Straight Line

Q1 $3y + 2x = 6$

(−2x) $3y = 6 - 2x$

(÷3) $y = 2 - \frac{2}{3}x$

The gradient of any line parallel to this will be $-\frac{2}{3}$.

Q2 $2x - 3y - 6 = 0$

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

$3y = 2x - 6$

(÷3) $y = \frac{2}{3}x - 2 \Rightarrow m = \frac{2}{3}$

L is perpendicular, so has gradient $-\frac{3}{2}$ since $m \times m_{\perp} = -1$.

Q3 $x + 2y = 1$

(−x) $2y = 1 - x$

(÷2) $y = \frac{1}{2} - \frac{1}{2}x \Rightarrow m = -\frac{1}{2}$

So, l_1 has gradient 2 since $m \times m_{\perp} = -1$.

$m = 2$

$(1, 10)$ with $a = 1$, $b = 10$

$y - b = m(x - a)$

$y - 10 = 2(x - 1)$

$y - 10 = 2x - 2$

(+10) $y = 2x + 8$ or $2x - y + 8 = 0$

Q4

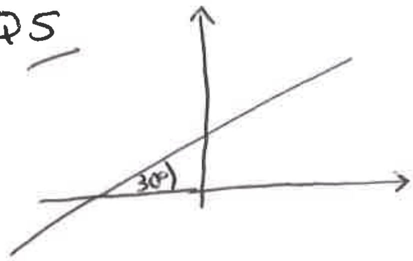
$$3x + y + 1 = 0$$

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

(-1) $\quad y = -3x - 1 \quad \Rightarrow \quad m = -3$

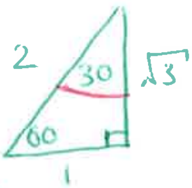
A line perpendicular to the above will have a gradient of $m = \frac{1}{3}$ so $\underline{\underline{a = \frac{1}{3}}}$ in the eq^n, $y = ax + 4$.

Q5



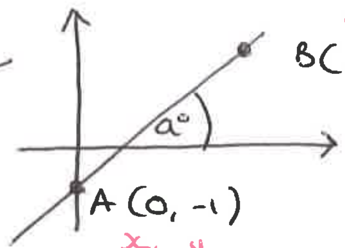
$$m = \tan\theta$$
$$= \tan 30°$$
$$= \underline{\underline{\frac{1}{\sqrt{3}}}}$$

It is expected that you can do this without the use of a calculator using the Exact Value Triangle



$T\,{}^{O}_{A}$ $\underline{\underline{\frac{1}{\sqrt{3}}}}$

Q6



$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{2 - (-1)}{3\sqrt{3} - 0}$$
$$= \frac{3}{3\sqrt{3}}$$
$$= \frac{1}{\sqrt{3}}$$

$$m = \tan\theta$$
$$\tan\theta = \frac{1}{\sqrt{3}}$$
$$\theta = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$$
$$= \underline{\underline{30°}}$$

Q7

$$y = 2x + 4$$
gradient $= 2$
$$m = \tan\theta$$
$$\tan\theta = 2$$
$$\theta = \tan^{-1}(2)$$
$$= \underline{\underline{63.4°}}$$

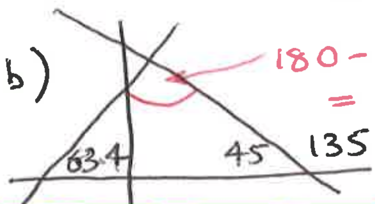
$$x + y = 13$$
$$y = 13 - x$$
gradient $= -1$
$$m = \tan\theta$$
$$\tan\theta = -1$$
$$\theta = \tan^{-1}(1)$$
$$= 45°$$

when the value is negative this means the answer will be larger than 90°

don't use negative sign.

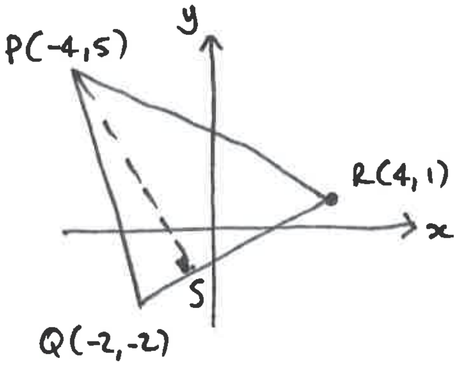
So, obtuse angle is $180 - 45° = \underline{\underline{135°}}$

b)



$180 - (63.4 + 45)$
$= \underline{\underline{71.6°}}$

Q8



GRADIENT

$$m_{QR} = \frac{1-(-2)}{4-(-2)} = \frac{3}{6} = \frac{1}{2}$$

$\Rightarrow m_{PS} = -2$ since $m \times m_{\perp} = -1$.

