

## 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)  $f(x) = \frac{x}{x^3 + 4}$

(c)  $g(t) = \ln(t + \sqrt{t^2 - 1})$

2. Find  $\frac{dy}{dx}$ :

(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)  $\int_1^4 (\sqrt{t} - \frac{2}{\sqrt{t}}) dt$

(b)  $\int \frac{x+1}{x^2+2x} dx$

(c)  $\int x \sin x \, dx$

(d)  $\int x^2 e^x dx$

4. (Newtonian Mechanics) A object is dropped from a height of 64 ft. with initial velocity zero. 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 the ground 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.

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

5. Find the function  $y(x)$  whose derivative satisfies:

(a)  $\frac{dy}{dx} = x^3 + \sin x$

(b)  $\frac{dy}{dx} = 2y$

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