1. A car braked with a constant deceleration of 16 feet per second per second, producing skid marks measuring 200 feet before coming to a stop. How fast was the car traveling when the brakes were first applied?

2. (a) Evaluate the right Riemann sum for \( f(x) = x^2 - x \) on \([0, 2]\) with four subintervals of uniform length. Explain with the aid of a diagram what the Riemann sum represents.

(b) Use the definition of the definite integral as a limit to calculate the value of the integral \( \int_0^2 (x^2 - x) \, dx \).

(c) Use the Fundamental Theorem of Calculus to check your answer to part (b).

(d) Draw a diagram to explain the geometric meaning of the integral in part (b).

3. Evaluate each of the following expressions.

   (a) \( \int_0^{\pi/2} \frac{d}{dx} \left( \frac{\sin x}{2} \cos \frac{x}{3} \right) \, dx \)

   (b) \( \frac{d}{dx} \int_0^{\pi/2} \left( \frac{\sin x}{2} \cos \frac{x}{3} \right) \, dx \)

   (c) \( \frac{d}{dx} \int_x^{\pi/2} \left( \sin \frac{t}{2} \cos \frac{t}{3} \right) \, dt \)

4. (a) Find the average value of the function \( f(x) = x^2 \sqrt{1 + x^3} \) on the interval \([0, 2]\).

(b) Given that the average value of the even function \( g(x) \) on \([0, 4]\) is \( \frac{9}{2} \), compute \( \int_0^4 g(x) \, dx \).

(c) Find the value of \( c \) guaranteed by the Mean Value Theorem for Integrals for the function \( f(x) = x^2 + 2 \) on \([2, 5]\).
5. (a) Find a lower bound and an upper bound for \( \int_{1}^{3} \sqrt{x^2 + 3} \, dx \) using the extrema of \( \sqrt{x^2 + 3} \) on \([1, 3]\).

(b) Evaluate \( \int_{0}^{1} (x + \sqrt{1 - x^2}) \, dx \) by interpreting it in terms of areas.

6. (a) Find a function \( f \) and a number \( a \) such that \( \int_{a}^{x} \frac{f(t)}{t^2} \, dt = 2x^4 - 32. \)

(b) If \( F(x) = \int_{1}^{x^2} f(t) \, dt \) and \( f(t) = \int_{1}^{t^4} \sqrt{y} \, dy \), compute \( F''(1) \).

7. Let \( g(x) = \int_{0}^{x} f(t) \, dt \), where \( f \) is the function shown in the graph below.

(a) At what values do the local extrema values of \( g \) occur?

(b) Where does \( g \) attain its absolute maximum value?

(c) On what interval(s) is \( g \) increasing?

(d) On what intervals is \( g \) concave downward?