

You must show all your work on this paper. Solutions without correct supporting work will not be accepted. All answers must be exact unless stated otherwise. You must omit one problem by clearly writing "OMIT" by the problem. If you do not omit a problem, I will omit the last one for you. You may work the problem you omit for up to 5 points extra credit if you wish. Circle your answers.

1. a. Evaluate $\int \left(\frac{3}{x^2} - \cos x + \csc^2 x \right) dx$.

b. Evaluate $\int \frac{1}{1-2x} dx$.

2. a. Evaluate $\int_e^{4e} \frac{1}{x} dx$

b. Set up, but do not evaluate, the limit to find the area of the region bounded by $f(x) = 25 - x^2$ and the x-axis between $x = -1$ and $x = 3$. The limit must be in the form where it is ready to be evaluated.

3. a. Evaluate $\int \frac{\sin^3 \theta}{1 - \cos^2 \theta} d\theta$

b. Fill in the blank: $\int \underline{\hspace{4cm}} dx = (ax^2 - a^2)^4 + C$

4. Evaluate $\lim_{n \rightarrow \infty} \sum_{i=1}^n \left(1 + \frac{i}{n}\right)^2 \left(\frac{2}{n}\right)$

5. Evaluate $\int \frac{8x^2 + 9x + 8}{x^2 + 1} dx$

6. An object has a constant acceleration of 12 feet per second squared, an initial velocity of 17 feet per second, and a position of 40 feet after 1 second. Find the position function describing the motion of this object. You must show all your steps.

7. Evaluate $\int_1^4 \frac{1}{x^2 - 2x + 10} dx$

8. a. Find the particular solution to $y' = \sin x$ given the general solution $y = C - \cos x$ and the initial condition $y(\pi/3) = 1$.

b. A radioactive element has a half-life of 50 days. What percentage of the original sample is left after 60 days? Round your answer to the nearest hundredth of a percent.

9. Find the general solution to the first order differential equation: $x \cos^2 y + \tan y \frac{dy}{dx} = 0$

10. Find the general solution: $(x^2 + y^2)dx + xy dy = 0$

11. Find the particular solution: $y' + y \sin x = \sin x, \quad y\left(\frac{\pi}{2}\right) = 2$