POINT $\overset{a}{(-4}, \overset{b}{5)}$

EQUATION

$y - b = m(x - a)$

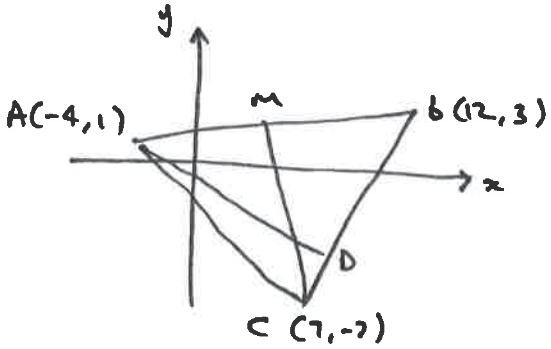
$y - 5 = -2(x - (-4))$

$y - 5 = -2(x + 4)$

$y - 5 = -2x - 8$

(+5) $\underline{\underline{y = -2x - 3}}$

Q9



(a) Midpoint $M = \left(\frac{-4+12}{2}, \frac{1+3}{2}\right) = \left(\frac{8}{2}, \frac{4}{2}\right) = \underline{\underline{(4, 2)}}$

Gradient

C $\overset{x_1}{(7}, \overset{y_1}{-7)}$

M $\overset{x_2}{(4}, \overset{y_2}{2)}$

$$m_{CM} = \frac{2-(-7)}{4-7} = \frac{9}{-} = \underline{\underline{-3}}$$

Equation

$\overset{a}{(4}, \overset{b}{2)}$

$m = -3$

$y - b = m(x - a)$

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

$y - 2 = -3x + 12$

(+3x) $3x + y - 2 = 12$

(+2) $\underline{\underline{3x + y = 14}}$

left in this form as I will be solving simultaneously in part (c)

b) <u>Gradient</u> CB

$\overset{x_1 \ \ y_1}{(12, 3)}$

$\overset{x_2 \ \ y_2}{(7, -7)}$

$$m = \frac{-7 - 3}{7 - 12}$$
$$= \frac{-10}{-5}$$
$$= 2 \Rightarrow M_{AD} = -\frac{1}{2} \text{ since } m \times m_{\perp} = -1$$

<u>Point</u> $(-4, 1)$

<u>Equation</u>

$$y - b = m(x - a)$$
$$y - 1 = -\frac{1}{2}(x - (-4))$$
$$y - 1 = -\frac{1}{2}(x + 4)$$
$$(\times 2) \quad 2y - 2 = -(x + 4)$$
$$2y - 2 = -x - 4$$
$$(+x) \quad x + 2y - 2 = -4$$
$$(+2) \quad x + 2y = -2$$

c) $3x + y = 14$ ①
$x + 2y = -2$ ②

① $\times 2$ $\quad 6x + 2y = 28$ ③
② $\times 1$ $\quad x + 2y = -2$ ④

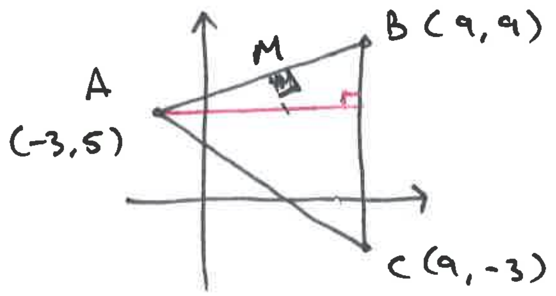
③ − ④ $\quad 5x = 30$
$(\div 5)$ $\quad x = 6$

Subst $x = 6$ in ②

$$x + 2y = -2$$
$$6 + 2y = -2$$
$$(-6) \quad 2y = -8$$
$$(\div 2) \quad y = -4$$

The point of intersection is $(6, -4)$

Q10



a) Gradient BC $= \frac{-3-9}{9-9} = \frac{-12}{0} = $?!

$\overset{x_1 \; y_1}{(9, 9)}$

$\overset{x_2 \; y_2}{(9, -3)}$

The eq^n is $\underline{\underline{x = 9}}$

HELP!!
Notice that B and C form a vertical line where x will always equal 9
There is no need to calculate the gradient here.

b) The altitude from A has been added to the diagram above - do this on yours too!

