# MATH 125 First Midterm

**September 29, 2026**

**Name:** _____ **ID:** _____ **Rec:** _____

| Question: | 1 | 2 | 3 | 4 | 5 | 6 | Total |
|---|---|---|---|---|---|---|---|
| Points: | 12 | 9 | 8 | 8 | 8 | 8 | 53 |
| Score: | | | | | | | |

There are 6 problems in this exam. Make sure that you have them all.

Do all of your work in this exam booklet, and cross out any work that the grader should ignore. You may use the backs of pages, but indicate what is where if you expect someone to look at it. **Books, calculators, extra papers, and discussions with friends are not permitted.** Telepathic communication with mathematically talented ducks is allowed, although you must also turn in the duck for grading along with your exam (geese and other fowl are not allowed). Please ensure the duck has a tag with your ID number on it.

**Points will be taken off for writing mathematically false statements, even if the rest of the problem is correct.**

**Use non-erasable pen** (not red) if you want to be able to contest the grading of any problems. Questions with erasures will not be regraded.

Leave all answers in exact form (that is, do *not* approximate $\pi$, square roots, and so on.)

You have 90 minutes to complete this exam.

**Name:** _____ **Id:** _____

1. Compute each of the following limits. If the limit is not a finite number, please distinguish between $+\infty$, $-\infty$, and a limit which does not exist (DNE). Justify your answer, at least a little bit.

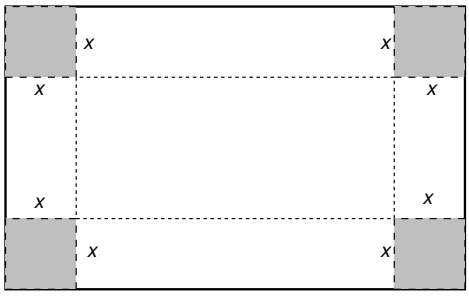
3 points (a) $\lim_{x \to 3} e^x \ln(x)$

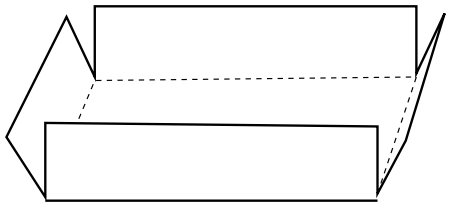
3 points (b) $\lim_{x \to 4} \dfrac{x^2 - 16}{5x(x-4)}$

3 points (c) $\lim_{x \searrow 4^+} \dfrac{x^2 - 9}{(x-4)}$

3 points (d) $\lim_{x \to +\infty} \sqrt{9x^2 + x} - 3x$

2. A box without a top is to be made from a rectangular piece of cardboard which is 12 inches by 20 inches by cutting out four equal squares of side length $x$ inches from each corner, and then folding up the flaps to form the sides of the box (see figure).

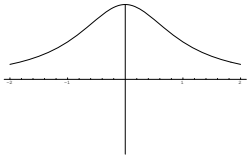


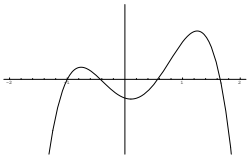



6 points (a) Express the volume of the box $V$ as a function of $x$.

3 points (b) What is the domain of the function $V(x)$?

8 points 3. For each of the 4 functions graphed in the left column, find the corresponding derivative function among any of the 8 choices on the right (not just on the same row) and put its letter in the corresponding box.





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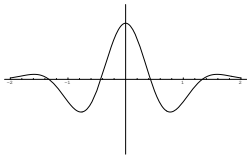

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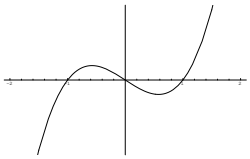

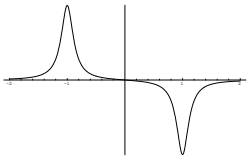

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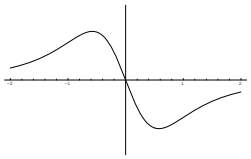

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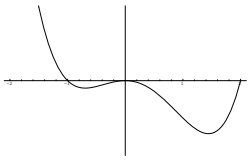

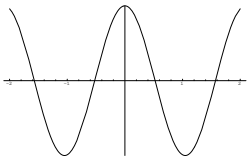

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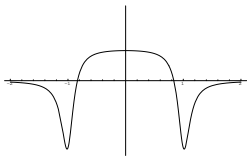

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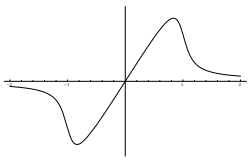

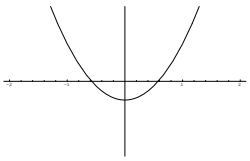

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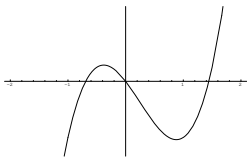

**H:**

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8 points 4. What value of $k$ is necessary so that the function

$$f(x) = \begin{cases} \dfrac{k}{x+4} & x < 1 \\ 5x^2 + x & x \geq 1 \end{cases}$$

is continuous for all positive values of $x$? If there is no such value of $k$, say so. Justify your answer fully.

