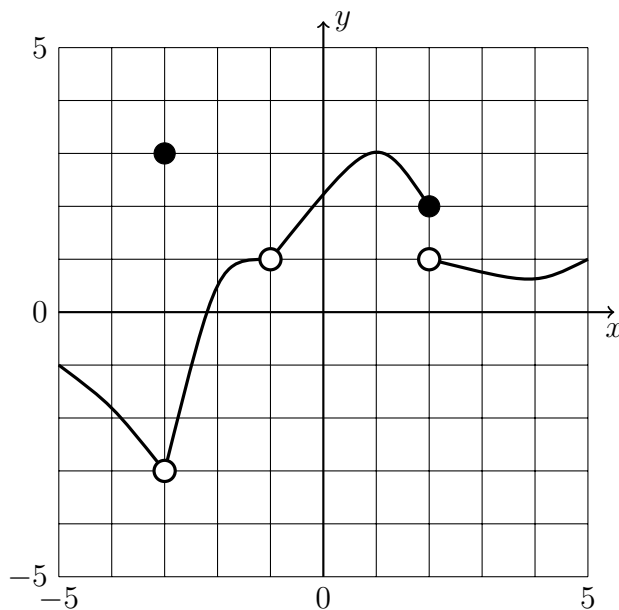


Math 231 Calculus 1 Fall 20 Sample Midterm 1

- (1) The graph of $y = f(x)$ is shown below. Evaluate each limit, or write DNE if the limit does not exist. No justifications are necessary.



- (a) $\lim_{x \rightarrow 2^-} f(x)$
- (b) $\lim_{x \rightarrow 2^+} f(x)$
- (c) $\lim_{x \rightarrow 2} f(x)$
- (d) $\lim_{x \rightarrow -1^-} f(x)$
- (e) $\lim_{x \rightarrow -1^+} f(x)$
- (f) $\lim_{x \rightarrow -3} f(x)$

- (2) Evaluate these limits. For an infinite limit, write $+\infty$ or $-\infty$. If a limit does not exist (DNE), you must justify why this is the case.

(a) $\lim_{x \rightarrow -2} \frac{x^2 - x - 12}{x + 3}$

(b) $\lim_{x \rightarrow \infty} \frac{\sqrt{5 + 2x^2}}{x - 4}$

(c) $\lim_{x \rightarrow 0} \frac{\sin 3x}{7x}$

(d) $\lim_{x \rightarrow 2+} \left(\frac{1}{\sqrt{x^2 - 9}} - \frac{1}{\sqrt{x - 3}} \right)$

- (3) For what value of c (if any) is the function $f(x)$ continuous at $x = 2$? Justify your answer.

$$f(x) = \begin{cases} x - \frac{1}{x-3} & x < 2 \\ c & x = 2 \\ \frac{-\cos(\pi x)}{x} & x > 2 \end{cases}$$

- (4) For a sphere of radius r , its surface area $S = 4\pi r^2$. What is the average rate of change of the surface area when the radius increases from $r = 5$ to $r = 6$?

- (5) Show that $\ln(x) = 1/x^2$ has a solution for some $x > 0$. You do not need to find this solution.

- (6) Find the derivatives of the following functions

(a) $5x - 2x^5 + 3\sqrt{x} - 2\sqrt[3]{1/x^2}$

(b) $3x^2 e^x$

(c) $\frac{2x + 1}{2x - 1}$

- (7) Find the second derivatives of the functions above.

- (8) Use the limit definition of the derivative to evaluate $f'(2)$, where

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

(b) $f(x) = \frac{1}{\sqrt{x + 2}}$