

# 1. Straight Line

1. a)  $T(3,2)$   $R(4,4)$  b)  $A(-1,3)$   $Q(4,8)$  c)  $C(-3,-2)$   $S(7,3)$

$$m_{TR} = \frac{4-2}{4-3} \\ = \underline{\underline{2}}$$

$$m_{AQ} = \frac{8-3}{4+1} \\ = \underline{\underline{-1}}$$

$$m_{CS} = \frac{3+2}{7+3} \\ = \underline{\underline{\frac{1}{2}}}$$

d)  $V(0,3)$   $L(-3,9)$  e)  $B(1,4)$   $H(-1,-2)$  f)  $G(-3,4)$   $W(-1,8)$

$$m_{VL} = \frac{9-3}{-3-0} \\ = \underline{\underline{-2}}$$

$$m_{BH} = \frac{-2-4}{-1-1} \\ = \underline{\underline{3}}$$

$$m_{GW} = \frac{8-4}{-1+3} \\ = \underline{\underline{2}}$$

g)  $K(9,-2)$   $N(5,-12)$  h)  $X(-7,-4)$   $E(-3,-2)$

$$m_{KN} = \frac{-12+2}{5-9} \\ = \underline{\underline{\frac{5}{2}}}$$

$$m_{XE} = \frac{-2+4}{-3+7} \\ = \underline{\underline{\frac{1}{2}}}$$

2. a)  $3y-5x=3$   
 $3y=5x+3$   
 $y=\frac{5}{3}x+1$   
 $m=\underline{\underline{\frac{5}{3}}}$   $c(\underline{\underline{0,1}})$

b)  $4x+3y=9$   
 $3y=-4x+9$   
 $y=-\frac{4}{3}x+3$   
 $m=\underline{\underline{-\frac{4}{3}}}$   $c(\underline{\underline{0,3}})$

c)  $2x-y=-12$   
 $y=2x+12$   
 $m=\underline{\underline{2}}$   $c(\underline{\underline{0,12}})$

d)  $5y+2x=0$   
 $5y=-2x$   
 $y=-\frac{2}{5}x$   
 $m=\underline{\underline{-\frac{2}{5}}}$   $c(\underline{\underline{0,0}})$

e)  $2y-6x+15=0$   
 $2y=6x-15$   
 $y=3x-\frac{15}{2}$   
 $m=\underline{\underline{3}}$   $c(\underline{\underline{0,-\frac{15}{2}}})$

f)  $4x-3y-7=0$   
 $3y=4x-7$   
 $y=\frac{4}{3}x-\frac{7}{3}$   
 $m=\underline{\underline{\frac{4}{3}}}$   $c(\underline{\underline{0,-\frac{7}{3}}})$

g)  $5x+2y+6=0$   
 $2y=-5x-6$   
 $y=-\frac{5}{2}x-3$   
 $m=\underline{\underline{-\frac{5}{2}}}$   $c(\underline{\underline{0,-3}})$

h)  $8y+4x-11=0$   
 $8y=-4x+11$   
 $y=-\frac{1}{2}x+\frac{11}{8}$   
 $m=\underline{\underline{-\frac{1}{2}}}$   $c(\underline{\underline{0,\frac{11}{8}}})$

3. a)  $y = 6x + 7$

b)  $y = -2x + 11$

c)  $y = \frac{1}{2}x + c$   $(-1, 4)$   
 $4 = \frac{1}{2} \times -1 + c$   
 $4 + \frac{1}{2} = c$   
 $c = 4\frac{1}{2} \left(\frac{9}{2}\right)$   
 $y = \frac{1}{2}x + \frac{9}{2}$

d) Parallel to x-axis —

so gradient = 0

Equation in form  $y =$

$\Rightarrow (-2, 4)$  means  $y = 4$

e) Parallel to y-axis

so gradient is undefined

Equation in form  $x =$

$\Rightarrow (5, 1)$  means  $x = 5$

f)  $y = \frac{2}{3}x - 4$

g)  $y = -\frac{1}{2}x + c$   $(-1, 4)$   
 $4 = -\frac{1}{2} \times -1 + c$   
 $c = \frac{7}{2}$

