

Name: _____

Discussion Section: _____

Solutions should show all of your work, not just a single final answer.

3.1: Derivatives of Polynomials and Exponential Functions

1. Use differentiation rules from Section 3.1 (**not other methods**) to compute the derivative of the following functions.

(a) $f(x) = 7x^3 - 5x + 8$

(b) $f(x) = e^x + x^e$

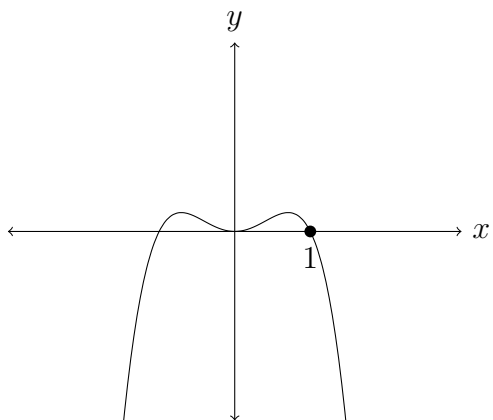
(c) $f(x) = 3x + \sqrt{3x}$

(d) $f(x) = \sqrt[4]{x} - 4e^x$

(e) $f(x) = \frac{x^2 + 4x + 3}{\sqrt{x}}$

(f) $f(x) = \frac{12}{x^5} - \frac{7}{\sqrt[3]{x}}$

2. Use differentiation rules to find the equation of the tangent line to $y = x^2 - x^4$ (see below) at the point $(1, 0)$.



3. Use differentiation rules to find the values of a and b that make the function

$$f(x) = \begin{cases} x^2 & \text{if } x \leq 2, \\ ax^3 + bx & \text{if } x > 2 \end{cases}$$

differentiable at $x = 2$.

4. Find all points $(c, f(c))$ on the graph of $f(x) = x^3 - 3x^2$ where the tangent line has slope 9.

5. T/F (with justification) If $f(x) = \sqrt{7}$ for all x , then $f'(x) = \frac{1}{2\sqrt{7}}$ for all x .

3.2: The Product and Quotient Rules

6. Compute the derivative of each function below using the methods from Sections 3.1 and 3.2 (**not other methods**).

(a) $f(x) = \frac{x}{x+3}$ (simplify numerator in final answer)

(b) $f(x) = \frac{e^x}{1+e^x}$ (simplify numerator in final answer)

(c) $f(x) = \sqrt{x}e^x$

(d) $f(x) = \frac{e^x}{x^n}$ for constant n , in two ways: (i) quotient rule and (ii) product rule

(e) $f(x) = \frac{1}{x} + \frac{1}{1-x}$ (in final answer, use a common denominator and simplify numerator)

7. In the function $h(x)$ below, defined in terms of $f(x)$ and $g(x)$, determine $h'(2)$ in each case if $f(2) = 3$, $g(2) = 4$, $f'(2) = 1$, and $g'(2) = -5$.

(a) $h(x) = 2f(x) + 5g(x)$

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

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

(d) $h(x) = \frac{g(x)}{f(x) + 2}$