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Exam 1

MATH 1190 – Calculus 1 (Fall 2025) -*section 555*

- No notes or technology (of any kind) allowed during the exam at any time.
- Silence all electronics. No headphones. Be respectful of others. Don't cheat. Leave quietly.
- Show your reasoning on problems. Convince me you know what you are talking about.

Please make sure your answers are neatly written, circle your final answers. Disorganized or unclear answers will not receive full credit.

Question 1. (7 points) For the function, f(x) graphed here find the following limits. If the limit does not exist, explain the reason.

a. $\lim_{x\to 1^+} f(x)$ -4

b. $\lim_{x\to 5^+} f(x)$ ∞

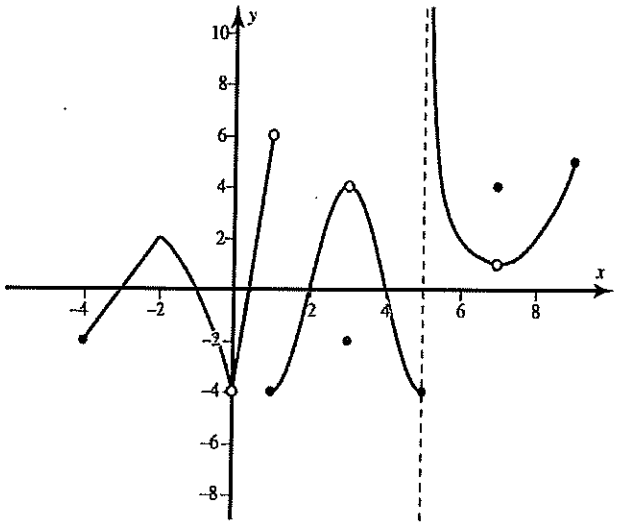
c. $\lim_{x\to 5^-} f(x)$ -4

d. $\lim_{x\to 5} f(x)$ DNE - There is an essential discontinuity

e. $\lim_{x\to 3} f(x)$ -2

f. F(3)= -2

g. $\lim_{x\to -4} f(x)$ -2



Question 2. (2 points) Using graph of question 1, is this function continuous at x=1, if not what is type of discontinuity. The function is continuous from the left, but not from the right.

It has a jump discontinuity.

Question 3. (5 points)

Find the equation of the tangent line to the graph of $f(x) = \frac{3}{\sqrt{x}}$ at $x = 64$.

$y - f(a) = f'(a)(x-a)$

$y - \frac{3}{8} = (x-64)$

$f(64) = \frac{3}{\sqrt{64}} = \frac{3}{8}$

$y - \frac{3}{8} = m(x-64)$

$\frac{f(x) - f(a)}{x-a}$ $\quad \frac{\frac{3}{\sqrt{x}} - \frac{3}{8}}{x-64}$

$\lim_{x \to 0} \frac{3}{\sqrt{0}} = \frac{3}{0}$

Question 4. (5 points) Find the average rate of change of the function $f(x) = x^3 - 2x + 1$ over the interval [-1,2].

$f(2) = 2^3 - 2(2) + 1 \Rightarrow 8 - 4 + 1 = 5$

$f(-1) = -1^3 - 2(-1) + 1 \Rightarrow -1 + 2 + 1 = 2$

$\frac{f(2) - f(-1)}{2+1}$

$\frac{5-2}{2+1} = \frac{3}{3} = 1$ AROC of $f(x)$ is (1)

Question 5. (3 points) Use calculus to determine if F(X) has any **horizontal asymptotes**. You must use calculus and show all your work to earn credit.

