You will be told when to begin the work and when to terminate work on the examination. You must stop when instructed. Points may be deducted in case of violations.

Please show your work to support your answers that require calculations. Correct but unsupported answers may not be given full credit.

The use of a cell phone or other electronic communication devices during the examination is not allowed. The exam will be canceled and a grade of “0” will be assigned to anyone who opens a cell phone during the examination or if one is found on their seat or hand.

No calculators are allowed!
1. (4 pts) We learned that the derivative of $\ln(x)$ is $\frac{1}{x}$. Does this information help us to find the integral of $\ln(x)$? If yes, then explain why/how and if no, then explain what we can imply from this information.

2. (6 pts each) Find the indefinite integral.
   (a) $\int 1 + x^2 \, dx$
   
   (b) $\int e^{3t}(e^t - 2) \, dt$
   
   (c) $\int \frac{\sqrt{x^2 + 1}}{x} \, dx$

3. (8 pts each) Find the indefinite integral
   (a) $\int x\sqrt{5x^2 - 3} \, dx$
(b) \( \int x e^{x^2 - 1} \, dx \)

(c) \( \int \frac{2 \ln(x)}{x} \, dx \)

4. (8 pts) Solve the given initial value problem for \( y = f(x) \).

\[ \frac{dy}{dx} = \frac{2}{x} - \frac{1}{x^2} \] where \( y = -1 \) when \( x = 1 \)
5. (8 pts each) Evaluate the integral and simplify your answer.

(a) \( \int_{0}^{1} \sqrt{u} \, du \)

(b) \( \int_{1}^{3} \frac{x-3}{(x^2-6x)^2} \, dx \)

(c) \( \int_{0}^{2} (2x - 3)^3 \, dx \)
6. (8 pts) A manufacturer estimates that the marginal cost of producing \( q \) units of a certain commodity is \( C'(q) = 3q^2 - 12q + 12 \) dollars per unit. If the cost of producing 1 unit is $20, what is the cost of producing 5 units? [You can leave your answer in calculator ready form. No simplification is necessary.]

7. (8 pts) Use the information below to evaluate the integrals:

\[
\int_1^5 f(x) \, dx = 3, \quad \int_3^5 f(x) \, dx = -2, \quad \int_1^5 g(x) \, dx = -1
\]

(a) \( \int_1^5 2f(x) - g(x) \, dx \)

(b) \( \int_1^3 f(x) \, dx \)
8. (4 pts) Determine if the following statement is true or false. Support your answer.

\begin{align*}
\text{(true / false)} \quad \int \frac{x^2}{x-1} \, dx &= \frac{1}{3}x^3 + C \\
&= \frac{1}{2}x^2 - x + C
\end{align*}

9. (4 pts) Verify that \( \int \ln(x) \, dx = x \ln(x) - x + C \)
Use this page if you need additional space.