

MATH 251, MIDTERM, FALL 2022

INSTRUCTOR: TUAN PHAM

Name

Instructions:

- This is a closed-book exam, 50 minutes long.
- A single sided, handwritten, 3" x 5" note card is allowed. A scientific calculator is allowed. Graphing/programmable/transmittable calculators are not allowed.
- For Problems 1-7, fill in the bubbles on this front page. To each problem, only one answer is correct.
- For Problems 8, 9 and 10, make sure to show all necessary steps. Mysterious answers will receive little or no credit.

1. Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ
4. Ⓐ Ⓑ Ⓒ Ⓓ
5. Ⓐ Ⓑ Ⓒ Ⓓ
6. Ⓐ Ⓑ Ⓒ Ⓓ
7. Ⓐ Ⓑ Ⓒ Ⓓ

Problem	Possible points	Earned points
1-7	14	
8	5	
9	5	
10	5	
Total	29	

Problem 1. (2 points) Let $f(x) = x^2 + 1$ and $g(x) = \frac{1}{x}$. Which of the following is the composite function $f \circ g$? That is, function $f(g(x))$.

- A. $\frac{1}{x^2+1}$
- B. $\frac{2}{x^2}$
- C. $\frac{1}{x^2} + 1$
- D. $\frac{1}{(x+1)^2}$

Problem 2. (2 points) Suppose a function f is not defined at $x = a$. Which of the following statements is false?

- A. f is not continuous at a .
- B. f is not differentiable at a .
- C. $\lim_{x \rightarrow a} f(x)$ does not exist.

Problem 3. (2 points) If the $\lim_{x \rightarrow a^-} f(x) \neq \lim_{x \rightarrow a^+} f(x)$ then f is discontinuous at a . True or false?

- A. True
- B. False

Problem 4. (2 points) Choose the correct value of the limit

$$\lim_{x \rightarrow -\infty} \frac{x}{\sqrt{x^2 + 1}}$$

- A. 1
- B. -1
- C. ∞
- D. $-\infty$

Problem 5. (2 points) Choose the correct value of the limit

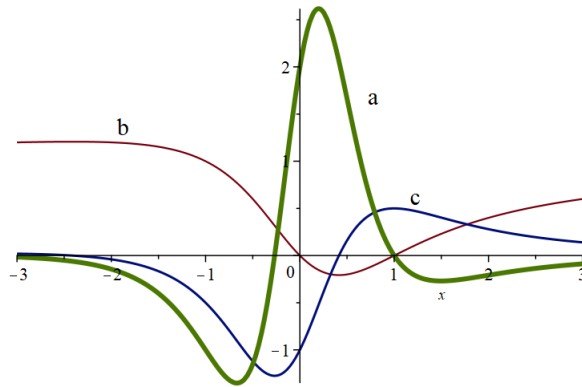
$$\lim_{x \rightarrow \infty} \frac{x(2x^2 - 3x + 5)}{(x^2 + 1)(x + 1)}$$

- A. 1
- B. 2
- C. 0
- D. ∞

Problem 6. (2 points) Let $f(x) = x + \frac{x}{x+1}$. Find $f'(1)$.

- A. $-1/4$
- B. $1/4$
- C. $3/4$
- D. $5/4$

Problem 7. (2 points) The figure below contains the graphs of f , f' , and f'' . The graphs of these functions in that order are



- A. a, b, c
- B. a, c, b
- C. b, a, c
- D. b, c, a

Problem 8. (5 points) Evaluate the polynomial $x^3 - 3x + 1$ at $x = -2, -1, 0, 1, 2$ and explain why it has three distinct roots.

Problem 9. (5 points) Use the limit laws you learned to find the limit

$$\lim_{x \rightarrow -1} \frac{x^2 - 2x - 3}{x^2 + 4x + 3}$$

Problem 10. (5 points) Find the point on the parabola $y = x^2 + x$ at which the tangent line to the parabola is parallel to the line $y = 3x$. What is the equation for the tangent line at that point?