$y = -\frac{1}{2}x + \frac{7}{2}$

4. a)  $y = 4x + 3$

$m = 4$

$\tan \theta = 4$

$\Rightarrow \theta = (\tan^{-1})4$

$= 76^\circ$

b)  $x + y = 3$

$y = -x + 3$

$m = -1$

$\tan \theta = -1$   $\frac{\circ}{\vee}$

$\theta = (45)$

$\Rightarrow \theta = 180 - 45$   
 $= 135^\circ$

c)  $3x + y = 12$

$y = -3x + 12$

$m = -3$

$\tan \theta = -3$   $\frac{\circ}{\vee}$

$\theta = (71.6^\circ)$

$\Rightarrow \theta = 180 - 71.6$   
 $= 108.4^\circ$

5. a)  $A(0, -2)$   $B(4\sqrt{3}, 2)$

$m = \frac{2 - (-2)}{4\sqrt{3} - 0}$   $(\frac{1}{\sqrt{3}})$

$= \frac{4}{4\sqrt{3}}$

$= \frac{1}{\sqrt{3}}$

b)  $m = \tan \theta$

$\tan \theta = \frac{1}{\sqrt{3}}$

$\theta = (\tan^{-1})\frac{1}{\sqrt{3}}$

$= 30^\circ$

$$6. a) \begin{aligned} 3x + 4y &= -7 \dots (1) \\ 2x + y &= -3 \dots (2) \quad \times -4 \end{aligned}$$

Elim y

$$\begin{aligned} 3x + 4y &= -7 \dots (1) \\ -8x - 4y &= -12 \dots (3) \end{aligned}$$

$$\hline -5x = 5$$

$$\underline{x = -1}$$

Sub  $x = -1$  in (1)

$$3(-1) + 4y = -7$$

$$4y = -4$$

$$\underline{y = -1}$$

Point  $(-1, -1)$

$$c) \begin{aligned} 2x - 5y &= 1 \dots (1) \times 3 \\ 4x - 3y &= 9 \dots (2) \times 5 \end{aligned}$$

Elim y

$$-6x + 15y = -3 \dots (3)$$

$$20x - 15y = 45 \dots (4)$$

$$\hline 14x = 42$$

$$\underline{x = 3}$$

Sub  $x = 3$  in (1)

$$(2 \times 3) - 5y = 1$$

$$-5y = -5$$

$$\underline{y = 1}$$

Point  $(3, 1)$

$$b) y = -x + 12 \dots (1)$$

$$y = x - 4 \dots (2)$$

Elim x

$$2y = 8$$

$$\underline{y = 4}$$

Sub  $y = 4$  in (2)

$$4 = x - 4$$

$$\underline{x = 8}$$

Point  $(8, 4)$

$$d) \begin{aligned} 2x + 4y &= 7 \dots (1) \times 3 \\ 4x - 3y &= 3 \dots (2) \times 4 \end{aligned}$$

Elim y

$$6x + 12y = 21 \dots (3)$$

$$16x - 12y = 12 \dots (4)$$

$$\hline 22x = 33$$

$$\underline{x = \frac{3}{2}}$$

Sub  $x = \frac{3}{2}$  in (1)

$$(2 \times \frac{3}{2}) + 4y = 7$$

$$4y = 4$$

$$\underline{y = 1}$$

Point  $(\frac{3}{2}, 1)$

$$e) \begin{aligned} 2x + 5y &= 16 \dots (1) \\ x - y &= 1 \dots (2) \times 5 \end{aligned}$$

Elim y

$$2x + 5y = 16 \dots (1)$$

$$5x - 5y = 5 \dots (3)$$

$$\hline 7x = 21$$

$$\underline{x = 3}$$

Sub  $x = 3$  in (2)

$$3 - y = 1$$

$$\underline{y = 2}$$

Point  $(3, 2)$



7.a)  $A(1,1) B(3,9) C(-2,-11)$

$$m_{AB} = \frac{9-1}{3-1} \quad m_{BC} = \frac{-11-9}{-2-3}$$

$$= \underline{\underline{4}} \quad = \underline{\underline{4}}$$

B is common point and

$m_{AB} = m_{BC}$  hence  
collinear.

