

Calculus I (Math 231) Exam 1

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Justify answers and show all work for full credit.

NAME: _____

Problem 1. *Compute these limits. For an infinite limit, write $+\infty$ or $-\infty$. Otherwise, if a limit does not exist (DNE), you must justify. Show all work!*

(a) $\lim_{x \rightarrow -1} \frac{x^2 - 4x}{x^2 - 3x - 4}$

(b) $\lim_{x \rightarrow 0^-} \frac{\sqrt{1+x} - 1}{x}$

$$(c) \lim_{x \rightarrow -2} \frac{2 - |x|}{2 + x}$$

$$(d) \lim_{x \rightarrow 0^-} \left(\frac{1}{x} - \frac{1}{|x|} \right)$$

Problem 2. *Compute and explain these limits. For an infinite limit, write $+\infty$ or $-\infty$. You must justify - show all work!*

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

(b) $\lim_{x \rightarrow 0} x^2 \cos\left(\frac{2\pi}{x}\right)$

(c) $\lim_{x \rightarrow 0} \left(\frac{1}{x\sqrt{1+x}} - \frac{1}{x} \right)$

(Bonus) Suppose $2x - 1 \leq f(x) \leq x^2$ for $0 < x < 3$. Find $\lim_{x \rightarrow 1} f(x)$.

Problem 3. *Compute and explain these limits. For an infinite limit, write $+\infty$ or $-\infty$. You must justify – show all work!*

(a) $\lim_{x \rightarrow -\infty} \frac{2x^3 + 4x + 1}{5x - 3x^2}$

$$(b) \lim_{x \rightarrow \infty} \frac{(x+2)^2}{1+3x^2}$$

Problem 4. Determine whether the function $f(x)$ is continuous at $x = 2$.

$$f(x) = \begin{cases} \frac{6}{x} & 0 < x \leq 2 \\ x^2 - \cos(\pi x) & x > 2 \end{cases}$$

Problem 5. For what value of the constant c is $g(x)$ everywhere continuous?

$$g(x) = \begin{cases} cx^2 + 2x & x < 2 \\ x^3 - cx & x \geq 2 \end{cases}$$