GRADIENT since this is a horizontal line the gradient is 0.

I know it is horizontal since it meets a vertical line at a right angle.

The eq^n is $\underline{\underline{y = 5}}$

c) Midpoint AB
A (-3, 5)
B (9, 9)

$\left(\frac{-3+9}{2}, \frac{5+9}{2}\right)$

$= \left(\frac{6}{2}, \frac{14}{2}\right)$

$= \underline{\underline{(3, 7)}}$

Please note that the perpendicular bisector of AB doesn't necessarily go through "C".

Gradient AB
A $\overset{x_1 \; y_1}{(-3, 5)}$
B $\underset{x_2 \; y_2}{(9, 9)}$

$m = \frac{9-5}{9-(-3)}$

$= \frac{4}{12}$

$= \frac{1}{3} \Rightarrow m_\perp = -3$ since $m \times m_\perp = -1$

Equation
$(\underset{a}{3}, \underset{b}{7})$
$m = -3$

$y - b = m(x - a)$
$y - 7 = -3(x - 3)$
$y - 7 = -3x + 9$
$\underline{\underline{y = -3x + 16}}$

d) Perpendicular bisector : $y = -3x + 16$

Altitude : $y = 5$

To find intersection point $-3x + 16 = 5$

$(-16) \quad -3x = -11$

$(\div -3) \quad x = \frac{11}{3}$

i.e. $(\ , y)$. Since we already know that $y = 5$

the point is $\left(\frac{11}{3}, 5\right)$

Vectors

Q1 $\quad \underline{p} = 3\underline{i} - 3\underline{j} + 2\underline{k} \quad \underline{q} = 4\underline{i} - \underline{j} + \underline{k} \quad \underline{r} = 4\underline{i} - 2\underline{j} + 3\underline{k}$

$$\begin{pmatrix}3\\-3\\2\end{pmatrix} \qquad \begin{pmatrix}4\\-1\\1\end{pmatrix} \qquad \begin{pmatrix}4\\-2\\3\end{pmatrix}$$

a) $2\underline{p} - \underline{q} + \underline{r}$

$$= 2\begin{pmatrix}3\\-3\\2\end{pmatrix} - \begin{pmatrix}4\\-1\\1\end{pmatrix} + \begin{pmatrix}4\\-2\\3\end{pmatrix}$$

$$= \begin{pmatrix}6\\-6\\4\end{pmatrix} - \begin{pmatrix}4\\-1\\1\end{pmatrix} + \begin{pmatrix}4\\-2\\3\end{pmatrix}$$

$$= \begin{pmatrix}6\\-7\\6\end{pmatrix} \rightarrow \underline{\underline{6\underline{i} - 7\underline{j} + 6\underline{k}}}$$

b) $|2\underline{p} - \underline{q} + \underline{r}|$

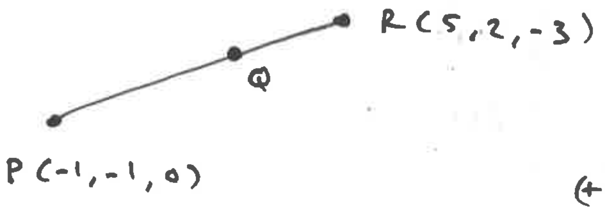
$$= \sqrt{6^2 + (-7)^2 + 6^2}$$

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

$$= \sqrt{121}$$

$$= \underline{\underline{11}}$$

Q2



$\therefore \quad \overrightarrow{PQ} = \frac{2}{3}\overrightarrow{PR}$

$$\underline{q} - \underline{p} = \frac{2}{3}\underline{r} - \frac{2}{3}\underline{p}$$

$(+\underline{p})$
$$\underline{q} = \frac{2}{3}\underline{r} + \frac{1}{3}\underline{p}$$

$$= \frac{2}{3}\begin{pmatrix}5\\2\\-3\end{pmatrix} + \frac{1}{3}\begin{pmatrix}-1\\-1\\0\end{pmatrix}$$

$$= \begin{pmatrix}\frac{10}{3}\\\frac{4}{3}\\-2\end{pmatrix} + \begin{pmatrix}-\frac{1}{3}\\-\frac{1}{3}\\0\end{pmatrix} = \begin{pmatrix}\frac{9}{3}\\\frac{3}{3}\\-2\end{pmatrix} = \begin{pmatrix}3\\1\\-2\end{pmatrix}$$

