

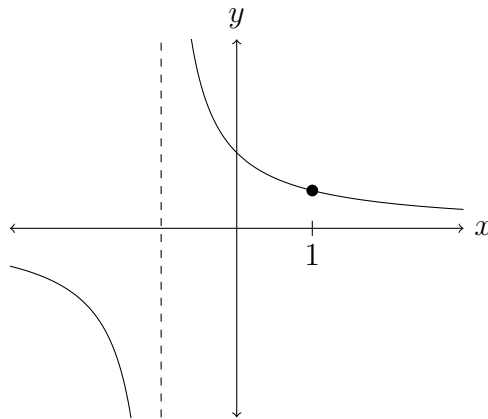
Name: _____

Discussion Section: _____

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

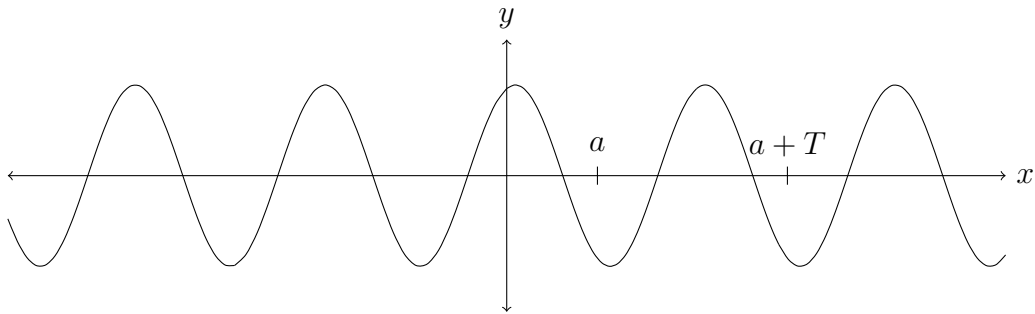
2.7: Derivatives and Rates of Change

1. The function $f(x) = \frac{1}{x+1}$ is graphed below. Find $f'(1)$ using the limit definition of the derivative (**no credit for using any other method**) and then find the equation of the tangent line to the graph at $x = 1$.



2. If a function $f(x)$ has $f(3) = 2$ and $f'(3) = 4$, work out an equation of the tangent line to the graph of $y = f(x)$ at the point $(3, f(3))$.

3. Below is the graph of a function $f(x)$ that's periodic: there's a $T > 0$, called the period, such that $f(x + T) = f(x)$ for all x . Explain why the derivative $f'(x)$ is also periodic with period T in two different ways.

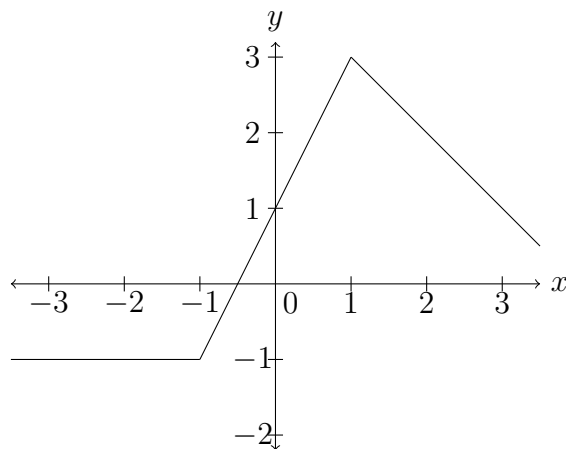


(a) using tangent lines to the graph of the function

(b) using the limit definition of the derivative

2.8: The Derivative as a Function

4. The graph of $y = f(x)$ is pictured below.



(a) Compute each derivative below, explaining your calculations. If a derivative does not exist, write DNE.

(a) $f'(-2)$

(b) $f'(1)$

(c) $f'(-1)$

(d) $f'(2)$

(e) $f'(0)$

(f) $f'(3)$

(g) Sketch a graph of the derivative $f'(x)$, leaving blank spots where it does not exist.

5. Find the derivative of $f(x) = \frac{8}{x^2}$ using the limit definition of the derivative (**no credit for using any other method**). Hint: Look at 9b on the Week 1 Worksheet.

6. T/F (with justification) A function that is continuous at a is also differentiable at a .

7. T/F (with justification) If $f'(2)$ exists, then $\lim_{x \rightarrow 2} f(x) = f(2)$.

3.1: Derivatives of Polynomials and Exponential Functions

8. 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) $f(x) = e^x + x^e$

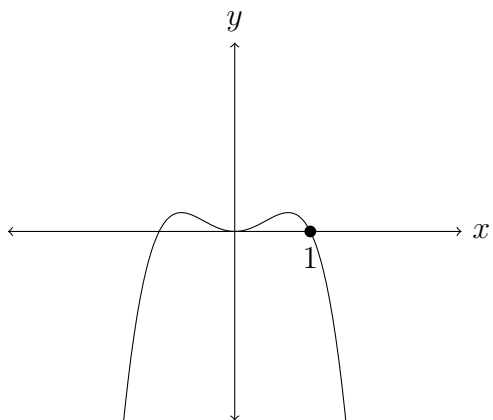
(c) $f(x) = 3x + \sqrt{3x}$

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

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

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

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



10. 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 $x = 2$.

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

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