Name:_____

Notesheet. Section 2.6 (Derivatives)

Math 1210

Definition 1. Let $f(x)$ be a function. We define the average rate of change of f from a to b by

Challenge 2. At time $t = 0$, a car traveling in a straight line at 15 m/s (roughly 34mph) starts accelerating at 5 m/s/s (roughly 11 mph/s). The position of the car is modeled by

$$x(t) = 2.5t^2 + 15t$$

What is the average rate of change of $x(t)$ from $t = 1$ to $t = 2$? What about the average rate of change of $x(t)$ from $t = 1$ to $t = 1.0001 = (1 + 0.0001)$?

Definition 3. Given $f(x)$, we define the derivative of $f(x)$ at $x = a$ as

Challenge 4. Let $f(x) = 2.5x^2 + 15x$. Use the definition of the derivative to compute $f'(1)$.

Challenge 5. Derivatives need not always exist. Does

$$f(x) = |x| = \begin{cases} -x & x < 0 \\ x & x \geq 0 \end{cases}$$

have a derivative at $x = 0$?

Challenge 6. For a constant c, compute $\dfrac{d}{dx}(c)$. Does your answer make sense?

Challenge 7. Using the binomial theorem

$$(x+h)^n = x^n + n\left(hx^{n-1} + \frac{n-1}{2}h^2x^{n-2} + \cdots\cdots + \frac{n-1}{2}h^{n-2}x^2 + h^{n-1}x\right) + h^n,$$

compute the derivative for $f(x) = x^n$ where n is a positive integer.

Definition 8. We define the power rule for any real number n to be $\dfrac{d}{dx}(x^n) =$