Ch 2.4 pg 87 # 1-11 odd, 19, 23, 25, 29, 32

ch 2 Review pg 91 #1-18

① $f(x) = x^3 - 1$

a) $[2,3]$ $\frac{f(3)-f(2)}{3-2} = \boxed{19}$

b) $[-1,1]$ $\frac{f(1)-f(-1)}{1-(-1)} = \boxed{1}$

③ $f(x) = e^x$

a) $[-2,0]$ $\frac{f(0)-f(-2)}{0-(-2)} = \frac{e^0 - e^{-2}}{2} = \frac{1-e^{-2}}{2} = \boxed{\frac{1}{2} - \frac{1}{2e^2}}$

b) $[1,3]$ $\frac{f(3)-f(1)}{3-1} = \frac{e^3 - e^1}{2} = \frac{e3}{2} - \frac{e}{2}$

⑤ $f(x) = \cot x$

a) $[\pi/4, 3\pi/4]$ $\frac{f(3\pi/4)-f(\pi/4)}{3\pi/4 - \pi/4} = \frac{(-1)-(1)}{\pi/2} = \boxed{\frac{-4}{\pi}}$

b) $[\pi/6, \pi/2]$ $\frac{f(\pi/2)-f(\pi/6)}{\pi/2 - \pi/6} = \frac{0-\sqrt{3}}{\pi/3} = \frac{-3\sqrt{3}}{\pi}$

⑦ Slope PQ_1 $\frac{650-225}{20-10} = 43$

PQ_2 $\frac{650-375}{20-14} = 46$

PQ_3 $\frac{650-475}{20-16.5} \approx 50$

PQ_4 $\frac{650-550}{20-18} = 50$

using this to approx slope at P ≈ 50 m/sec

(9) $y=x^2$ at $x=-2$

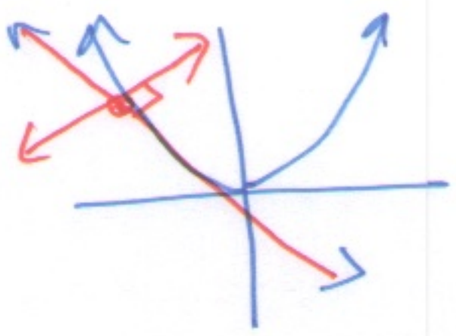
a) $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h} = \frac{(x+h)^2-x^2}{h} = \frac{x^2+2xh+h^2-x^2}{h} = \frac{2xh+h^2}{h}$

$\lim_{h\to 0} 2x+h \to 0 = \boxed{2x \text{ at } x=-2 \quad \text{slope} = -4}$

b) $(-2,4) \Rightarrow (y-4) = -4(x+2)$

c) $(-2,4) \Rightarrow (y-4) = 1/4\ (x+2)$

d)



(11) $y = \frac{1}{x-1}$ at $x=2$

a) $\lim_{h\to 0} \frac{\frac{1}{(2+h)-1} - \frac{1}{2-1}}{h} = \frac{\frac{1}{1+h} - 1}{h} = \frac{1}{h}\left[\frac{1}{1+h} - \frac{1+h}{1+h}\right]$

$\lim_{h\to 0} \frac{h}{1+h} \cdot \frac{1}{h} = \frac{1}{1+h} = \boxed{1}$

b) $(2,1)\ m=1 \quad (y-1) = 1(x-2)$

c) $(2,1)\ m=-1 \quad (y-1) = -1(x-2)$

(19) a) at $x=a$ $y=x^2+2$ $f(a) = a^2+2$

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

b) slope increases as x increases

a	m $= 2a$
0	0
1	2
2	4
3	6

(23) $h(t) = 100 - 4.9t^2$ meters

Velocity at $t=2$

$h(2) = 100 - 4.9(2)^2 = 80.4$

$h(2+h) = 100 - 4.9(2+h)^2$

cancel stuff

$$\lim_{h\to 0} \frac{19.6 - 4.9(4+4h+h^2) - 100}{h} = \lim_{h\to 0} \frac{-19.6h - 4.9h^2}{h}$$

$$\lim_{h\to 0} -19.6 - 4.9h^{\to 0} = \boxed{-19.6 \text{ m/s}}$$

(23) $A = \pi r^2$ $\quad A(3) = 9\pi$ $\quad A(3+h) = \pi(3+h)^2 = 9\pi + 6\pi h + \pi h^2$

$$\lim_{h\to 0} \frac{9\pi + 6\pi h + \pi h^2 - 9\pi}{h} = \frac{6\pi h + \pi h^2}{h} = 6\pi + \pi h^{\to 0} = 6\pi \text{ in}^2/\text{in}$$

The area is changing 6π in^2 for every additional inch.

(29) $f(x) = x^2 + 4x - 1$ $\quad$ horizontal when slope $= 0$

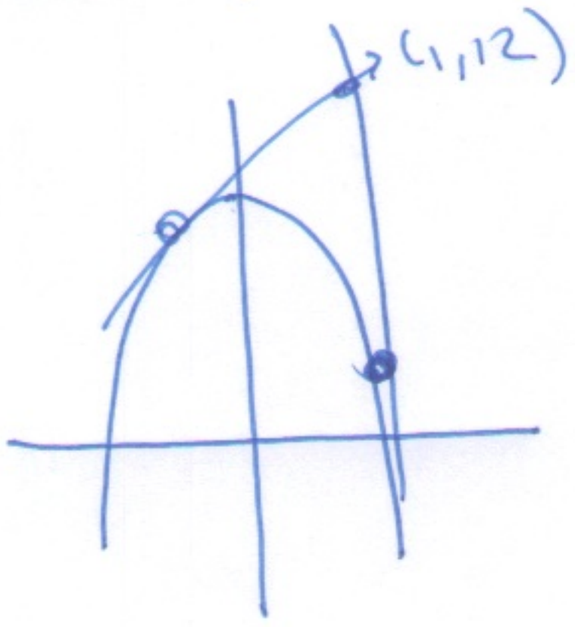
$$\lim_{h\to 0} \frac{f(a+h) - f(a)}{h} = 0$$

$$\lim_{h\to 0} \frac{\left[(a+h)^2 + 4(a+h) - 1\right] - \left[a^2 + 4a - 1\right]}{h} = \frac{2ah + h^2 + 4h}{h}$$

$$\lim_{h\to 0} 2a + h + 4 = 2a + 4 \quad \text{so} \quad 2a + 4 = 0 \quad \text{when } a = -2$$

Point $(-2, -5)$

(32) $y = 9 - x^2$



2 answers passes through (1,12)

Two points $(a, 9-a^2)$ and $(1,12)$

slope $\dfrac{12-(9-a^2)}{1-a} = \boxed{\dfrac{3+a^2}{1-a}}$

$\lim_{h\to 0} \dfrac{(9-(a+h)^2)-(9-a^2)}{h} = \dfrac{(9-a^2-2ah-h^2)}{h}$ minus

$= \lim_{h\to 0} \dfrac{-2ah-h^2}{h} = -2a - \cancel{h}^{0} \boxed{= -2a}$

set two slopes equal

$-2a = \dfrac{3+a^2}{1-a} \Rightarrow -2a + 2a^2 = 3 + a^2$

$a^2 - 2a - 3 = 0$

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

$a = 3 \quad a = -1$

(3,0) (-1,8)

a) (3,0) slope $= -2a = -6$

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

b) (-1,8) slope $= -2(a) = -2(-1) = 2$

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