Math 141, Exam 1
Spring 2025

Name: _____

Student ID: _____

Version: **A**

Instructions:

- Do NOT open exam booklet until instructed.
- Write your Name and Student ID Number on the lines above.
- Write your Name and Student ID Number on the answer sheet.
- Fill in version (A or B) on your answer sheet.
- No calculators, personal devices (phones, computers, tablets, etc.), or reference materials may be used during the exam.
- Indicate your answer to each question on the answer sheet by fully filling in the appropriate bubble.
- You may use any blank space on this exam booklet for your scratch work.
- The exam booklet and answer sheet will be collected at the end of the exam. Only the answer sheet will be graded.

Answer #1-2 for the function $f(x) = \begin{cases} x-3, & x<4 \\ 2, & x=4 \\ \frac{3}{4}x+\frac{1}{2}, & x>4 \end{cases}$.

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

(a) 1

(b) 2

(c) 3.5

(d) the limit does not exist

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

(a) 1

(b) 2

(c) 3.5

(d) the limit does not exist

3. There are three conditions that must be met for a function $g(x)$ to be continuous at a given x-value. If $\lim_{x\to 3} g(x) = 12$ and $g(3)$ exists, what it the third condition that must be met for $g(x)$ to be continuous at $x = 3$?

(a) $g(3)$ cannot equal 0.

(b) $\lim_{x\to 3^+} g(x) = \lim_{x\to 3^-} g(x)$.

(c) $\lim_{x\to 3} g(x)$ cannot equal 0.

(d) $g(3) = 12$.

4. Evaluate $\lim_{x\to -2}(x^3+3)$.

(a) -5

(b) 11

(c) 7

(d) the limit does not exist

5. Evaluate $\lim_{x\to 1} \frac{x^2-1}{x-1}$.

(a) 0

(b) ∞

(c) 2

(d) the limit does not exist

6. A car's distance s in miles from its starting point after t hours is given by $s(t) = 3t^2$. Find the average rate of change of distance with respect to time (average velocity) as t changes from $t_1 = 2$ to $t_2 = 5$.

(a) 7 miles/hour

(b) 21 miles/hour

(c) 63 miles/hour

(d) 30 miles/hour

7. A car's distance s in miles from its starting point after t hours is given by $s(t) = 3t^2$. Find the instantaneous rate of change of distance with respect to time (instantaneous velocity) at $t = 5$.

(a) 75 miles/hour

(b) 30 miles/hour

(c) 12 miles/hour

(d) 63 miles/hour

8. What is the difference quotient, and what does it represent?

(a) $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$; it is the average rate of change between two points.

(b) $\frac{f(x+h)-f(x)}{h}$; it is the derivative of the function.

(c) $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$; it is the instantaneous rate of change at a point.

(d) $\frac{f(x+h)-f(x)}{h}$; it is the average rate of change between two points.

(e) $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$; it is the derivative of the function.

Consider the function $f(x) = x^2 + 10x$ when answering # 9-12.

9. Find the simplified form of the difference quotient for the function $f(x) = x^2 + 10x$.

(a) $2xh + h + 10h$

(b) $2x + h + 10$

(c) $2x + h$

(d) $2x + 10$

Use your answer from question to help you complete the following table, then answer questions #10-12.

x	h	value of difference quotient
2	1	
2	.1	
2	.01	

10. Consider your answer in the table when $x = 2$ and $h = 1$. What does the value of the difference quotient represent?

(a) The slope of the secant line between the points $(2, f(2))$ and $(3, f(3))$.

(b) The slope of the tangent lne at $x = 2$.

(c) The slope of the secant line between $(2, f(2))$ and $(1, f(1))$.

(d) The slope of the tangent line at $h = 1$.

11. As h gets closer and closer to 0, the difference quotient gets closer and closer to ____.

(a) 10

(b) 14

(c) 4

(d) 2

12. What does your answer to #11 represent?

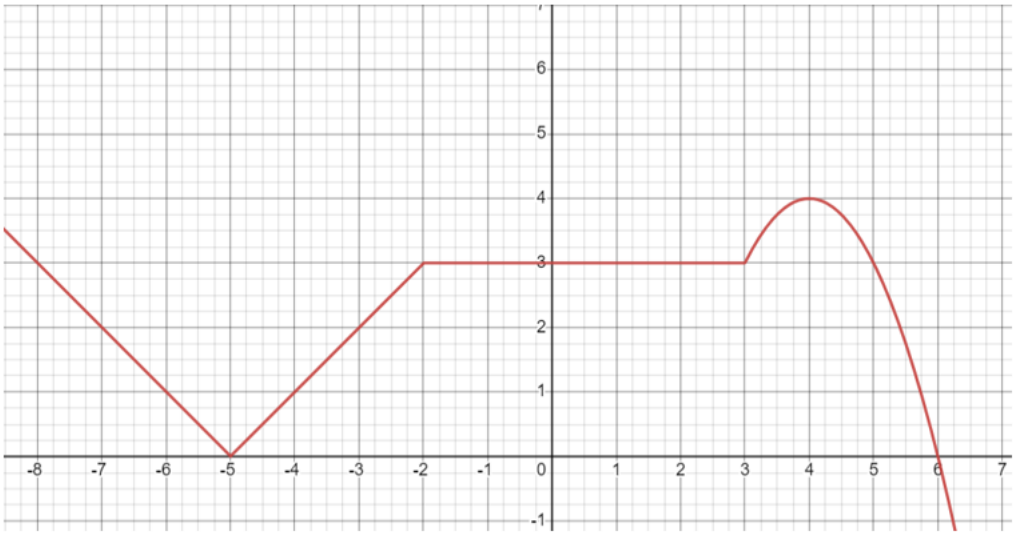
(a) The slope of the secant line at $x = 2$.

