11.1

1. Given $A(0,1)$, $B(-2,1)$

$M_{AB} = \left(\frac{0-2}{2}, \frac{1+1}{2}\right)$

$= (-1, 1)$

$\because y_A = y_B$

$\therefore$ A and B lies on a horizontal line

$\therefore$ any line $y=k$ has the same perpendicular distance with point A and B, being $|1-k|$.

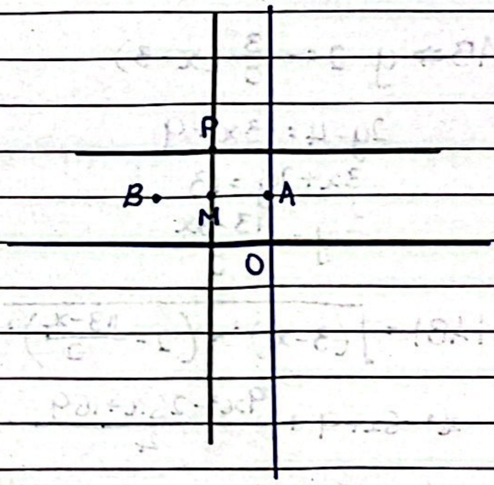
In order for the line to pass through $P(-1,2)$, $y=2$.

Also, any vertical line that passes through $M(A,B)$ is also equal in distance with point A and B, being $x=k$.

Notice that $P_x = M_x$

$\therefore x = -1$

$\therefore$ There are two lines #



2. Let $A(a,b)$, $B(-b,a)$, $C(0,0)$, $D(x,y)$

$M_{AB} = \left(\frac{a-b}{2}, \frac{a+b}{2}\right)$

$M_{CD} = M_{AB}$

$\left(\frac{x+0}{2}, \frac{y+0}{2}\right) = \left(\frac{a-b}{2}, \frac{a+b}{2}\right)$

$x = a-b$, $y = a+b$

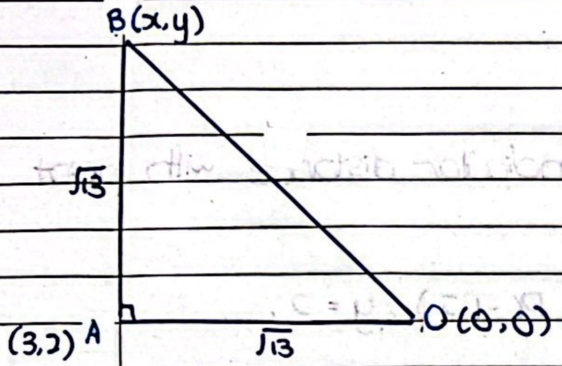
$\therefore D(a-b, a+b)$ #

11.2

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

$= \sqrt{9+4}$

$= \sqrt{13} = |AB|$



$m_{OA} = \frac{2}{3}$

$m_{AB} = -\frac{3}{2}$ $(AO \perp AB)$

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

$2y-4 = -3x+9$

$3x+2y = 13$

$y = \frac{13-3x}{2}$

$|AB| = \sqrt{(3-x)^2+\left(2-\frac{13-3x}{2}\right)^2} = \sqrt{13}$

$x^2-6x+9+\frac{9x^2-78x+169}{4}-2(13-3x)+4 = 13$

$4x^2-24x+36+9x^2-78x+169-8(13-3x)+16 = 52$

$13x^2-102x+205-104+24x-36 = 0$

$13x^2-78x+65 = 0$

$x^2-6x+5 = 0$

$(x-5)(x-1) = 0$

$x=1$ or $x=5$

When $x=1$, $y = \frac{13-3}{2} = 5$

When $x=5$, $y = \frac{13-15}{2} = -1$

$\therefore B(1,5)$ or $B(5,-1)$ //

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11.3

1. Let $A(0,0)$, $B(x,0)$, $C(0,y)$

$|y-x| = 3$ —— ①

$\Delta = \frac{1}{2}\begin{vmatrix} 0 & x & 0 & 0 \\ 0 & 0 & y & 0 \end{vmatrix} = 2$

$|0+xy+0-0-0-0| = 4$

$|xy| = 4$

$\because \Delta$ is in 1st quadrant

$\therefore x>0,\ y>0$

$\therefore xy>0$

$\therefore xy = 4$

$y = \frac{4}{x}$

Sub into ①,

$|y-x| = 3$

$\left|\frac{4}{x} - x\right| = 3$

$\frac{4}{x} - x = \pm 3$

$\frac{4-x^2}{x} = \pm 3$

$4 - x^2 = \pm 3x$

$x^2 \pm 3x - 4 = 0$

When $x^2+3x-4=0$

$(x+4)(x-1)=0$

$x=1$ or $x=-4$ (rejected)

When $x^2-3x-4=0$

$(x-4)(x+1)=0$

$x=4$ or $x=-1$ (rejected)

