

Answer the problems on separate paper. You do not need to rewrite the problem statements on your answer sheets. Work carefully. Do your own work. **Show all relevant supporting steps!**

Bald solutions to integral problems – indefinite or definite, proper or improper – without accompanying documentative/associative/supportive work will receive **no** credit.

Part I. Find each of the following anti-derivatives. **No** reference may be given to entries from integral tables for solutions of problems in this section.

1. (8 pts) $\int \frac{x}{\sqrt{9x^2 - 1}} dx$

2. (8 pts) $\int \sin^3 2x \cos^2 2x dx$

3. (8 pts) $\int (x^2 + 1) e^{-3x} dx$

4. (8 pts) $\int x (1 + 2x)^{1/3} dx$

Part II. Find each of the following anti-derivatives. Reference may be made to entries from integral tables in the solutions of problems in this section. Any solution based on usage from integral tables should be appropriately and fully documented.

5. (8 pts) $\int \frac{x}{\sqrt{4x^4 + 9}} dx$

6. (8 pts) $\int \tan^2 x \sec x dx$

7. (8 pts) $\int \frac{2-x}{\sqrt{4-x^2}} dx$

8. (16 pts) $\int \frac{x^2 - x + 3}{(x+1)^2 (x^2 + 9)} dx$

Part III. Solve the following differential equation and compute the following definite integrals, providing accompanying documentative/associative/supportive work. Integral tables may be used if desired but are not required.

9. Consider the differential equation: $x^2 \frac{dy}{dx} + 3xy = \sin \pi x$

a. (8 pts) Find the general solution for the differential equation.

b. (4 pts) Find the particular solution for the differential equation which satisfies the initial value conditions $y(-1) = 2$

10. (8 pts) $\int_0^1 \frac{dx}{(1+x)^{1/5}}$

11. (8 pts) $\int_0^1 \frac{dx}{\sqrt{1-x}}$

12. (8 pts) $\int_1^\infty x e^{-4x} dx$