1. Calculate:

(a) \( \int_{-\pi/2}^{0} 3 \sin^2(x) \cdot \cos(x) \, dx \)

(b) \( \int \frac{1}{\sinh^{-1}(x)\sqrt{1+x^2}} \, dx \)

(c) \( \int_{1}^{25} \frac{\log_5(t)}{t} \, dt \)

(d) \( \int \frac{e^{\sqrt{t}}}{\sqrt{t}} \, dt \)

2. Find the area in the \( xy \)-plane enclosed between the curves \( y = 3x - 1 \) and \( y = x^2 + 3x - 2 \).

3. Use any appropriate method (e.g., discs, washers, or shells) to find the volume of each of the solids described below:

(a) The solid generated by revolving the curve \( f(x) = 1 + e^x, \ 0 \leq x \leq \ln(2) \) about the \( x \)-axis.

(b) The solid generated by revolving the curve \( g(y) = \sqrt[5]{y}, \ 0 \leq y \leq 32 \) about the \( y \)-axis.

4. Find the length of the curve along \( x = \frac{y^4}{4} + \frac{1}{5y^2} \) from \( y = 1 \) to \( y = 2 \).

5. Find the area of the surface of revolution obtained by revolving about the \( x \)-axis the curve \( h(x) = \sqrt{2x - x^2}, \ 0 \leq x \leq 1 \)

6. A spring requires 0.2N of force to hold it steady when stretched to a distance of 0.01m from equilibrium. How much work is done by stretching the same spring from equilibrium to a distance of 0.1m?

7. Solve each of the separable differential equation; write your answers as functions in terms of \( x \).

(a) \( \frac{dy}{dx} = (-2x + 1)e^y \)

(b) \( \frac{1}{x^2 - x} \frac{dy}{dx} = \cos^2(y) \)

8. Determine whether \( f(t) = e^t + 5\sin(t) \) is a solution to the differential equation \( y' + y'' = 2e^t \)

9. Solve the initial value problem \( (y + 1) \frac{dy}{dt} = yt, \ y(0) = 1 \)

10. Find the derivative of each of the functions below.

(a) \( f(x) = \sinh^2(x^3) \)

(b) \( g(x) = \cosh(e^x) \sinh(e^x) \)

(c) \( h(x) = \frac{x^2 + 1}{\tanh^{-1}(x)} \)