Civil Engineering Licensure Exam – Mock Exam (Day 6: Integral Calculus)

February 23, 2025

Instructions

- Time Limit: 60 Minutes
- Coverage: Definite and Indefinite Integrals, Applications
- 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 indefinite integral:

$$\int (3x^2 - 2x + 5)\, dx$$

   (a) $x^3 - x^2 + 5x + C$
   (b) $x^3 - 2x^2 + 5x + C$
   (c) $x^3 + x^2 + 5x + C$
   (d) $x^3 - 2x^2 - 5x + C$

2. Compute:

$$\int e^x\, dx$$

   (a) $e^x + C$

(b) $xe^x + C$

(c) $\frac{e^x}{x} + C$

(d) $\ln|x| + C$

3. Evaluate:

$$\int \frac{dx}{x}$$

(a) $\frac{1}{x} + C$

(b) $x \ln x + C$

(c) $\ln|x| + C$

(d) $e^x + C$

4. Find the definite integral:

$$\int_0^1 (x^3 + 2x)\, dx$$

(a) $\frac{5}{4}$

(b) $\frac{3}{4}$

(c) $\frac{7}{4}$

(d) $\frac{9}{4}$

5. If $f(x) = \int_1^x (t^2 + 3t)\, dt$, find $f'(x)$.

(a) $x^2 + 3x$

(b) $x^2 + 3$

(c) $2x + 3$

(d) $x + 3$

Section B: Problem-Solving

1. Evaluate:
$$\int (4x^3 - 2x + 1)\, dx$$

2. Compute the area under the curve $y = x^2$ from $x = 1$ to $x = 3$.

3. Find the volume of the solid obtained by rotating the region bounded by $y = x^2$ and $x = 2$ around the x-axis.

4. Solve the differential equation:
$$\frac{dy}{dx} = 3x^2 - 2x, \quad y(0) = 4$$

5. A tank is being filled with water at a rate of $r(t) = 3t^2$ liters per minute. Find the total amount of water added from $t = 0$ to $t = 4$.