Problem 1. Evaluate the following derivatives.

  a. Let $f(x) = \frac{1}{2}x^3 + 3x^2 + e^{4x}$. What is $f'(x)$?

  b. Let $g(y) = 3y - 4 + e^{-3y^2}$. What is $g'(y)$?

  c. Let $h(t) = \sqrt{3t} + \frac{8}{5t^2}$. What is $\frac{d}{dt}h(t)$?

Problem 2. Determine the antiderivative of each of the following functions.
(Assume $x > 0$ in all cases.)

  a. $f(x) = 3x^2 - 4\sqrt{x}$.

  b. $g(x) = 3e^{-5x}$.

  c. $h(x) = x^3 + \dfrac{1}{x^3} - \dfrac{4}{x}$.

Problem 3. Compute each of the following definite integrals.

  a. $\displaystyle\int_0^4 x - 3x^2\,dx$.

  b. $\displaystyle\int_1^4 \sqrt{x}\,dx$.

  c. $\displaystyle\int_2^5 e^{-2x}\,dx$.

Problem 4. Find the value of C so that

$$\int_0^2 Cx^2 dx = 1.$$

Problem 5. Consider the following piecewise-defined function:

$$f(x) = \begin{cases} 2x, & x \in [0,1] \\ 4 - 2x, & x \in (1,2] \\ 0, & \text{otherwise} \end{cases}$$

  a. Sketch a graph of this function.

  b. Is this a continuous function?

  c. For what values of x is this function differentiable?

  d. Write $f'(x)$ as a piecewise-defined function.

  e. For all $x > 0$, determine $F(x) = \int_0^x f(y)\,dy$.

  f. Sketch $F(x)$.