c)  $S(2,1) T(5,-2) U(3,0)$

$$m_{ST} = \frac{-2-1}{5-2} \quad m_{TU} = \frac{0+2}{3-5}$$

$$= \underline{\underline{-1}} \quad = \underline{\underline{-1}}$$

T is common point and

$m_{ST} = m_{TU}$  hence collinear

8.  $(2,-2) (3,P) (-1,7)$   
A B C

If collinear  $m_{AB} = m_{BC}$

$$\Rightarrow \frac{P+2}{3-2} = \frac{7-P}{-1-3}$$

$$\frac{P+2}{1} = \frac{7-P}{-4}$$

$$-4(P+2) = 7-P$$

$$-4P-8 = 7-P$$

$$-15 = 3P$$

$$\underline{\underline{P = -5}}$$

b)  $P(-2,-3) Q(0,1) R(5,11)$

$$m_{PQ} = \frac{1+3}{0+2} \quad m_{QR} = \frac{11-1}{5-0}$$

$$= \underline{\underline{2}} \quad = \underline{\underline{2}}$$

Q is common point and

$m_{PQ} = m_{QR}$  hence collinear.

d)  $D(-2,1) E(-1,0) F(7,-8)$

$$m_{DE} = \frac{0-1}{-1+2} \quad m_{EF} = \frac{-8-0}{7+1}$$

$$= \underline{\underline{-1}} \quad = \underline{\underline{-1}}$$

E is common point and

$m_{DE} = m_{EF}$  hence collinear.

$$9 \quad a) \text{Dist}_{AB} = \sqrt{(3-5)^2 + (3-1)^2}$$

$$= \sqrt{4+4}$$

$$= \sqrt{8}$$

$$= \underline{\underline{2\sqrt{2}}}$$

$$b) \text{Dist}_{PQ} = \sqrt{(3+7)^2 + (8-1)^2}$$

$$= \sqrt{100+49}$$

$$= \underline{\underline{\sqrt{149}}}$$

$$c) \text{Dist}_{CO} = \sqrt{(7+3)^2 + (1+5)^2}$$

$$= \sqrt{100+36}$$

$$= \sqrt{136}$$

$$= \underline{\underline{2\sqrt{34}}}$$

$$d) \text{Dist}_{VW} = \sqrt{(-7-6)^2 + (9-3)^2}$$

$$= \sqrt{49+36}$$

$$= \underline{\underline{\sqrt{85}}}$$

$$e) \text{Dist}_{GH} = \sqrt{(-1-7)^2 + (-2-3)^2}$$

$$= \sqrt{64+25}$$

$$= \underline{\underline{\sqrt{89}}}$$

$$f) \text{Dist}_{RS} = \sqrt{(-1+2)^2 + (8-3)^2}$$

$$= \sqrt{1+25}$$

$$= \underline{\underline{\sqrt{26}}}$$

$$10. \quad a) i) \text{mid}_{AB} = \left( \frac{-3+1}{2}, \frac{1+3}{2} \right)$$

