Section 2.1

Definition of Tangent Line with Slope m: If f is defined on an open interval containing c, and if the limit

$$\lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = \lim_{\Delta x \to 0} \frac{f(c + \Delta x) - f(c)}{\Delta x} = m$$

exists, then the line passing through $\big(c, f(c)\big)$ with slope m is the **tangent line** to the graph of f at the point $\big(c, f(c)\big)$.

1) Find the slope of the graph of $f(x) = 3x + 5$ at the point $(-1, 2)$.

2) Find the slopes of the tangent lines to the graph of $f(x) = 2x^2 + 4x - 1$ at the following points:

   a) $(1, 5)$

   b) $(-1, -3)$

Definition of the Derivative of a Function: The **derivative** of f at x is

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

provided the limit exists. For all x for which the limit exists, f' is a function of x.

3) Find the derivative of $f(x) = 2x^2 - x + 1$.

4) Find $f'(x)$ for $f(x) = \frac{1}{x}$. Then find the slope of the graph of f at the points $(1, 1)$ and $\left(2, \frac{1}{2}\right)$.

Alternative Form of the Derivative: The derivative of f at c is

$$f'(c) = \lim_{x \to c} \frac{f(x) - f(c)}{x - c}$$

5) Use the alternative definition of the derivative to show that the function $f(x) = |x - 1|$ is not differentiable at $x = 1$.

6) Find the derivative of the function $f(x) = x^{1/5}$ at the point $(0, 0)$. What can you conclude about the slope of the tangent line at that point?

7) Give an example of a function $f(x)$ that is continuous at some point $\big(c, f(c)\big)$ but not differentiable at that point.

Homework for this section: Read the section and watch the videos/tutorials. Then do these problems in preparation for the quiz:#2, 10, 18, 34, 66, 76, 89