i.e. Q is $\underline{\underline{(3, 1, -2)}}$

Q3 $\quad P(2,2,3) \quad Q(4,4,1) \quad R(5,5,0)$

$$\overrightarrow{PQ} = \underset{\sim}{q} - \underset{\sim}{p} = \begin{pmatrix}4\\4\\1\end{pmatrix} - \begin{pmatrix}2\\2\\3\end{pmatrix} = \begin{pmatrix}2\\2\\-2\end{pmatrix} = 2\begin{pmatrix}1\\1\\-1\end{pmatrix}$$

$$\overrightarrow{QR} = \underset{\sim}{r} - \underset{\sim}{q} = \begin{pmatrix}5\\5\\0\end{pmatrix} - \begin{pmatrix}4\\4\\1\end{pmatrix} = \begin{pmatrix}1\\1\\-1\end{pmatrix}$$

Since $\overrightarrow{PQ} = 2\overrightarrow{QR}$ vectors parallel and since Q is a common point P, Q, R are collinear.

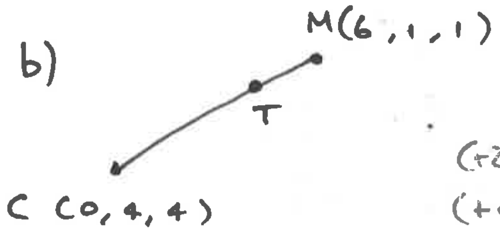
Ratio $\quad \overrightarrow{PQ} : \overrightarrow{QR}$

$\quad 2 : 1$

Q4 a) $\quad A(4,-1,3) \quad B(8,3,-1) \quad C(0,4,4) \quad D(-4,0,8)$

$$M = \left(\frac{4+8}{2}, \frac{-1+3}{2}, \frac{3+(-1)}{2}\right) = \left(\frac{12}{2}, \frac{2}{2}, \frac{2}{2}\right) = (6, 1, 1)$$

b)



$$\overrightarrow{CT} = 2\overrightarrow{TM}$$

$$\underset{\sim}{t} - \underset{\sim}{c} = 2\underset{\sim}{m} - 2\underset{\sim}{t}$$

$$(+2t) \quad 3\underset{\sim}{t} - \underset{\sim}{c} = 2\underset{\sim}{m}$$

$$(+\underset{\sim}{c}) \quad 3\underset{\sim}{t} = 2\underset{\sim}{m} + \underset{\sim}{c}$$

$$3\underset{\sim}{t} = 2\begin{pmatrix}6\\1\\1\end{pmatrix} + \begin{pmatrix}0\\4\\4\end{pmatrix}$$

$$3\underset{\sim}{t} = \begin{pmatrix}12\\2\\2\end{pmatrix} + \begin{pmatrix}0\\4\\4\end{pmatrix}$$

$$3\underset{\sim}{t} = \begin{pmatrix}12\\6\\6\end{pmatrix}$$

$$(\div 3) \quad \underset{\sim}{t} = \begin{pmatrix}4\\2\\2\end{pmatrix} \quad \text{i.e. } (4, 2, 2)$$

c) B $(8, 3, -1)$ T $(4, 2, 2)$ D $(-4, 0, 8)$

$\overrightarrow{BT}$

$= \underline{t} - \underline{b}$

$= \begin{pmatrix}4\\2\\2\end{pmatrix} - \begin{pmatrix}8\\3\\-1\end{pmatrix}$

$= \begin{pmatrix}-4\\-1\\3\end{pmatrix}$

$\overrightarrow{TD}$

$= \underline{d} - \underline{t}$

$= \begin{pmatrix}-4\\0\\8\end{pmatrix} - \begin{pmatrix}4\\2\\2\end{pmatrix}$

$= \begin{pmatrix}-8\\-2\\6\end{pmatrix}$

$= 2\overrightarrow{BT}$

Since $\overrightarrow{TD} = 2\overrightarrow{BT}$ vectors parallel and since T is a common point B, T, D are collinear.