$$= \underline{\underline{(-1, 2)}}$$

$$ii) \text{mid}_{PQ} = \left( \frac{1+9}{2}, \frac{4+8}{2} \right)$$

$$= \underline{\underline{(5, 6)}}$$

$$iii) \text{mid}_{CO} = \left( \frac{3-6}{2}, \frac{-3+1}{2} \right)$$

$$= \underline{\underline{\left(-\frac{3}{2}, -1\right)}}$$

$$iv) \text{mid}_{VW} = \left( \frac{-7+3}{2}, \frac{1+9}{2} \right)$$

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

$$v) \text{mid}_{GH} = \left( \frac{2-2}{2}, \frac{4-2}{2} \right)$$

$$= \underline{\underline{(0, 1)}}$$

$$vi) \text{mid}_{RS} = \left( \frac{-6-2}{2}, \frac{2+8}{2} \right)$$

$$= \underline{\underline{(-4, 5)}}$$

$$b) (5, 3) = \left( \frac{-3+x}{2}, \frac{2+y}{2} \right)$$

$$c) (-2, 7) = \left( \frac{3+x}{2}, \frac{-7+y}{2} \right)$$

$$\Rightarrow \frac{-3+x}{2} = 5 \quad \frac{2+y}{2} = 3$$

$$\Rightarrow \frac{3+x}{2} = -2 \quad \frac{-7+y}{2} = 7$$

$$-3+x=10$$

$$2+y=6$$

$$3+x=-4$$

$$-7+y=14$$

$$\underline{\underline{x=13}}$$

$$\underline{\underline{y=4}}$$

$$\underline{\underline{x=-7}}$$

$$\underline{\underline{y=21}}$$

$$\underline{\underline{O(13, 4)}}$$

$$\underline{\underline{B(-7, 21)}}$$

$$11. a) m = 3$$

$$m_{\perp} = \underline{\underline{-\frac{1}{3}}}$$

$$b) m = -2$$

$$m_{\perp} = \underline{\underline{\frac{1}{2}}}$$

$$c) m = 6$$

$$m_{\perp} = \underline{\underline{-\frac{1}{6}}}$$

$$d) m = \frac{1}{3}$$

$$m_{\perp} = \underline{\underline{-3}}$$

$$e) m = -\frac{1}{4}$$

$$m_{\perp} = \underline{\underline{4}}$$

$$f) m = \frac{1}{5}$$

$$m_{\perp} = \underline{\underline{-5}}$$

$$g) m = -\frac{2}{3}$$

$$m_{\perp} = \underline{\underline{\frac{3}{2}}}$$

$$h) m = \frac{5}{4}$$

$$m_{\perp} = \underline{\underline{-\frac{4}{5}}}$$

$$i) m = -\frac{3}{5}$$

$$m_{\perp} = \underline{\underline{\frac{5}{3}}}$$

$$j) m = 0$$

$$m_{\perp} = \underline{\underline{\text{undefiniert}}}$$

$$12. a) y = 5x + 2$$

$$m = 5$$

$$m_{\perp} = \underline{\underline{-\frac{1}{5}}}$$

$$b) y = \frac{2}{3}x - 7$$

$$m = \frac{2}{3}$$

$$m_{\perp} = \underline{\underline{-\frac{3}{2}}}$$

$$c) y = 2 - 3x$$

$$m = -3$$

$$m_{\perp} = \underline{\underline{\frac{1}{3}}}$$

$$d) y = 4 - \frac{1}{2}x$$

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

$$m_{\perp} = \underline{\underline{2}}$$

$$e) y = 3x - 3$$

$$m = 3$$

$$m_{\perp} = \underline{\underline{-\frac{1}{3}}}$$

$$f) y = x + 9$$

$$m = 1$$

$$m_{\perp} = \underline{\underline{-1}}$$

$$g) y - 4x + 12 = 0$$

$$y = 4x - 12$$

$$m = 4$$

$$m_{\perp} = \underline{\underline{-\frac{1}{4}}}$$

$$h) 3x - y - 8 = 0$$

$$y = 3x - 8$$

$$m = 3$$

$$m_{\perp} = \underline{\underline{-\frac{1}{3}}}$$

