

(1)

ASSIGNMENT # 3
NYA - ELECTROTECH
SOLUTIONS

① $y = 6x + 3$

$$\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{(6(x+h)+3) - (6x+3)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{6x + 6h + 3 - 6x - 3}{h}$$

$$= \lim_{h \rightarrow 0} \frac{6h}{h} = \boxed{6}$$

② $y = 3x - \frac{1}{2}x^2$

$$\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{[3(x+h) - \frac{1}{2}(x+h)^2] - [3x - \frac{1}{2}x^2]}{h}$$

$$= \lim_{h \rightarrow 0} \frac{3x + 3h - \frac{1}{2}(x^2 + 2xh + h^2) - 3x + \frac{1}{2}x^2}{h}$$

$$= \lim_{h \rightarrow 0} \frac{3h - xh - \frac{1}{2}h^2}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{h}(3 - x - \frac{1}{2}h)}{\cancel{h}} = \boxed{3 - x}$$

$$\textcircled{3} \quad y = \frac{3}{5x+3}$$

$$\begin{aligned} \frac{dy}{dx} &= \lim_{h \rightarrow 0} \frac{\frac{3}{5(x+h)+3} - \frac{3}{5x+3}}{h} \\ &= \lim_{h \rightarrow 0} \frac{15x+9 - 3(5x+5h+3)}{(5(x+h)+3)(5x+3)} \cdot \frac{1}{h} \\ &= \lim_{h \rightarrow 0} \frac{15x+9 - 15x - 15h - 9}{(5(x+h)+3)(5x+3)} \cdot \frac{1}{h} \\ &= \lim_{h \rightarrow 0} \frac{-15h}{(5(x+h)+3)(5x+3)} \cdot \frac{1}{h} \\ &= \frac{-15}{(5x+3)(5x+3)} = \boxed{\frac{-15}{(5x+3)^2}} \end{aligned}$$

$$\textcircled{4} \quad y = 3x^2 - 2x \quad \text{AT } (-1, 5)$$

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

$$= \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 2x - 2h + 3x^2 + 2x}{h}$$

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

$$= \boxed{6x - 2}$$

$$\text{AT } x = -1 \Rightarrow -6 - 2 = \boxed{-8}$$

$$\textcircled{5} \quad y = x^2 - 4x$$

$$\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{[(x+h)^2 - 4(x+h)] - [x^2 - 4x]}{h}$$
$$= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - 4x - 4h - x^2 + 4x}{h}$$

$$= \lim_{h \rightarrow 0} \frac{2xh + h^2 - 4h}{h} = \lim_{h \rightarrow 0} \frac{h(2x + h - 4)}{h}$$

$$= 2x - 4$$

WHEN is the slope = 6?

$$2x - 4 = 6$$

$$2x = 10$$

$$x = 5$$

y value $y = 5^2 - 4(5) = 25 - 20 = 5$

POINT : $(5, 5)$

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

PHYSICS 433

PROBLEM SET 1

Due: Monday, September 10, 2012

1. (10 points)

(a) (5 points)

Consider a particle of mass m moving in a potential $V(x)$.

(b) (5 points)

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