1. Find derivatives of each of the following functions. Using Leibniz notation (i.e. $\frac{dy}{dx}$, $\frac{dP}{dt}$, etc.), put your final answer in the form of an equation where the right hand side is your derivative formula, and the left hand side is the notation for your derivative.

   (a) $y = \dfrac{1}{x}$

   (b) $P = 100e^{3t}$

   (c) $w = e^{-r}$

   (d) $h = \ln(2q)$

2. Find functions whose derivatives are given below.

   (a) $\dfrac{dy}{dx} = 8x^3 - x^2 + 5x - 10$

   (b) $\dfrac{dP}{dt} = \dfrac{2}{t} - \dfrac{3}{t^2}$

   (c) $\dfrac{dh}{ds} = 30e^{2s} + e^{3s}$

   (d) $\dfrac{dq}{dt} = 50e^{-t}$

3. Evaluate the following indefinite integrals

   (a) $\displaystyle\int \left(t^3 + \frac{1}{t^3}\right)\, dt$

   (b) $\displaystyle\int \frac{dx}{x}$

   (c) $\displaystyle\int e^{3y}\, dy$

   (d) $\displaystyle\int \frac{100}{e^r}\, dr$

4. Find explicit solutions to the following initial value problems.

(a) $\dfrac{dq}{dr} = 0.4r, \qquad q(0) = 300$

(b) $\dfrac{dh}{dr} = 0.1h, \qquad h(0) = 400$

(c) $\dfrac{dP}{dt} = -0.2P, \qquad P(0) = 500$

(d) $\dfrac{dw}{dt} = 6e^{2t}, \qquad w(0) = 8$

(e) $\dfrac{dy}{dx} = e^{-y}, \qquad y(0) = 0$

(f) $\dfrac{dy}{dx} = e^{-x}, \qquad y(0) = 0$

(g) $\dfrac{dW}{dx} = 8x^3 + 3x^2, \qquad W(1) = 8$

(h) $\dfrac{dq}{dt} = \dfrac{1}{t^2}, \qquad q(1) = 3$

(i) $\dfrac{dq}{dt} = \dfrac{1}{q^2}, \qquad q(1) = 3$

(j) $\dfrac{dy}{dx} = 9x^2y^2, \qquad y(0) = \dfrac{1}{4}$

(k) $\dfrac{dy}{dx} = y + 10, \qquad y(0) = 50$

(l) $\dfrac{dy}{dx} = x + 10, \qquad y(0) = 50$