HOMEWORK ANSWERS

Lesson 2-4 HW:
pp. 93 – 95 / 1, 2, 7, 10, 11, 15, 33, 36, 44

1. $f(x) = x^3 + 1$

a. $A_{RoC} = \frac{f(3) - f(2)}{3-2} = \frac{28-9}{1} = \boxed{19}$

b. $A_{RoC} = \frac{f(1) - f(-1)}{1--1} = \frac{2-0}{1} = \boxed{2}$

2. $f(x) = \sqrt{4x+1}$

a. $A_{RoC} = \frac{f(2) - f(0)}{2-0} = \frac{3-1}{2} = \boxed{1}$

b. $A_{RoC} = \frac{f(12) - f(10)}{12-10} = \frac{7-\sqrt{41}}{2} \approx \boxed{.298}$

7. Using:

a. $Q_1 = (10, 225)$ $Q_2 = (14, 375)$ $Q_3 = (16.5, 475)$

$Q_4 = (18, 550)$ $P = (20, 650)$

Secant	Slope (m/sec)
PQ_1	43
PQ_2	46
PQ_3	50
PQ_4	50

b. ≈ 50 m/sec

10. $y = x^2 - 4x$ at $x = 1$

a. $\lim_{h \to 0} \frac{(x+h)^2 - 4(x+h) - (x^2 - 4x)}{h}$

$= \lim_{h \to 0} \frac{\cancel{x^2} + 2xh + h^2 \cancel{-4x} - 4h - \cancel{x^2} \cancel{+4x}}{h}$

$= \lim_{h \to 0} \frac{h^2 + 2xh - 4h}{h}$

$= \lim_{h \to 0} \frac{\cancel{h}(h + 2x - 4)}{\cancel{h}} = \boxed{2x-4}$

at $x = 1$

$(2)(1) - 4 = \boxed{-2}$

b. $f(1) = 1^2 - 4(1) = -3$

$f(1) = -3$

$\boxed{y + 3 = -2(x-1)}$ T.L.

c. $\boxed{y + 3 = \frac{1}{2}(x-1)}$ N.L.

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11. $y = \dfrac{1}{x-1}$ at $x = 2$

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

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

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

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

$= \dfrac{-1}{(x-1)^2}$

When $x=2$, $m=-1$

b. $f(2) = 1$

$y - 1 = -1(x-2)$ T.L.

c. $y - 1 = 1(x-2)$ N.L.

15. $f(x) = \begin{cases} 2-2x-x^2, & x<0 \\ 2x+2, & x\geq 0 \end{cases}$ at $x=0$

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

$\displaystyle\lim_{h\to 0^-} \frac{\cancel{2}-\cancel{2x}-2h-\cancel{x^2}-2xh-h^2-\cancel{2}+\cancel{2x}+\cancel{x^2}}{h} =$

$\displaystyle\lim_{h\to 0^-} \frac{-2h-2xh-h^2}{h} =$

$\displaystyle\lim_{h\to 0^-} \frac{\cancel{h}(-2-2x-h)}{\cancel{h}} = -2-2x$

at $x=0$, $m=-2$ $\neq$

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

$\displaystyle\lim_{h\to 0^+} \frac{\cancel{2x}+2h+\cancel{2}-\cancel{2x}-\cancel{2}}{h} =$

$\displaystyle\lim_{h\to 0^+} \frac{2\cancel{h}}{\cancel{h}} = 2$

No; Limit of difference quotient DNE

33. $\displaystyle\lim_{h\to 0} \frac{(x+h)^2+4(x+h)-1-(x^2+4x-1)}{h} =$

$\displaystyle\lim_{h\to 0} \frac{\cancel{x^2}+2xh+h^2+\cancel{4x}+4h-\cancel{1}-\cancel{x^2}-\cancel{4x}+\cancel{1}}{h} =$

$\displaystyle\lim_{h\to 0} \frac{2xh+h^2+4h}{h} =$

$\displaystyle\lim_{h\to 0} \frac{\cancel{h}(2x+h+4)}{\cancel{h}} = 2x+4$

$2x+4=0$

$2x=-4$

$x=-2$ plug into original function

$f(-2) = (-2)^2+4(-2)-1$

$= -5$ $\boxed{(-2,-5)}$

minimum of parabola

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36. $\lim_{h\to 0} \frac{9-(x+h)^2-(9-x^2)}{h}$

$= \lim_{h\to 0} \frac{\cancel{9}-\cancel{x^2}-2xh-h^2-\cancel{9}+\cancel{x^2}}{h}$

$= \lim_{h\to 0} \frac{\cancel{h}(-2x-h)}{\cancel{h}} = -2x \leftarrow$ slope of T.L.

☆ $(1,12)$ is not on the graph $y = 9-x^2$
so find eq. of T.L.s thru $(1,12)$ and $(x, 9-x^2)$

$\frac{\Delta y}{\Delta x} = \frac{9-x^2-12}{x-1} = -2x$

$-2x(x-1) = -x^2-3$

$-2x^2+2x = -x^2-3$

$2x = x^2-3$

$0 = x^2-2x-3$

$0 = (x-3)(x+1)$

$x=3 \quad x=-1$

$f(-1) = 9-(-1)^2 = 8 \quad (-1,8)$ point of tangency

$m_{T.L.} = -2(-1) = 2$

$\boxed{y-8 = 2(x+1)}$

$f(3) = 9-3^2 = 0 \quad (3,0)$ point of tangency

$m_{T.L.} = -2(3) = -6$

$y-0 = -6(x-3)$

$\boxed{y = -6(x-3)}$

44. E.