$$i) 3x - 2y + 7 = 0$$

$$2y = 3x + 7$$

$$y = \frac{3}{2}x + \frac{7}{2}$$

$$m = \frac{3}{2}$$

$$m_{\perp} = \underline{\underline{-\frac{2}{3}}}$$

$$j) 8y + 4x - 2 = 0$$

$$8y = -4x + 2$$

$$y = -\frac{1}{2}x + \frac{1}{4}$$

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

$$m_{\perp} = \underline{\underline{2}}$$



13. a)  $(3, 4) (1, 2)$

$$m = \frac{2-4}{1-3} = \underline{\underline{1}}$$

$$y-b=m(x-a) \parallel m=1$$

$$y-2=1(x-1) \parallel (1, 2)$$

$$y-2=x-1$$

$$\underline{\underline{y=x+1}}$$

b)  $(0, 1) (-5, -2)$

$$m = \frac{-2-1}{-5-0} = \frac{3}{5}$$

$$y-b=m(x-a) \parallel m=\frac{3}{5}$$

$$y-1=\frac{3}{5}(x-0) \parallel (0, 1)$$

$$5y-5=3(x-0)$$

$$5y-5=3x$$

$$5y=3x+5$$

or

$$\underline{\underline{3x-5y+5=0}}$$

c)  $(-1, -3) (4, 0)$

$$m = \frac{0+3}{4+1} = \frac{3}{5}$$

$$y-b=m(x-a) \parallel m=\frac{3}{5}$$

$$y-0=\frac{3}{5}(x-4) \parallel (4, 0)$$

$$5y=3(x-4)$$

$$5y=3x-12$$

$$\underline{\underline{3x-5y-12=0}}$$

d)  $(0, 0) (2, -3)$

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

$$y-b=m(x-a) \parallel m=-\frac{3}{2}$$

$$y-0=-\frac{3}{2}(x-0) \parallel (0, 0)$$

$$2y=-3x$$

$$\underline{\underline{3x+2y=0}}$$

e)  $(1, -4) (3, -6)$

$$m = \frac{-6+4}{3-1} = -1$$

$$y-b=m(x-a) \parallel m=-1$$

$$y+4=-1(x-1) \parallel (1, -4)$$

$$y+4=-x+1$$

$$\underline{\underline{x+y+3=0}}$$

f)  $(-5, -2) (-8, -1)$

$$m = \frac{-1+2}{-8+5} = \underline{\underline{-\frac{1}{3}}}$$

$$y-b=m(x-a) \parallel m=-\frac{1}{3}$$

$$y+2=-\frac{1}{3}(x+5) \parallel (-5, -2)$$

$$3y+6=-(x+5)$$

$$3y+6=-x-5$$

$$\underline{\underline{x+3y+11=0}}$$

$$14.a) y = 6x - 4$$

$$m = 6$$

$$y - b = m(x - a) \parallel m = 6$$

$$y - 3 = 6(x - 2) \parallel (2, 3)$$

$$y - 3 = 6x - 12$$

$$6x - y - 9 = 0$$

$$b) x + y = 5$$

$$y = -x + 5$$

$$m = -1$$

$$y - b = m(x - a) \parallel m = -1$$

$$y - 2 = -1(x + 5) \parallel (-5, 2)$$

$$y - 2 = -x - 5$$

$$x + y + 3 = 0$$

$$c) x - y = 0$$

$$y = x$$

$$m = 1$$

$$y - b = m(x - a) \parallel m = 1$$

$$y - 0 = 1(x - 1) \parallel (1, 0)$$

$$y = x - 1$$

$$x - y - 1 = 0$$

$$d) 2x + 3y + 4 = 0$$

$$3y = -2x - 4$$

$$y = -\frac{2}{3}x - \frac{4}{3}$$

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

$$y - b = m(x - a) \parallel m = -\frac{2}{3}$$

$$y - 2 = -\frac{2}{3}(x + 3) \parallel (-3, 2)$$

$$3y - 6 = -2(x + 3)$$

$$3y - 6 = -2x - 6$$

$$2x + 3y = 0$$

$$15a) y = 2x - 3$$

$$m = 2 \quad m_{\perp} = -\frac{1}{2}$$

$$y - b = m(x - a) \parallel m = -\frac{1}{2}$$

$$y + 1 = -\frac{1}{2}(x - 6) \parallel (6, -1)$$

$$2y + 2 = -(x - 6)$$

$$2y + 2 = -x + 6$$

$$x + 2y - 4 = 0$$

