V.I.P solutions from polynomial calculus

P.1

5) points $(-2,3)$, $(3,1)$

slope $m = \frac{y_2-y_1}{x_2-x_1} = \frac{1-3}{3--2} = \boxed{-\frac{2}{5}}$

15) $6x-2y=4$

$6x = 4+2y$

$6x-4=2y$

$3x-2=y$ $\quad \boxed{y=3x-2}$

$\boxed{\text{slope} = 3 \quad y \text{ intercept} = -2}$

17) thru $(1,1)$, slope 3, so

pt-slope eqtn of line is $(y-1) = 3(x-1)$

slope-intercept eqtn is $y = 3x-3+1$

$\boxed{y=3x-2}$

19) perpendicular ($\perp$) lines have slopes which are negative reciprocals,

i.e. $m_1 m_2 = -1$

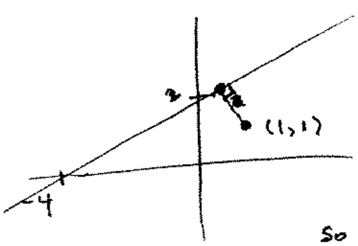
or $m_2 = -\frac{1}{m_1}$.

Thus $\perp$ line to $y=3x+2$ has slope $m_2 = -\frac{1}{3}$, so eqtn of this $\perp$ line is

$(y-0) = -\frac{1}{3}(x-1)$

or $\boxed{y = -\frac{1}{3}x + \frac{1}{3}}$

23) Draw a picture to guide your work!



$2y-x=4$

$2y = x+4$

$y = \frac{1}{2}x+2$

L has slope ½

so perp. line has slope -2

so pt-slope eqtn is

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

or $y = -2x+3$

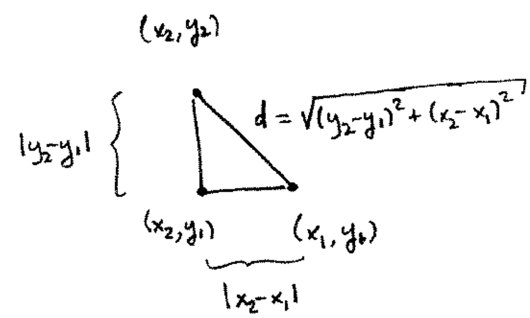
the point of intersection satisfies $\frac{1}{2}x+2 = -2x+3$

$\frac{5}{2}x = 1$

$x = 2/5 = .4$

so $y = -2(2/5)+3 = 2\,1/5 = 2.2$

$\boxed{(.4, 2.2) \text{ is intersection point}}$



The distance from this point to $(1,1)$ is the distance from $(1,1)$ to L. Use Pythagorean Theorem distance formula at right.

If $(x_1,y_1) = (1,1)$, $(x_2,y_2) = (.4, 2.2)$ the distance $d = \sqrt{(2.2-1)^2 + (.4-1)^2} = \sqrt{(1.2)^2+(.6)^2}$

$= \sqrt{1.44+.36} = \sqrt{1.80}$

≈ 1.34

P.2 6a) $f(x) = 3x^2 - 2$, $x = 1$

$$\frac{f(x+h)-f(x)}{h} = \frac{f(1+h)-f(1)}{h} = \frac{[3(1+h)^2-2]-[\overset{1}{\overbrace{3-2}}]}{h} = \frac{3(1+2h+h^2)-2-1}{h}$$

$$= \frac{\cancel{3}+6h+3h^2-\cancel{3}}{h} = \boxed{6+3h}$$

6b) $\lim_{h\to 0} 6+3h = \boxed{6}$

10) $f(x) = 2x+5$

$$\frac{f(x+h)-f(x)}{h} = \frac{[2(x+h)+5]-[2x+5]}{h} = \frac{\cancel{2x}+2h+\cancel{5}-\cancel{2x}-\cancel{5}}{h} = \frac{2h}{h} = 2$$

$$\lim_{h\to 0} 2 = \boxed{2}$$

12) $f(x) = x^2 - 2x + 3$

$$\frac{f(x+h)-f(x)}{h} = \frac{[(x+h)^2-2(x+h)+3]-[x^2-2x+3]}{h}$$

$$= \frac{\cancel{x^2}+2hx+h^2-\cancel{2x}-2h+\cancel{3}-\cancel{x^2}+\cancel{2x}-\cancel{3}}{h}$$

$$= \frac{2hx+h^2-2h}{h}$$

$$= 2x+h-2 \qquad \lim_{h\to 0} 2x+h-2 = \boxed{2x-2}$$

13) $f(x) = x^3$

$$\frac{f(x+h)-f(x)}{h} = \frac{(x+h)^3 - x^3}{h}$$

$$= \frac{\cancel{x^3}+3hx^2+3h^2x+h^3-\cancel{x^3}}{h}$$

$$\% = 3x^2+3hx+h^2$$

$$\lim_{h\to 0}(\%) = 3x^2+0+0 = \boxed{3x^2} = (x^3)'$$

$$(x+h)^3 = (x+h)(x+h)^2$$
$$= (x+h)(x^2+2hx+h^2)$$
$$= x^3+2hx^2+h^2x$$
$$+ hx^2+2h^2x+h^3$$
$$= x^3+3hx^2+3h^2x+h^3$$

15) $f(x) = x^2$

$f'(x) = 2x$ is the slope function for the parabola $y = x^2$

thus when $x = -2$ the slope of the parabola is $f'(2) = -4$.

tangent line has slope -4,
goes thru point $(-2, 4)$ so
has pt-slope eqtn $\boxed{(y-4) = -4(x+2)}$
(slope-int eqtn $y = -4x-4$)