MATH 115-018 QUIZ 8 / 10 March 2005 Name:____________________________________

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1. (4 points) The following table gives values for $f(x)$, $f'(x)$, $g(x)$, and $g'(x)$ at different values of x.

$x =$	0	1	2	3
$f(x) =$	1	2	-1	0
$f'(x) =$	2	-1	1	3
$g(x) =$	3	2	0	1
$g'(x) =$	1	3	2	-1

a. If $p(x) = f(g(x))$, find $p'(1)$.

b. If $q(x) = f(x) \cdot g(x)$, find $q'(1)$.

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Solution: For part (**a**): $p'(x) = f'(g(x)) \cdot g'(x)$, so $p'(1) = f'(g(1)) \cdot g'(1)$. $g(1) = 2$, so this is $p'(1) = f'(2) \cdot g'(1)$. Reading these off the table, we have $p'(1) = 1 \cdot 3 = 3$.

For part (**b**): $q'(x) = f'(x) \cdot g(x) + f(x) \cdot g'(x)$, so $q'(1) = f'(1) \cdot g(1) + f(1) \cdot g'(1)$. Reading these values off the table, we have $q'(1) = -1 \cdot 2 + 2 \cdot 3 = 4$.

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2. (2 points) If $3xy + \cos(y) + 4 = x^3$, find $\frac{dy}{dx}$.

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Solution: Differentiating both sides of the equation, and remembering to consider y as a(n implicit) function of x, we get

$$\begin{aligned} 3y + 3x\frac{dy}{dx} - \sin(y)\frac{dy}{dx} &= 3x^2, \quad \text{or} \\ (3x - \sin(y))\frac{dy}{dx} &= 3x^2 - 3y, \quad \text{so} \\ \frac{dy}{dx} &= \frac{3x^2 - 3y}{3x - \sin(y)}. \end{aligned}$$

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3. (2 points) If $y = 3x - 3$ is the linear approximation to $f(x) = x^2 - (a+1)x + a$ at $x = 1$, what is a?

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Solution: We know that $y = 3x - 3$ must have the same y value as $y = f(x)$ at $x = 1$, and that its slope must be equal to $f'(1)$. At $x = 1$, the y value on the line is $y = 3 - 3 = 0$, and $f(1) = 1 - a - 1 + a = 0$, so that doesn't tell us anything.

Then $f'(x) = 2x - (a+1)$, so $f'(1) = 2 - a - 1 = 1 - a$. Because $f'(1) = 3$, this is $1 - a = 3$, or $a = -2$.