

Name: _____

Basic Differentiation Rules

1) Find the derivative of each of the following functions.

(1) $f(x) = x^4 + 2x^3 - x^2 + 3x - 6$

(2) $f(x) = \frac{x^2 - 4}{x}$

(3) $f(x) = \sqrt{x} - 6\sqrt[3]{x}$

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

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

2) Write each of the following powers as a product. Then use the product rule to find $f'(x)$.

1. $f(x) = (2x^3 + x)^2$

2. $f(x) = (2x-3)^3$

3) Find the slope of the tangent line to the given curve at the given point. Use the product rule to find the derivative.

1. $f(x) = (x^3 - 2)(x^2 + 2x - 7)$, $x = 0$

2. $f(x) = (x-2)(2x+5)(3x-4)$, $x = 1$

3. $f(x) = (2x + x^{-1})(x^{-2} - 2x^{-3})$, $x = -1$

4) Find each of the following derivatives using the product rule. Leave your answer in a non-simplified form (stop after the first line of differentiation).

1. $y = (x^2 - 2x - 5)(x^2 + 2x + 7)$

2. $y = (2x^2 + 5x)(x^2 - 7x - 8)$

3. $y = x(3x+5)(2x-1)$

4. $y = (2x^3)(x^2 - 7x)(3x^2 + 4x - 8)$

- 5) Marie's annual salary over the past 25 years of her working life can be modeled by the function $y = 2(x+100)(x^2+50)$, where y is her salary in dollars in her x^{th} year of work.
- (1) How much was she earning when she started work, that is when $x=0$?
 - (2) How much was she earning in her 20th year?
 - (3) What would $\frac{dy}{dx}$ represent?
 - (4) Find $\frac{dy}{dx}$ as a function of x .
 - (5) Find $\left.\frac{dy}{dx}\right|_{x=10}$ and $\left.\frac{dy}{dx}\right|_{x=20}$. Interpret the results.
 - (6) Is $\frac{dy}{dx}$ increasing or decreasing?
- 6) The reaction of the body to a dose of medicine can often be represented by an equation of the form $R = M^2\left(\frac{C}{2} - \frac{M}{3}\right)$, where C is a positive constant and M is the amount of medicine absorbed in the blood. If the reaction is a change in blood pressure, R is measured in millimeters of mercury. If the reaction is a change in temperature, R is measured in degrees, and so on.
- Find $\frac{dR}{dM}$. This derivative, as a function of M , is called the sensitivity of the body to the medicine.
- 7) Let $f(x) = x^2 + 1$. Find $f'(2)$
- 8) Find the derivative of each function
- 1) $y = f(x) = 3x^4 + 2x^3$
 - 2) $s = f(t) = 2t^{11} + \frac{1}{2}t^3$
 - 3) $y = f(x) = 5x + 4x^{1/2}$
 - 4) $y = f(x) = 3x^4 - \frac{3}{x^3} + 2x - 3$
- 9) Differentiate with respect to whatever letter the function is written in on the right-hand side.
- 1) $y = 7x^2 + 3x^4$
 - 2) $v = 5t - 1$
 - 3) $y = 3 - \frac{2}{x^3}$
 - 4) $v = 2t^{1/2} + 3t - \frac{1}{2}$