1. Find $\frac{dy}{dx}$ if
   (a) $y = \int_x^2 e^t \, dt$
   (b) $y = \int_0^x \sin(t^4) \, dt$

2. Evaluate:
   (a) $\int \sec^4 x \tan^4 x \, dx$
   (b) $\int e^x \sin x \, dx$
   (c) $\int \frac{x^3}{x^2 - 3x + 2} \, dx$

3. Evaluate
   (a) $\int \frac{5x^3 + 5x^2 - 5x}{3x^4 + 4x^3 - 6x^2} \, dx$
   (b) $\int x^2 \cos x \, dx$
   (c) $\int \frac{dx}{x \sqrt{3 - x^2}}$

4. Evaluate
   (a) $\int \frac{x^2 + 2x}{\sqrt{x + 2}} \, dx$
   (b) $\int \frac{dx}{x^4 \sqrt{x^2 - 9}}$
   (c) $\int \frac{x^2 + 3x + 2}{x^3 + x} \, dx$

5. Evaluate:
   (a) $\int_1^2 \ln x \, dx$
   (b) $\int_1^4 \frac{1}{(x - 2)^2} \, dx$
   (c) $\int_0^\infty \frac{5x}{(x^2 + 1)^2} \, dx$

6. Consider the region bounded by the graphs of $y = \sqrt{x}$ and $y = x^3$.
   (a) Find the area of the region.
   (b) Set up the integral corresponding to the volume of the solid generated by
       revolving the region about the $x$-axis.
   (b) Set up the integral corresponding to the volume of the solid generated by
       revolving the region about the $y$-axis.
   (b) Set up the integral corresponding to the volume of the solid generated by
       revolving the region about the line $y = 2$.

7. Given the curve $y = \cot x$, $\frac{\pi}{4} \leq x \leq \frac{\pi}{2}$, set up the integrals (without evaluating) corresponding to
   (a) the arc length of the curve,
   (b) area of the surface obtained by rotating the curve about the $x$-axis,
   (c) area of the surface obtained by rotating the curve about the $y$-axis,
   (d) area of the surface obtained by rotating the curve about the line $x = \pi$,
   (e) area of the surface obtained by rotating the curve about the line $y = 1$.

8. Consider $f(x, y, z) = \frac{xe^y}{z}$
   (a) find all first partial derivatives of $f$,
   (b) verify that $f_{xz} = f_{x\bar{x}}$

9. Solve:
   (a) $y^3 y' = (y^4 + 1) \cos x$
   (b) $xy' - y = x$, $x > 0$
   (c) $y' + 2xy = x$, $y(0) = -2$

10. Solve:
    (a) $y'' + 2y' - 8y = 0$, $y(0) = 5$, $y'(0) = -2$
    (b) $y'' - 2y' + y = 0$, $y(0) = -1$, $y(1) = 2e$
    (c) $y'' - 4y' + 5y = 0$, $y(0) = 2$, $y(\pi/2) = e^\pi$