You have 75 minutes to complete your work. The total: 40 points.

Except for True/False and matching problems, show your reasons and computations.

No notes, books, calculators, computers, or other electronic aids are allowed.

**Problem 1.** (8 points) Mark True or False. No justification is needed.

1. T F The function $\tan(x)$ is continuous everywhere on the $x$-axis.
2. T F Any function passes the horizontal line test.
3. T F $\ln(\ln e) = 0$.
4. T F The intermediate value theorem assures that a continuous function has a derivative.
5. T F $\arcsin(-\frac{1}{\sqrt{2}}) = \frac{7\pi}{4}$.
6. T F The 100th derivative of the function $f(x) = e^x + x^{99}$ is $f^{(100)}(x) = e^x$.
7. T F $\lim_{x \to 0} \sin(\frac{1}{x}) = 0$.
8. T F $f(x) = \frac{1 - 2^x}{1 + 2^x}$ is an even function.

**Problem 2.** (4 points) The graph of $y = f(x) = \ln(x)$ is shown. Match the functions (1) – (5) on the left and curves (a) – (e) on the right. No justification is needed.

1. $\leftrightarrow$ ( ) $y = 4f(x)$
2. $\leftrightarrow$ ( ) $y = -f(x) + 1$
3. $\leftrightarrow$ ( ) $y = f(-x)$
4. $\leftrightarrow$ ( ) $y = f(2x + 2)$
5. $\leftrightarrow$ ( ) $y = f(2x - 3)$
Problem 3. (4 points) Match the graphs (1) – (5) on the top for \( y = f(x) \) with the graphs (a) – (e) on the bottom for the derivatives \( y = f'(x) \). No justification is needed.

(1) \( \quad \) (2) \( \quad \) (3) \( \quad \) (4) \( \quad \) (5) \( \quad \)

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(1) \quad (2) \quad (3) \quad (4) \quad (5)
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(a) \( \quad \) (b) \( \quad \) (c) \( \quad \) (d) \( \quad \) (e) \( \quad \)

Problem 4. (Limits) (3 \times 3 = 9 points) Compute the following limits. Show your work. If the limit does not exist, explain why.

1. \( \lim_{x \to 1} \frac{x^2 - 4x + 3}{x - 1} \).
2. \( \lim_{x \to 1} \frac{x^2 - 1}{|x - 1|} \).
3. \( \lim_{x \to +\infty} \sqrt{x^2 + 4} - x \).

Problem 5. (Derivatives) (3 \times 3 = 9 points) Compute \( f'(x) \) for the following functions. Show your work.

1. \( f(x) = x^2(1 - 2\sqrt{x}) \).
2. \( f(x) = \frac{x + 3}{x^2 + 1} \).
3. \( f(x) = x^3(e^x + 1) \).

Problem 6. (Tangent lines) (3 points) Find an equation of the tangent line to the curve \( y = x^4 + 1 \) that is parallel to the line \( 32x - y = 15 \).

Problem 7. (Asymptotes) (3 points) Find all the horizontal and vertical asymptotes of the curve \( y = f(x) = \frac{x^4 + 4}{x^2 - x^4} \).