Math 234 B Discussion BD4 Quiz 3 **Name (Last,First):** Solutions

Use the *definition* of the deriviative. You may *not* use any advanced differentiation techniques. You must show all your work to receive credit.

1.] (a.)(2pts) Compute $f'(x)$ (the derivative of $f(x)$), if $f(x) = \frac{1}{x+2}$.

$$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h} = \lim_{h\to 0} \frac{\frac{1}{x+h+2} - \frac{1}{x+2}}{h} = \lim_{h\to 0} \frac{\frac{(x+2)(x+h+2)}{x+h+2} - \frac{(x+2)(x+h+2)}{x+2}}{h}$$

$$= \lim_{h\to 0} \frac{x+2-(x+h+2)}{h(x+2)(x+h+2)} = \lim_{h\to 0} \frac{-h}{h(x+2)(x+h+2)} = \lim_{h\to 0} \frac{-1}{(x+2)(x+h+2)} = \frac{-1}{(x+2)(x+0+2)}$$

$$= \frac{-1}{(x+2)^2}.$$

(b.)(1pts) Find the slope of the line that is tangent to the graph of $f(x)$ at $x = 1$.

$$f'(1) = \frac{-1}{(1+2)^2} = \frac{-1}{9}.$$

2.] (a.)(2pts) Compute the derivative of the function $f(x) = 9 - 4x$.

$$\lim_{h\to 0} \frac{9-4(x+h)-(9-4x)}{h} = \lim_{h\to 0} \frac{9-4x-4h-9+4x}{h} = \lim_{h\to 0} \frac{-4h}{h}$$

$$= \lim_{h\to 0} -4 = -4 = f'(x)$$

(b.)(2pts) Find the *equation* of the line that is tangent to the graph of $f(x)$ at the point $\left(\frac{1}{4}, f\left(\frac{1}{4}\right)\right)$. Does your answer confuse you?

$y = mx+b$

$8 = -4(\frac{1}{4})+b$

$9 = b.$

$m_{tan} = f'(\frac{1}{4}) = -4. \quad f(\frac{1}{4}) = 9-4(\frac{1}{4}) = 8.$

So $y = -4x+9$. This makes sense because the tangent line to a line is just the same line.

3.] (3pts) Find the rate of change $\frac{dy}{dx}$ at $x = -11$ for $y = 3x^2 - 5$.

$$\frac{dy}{dx} = \lim_{h\to 0} \frac{[3(x+h)^2-5]-[3x^2-5]}{h} = \lim_{h\to 0} \frac{3x^2+6xh+3h^2-5-3x^2+5}{h}$$

$$= \lim_{h\to 0} \frac{6xh+3h^2}{h} = \lim_{h\to 0} 6x+3h = 6x+3(0) = 6x.$$

So, $\left.\frac{dy}{dx}\right|_{x=-11} = 6(-11) = \boxed{-66}.$