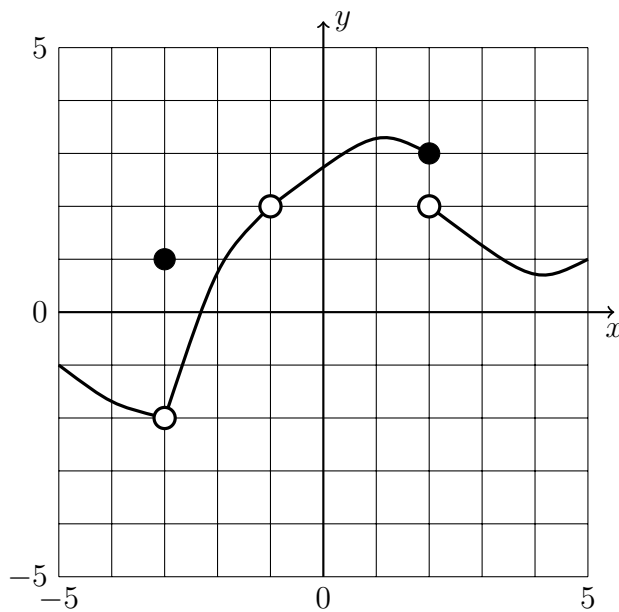


Math 231 Calculus 1 Fall 18 Sample Midterm 1

- (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)  $\lim_{x \rightarrow -2} \frac{x^2 - x - 6}{x + 2}$

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

(c)  $\lim_{x \rightarrow 0} \frac{\sin 4x}{5x}$

(d)  $\lim_{x \rightarrow 2^+} \left( \frac{1}{\sqrt{x-2}} - \frac{1}{\sqrt{x^2-4}} \right)$

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

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

- (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  $r = 3$  to  $r = 4$ ?

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

- (6) Find the derivatives of the following functions

(a)  $3x - 4x^{12} - 7\sqrt{x} + \sqrt[3]{1/x}$

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

(c)  $\frac{x-4}{x+4}$

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

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

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

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