Math 220
Calculus Review Problems

Based on the text: Hughes-Hallet, Gleason, et al, *Calculus*, Wiley.

1. Find the derivatives for the following functions:
   (a) $f(x) = (3x^2 + \pi)(e^x - 4)$
   (b) $f(x) = \dfrac{x}{x^3 + 4}$
   (c) $g(t) = \ln(t + \sqrt{t^2 - 1})$

2. Find $\dfrac{dy}{dx}$:
   (a) $2y^2 + xy = x^2 + 3$
   (b) $\sqrt{x+y} + \sqrt{xy} = 6$
   (c) $x \sin y + \cos 2y = \cos y$
   (d) $y = \int_0^{x^2} \sec t \ dt$

3. Integrate (remember to check your answers)
   (a) $\displaystyle\int_1^4 (\sqrt{t} - \frac{2}{\sqrt{t}})dt$
   (b) $\displaystyle\int \frac{x+1}{x^2 + 2x}\ dx$
   (c) $\displaystyle\int x \sin x \ dx$
   (d) $\displaystyle\int x^2 e^x dx$

4. A object is dropped from a height of 64 ft. Find the height of the object above the ground, $h(t)$, and the velocity, $v(t)$, as functions of time. Also find the time the object hits and the velocity on contact. Hint: use the fact that the rate of change of velocity is equal to the constant acceleration due to gravity, i.e.

$$\frac{dv}{dt} = -g, \quad g = 32 \text{ ft/sec}^2$$

5. Find the function $y(x)$ whose derivative satisfies:
   (a) $\dfrac{dy}{dx} = x^3 + \sin x$
   (b) $\dfrac{dy}{dx} = 2y$

6. If $y(x) = \displaystyle\int_x^0 e^t \ dt$, find $y'(x)$.