

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  $f(x) = \frac{x-1}{x+1}$ . 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  $\lim_{x \rightarrow 1} \frac{P(x)}{Q(x)} = \frac{P'(1)}{Q'(1)}$ . (If you know L'Hôpital's rule, you may NOT use it!)