$$b) y - 4x = 1$$

$$y = 4x + 1$$

$$m = 4 \quad m_{\perp} = -\frac{1}{4}$$

$$y - b = m(x - a) \parallel m = -\frac{1}{4}$$

$$y - 3 = -\frac{1}{4}(x - 9) \parallel (9, 3)$$

$$4y - 12 = -(x - 9)$$

$$4y - 12 = -x + 9$$

$$x + 4y - 21 = 0$$

$$c) 2y - x - 5 = 0$$

$$2y = x + 5$$

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

$$m = \frac{1}{2} \quad m_{\perp} = -2$$

$$y - b = m(x - a) \parallel m = -2$$

$$y - 4 = -2(x - 3) \parallel (3, 4)$$

$$y - 4 = -2x + 6$$

$$2x + y - 10 = 0$$

$$d) 2x + 3y + 1 = 0$$

$$3y = -2x - 1$$

$$y = -\frac{2}{3}x - \frac{1}{3}$$

$$m = -\frac{2}{3} \quad m_{\perp} = \frac{3}{2}$$

$$y - b = m(x - a) \parallel m = \frac{3}{2}$$

$$y - 0 = \frac{3}{2}(x - 5) \parallel (5, 0)$$

$$2y = 3(x - 5)$$

$$2y = 3x - 15$$

$$3x - 2y - 15 = 0$$



15. a)  $y = 2x - 3$

$m = 2 \quad m_{\perp} = -\frac{1}{2}$

$y - b = m(x - a) \quad \parallel m = -\frac{1}{2}$   
 $y + 1 = -\frac{1}{2}(x - 6) \quad \parallel (6, -1)$

$2y + 2 = -1(x - 6)$

$2y + 2 = -x + 6$

$x + 2y - 4 = 0$

c)  $2y - x - 5 = 0$

$2y = x + 5$

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

$m = \frac{1}{2} \quad m_{\perp} = -2$

$y - b = m(x - a) \quad \parallel m = -2$

$y - 4 = -2(x - 3) \quad \parallel (3, 4)$

$y - 4 = -2x + 6$

$2x + y - 10 = 0$

b)  $y - 4x = 1$

$y = 4x + 1$

$m = 4 \quad m_{\perp} = -\frac{1}{4}$

$y - b = m(x - a) \quad \parallel m = -\frac{1}{4}$

$y - 3 = -\frac{1}{4}(x - 9) \quad \parallel (9, 3)$

$4y - 12 = -1(x - 9)$

$4y - 12 = -x + 9$

$x + 4y - 21 = 0$

d)  $2x + 3y + 1 = 0$

$3y = -2x - 1$

$y = -\frac{2}{3}x - \frac{1}{3}$

$m = -\frac{2}{3} \quad m_{\perp} = \frac{3}{2}$

$y - b = m(x - a) \quad \parallel m = \frac{3}{2}$

$y - 0 = \frac{3}{2}(x - 5) \quad \parallel (5, 0)$

$2y = 3(x - 5)$

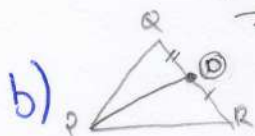
$2y = 3x - 15$

$3x - 2y - 15 = 0$

16a)  $P(3, 5) \quad Q(-3, 1) \quad R(5, -3)$

mid QR =  $(\frac{-3+5}{2}, \frac{1-3}{2})$

$= (1, -1) \quad (0)$



$m_{PD} = \frac{-1 - 5}{1 - 3}$

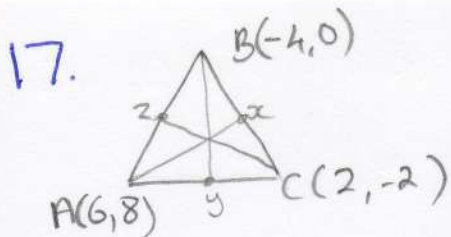
$= 3$

c)  $y - b = m(x - a) \quad \parallel m = 3$

$y + 1 = 3(x - 1) \quad \parallel (1, -1)$

$y + 1 = 3x - 3$

$3x - y - 4 = 0$



$$\text{mid}_{BC} = \left( \frac{-4+2}{2}, \frac{0-2}{2} \right) \\ = \underline{\underline{(-1, -1)}}$$

$$m_{Ax} = \frac{8+1}{6+1} \\ = \frac{9}{7}$$

$$y-b = m(x-a) \quad \parallel m = \frac{9}{7} \\ y+1 = \frac{9}{7}(x+1) \quad \parallel (-1, -1) \\ 7y+7 = 9(x+1) \\ 7y+7 = 9x+9 \\ \underline{\underline{9x-7y+2=0}}$$

$$\text{mid}_{AC} = \left( \frac{6+2}{2}, \frac{8-2}{2} \right) \\ = \underline{\underline{(4, 3)}}$$

