1. Find an antiderivative for each function.
   (a) $f(x) = x + 7$
   (b) $f(x) = 9x - \frac{1}{2}$
   (c) $f(x) = x^3 + 3x^2 - 12$
   (d) $f(x) = \pi x^4 - 9x - \pi$
   (e) $f(x) = -\cos(x)$
   (f) $f(x) = \dfrac{1}{x^2}$
   (g) $f(x) = \sqrt{x}$
   (h) $f(x) = x\left(x^2 + 3\right)$
   (i) $f(x) = -5\sec(x)\tan(x)$

2. Evaluate each indefinite integral.
   (a) $\displaystyle\int 3x^2\,dx$
   (b) $\displaystyle\int x^3 - 7x + \frac{3}{2}\,dx$
   (c) $\displaystyle\int 2\sin(x) + 3\cos(x)\,dx$
   (d) $\displaystyle\int \frac{1}{(3x)^2}\,dx$
   (e) $\displaystyle\int (x+1)(3x-2)\,dx$
   (f) $\displaystyle\int \sqrt{x} + \frac{1}{2\sqrt{x}}\,dx$
   (g) $\displaystyle\int \frac{x^3 + x^2 + 10}{\sqrt{x}}\,dx$
   (h) $\displaystyle\int \frac{x^4 + 2x^2 - 1}{\sqrt[3]{x^4}}\,dx$
   (i) $\displaystyle\int \sec^2(\theta) - \sin(\theta)\,d\theta$
   (j) $\displaystyle\int \tan^2(\theta) + 1\,d\theta$
   (k) $\displaystyle\int \frac{\cos(x)}{1 - \cos^2(x)}\,dx$

3. The rate of change of the volume of a balloon is given by

$$\frac{dV}{dt} = 6t^2 - 8t + 3.$$

   Find an expression for the volume, V, of the balloon at any time, t, given that the volume at $t = 3$ seconds is 0.5 in^3.

4. Solve the differential equation $h'(t) = 8t^3 + 5$ subject to the initial condition $h(1) = -4$.

5. Find a function, $f(x)$, whose second derivative is $f''(x) = 2(x-1)$.

6. Solve the differential equation $f''(x) = x^{-1/2}$ subject to the conditions $f'(2) = 4$ and $f(0) = 0$.

7. A particle moves along the $x-$axis at a velocity of

$$v(t) = \frac{1}{\sqrt{t}} \quad , \qquad t > 0.$$

   At time $t = 1$, its position is $x = 4$. Find the acceleration and position functions for the particle.

8. Verify that $y = 7\left(1+x^2\right)$ is a solution to the differential equation $\left(1+x^2\right)y' - 2xy = 0$.
9. Verify that the function $y = 2\cos(x) + 3\sin(x)$ is a solution to the differential equation $y'' = -y$. Is this the only solution to this equation? If so, explain. If not, find all solutions.
10. Give an example of a relatively simple function with no antiderivative.