Math 221 Worksheet 7
September 24, 2020
Section 2.3 - Differentiation Formulas

1. Let $f(x) = x + 2$ and $g(x) = 2x - 1$.

   (a) Compute $f'(x)$ and $g'(x)$.

   (b) Compute $[f(x)g(x)]'$. How does it compare to $f'(x)g'(x)$?

2. Let f and g be functions such that $f(2) = 3$, $f'(2) = -1$, $g(2) = -5$, and $g'(2) = 2$. Use differentiation rules to find $h'(2)$ if:

   (a) $h(x) = 3f(x) - g(x)$

   (b) $h(x) = f(x)g(x)$

   (c) $h(x) = \frac{1}{f(x)}$

   (d) $h(x) = \frac{g(x)}{f(x)}$

3. Compute the derivatives of the following functions:

   (a) $f(x) = 4\pi^2$

   (b) $f(x) = x^3 + 2x + 4$

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

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

4. Suppose that f is a function whose graph passes through the point $(4, 3)$ and that the tangent line at $(4, 3)$ also passes through the point $(0, 2)$.

   (a) Sketch the tangent line along with a *possible* graph of f (make sure to label the two given points).

   (b) Find an equation of the tangent line you drew.

   (c) What is $f(4)$? What is $f'(4)$?

5. Let $f(x) = \dfrac{x-1}{x+1}$. What is $(x+1)f(x)$? Can you use this to come up with a formula for $f'(x)$ without using the quotient rule?

6. Optional/challenge: Let P and Q be polynomials such that $P(1) = Q(1) = 0$ and $Q'(1) \neq 0$. Show that $\lim_{x\to 1} \frac{P(x)}{Q(x)} = \frac{P'(1)}{Q'(1)}$. (If you know L'Hôpital's rule, you may NOT use it!)