8 points 5. Write a limit that represents the slope of the line tangent to the graph of the function

$$f(x) = x \ln(2 + x) \qquad \text{at} \qquad x = 3\,.$$

You **do not need to evaluate the limit.**

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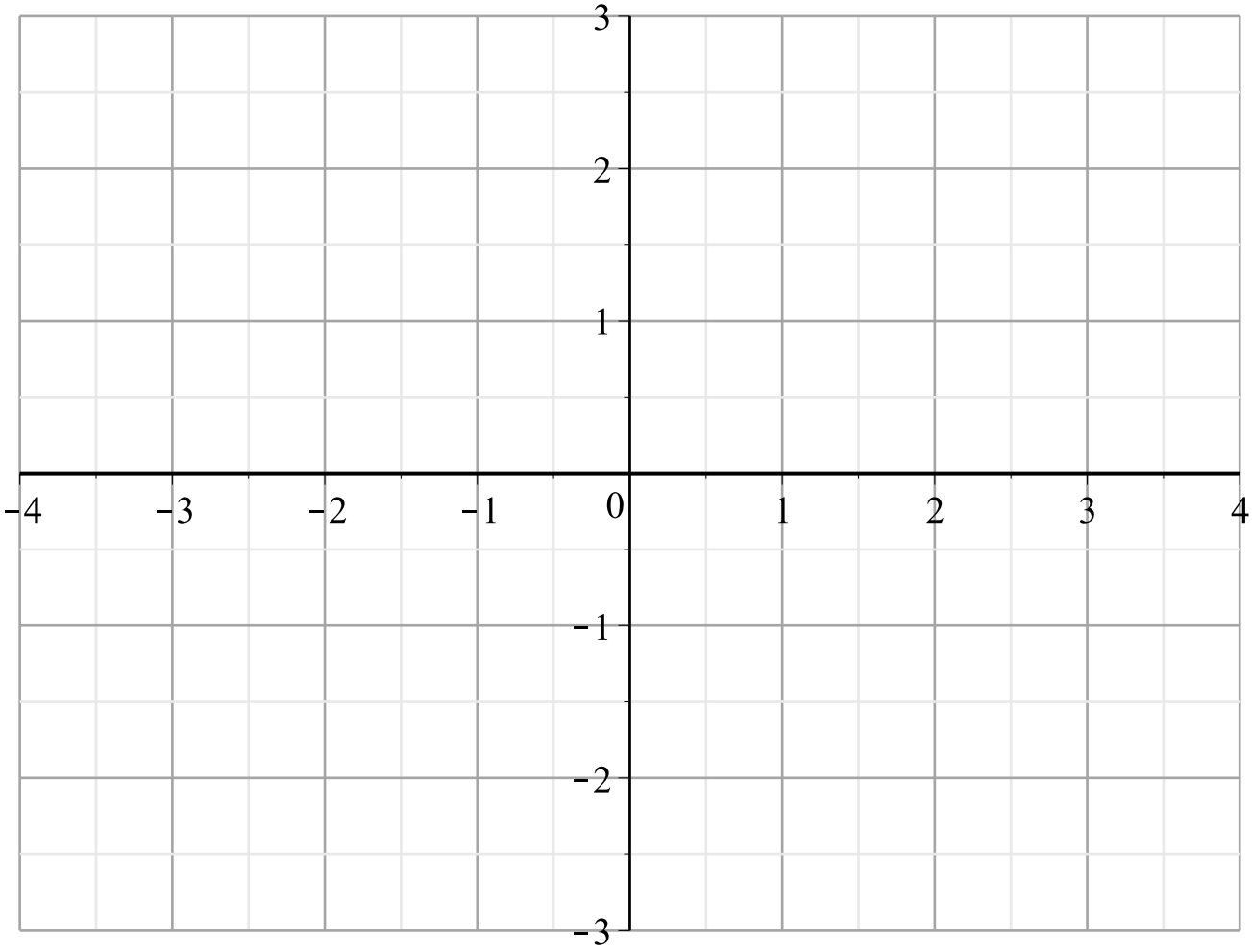
8 points 6. Sketch the graph of a function $f(x)$ which satisfies all of the following properties:

- $f(2) = 2$
- $\lim_{x \to 2} f(x) = 0$
- $\lim_{x \to 1} f(x) = 1$
- $\lim_{x \searrow 0^+} f(x) = +\infty$
- $\lim_{x \nearrow 0^-} f(x) = -\infty$
- $\lim_{x \to +\infty} f(x) = 0$
- $\lim_{x \to -\infty} f(x) = -\infty$
- $f'(-1) = 0$

Be sure to label all important values.