$\overrightarrow{BT} : \overrightarrow{TD}$

$1 : 2$

Q5 B $(4, 4, 0)$

b) D $(2, 2, 6)$ B $(4, 4, 0)$ M $(2, 0, 0)$

$\overrightarrow{DB} = \underline{b} - \underline{d}$

$= \begin{pmatrix}4\\4\\0\end{pmatrix} - \begin{pmatrix}2\\2\\6\end{pmatrix}$

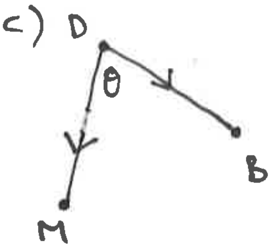
$= \begin{pmatrix}2\\2\\-6\end{pmatrix}$

$\overrightarrow{DM} = \underline{m} - \underline{d}$

$= \begin{pmatrix}2\\0\\0\end{pmatrix} - \begin{pmatrix}2\\2\\6\end{pmatrix}$

$= \begin{pmatrix}0\\ \\-6\end{pmatrix}$

c)



$\cos\theta = \dfrac{\overrightarrow{DB} \cdot \overrightarrow{DM}}{|\overrightarrow{DB}|\,|\overrightarrow{DM}|}$

$= \dfrac{32}{\sqrt{44}\,\sqrt{40}}$

$\theta = \cos^{-1}\left(\dfrac{32}{\sqrt{44}\sqrt{40}}\right)$

$= 40.3^\circ$ (1dp)

$|\overrightarrow{DB}| = \sqrt{2^2+2^2+(-6)^2}$

$= \sqrt{44}$

$|\overrightarrow{DM}| = \sqrt{0^2+(-2)^2+(-6)^2}$

$= \sqrt{40}$

$\overrightarrow{DB} \cdot \overrightarrow{DM} = 2(0) + 2(-2) + (-6)(-6)$

$= 32$

Q6

(a) M $(0, 1, 0)$ N $(4, 2, 2)$

(b) $\overrightarrow{VM}$

$= \underline{m} - \underline{v}$

$= \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} - \begin{pmatrix} 0 \\ 2 \\ 3 \end{pmatrix}$

$= \begin{pmatrix} 0 \\ -1 \\ -3 \end{pmatrix}$

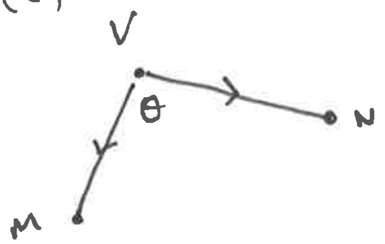
$\overrightarrow{VN}$

$= \underline{n} - \underline{v}$

$= \begin{pmatrix} 4 \\ 2 \\ 2 \end{pmatrix} - \begin{pmatrix} 0 \\ 2 \\ 3 \end{pmatrix}$

$= \begin{pmatrix} 4 \\ 0 \\ -1 \end{pmatrix}$

(c)



$$\cos \theta = \frac{\overrightarrow{VM} \cdot \overrightarrow{VN}}{|\overrightarrow{VM}||\overrightarrow{VN}|}$$

$$= \frac{3}{\sqrt{10}\sqrt{17}}$$

$$\theta = \cos^{-1}\left(\frac{3}{\sqrt{10}\sqrt{17}}\right)$$

$$= 76.7^\circ$$

$\overrightarrow{VM} \cdot \overrightarrow{VN} = 0(4) + (-1)(0) + (-3)(-1$

$= 3$

$|\overrightarrow{VM}| = \sqrt{0^2 + (-1)^2 + (-3)^2}$

$= \sqrt{10}$

$|\overrightarrow{VN}| = \sqrt{4^2 + 0^2 + (-1)^2}$

$= \sqrt{17}$

Q7 $\overrightarrow{AB}$

$= \underline{b} - \underline{a}$

$= \begin{pmatrix} 3 \\ 6 \\ 5 \end{pmatrix} - \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix}$

$= \begin{pmatrix} 1 \\ 7 \\ 2 \end{pmatrix}$

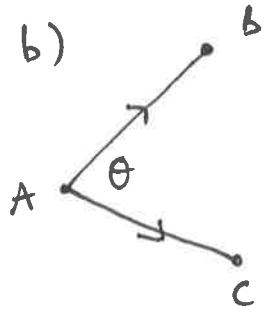
$\overrightarrow{AC}$

$= \underline{c} - \underline{a}$

$= \begin{pmatrix} 6 \\ 6 \\ -2 \end{pmatrix} - \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix}$

$= \begin{pmatrix} 4 \\ 7 \\ -5 \end{pmatrix}$

b)



$\cos\theta = \dfrac{\overrightarrow{AB} \cdot \overrightarrow{AC}}{|\overrightarrow{AB}||\overrightarrow{AC}|}$

