# Answer Key: Civil Engineering Licensure Exam – Mock Exam (Day 5: Calculus)

February 23, 2025

## Answer Key

### Section A: Multiple Choice Solutions

1. Evaluating the limit:

$$\lim_{x \to 3}(x^2 - 9) = 3^2 - 9 = 0$$

**Answer: (a)** 0

2. Differentiating $f(x) = 5x^3 - 2x^2 + 7x - 4$:

$$f'(x) = 15x^2 - 4x + 7$$

**Answer: (a)** $15x^2 - 4x + 7$

3. Derivative of $y = e^{3x}$:

$$\frac{dy}{dx} = 3e^{3x}$$

**Answer: (c)** $3e^{3x}$

4. Differentiating $f(x) = \ln(x^2 + 1)$:

$$f'(x) = \frac{2x}{x^2 + 1}$$

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

5. L'Hôpital's Rule:

$$\lim_{x \to 0} \frac{\sin x}{x} = 1$$

**Answer: (b)** 1

**Section B: Problem-Solving Solutions**

1. Evaluating the limit:

$$\lim_{x \to 2} \frac{x^2 - 4}{x - 2}$$

Factorizing:

$$\frac{(x-2)(x+2)}{x-2} = x + 2$$

Substituting $x = 2$:

$$2 + 2 = 4$$

2. Differentiating:

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

$$f'(x) = 2x - \frac{2}{x^2}$$

3. Tangent line equation:

$$f'(x) = 2x + 3$$

At $x = 2$:

$$f'(2) = 4 + 3 = 7$$

$$y - f(2) = 7(x - 2)$$

4. Implicit differentiation:

$$2x + 2y\frac{dy}{dx} = 0$$

$$\frac{dy}{dx} = -\frac{x}{y}$$

5. Finding critical points:

$$g'(x) = 3x^2 - 12x + 9$$

Solving $g'(x) = 0$:

$$3(x^2 - 4x + 3) = 0$$

$$3(x - 3)(x - 1) = 0$$

**Critical points:** $x = 1, 3$.