Time: 50 minutes.

Books, notes, calculators, cell phones, electronic memory devices, and electronic communication devices are NOT allowed.

Justify your answers and show all your work. If you need more space on a question, use the back of the page which precedes that question. Unless otherwise indicated, simplification of answers is not required.
1. Evaluate \( \int \frac{x^2 - 3x + 8}{(3x - 1)(x - 3)^2} \, dx \).

2. Evaluate \( \int_0^{\pi/3} \tan^3 x \, dx \).
3. Find the limit of the sequence or show that it is divergent.

\[ a_n = \frac{\cos n}{n^2} \]

4. Evaluate \( \int e^{-2x} \cos x \, dx \).
5. Evaluate \( \int \frac{x}{(x^2 + 4x + 8)^{3/2}} \, dx \).

6. A cube with 2 ft long sides is sitting on the bottom of a tank that is filled with liquid 5 ft deep. The weight density \( \delta = \rho g \) of the liquid is 70 lb/ft\(^3\). Find the hydrostatic force on (a) the top of the cube and (b) one of the vertical faces of the cube.
7. Evaluate the integral or show that it is divergent.

\[ \int_{1}^{4} \frac{1}{(x - 2)^3} \, dx \]

8. Solve the initial-value problem

\[ \frac{dy}{dx} = \frac{1}{y + x^2 y}, \quad y(0) = -2. \]
9. If $|f''(x)| \leq K$ for $a \leq x \leq b$, then the error $E_T$ in the Trapezoidal Rule approximation to $\int_a^b f(x) \, dx$ satisfies

$$|E_T| \leq \frac{K(b-a)^3}{12n^2}.$$ 

(a) If $f(x) = \cos(e^x)$, show that $|f''(x)| \leq 12$ for $0 \leq x \leq 1$. 

*Hint: Use the fact that $e < 3$.*

(b) Find an integer $n$ that guarantees the Trapezoidal Rule approximation to $\int_0^1 \cos(e^x) \, dx$ is accurate to within 0.000001.