$= \dfrac{43}{\sqrt{54}\sqrt{90}}$

$\theta = \cos^{-1}\left(\dfrac{43}{\sqrt{54}\sqrt{90}}\right)$

$= \underline{\underline{51.9^\circ}}$ (1dp)

$\overrightarrow{AB} \cdot \overrightarrow{AC}$

$= 1(4) + 7(7) + 2(-5)$

$= 43$

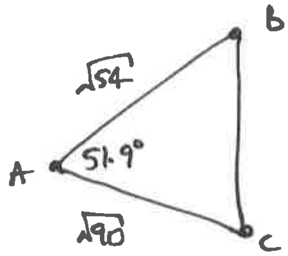
$|\overrightarrow{AB}| = \sqrt{1^2 + 7^2 + 2^2}$

$= \sqrt{54}$

$|\overrightarrow{AC}| = \sqrt{4^2 + 7^2 + (-5)^2}$

$= \sqrt{90}$

c)



Area $= \frac{1}{2} ab \sin C$

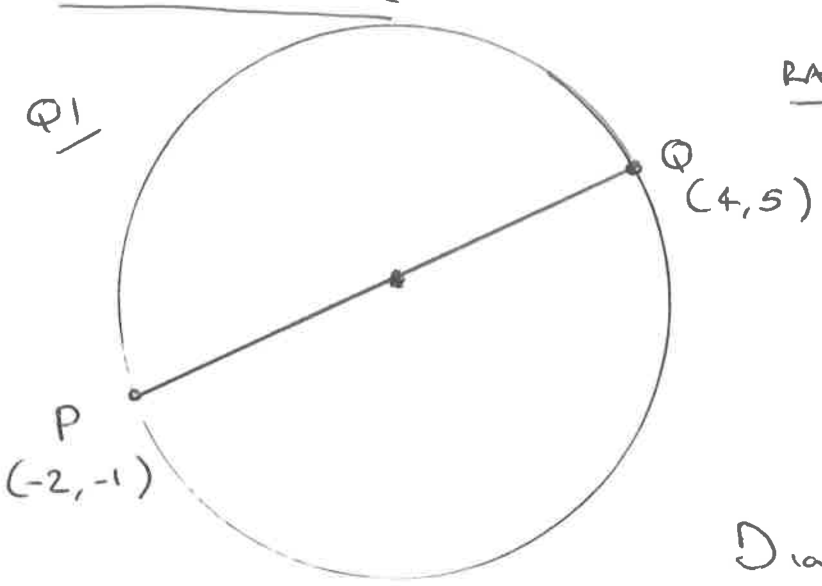
$= \frac{1}{2} \times \sqrt{54} \times \sqrt{90} \times \sin 51.9$

$= 27.430\ldots$

$= \underline{\underline{27.4}}$

The Circle

Q1



RADIUS

$$PQ = \sqrt{(-2-(-4))^2 + (-1-5)^2}$$
$$= \sqrt{(-6)^2 + (-6)^2}$$
$$= \sqrt{36+36}$$
$$= \sqrt{64}$$
$$= 8$$

Diameter $= 8$ units
Radius $= \underline{\underline{4}}$ units.

CENTRE

midpoint PQ $\left(\dfrac{x_1+x_2}{2}, \dfrac{y_1+y_2}{2}\right)$

$$\left(\frac{-2+4}{2}, \frac{-1+5}{2}\right)$$
$$= \left(\frac{2}{2}, \frac{4}{2}\right)$$
$$= \underline{\underline{(1, 2)}}.$$

EQUATION OF CIRCLE

radius $= 4$
centre $= (1, 2)$

$$(x-a)^2 + (y-b)^2 = r^2$$
$$\underline{\underline{(x-1)^2 + (y-2)^2 = 16}}$$

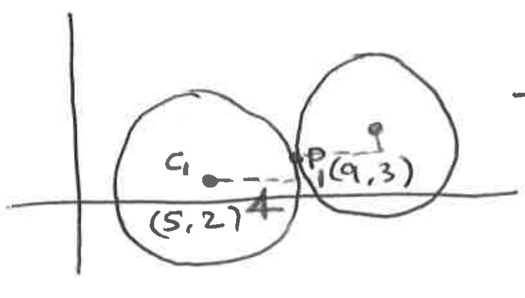
Q2 $\quad x^2 + y^2 - 10x - 4y + 12 = 0$

$x^2 + y^2 + 2gx + 2fy + c = 0$

$2g = -10 \qquad 2f = -4 \qquad c = 12$
$g = -5 \qquad f = -2$

centre circle 1 $(-g, -f)$
$\underline{\underline{(5, 2)}}$.

