Civil Engineering Licensure Exam – Mock Exam (Day 5: Calculus – Limits and Differentiation)

February 23, 2025

Instructions

- Time Limit: 60 Minutes
- Coverage: Limits, Derivatives, and Differentiation Rules
- Total Questions: 10 (Multiple Choice & Problem-Solving)
- Show complete solutions for problem-solving questions.

Section A: Multiple Choice Questions (MCQs)

Choose the best answer.

1. Evaluate the limit:

$$\lim_{x \to 3}(x^2 - 9)$$

   (a) 0
   (b) 6
   (c) 9
   (d) 12

2. Find the derivative of $f(x) = 5x^3 - 2x^2 + 7x - 4$.

   (a) $15x^2 - 4x + 7$
   (b) $15x^2 - 4x + 4$

(c) $10x^2 - 4x + 7$

(d) $15x^2 - 4x - 7$

3. If $y = e^{3x}$, find $\frac{dy}{dx}$.

   (a) $3e^x$

   (b) e^{3x}

   (c) $3e^{3x}$

   (d) e^x

4. Find the derivative of $f(x) = \ln(x^2 + 1)$.

   (a) $\frac{1}{x^2+1}$

   (b) $\frac{2x}{x^2+1}$

   (c) $\frac{2}{x^2+1}$

   (d) $\frac{x}{x^2+1}$

5. Using L'Hôpital's Rule, evaluate:

$$\lim_{x \to 0} \frac{\sin x}{x}$$

   (a) 0

   (b) 1

   (c) -1

   (d) ∞

Section B: Problem-Solving

1. Evaluate:
$$\lim_{x \to 2} \frac{x^2 - 4}{x - 2}$$

2. Differentiate:
$$f(x) = \frac{x^3 - 5x + 2}{x}$$

3. Find the equation of the tangent line to $f(x) = x^2 + 3x - 5$ at $x = 2$.

4. Use implicit differentiation to find $\frac{dy}{dx}$ if:
$$x^2 + y^2 = 25$$

5. Find the critical points of $g(x) = x^3 - 6x^2 + 9x + 4$.