)$?

Challenge 6. Let $f(x) = x^n$ and $g(x) = x$. What is $\frac{d}{dx}[(f \circ g)(x)]$? What is $\frac{d}{dx}[(g \circ f)(x)]$?

Definition 7. We define the chain rule for derivatives to be

Challenge 8. Let $f(x)$ and $g(x)$ be differentiable functions. What is the derivative of $\frac{f(x)}{g(x)} = f(x)[g(x)]^{-1}$? (Hint: Use the product rule and the chain rule.)