When $x=1$, $y=4 \Rightarrow B(1,0), C(0,4)$

$\frac{y-0}{x-1} = \frac{4-0}{0-1}$

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

$-y = 4x-4$

$4x+y-4=0$ #

When $x=4$, $y=1 \Rightarrow B(4,0), C(0,1)$

$\frac{y-0}{x-4} = \frac{1-0}{0-4}$

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

$-4y = x-4$

$x+4y-4=0$ #

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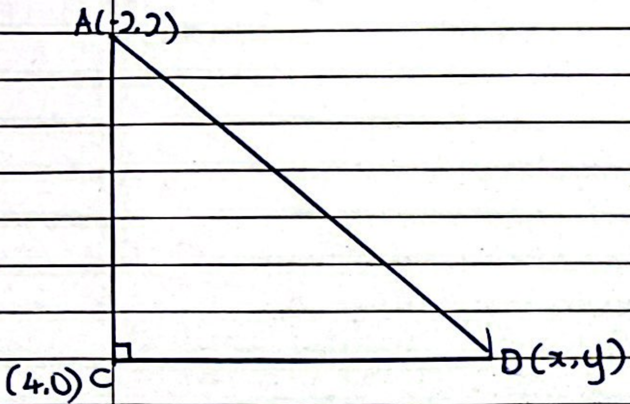
2. $A_{\Delta BAC} = \frac{1}{2}\begin{vmatrix} -2 & 3 & 4 & -2 \\ 2 & 7 & 0 & 2 \end{vmatrix}$

$= \frac{1}{2}\left| -14 + 0 + 8 - 6 - 28 - 0 \right|$

$= 20$



$m_{AC} = \frac{0-2}{4+2} = -\frac{1}{3}$

$m_{CD} = 3 \; (AC \perp CD)$

$y - 0 = 3(x-4)$

$CD \Rightarrow y = 3x - 12$

$A_{\Delta ACD} = \frac{1}{2}\begin{vmatrix} -2 & 4 & x & -2 \\ 2 & 0 & y & 2 \end{vmatrix} = 20$

$|0 + 4y + 2x - 8 - 0 + 2y| = 40$

$|2x + 6y - 8| = 40$

$2x + 6y - 8 = \pm 40$

$x + 3y - 4 = \pm 20$

$x + 3y = 4 \pm 20$

$x + 3y = 24$ or $x + 3y = -16$

When $x + 3y = 24$,

$x + 3(3x - 12) = 24$

$x + 9x - 36 = 24$

$10x = 60$

$x = 6$

$y = 3(6) - 12$

$= 6$

$\therefore D(6, 6)$ //

When $x + 3y = -16$

$x + 3(3x - 12) = -16$

$x + 9x - 36 = -16$

$10x = 20$

$x = 2$

$y = 3(2) - 12$

$= -6$

$\therefore D(2, -6)$ //

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11.4

1. $A_{OABC} = \frac{1}{2}\begin{vmatrix} 0 & 1 & 5 & 4 & 0 \\ 0 & 6 & 4 & 3 & 0 \end{vmatrix}$

$= \frac{1}{2}\left|0+4+15+0-0-30-16-0\right|$

$= \frac{1}{2}(27)$

$= 13.5$

~~11.5~~

~~1. $\left(\frac{3(3)+1}{4}\right.$~~

11.5

1.
$$\underset{A(1,-2)}{\bullet}\xrightarrow{\quad 2 \quad}\underset{B(3,m)}{\bullet}\xrightarrow{\quad 1 \quad}\underset{P(n,1)}{\bullet}$$

$AP : BP = 3 : 1$

$(AB + BP) : BP = 3 : 1$

$AB : BP = 2 : 1$

$\left(\frac{2n+1}{3}, \frac{2(1)+(-2)}{3}\right) = (3, m)$

$\frac{2n+1}{3} = 3$

$2n+1 = 9$

$2n = 8$

$n = 4$

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

$m = 0$

$\therefore m = 0, n = 4$ #

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1. (i) $A_{\Delta ABC} = \frac{1}{2}\begin{vmatrix} 1 & 2 & 3 & 1 \\ 8 & 5 & 6 & 8 \end{vmatrix}$

$= \frac{1}{2}\left|5+12+24-16-15-6\right|$

$= \frac{1}{2}(4)$

$= 2 \text{ units}^2$ #

(ii) $|AB| = \sqrt{(2-1)^2+(5-8)^2}$

$= \sqrt{1+9}$

$= \sqrt{10}$

$|BC| = \sqrt{(6-5)^2+(3-2)^2}$

$= \sqrt{2}$

$|CA| = \sqrt{(3-1)^2+(6-8)^2}$

$= \sqrt{8}$

$\cos\angle B = \frac{BC^2+AB^2-CA^2}{2 \cdot BC \cdot AB}$

$= \frac{2+10-8}{2\cdot\sqrt{2}\cdot\sqrt{10}}$

$= \frac{4}{4\sqrt{5}}$

$= \frac{1}{\sqrt{5}}$

$\angle B = 63.43^\circ$ #

(iii)

$B(2,5)$ ——2—— $A(1,8)$ ——1—— $D(x,y)$

$BD = 3AD$

$BA + AD = 3AD$

$BA = 2AD$

$\frac{BA}{AD} = 2$

$BA : AD = 2:1$

$\left(\frac{2x+2}{3}, \frac{2y+5}{3}\right) = (1,8)$

$\frac{2x+2}{3} = 1$ $\qquad$ $\frac{2y+5}{3} = 8$

$2x+2 = 3$ $\qquad$ $2y+5 = 24$

$x = \frac{1}{2}$ $\qquad$ $y = \frac{19}{2} = 9\frac{1}{2}$

$\therefore D\left(\frac{1}{2}, 9\frac{1}{2}\right)$ #