1. Find the general antiderivative of \( f(x) = e^{-x/3} + \frac{5}{2x^{1/2} + 2} \)

2. Approximate the area \( \int_{3}^{4} x^{-1} \, dx \) using 4 equal subintervals with right endpoints.

3. Express \( \int_{0}^{4} x^3 \, dx \) as a limit of Riemann sums.

4. Use the fundamental theorem of calculus (FTC) part II to find \( \int_{-1}^{1} x^5 \, dx \)

5. Find \( \frac{d}{dx} \int_{0}^{x^3} e^{-5w^2} \, dw \)

6. Find \( \int \left( \frac{x^2 + 5 + \sqrt{2}}{2x^{3/2}} \right) \, dx \)

7. Find \( \int_{0}^{\pi/4} (e^{\tan 5x} \sec^2 5x) \, dx \)

8. Find \( \int 5xe^{3x} \, dx \)

9. Find \( \int x^3 \sin x^2 \, dx \)

10. Find the partial fraction decomposition of \( \frac{1}{x^{(2x+1)}} \)

11. Use partial fraction decomposition to find \( \int \frac{2x^2 - 3x + 2}{(x^2 + 1)^2} \, dx \)

12. Find \( \int_{1}^{\infty} \frac{1}{\pi x} \, dx \) if it exists.

13. Find \( \int_{0}^{2} \frac{1}{x^2 - 2x} \, dx \) if it exists.

14. Suppose we approximated \( \int_{0}^{2} \sin(x) \, dx \) using 4 equal width subintervals and the midpoint rule. What is an upper bound for the error of this estimate (no need to simplify your answer)?

15. Find the third degree taylor polynomial \( P_3 \) centered about \( x = 0 \) for the function \( f(x) = e^{x^2} \)

16. Solve the differential equation \( \frac{dy}{dx} = (y + 3) \sin(x) \) where \( y = 5 \) when \( x = \pi/2 \)

17. Find and analyze the stability of all equilibria for \( \frac{dP}{dt} = 10(5 - t)(5 + t) \)

18. Consider a compartment with a volume of 10 liters filled with a solution with concentration 5 grams/liter. If another solution with a concentration of 2 grams/liter is being pumped in at a rate of 1/4 liter/second, then write down a differential equation to describe how the concentration of the solution in the compartment is changing.