

$$= 3x - x^2$$

- 1) Find the average rate of change of f from $x = 1$ to $x = 3$.

$$\frac{f(3) - f(1)}{3 - 1} = \frac{0 - 2}{2} = \boxed{-1}$$

- b) Find an equation of the corresponding secant line.

Remember you can leave this in point slope form

$$(1, 2) (3, 0)$$

$$m = \frac{0 - 2}{3 - 1} = -1$$

$$y - 2 = -1(x - 1)$$

$$y = -1(x - 3)$$

- c) Sketch the graphs of f and the secant line.

$$f(x) = x(3-x) \text{ vertex: } x = \frac{3}{2} = 1.5 \quad y = 3(\frac{3}{2}) - (\frac{3}{2})^2$$

- d) Find the instantaneous rate of change at $x = 4$. $\frac{9}{2} - \frac{9}{4} = \frac{9}{4}$

$$f'(x) = \lim_{h \rightarrow 0} \frac{3(x+h) - (x+h)^2 - (3x-x^2)}{h} = 3 - 2x \quad f'(4) = 3 - 2(4) = \boxed{-5}$$

- e) Write the equation of the line tangent to $f(x)$ at $x = 4$.

$$m = -5 \quad \text{pt. } (4, -4) \quad y + 4 = -5(x - 4)$$

- f) Sketch the graph of the tangent line on the same axes as part c.

$$y = -5x + 16$$

- 2) Determine the average rate of change of $f(x) = \sqrt{x+1}$ over the interval $[0, 3]$

- A. -3 B. -1 C. $-\frac{1}{3}$ D. $\frac{1}{3}$ E. 3

****Yes, this is multiple choice, but still show your work here****

$$\frac{f(3) - f(0)}{3 - 0} = \frac{2 - 1}{3} = \frac{1}{3}$$

- 3) Which of the following is an equation for the tangent line to $f(x) = 9 - x^2$ at $x = 2$?

- A. $y + 5 = \frac{1}{4}(x + 2)$ B. $y - 5 = 4(x - 2)$ C. $y - 5 = -4(x - 2)$ D. $y + 7 = -4(x + 2)$ E. $y + 5 = -4(x + 2)$

****Yes, this is multiple choice, but still show your work here****

$$f'(x) = \lim_{h \rightarrow 0} \frac{9 - (x+h)^2 - (9-x^2)}{h} = \lim_{h \rightarrow 0} \frac{9 - x^2 - 2xh - h^2 - 9 + x^2}{h} = \lim_{h \rightarrow 0} (-2x - h) = -2x$$

$$f'(2) = -2(2) = -4 \text{ slope} \quad \text{pt. } (2, 5) \quad y - 5 = -4(x - 2)$$

- 4) Let $f(x) = 2x - x^2$

a) Find $f(3)$ $2(3) - 3^2 = \boxed{-3}$

b) Find $f(3+h)$ $2(3+h) - (3+h)^2 = 6 + 2h - 9 - 6h - h^2 = \boxed{-3 - 4h - h^2}$

c) Find $\frac{f(3+h) - f(3)}{h}$ $\frac{-3 - 4h - h^2 - (-3)}{h} = \boxed{-4 - h}$

d) Find the instantaneous rate of change of f at $x = 3$. $\lim_{h \rightarrow 0} (-4 - h) = \boxed{-4}$

- e) Write the equation of the line tangent to the curve at $x = 3$.

$$m = -4 \quad \text{pt. } (3, -3) \quad y + 3 = -4(x - 3)$$

- f) Write the equation of the line normal to the curve at $x = 3$.

$$m = \frac{1}{4} \quad \text{pt. } (3, -3) \quad y + 3 = \frac{1}{4}(x - 3)$$

