MATH 12002
Quiz #3

January 27, 2012 NAME: SOLUTIONS

In the following problems, let $f(x) = x^2 - 4x + 2$.

1. (6 points) Find $f'(3)$ *using only the limit definition of the derivative.*

$$f'(3) = \lim_{h\to 0} \frac{f(3+h)-f(3)}{h} = \lim_{h\to 0} \frac{[(3+h)^2-4(3+h)+2]-[3^2-4(3)+2]}{h}$$

$$= \lim_{h\to 0} \frac{9+6h+h^2-12-4h+2-9+12-2}{h}$$

$$= \lim_{h\to 0} \frac{2h+h^2}{h} = \lim_{h\to 0} \frac{h(2+h)}{h} = \lim_{h\to 0} (2+h) = \boxed{2 = f'(3)}$$

2. (4 points) Find the equation of the line tangent to the graph of $f(x)$ at the point where $x = 3$.

By #1, $f'(3) = 2$, so the slope of the line is 2.
The line passes through the point $(3, f(3))$, and
$f(3) = 3^2 - 4(3) + 2 = 9 - 12 + 2 = -1$; hence the point is $(3, -1)$.
The equation is then

$$\boxed{y-(-1) = 2(x-3)}$$

$$y+1 = 2x-6$$

or $\boxed{y = 2x-7}$.