Math 220 (section AD?) **Quiz 4** **Spring 2013**

Name SOLUTIONS

- You have 15 minutes
- No calculators
- Show sufficient work

1. (2 points) Find the x-value for each point on the graph of $f(x) = x^3 + 150$ where the line tangent to the curve is perpendicular to the line $y = -12x + 7$.

The line $y=-12x+7$ has slope -12. Any line perpendicular to this line has slope $-\frac{1}{-12}=\frac{1}{12}$. Thus the tangent line has slope $\frac{1}{12}$.

$f'(x)=3x^2$

$3x^2=\frac{1}{12}$

$x^2=\frac{1}{36}$

$x=\pm\frac{1}{6}$

2. (2 points) What is the slope of the curve $y = 5\tan x + 3\cos x$ at its y-intercept?

At the y-intercept, $x=0$.

we need $y'(0)$

$y'=5\sec^2 x-3\sin x$

$y'(0)=5\sec^2(0)-3\sin(0)$

$=\frac{5}{\cos^2(0)}-3\sin(0)$

$=5$

3. (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 (a) simplify your answer.

(a) $q = \left(\frac{x\sqrt{x}}{\sqrt[3]{x}}\right)^{12}$ $= \left(\frac{x \cdot x^{1/2}}{x^{1/3}}\right)^{12} = \left(\frac{x^{3/2}}{x^{1/3}}\right)^{12} = \frac{(x^{3/2})^{12}}{(x^{1/3})^{12}}$

$= \frac{x^{18}}{x^4} = x^{14}$

$\frac{dq}{dx} = 14x^{13}$

since $\ln(5/e^2)$ is a constant

(b) $p = 10y^3 \sin y + \ln\left(\frac{5}{e^2}\right)$

$\frac{dp}{dy} = \frac{d}{dy}(10y^3) \cdot (\sin y) + (10y^3) \cdot \frac{d}{dy}(\sin y) + 0$

$\frac{dp}{dy} = 30y^2 \sin y + 10y^3 \cos y$

(c) $w = \frac{4}{t^8 + 5e^t}$

$\frac{dw}{dt} = \frac{\frac{d}{dt}(4) \cdot (t^8 + 5e^t) - (4) \cdot \frac{d}{dt}(t^8 + 5e^t)}{(t^8 + 5e^t)^2}$

$\frac{dw}{dt} = \frac{0 \cdot (t^8 + 5e^t) - 4 \cdot (8t^7 + 5e^t)}{(t^8 + 5e^t)^2}$

$\frac{dw}{dt} = \frac{-4(8t^7 + 5e^t)}{(t^8 + 5e^t)^2}$