radius $= \sqrt{g^2+f^2-c}$
$= \sqrt{5^2+2^2-12}$
$= \sqrt{25+4-12}$
$= \underline{\underline{\sqrt{17}}}$



→ Centre of circle 2 is. $(13, 4)$
Radius of circle 2 is $\sqrt{17}$

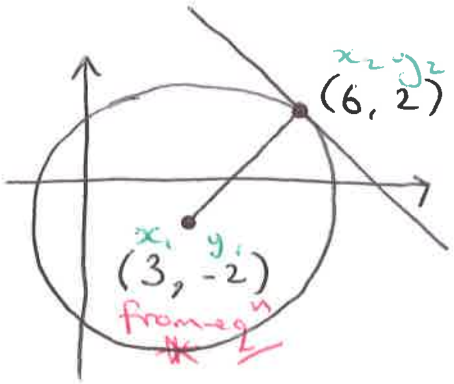
Eqⁿ, of circle 2
$$(x-a)^2 + (y-b)^2 = r^2$$
$$\underline{\underline{(x-13)^2 + (y-4)^2 = 17}}$$

Q3 $\quad (x-3)^2 + (y+2)^2 = 25$ *

Eqⁿ of tangent = Eqⁿ of line

USE $y - b = m(x-a)$

NEED gradient (m)
point (a, b)



$$m = \frac{2-(-2)}{6-3} = \frac{4}{3}$$

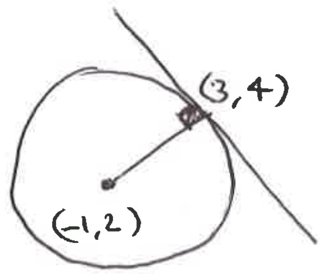
Since radius and tangent are perpendicular the gradient of the tangent is $-\frac{3}{4}$ (since $m \times m_{\perp} = -1$)

EQUATION OF TANGENT

$m = -\frac{3}{4}$

$\overset{a}{(6}, \overset{b}{2)}$

$$y - b = m(x-a)$$
$$y - 2 = -\frac{3}{4}(x-6)$$
$$(\times 4) \quad 4y - 8 = -3(x-6)$$
$$4y - 8 = -3x + 18$$
$$(+3x) \quad 3x + 4y - 8 = 18$$
$$(-18) \quad \underline{3x + 4y - 26 = 0}$$



Q4 $\quad x^2 + y^2 + 2x - 4y - 15 = 0$

$x^2 + y^2 + 2gx + 2fy + c = 0$

$2g = 2 \quad\quad 2f = -4$
$g = 1 \quad\quad f = -2$

So centre is $(-g, -f) = (-1, 2)$

Gradient of radius $= \dfrac{4-2}{3-(-1)} = \dfrac{2}{4} = \dfrac{1}{2}$ $\Rightarrow$ Gradient of tangent $= -2$ (since $m \times m_{\perp} = -1$)

EQUATION OF TANGENT

$m = -2$

$\overset{a}{(3}, \overset{b}{4)}$

$$y - b = m(x-a)$$
$$y - 4 = -2(x-3)$$
$$y - 4 = -2x + 6$$
$$(+4) \quad \underline{y = -2x + 10}$$

Q5 $x^2 + y^2 + 6x + 2y - 22 = 0$

Subst $x = 1$ and $y = 3$ i.e. $(1, 3)$ into above.

$$x^2 + y^2 + 6x + 2y - 22$$
$$= 1^2 + 3^2 + 6(1) + 2(3) - 22$$
$$= 1 + 9 + 6 + 6 - 22$$
$$= 22 - 22$$
$$= 0$$

as required to show. Therefore $(1, 3)$ lies on the circle.

Q6 $2x - y + 6 = 0$

$(+y)$ $y = 2x + 6$ Subst. this into circle eq^n:

$$x^2 + y^2 + 2x + 2y - 8 = 0$$
$$x^2 + (2x+6)^2 + 2x + 2(2x+6) - 8 = 0$$
$$x^2 + 4x^2 + 24x + 36 + 2x + 4x + 12 - 8 = 0$$
$$5x^2 + 30x + 40 = 0$$
$(\div 5)$ $$x^2 + 6x + 8 = 0$$

$$(2x+6)^2$$
$$= (2x+6)(2x+6)$$
$$= 4x^2 + 12x + 12x + 36$$
$$= 4x^2 + 24x + 36$$

