

Math 131 - Assignment 4

February 14, 2024

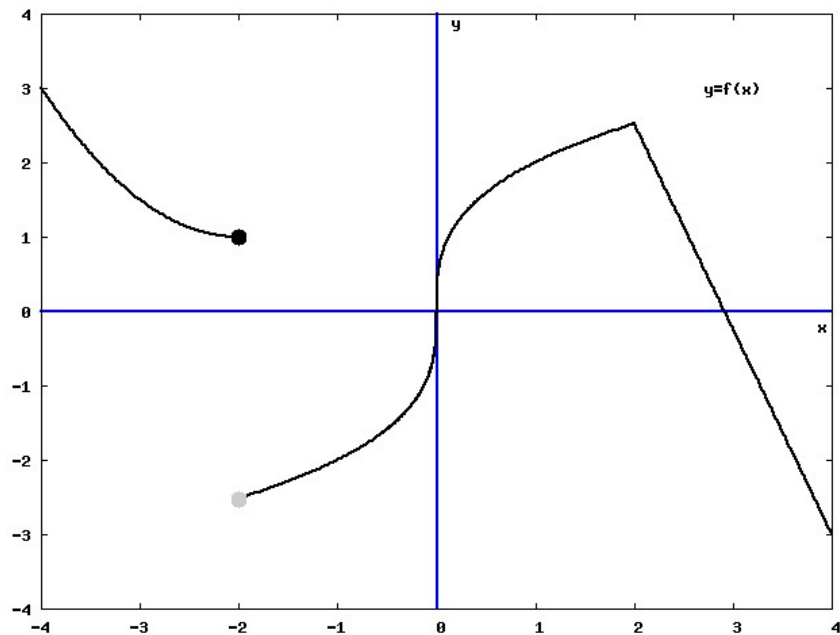
Name _____

Score _____

Show all work to receive full credit. Evaluate all limits analytically. Supply explanations when necessary. This assignment is due February 21.

1. Let $f(x) = 2 - x + \sin x$. Find an interval of length one that contains a solution of the equation $f(x) = 0$. Then use the Intermediate Value Theorem to explain how you know.
2. Use the limit definition of derivative to determine $f'(x)$ when $f(x) = 3x^2 - x + 1$. (Use extra paper as necessary.)
3. Let $f(x) = \sqrt{x^2 + 16}$. We will soon learn that $f'(x) = \frac{x}{\sqrt{x^2 + 16}}$. For now, just use the given information to find an equation of the line tangent to the graph of f at the point where $x = 3$.
4. Use the limit definition of derivative to determine $f'(x)$ when $f(x) = \frac{1}{x}$. (Use extra paper as necessary.)

5. The graph of $y = f(x)$ is shown below. Give the x -coordinates of three points at which $f'(x)$ does not exist. For each point, very briefly say why f' does not exist.



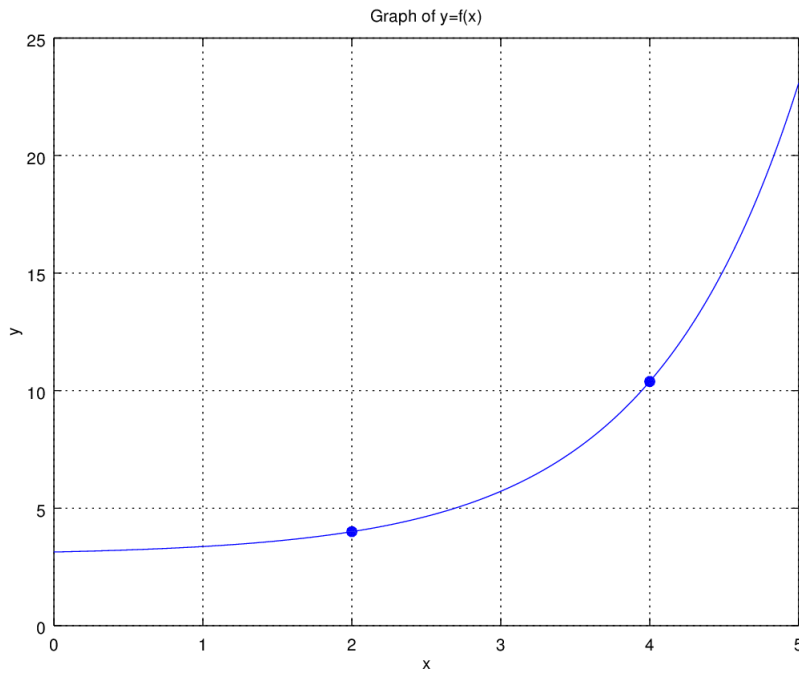
6. Use basic derivative rules (not the definition) to find each derivative.

(a) $\frac{d}{dx} \left(7x^3 - 10 + \sqrt[3]{x} - \frac{7}{x^3} \right)$

(b) $\frac{d}{dx} (5 \sin x - 12 \cos x)$

(c) $\frac{d}{dx} \frac{5x^4 + 8x - 3}{x^2}$ (Do not use the quotient rule. Use algebra to rewrite the expression before you differentiate.)

7. The graph of $y = f(x)$ is shown below.



- (a) Sketch the secant line through the indicated points at $x = 2$ and $x = 4$. Let m be the slope of the secant line through those points. Estimate the value of m .
- (b) Sketch the tangent line through the point where $x = 2$. Use your tangent line to estimate $f'(2)$.
- (c) Sketch the tangent line through the point where $x = 4$. Use your tangent line to estimate $f'(4)$.
8. Find an equation of the line tangent to the graph of $y = \sqrt{x} + \frac{1}{\sqrt{x}}$ at the point where $x = 4$.