$f(x) = \frac{x+10}{x^2+x-12}$ ← degree is 1

↑ degree is 2

$\lim_{x \to 0} \frac{x}{x^2} = \frac{0}{0}$ Indeterminate form

$-3 + 4 = 1$

$-3 \times 4 = -12$

$x^2 + 4x - 3x - 12$

$x(x+4) - 3(x+4)$

$\frac{x+10}{(x-4)(x+3)}$

There is no horizontal asymptote

Question 6. (3 points each) Evaluate the limits if it exists (or clearly state, and prove that it doesn't exist, if that's the case).

a) $\lim_{x\to -5} \frac{x+5}{x^2-25}$ $\quad \frac{-5+5}{-5^2-25} = \frac{0}{0}$ indeterminate form

$\frac{x+5}{(x+5)(x-5)} \to \frac{1}{x-5} \to \frac{1}{(-5)-5} = \frac{1}{-10}$ $\quad -\frac{1}{10}$

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b) $\lim_{x\to 9} \frac{\sqrt{x}-3}{x-9}$ $\quad \frac{\sqrt{9}-3}{(9)-9} \Rightarrow \frac{3-3}{9-9} = \frac{0}{0}$ indeterminate form

$\frac{\sqrt{x}^2-3^2}{x^2-9^2} \Rightarrow \frac{x-9}{x^2-81} \to \frac{x-9}{(x-9)(x+9)} = \frac{1}{x+9} \to \frac{1}{9+9} = \frac{1}{18}$ $\quad \frac{1}{18}$

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c) $\lim_{x\to -5^+} \frac{|x+5|}{x+5}$ $\quad \frac{|-5+5|}{-5+5} = \frac{|0|}{0} \to \frac{0}{0}$ indeterminate form

$\frac{|-4.9+5|}{-4.9+5} = \frac{0.1}{0.1} = 1$ $\quad \frac{|-4.9+5|}{-4.9+5} = \frac{0.5}{0.5} = 1$ $\quad 1$

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d) $\lim_{x\to \infty} \frac{x^3+5}{x^2-7x^3}$ $\quad \frac{\infty^3+5}{\infty^2-7(\infty)^3} = \infty$

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e) $\lim_{x\to 0} \frac{\sin 5x}{3x}$ $\quad \frac{\sin 5x}{x} \cdot \frac{1}{3}$ $\quad \frac{\sin x}{x} = 1$

$\downarrow$

$1 \cdot 5 \cdot \frac{1}{3} = 5/3$

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f) $\lim_{x\to 5^+} \frac{3-x}{x-5}$ $\quad \frac{3-5}{5-5} = \frac{-2}{0} = -\infty$

$\frac{3-5.1}{5.1-5} = \frac{-2.1}{0.1} = -21$ $\quad \frac{3-5.2}{5.2-5} = \frac{-2.2}{0.2} = -11$

Question 7. (5 points) **Use the definition**, calculated derivative of function $f(x) = 5x^2 + 3x$.

$\lim_{x \to 1} 5x^2 + 3x$

(8)

$5(1)^2 + 3(1) = 5 + 3 = 8$

Question 8: (5 points) Find a value for the constant c that makes the function continuous.

$c = 39$

$$f(x) = \begin{cases} 8x + 9x^{-1} & \text{for } x > 3 \\ -4x + c & \text{for } x \leq 3 \end{cases}$$

$8(3) + \frac{9}{3} = 24 + 3 = 27$

$-4(3) + c = -12 + c$

$27 = -12 + c$

$+12 \quad +12$

$39 = c$

Check/verify

$-4(3) + 39 = -12 + 39 = 27$

$\lim_{x \to 3} -4x + 39$

$-4(3) + 39 = -12 + 39 = 27$

$\lim_{x \to 3} -4(3) + 39$

$\lim_{x \to 3^+} 8x + 9x^{-1} \rightarrow 8x + \frac{9}{x^1}$

$8(3) + 9/3^1 = 24 + 3 = 27$

$\lim_{x \to 3^+} 8x + 9x^{-1} = 27$

$\lim_{x \to 3^-} -4x + 39$

$-4(3) + 39 = -12 + 39 = 27$

$\lim_{x \to 3^-} -4x + 39 = 27$