

Math 131 - Assignment 1

January 22, 2025

Name key
Score _____

Show all work to receive full credit. Supply explanations when necessary. This assignment is due January 29.

- ①. Use a table of numerical values to estimate the limit. Your table must show function values at six or more points.

$$f(x) = \frac{1 - \cos(\pi x)}{\pi x^2}$$

$$\lim_{x \rightarrow 0} \frac{1 - \cos(\pi x)}{\pi x^2}$$

IT LOOKS LIKE THE LIMIT IS ≈ 1.571 .

x	0.1	0.01	0.001	-0.1	-0.01	-0.001
f(x)	1.55792	1.57067	1.57080	1.55792	1.57067	1.57080

IN FACT, THE ACTUAL LIMIT IS $\frac{\pi}{2}$.

- ②. Use a table of numerical values to estimate the limit. Your table must show function values at six or more points.

$$f(x) = \frac{2x+1}{(7-x)^2}$$

$$\lim_{x \rightarrow 7} \frac{2x+1}{(7-x)^2}$$

LOOKS LIKE LIMIT DNE BECAUSE $f(x)$ VALUES ARE GROWING WITHOUT BOUND.

x	7.1	7.01	7.001	6.9	6.99	6.999
f(x)	1520	150,200	15,002,000	1480	149,800	14,998,000

- ③. Use a table of numerical values to estimate the limit. Your table must show function values at six or more points.

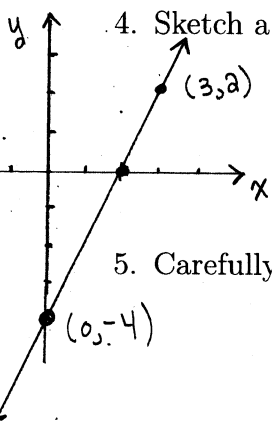
$$f(x) = \frac{110 - 3x - x^2}{x-2}$$

$$\lim_{x \rightarrow 2} \frac{110 - 3x - x^2}{x-2}$$

LIMIT DNE. IT LOOKS LIKE THE LIMIT FROM THE RIGHT IS 7, WHILE THE LIMIT FROM THE LEFT IS -7.

x	2.1	2.01	2.001	1.9	1.99	1.999
f(x)	7.1	7.01	7.001	-6.9	-6.99	-6.999

4. Sketch a good graph of $f(x) = 2x - 4$. Then use your graph to determine $\lim_{x \rightarrow 2} f(x)$.



LOOKS LIKE

$$\lim_{x \rightarrow 2} f(x) = 0$$

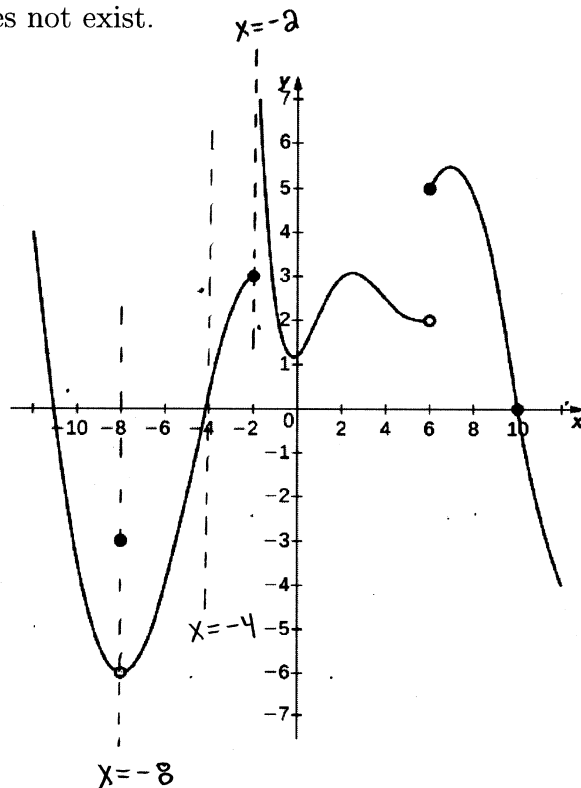
5. Carefully explain why the limit does not exist: $\lim_{x \rightarrow 0} x \ln x$.

$f(x) = x \ln x$ IS NOT DEFINED TO THE LEFT OF $x = 0$ BECAUSE $y = \ln x$ HAS DOMAIN $(0, \infty)$.

Turn over.

FAILURE #4.

6. Referring to the graph of $y = f(x)$ shown below, determine each of the following or explain why it does not exist.



(a) $\lim_{x \rightarrow -4} f(x) = \circ$

(b) $f(-2) = 3$

(c) $\lim_{x \rightarrow -8} f(x) = -6$

(d) $\lim_{x \rightarrow -2} f(x)$ DNE FUNCTION VALUES GROW WITHOUT BOUND AS $x \rightarrow -2$ FROM RIGHT.

7. Find the limit analytically by using limit laws. Show how you use the limit laws.

$$\begin{aligned} \lim_{x \rightarrow -2} x^2(2x+1) &= \left(\lim_{x \rightarrow -2} x \right)^2 \left(2 \lim_{x \rightarrow -2} x + \lim_{x \rightarrow -2} 1 \right) \\ &= (-2)^2 (2(-2) + 1) = \boxed{-12} \end{aligned}$$

8. Suppose that

$$f(4) = -13, \quad \lim_{x \rightarrow 4} f(x) = 8, \quad g(4) = 9, \quad \lim_{x \rightarrow 4} g(x) = -6.$$

Use limit laws to find the limit below. Show how you use the limit laws.

$$\begin{aligned} \lim_{x \rightarrow 4} \left[\frac{f(x)}{x g(x)} \right] &= \frac{\lim_{x \rightarrow 4} f(x)}{\left(\lim_{x \rightarrow 4} x \right) \left(\lim_{x \rightarrow 4} g(x) \right)} = \frac{8}{4 \cdot (-6)} = \frac{8}{-24} \\ &= \boxed{-\frac{1}{3}} \end{aligned}$$