(b) The slope of the tangent line at $x = 2$.

(c) The slope of the secant line at $h = 0$.

(d) The slope of the tangent line at $h = 0$.

Consider the function $f(x)$, which is graphed below, when answering #13 - 16.



13. Which of the following statements is true?

(a) $f(5)$ is positive $f'(5)$ is positive.

(b) $f(5)$ is positive $f'(5)$ is negative.

(c) $f(5)$ is negative $f'(5)$ is positive.

(d) $f(5)$ is negative $f'(5)$ is negative.

(e) None of the above statements are true.

14. Which of the following statements is true?

(a) $f(0)$ is positive $f'(0)$ is positive.

(b) $f(0)$ is positive $f'(0)$ is negative.

(c) $f(0)$ is negative $f'(0)$ is positive.

(d) $f(0)$ is negative $f'(0)$ is negative.

(e) None of the above statements are true.

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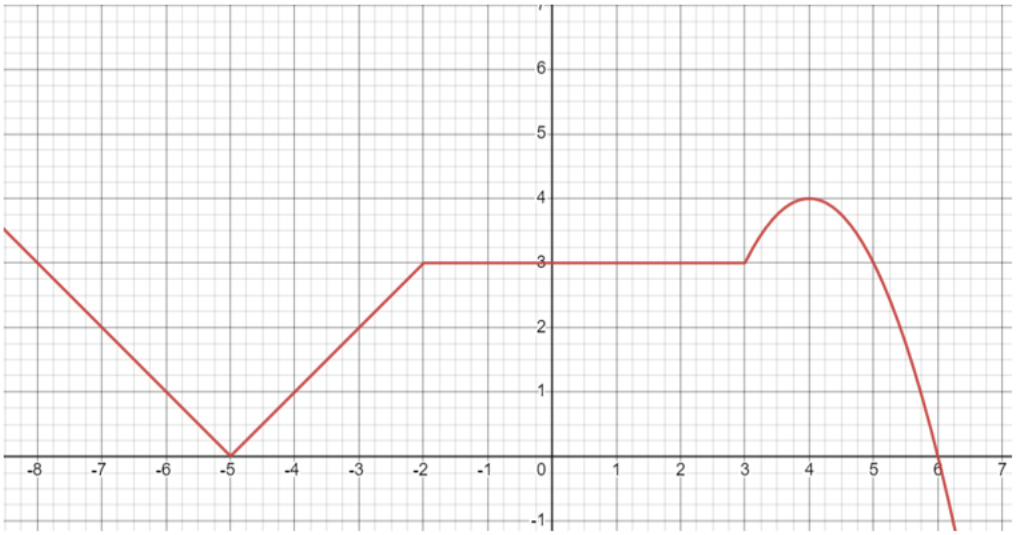
Consider the function $f(x)$, which is graphed below, when answering #13 - 16.



15. For which x-value is $f(x)$ not differentiable.

(a) -2

(b) 1

(c) 4

(d) $f(x)$ is differentiable at all of the above x-values

16. Which of the following has the **smallest** value?

(a) $f'(-7)$

(b) $f'(1)$

(c) $f'(5)$

(d) $f'(4.5)$

(e) $f'(6)$

17. Find the derivative of the function $h(x) = \sqrt{3x+4}$.

(a) $\frac{3}{2}\sqrt{3x+4}$

(b) $\frac{1}{2\sqrt{3x+4}}$

(c) $\frac{1}{2}\sqrt{3x+4}$

(d) $\frac{3}{2\sqrt{3x+4}}$

18. Compute the slope of the tangent line to $g(x) = x(x^3+2x)$ at $x = 1$.

(a) 8

(b) 11

(c) 5

(d) 3

19. Let $y = \frac{2x-1}{x+3}$. Find $\frac{dy}{dx}$.

(a) $\frac{-7}{(x+3)^2}$

(b) $\frac{7}{(x+3)^2}$

(c) $\frac{4-x}{(x+3)^2}$

(d) $\frac{x-4}{(x+3)^2}$

20. Find the **second derivative** of $f(x) = x^3 - 2x^2 + 5x$.

(a) $3x^2 - 4x + 5$

(b) $3x^2 - 4x$

(c) $12x - 4$

(d) $6x - 4$