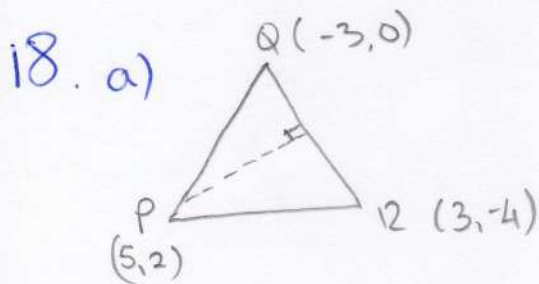
$$m_{By} = \frac{3-0}{4+4} \\ = \frac{3}{8}$$

$$y-b = m(x-a) \quad \parallel m = \frac{3}{8} \\ y-3 = \frac{3}{8}(x-4) \quad \parallel (4, 3) \\ 8y-24 = 3(x-4) \\ 8y-24 = 3x-12 \\ \underline{\underline{3x-8y+12=0}}$$

$$\text{mid}_{AB} = \left( \frac{6-4}{2}, \frac{8+0}{2} \right) \\ = \underline{\underline{(1, 4)}}$$

$$m_{Cz} = \frac{4+2}{1-2} \\ = -6$$

$$y-b = m(x-a) \quad \parallel m = -6 \\ y-4 = -6(x-1) \quad \parallel (1, 4) \\ y-4 = -6x+6 \\ \underline{\underline{6x+y-10=0}}$$



$$m_{QR} = \frac{-4-0}{3+3} \\ = \frac{-4}{6} \\ = \underline{\underline{-\frac{2}{3}}}$$

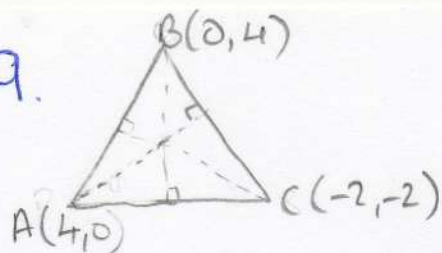
b)

$$m_{QR} = -\frac{2}{3} \\ \Rightarrow m_{\perp} = \underline{\underline{\frac{3}{2}}}$$

c)

$$y-b = m(x-a) \quad \parallel m = \frac{3}{2} \\ y-2 = \frac{3}{2}(x-5) \quad \parallel P(5, 2) \\ 2y-4 = 3(x-5) \\ 2y-4 = 3x-15 \\ \underline{\underline{3x-2y+11=0}}$$

19.



$$m_{AC} = \frac{0+2}{4+2} \quad m_{\perp} = \underline{\underline{-3}}$$

$$= \underline{\underline{\frac{1}{3}}}$$

$$y-b=m(x-a) \parallel m=-3$$

$$y-4=-3(x-0) \parallel B(0,4)$$

$$y-4=-3x$$

$$\underline{\underline{3x+y-4=0}}$$

$$m_{AB} = \frac{4-0}{0-4} \quad m_{\perp} = \underline{\underline{1}}$$

$$= \underline{\underline{-1}}$$

$$y-b=m(x-a) \parallel m=1$$

$$y+2=1(x+2) \parallel C(-2,-2)$$

$$y+2=x+2$$

$$\underline{\underline{x-y=0}}$$

$$m_{BC} = \frac{4+2}{0+2} \quad m_{\perp} = \underline{\underline{-\frac{1}{3}}}$$

$$= \underline{\underline{3}}$$

$$y-b=m(x-a) \parallel m=-\frac{1}{3}$$

$$y-0=-\frac{1}{3}(x-4) \parallel A(4,0)$$

$$3y=-1(x-4)$$

$$3y=-x+4$$

$$\underline{\underline{x+3y-4=0}}$$

20. a) mid OE =  $(\frac{8+2}{2}, \frac{4+6}{2})$

$$= (5, 5)$$

$$m_{OE} = \left( \frac{4-6}{8-2} \right) \quad m_{\perp} = \underline{\underline{-3}}$$

