Math 220 (section ???) **Quiz 4** **Fall 2011**

Name SOLUTIONS

- No calculators allowed.
- Show sufficient work to justify each answer.
- You have 15 minutes for this quiz.

1. (4 points) Find the x-value for each point on the graph of $f(x) = x^3 + x^2 + 4x$ where the line tangent to the curve is parallel to the line $y = 5x + 7$.

for each x-value, $f'(x) = 3x^2 + 2x + 4$ gives the slope of the line tangent to the curve $y = f(x)$. We want tangent lines with slope 5 in order to be parallel to $y = 5x + 7$.

Thus
$$3x^2 + 2x + 4 = 5$$
$$3x^2 + 2x - 1 = 0$$
$$(3x - 1)(x + 1) = 0$$
$$3x - 1 = 0 \quad \text{or} \quad x + 1 = 0$$
$$x = \frac{1}{3} \quad \text{or} \quad x = -1$$

2. (2 points each) Using Leibniz notation (i.e., $\frac{dy}{dx}$, $\frac{dP}{dt}$, etc.), find derivatives for each of the following functions. For part (b) simplify your answer.

(a) $q = 5e^r + \ln 3$

$$\frac{dq}{dr} = 5e^r$$

(note $\ln 3$ is a constant so its derivative is 0.)

(b) $w = \left(\frac{1}{x\sqrt[3]{x^2}}\right)^6$

$$= \left(\frac{1}{x \cdot x^{2/3}}\right)^6$$

$$w = \left(\frac{1}{x^{5/3}}\right)^6$$

$$w = \frac{1^6}{(x^{5/3})^6}$$

$$w = \frac{1}{x^{10}} = x^{-10}$$

$$\frac{dw}{dx} = -10x^{-11}$$

(c) $y = \frac{2}{t^6 + 3}$

$$\frac{dy}{dt} = \frac{\frac{d}{dt}(2) \cdot (t^6+3) - 2 \cdot \frac{d}{dt}(t^6+3)}{(t^6+3)^2}$$

$$\frac{dy}{dt} = \frac{0 \cdot (t^6+3) - 2(6t^5)}{(t^6+3)^2}$$

$$\frac{dy}{dt} = \frac{-12t^5}{(t^6+3)^2}$$