Compare $ax^2 + bx + c = 0$

$a = 1$

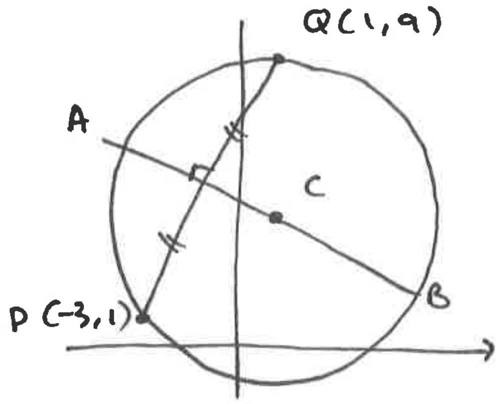
$b = 6$

$c = 8$

$$b^2 - 4ac$$
$$= 6^2 - 4(8)(1)$$
$$= 36 - 32$$
$$= 4$$

Since $b^2 - 4ac > 0$ there are two points of intersection.

Q7



Gradient PQ $= \dfrac{1-9}{-3-1} = \dfrac{-8}{-4} = \underline{\underline{2}}$

$\begin{matrix} x_1 & y_1 \\ (1, & 9) \end{matrix}$

$\begin{matrix} (-3, & 1) \\ x_2 & y_2 \end{matrix}$

$\Rightarrow m_{AB} = -\frac{1}{2}$ since $m \times m_{\perp} = -1$

Midpoint PQ $= \left(\frac{1+(-3)}{2}, \frac{9+1}{2}\right)$

$= \left(\frac{-2}{2}, \frac{10}{2}\right)$

$= \underline{\underline{(-1, 5)}}$

Equation

Point $(\overset{a}{-1}, \overset{b}{5})$

GRADIENT

$y - b = m(x - a)$

$y - 5 = -\frac{1}{2}(x - (-1))$

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

$(\times 2)$ $2y - 10 = -(x + 1)$

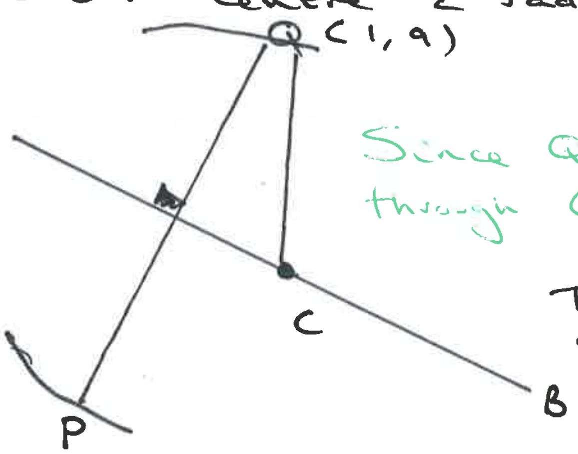
$2y - 10 = -x - 1$

$\underline{\underline{x + 2y - 9 = 0}}$

$\left[\text{or } y = \frac{9}{2} - \frac{1}{2}x\right]$

b) EQUATION OF A CIRCLE...

I NEED : centre & radius.



Since QC is a vertical line going through (1, 9) the eq^n of it is $\underline{\underline{x = 1}}$

This also means that the coordinate of C is (1, ?)

Since "C" lies on line AB with eq^n,

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

$y = \frac{9}{2} - \frac{1}{2}(1)$

$= \frac{8}{2}$

$= 4$

i.e. C is $\underline{\underline{(1,4)}}$

And since CQ is the radius, $r = 5$

(since C is (1, 4) and Q is (1, 9))

EQUATION

$r = 5$

$c = (1, 4)$

$(x - a)^2 + (y - b)^2 = r^2$

$\underline{\underline{(x - 1)^2 + (y - 4)^2 = 25}}$

(c) i) EQUATION OF TANGENT ∘∘ point $(1, 9)$

gradient ?

Since m = "undefined" and the radius and tangent meet at 90° (i.e. perpendicular) the gradient of the tangent at Q must be 0 (i.e. horizontal)

So the eq^n, of the tangent at Q is $\underline{\underline{y = 9}}$

ii) Use eq^n, of AB from part (a).

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

$9 = \frac{9}{2} - \frac{1}{2}x$

$(\times 2)$ $18 = 9 - x$

(-9) $9 = -x$

$x = -9$ i.e. coordinate of T is $\underline{\underline{(-9, 9)}}$

∘∘ Before starting this question I would draw a diagram to picture a tangent kite.