$$= \underline{\underline{-\frac{1}{3}}}$$

$$y-b=m(x-a) \parallel m_{\perp}=3$$

$$y-5=3(x-5) \parallel (5,5)$$

$$y-5=3x-15$$

$$\underline{\underline{3x-y-10=0}}$$

b) mid FG =  $(\frac{-1+1}{2}, \frac{3-3}{2})$

$$= (0, 0)$$

$$m_{FG} = \frac{-3-3}{1+1} \quad m_{\perp} = \underline{\underline{\frac{1}{3}}}$$

$$= \underline{\underline{-3}}$$

$$y-b=m(x-a) \parallel m_{\perp}=\frac{1}{3}$$

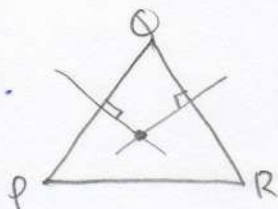
$$y-0=\frac{1}{3}(x-0) \parallel (0,0)$$

$$3y=x$$

$$\underline{\underline{x-3y=0}}$$



21.



$$a) i) m_{PQ} = \frac{5-1}{5+3} = \frac{1}{2}$$

$$m_{\perp} = \underline{\underline{-2}}$$

$$\text{mid}_{PQ} = \left( -\frac{3+5}{2}, \frac{1+5}{2} \right) \\ = \underline{\underline{(1, 3)}}$$

$$y-b=m(x-a) \parallel m=-2$$

$$y-3=-2(x-1) \parallel (1, 3)$$

$$y-3=-2x+2$$

$$\underline{\underline{2x+y-5=0}}$$

$$ii) 2x+y-5=0 \dots ① \times 7$$

$$x-7y+5=0 \dots ②$$

$$14x+7y-35=0 \dots ③$$

$$x-7y+5=0 \dots ②$$

$$15x-30=0$$

$$\underline{\underline{x=2}}$$

$$\text{Point } S \underline{\underline{(2, 1)}}$$

$$m_{QR} = \frac{-2-5}{6-5} = -7$$

$$m_{\perp} = \frac{1}{7}$$

$$\text{mid}_{QR} = \left( \frac{5+6}{2}, \frac{5-2}{2} \right) \\ = \underline{\underline{\left( \frac{11}{2}, \frac{3}{2} \right)}}$$

$$y-b=m(x-a) \parallel m=\frac{1}{7}$$

$$y-\frac{3}{2}=\frac{1}{7}\left(x-\frac{11}{2}\right) \parallel \left(\frac{11}{2}, \frac{3}{2}\right)$$

$$7y-\frac{21}{2}=x-\frac{11}{2}$$

$$\underline{\underline{x-7y+5=0}}$$

$$\text{sub } x=2 \text{ in } ②$$

$$2-7y+5=0$$

$$7y=7$$

$$\underline{\underline{y=1}}$$

2) b)

$$m_{PR} = \frac{-2-1}{6+3}$$

$$= -\frac{1}{3}$$

$$m_{\perp} = \underline{\underline{3}}$$

$$\text{mid}_{PR} = \left( -\frac{3+6}{2}, \frac{1-2}{2} \right)$$

$$= \underline{\underline{\left( \frac{3}{2}, -\frac{1}{2} \right)}}$$

$$y-b=m(x-a) \parallel m_{\perp}=3$$

$$y+\frac{1}{2}=3\left(x-\frac{3}{2}\right) \parallel \left(\frac{3}{2}, -\frac{1}{2}\right)$$

$$y+\frac{1}{2}=3x-\frac{9}{2}$$

$$\underline{\underline{3x-y-5=0}}$$

$$3x-y-5=0 \quad s(2,1)$$

$$(3 \times 2) - 1 - 5 = 0$$

$$0=0$$

As S makes

LHS = RHS it lies  
on the line  $3x-y-5=0$