Name:
Result:

**1.** *(4 points)*

Line $l_1$ has the equation $2x + 3y + 6 = 0$.

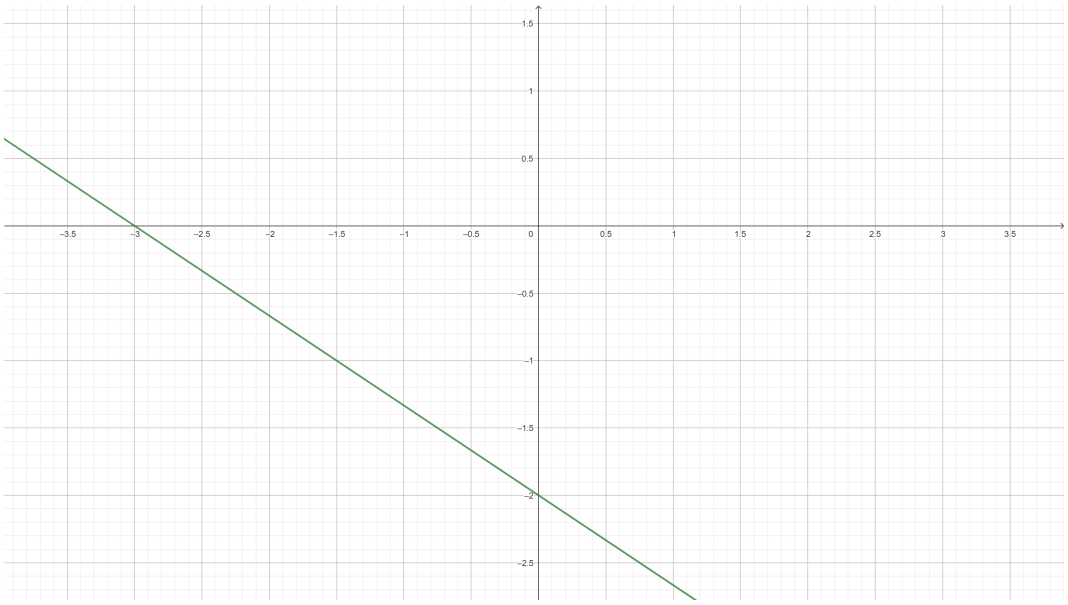
(a) Sketch the $l_1$, clearly indicate the coordinates of the intersections with the axes. [1]

Line $l_2$ is perpendicular to $l_1$ and passes through $(1, 1)$.

(b) Find the equation of $l_2$. [1]

(c) Find the exact coordinates of the point of intersection of the two lines. [2]

Axes intercepts are $x$-axis: $(-3, 0)$; $y$-axis: $(0, -2)$. Graph:




The equation is $3x - 2y + C = 0$. We substitute the point to get $C = -1$, so the equation of $l_2$ is:

$$3x - 2y - 1 = 0$$

We need to solve:

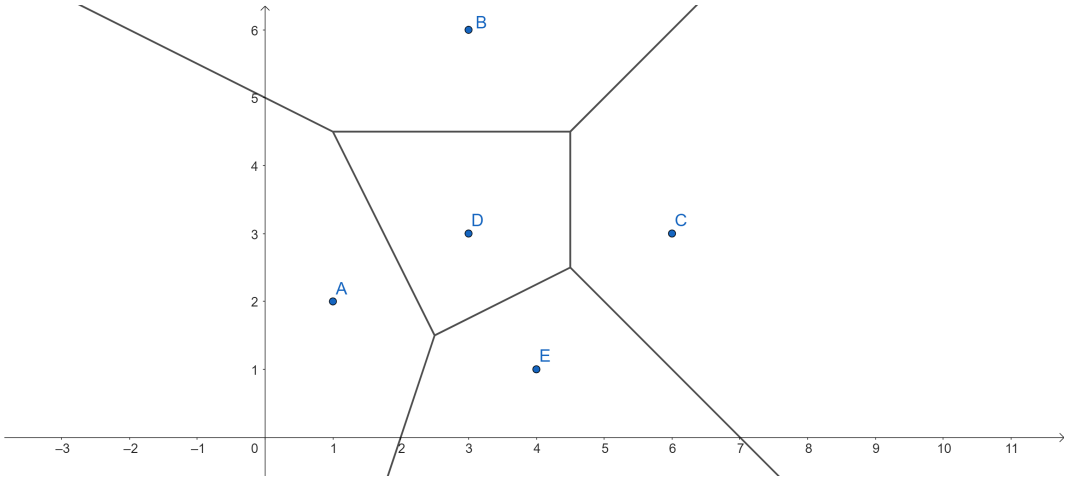
$$\begin{cases} 2x + 3y + 6 = 0 \\ 3x - 2y - 1 = 0 \end{cases}$$

The quickest method is to move the 6 and $-1$ to the RHS and use GDC. You can also multiply the first equation by 2 and the second by 3 and then add them. You should get $x = -\frac{9}{13}$, $y = -\frac{20}{13}$.

**2.** *(6 points)*

In this question the $x$ direction is due east, the $y$ direction is due north and distances are measured in kilometres.

The coordinates of the shelters are $A(1,2), B(3,6), C(6,3), D(3,3)$ and $E(4,1)$. The Voronoi diagram for these shelters as sites is shown below:




(a) Find the equation of the edge between cells containing $A$ and $D$. [2]

(b) Tomasz is equidistant from sites $B, C$ and $D$. Find Tomasz's coordinates. [1]

(c) Maria is at $(1,5)$. [3]

(i) State the site, which is closest to Maria.

(ii) Find the distance from Maria to the closest site.

(iii) Find the bearing from Maria to the closest site.

(a) The vector $\overrightarrow{AD} = \binom{2}{1}$, so the equation of the perpendicular bisector will be of the form $2x + y + C = 0$. The midpoint is $(2, 2.5)$, so the equation is $2x + y - 6.5 = 0$ or:

$$4x + 2y - 13 = 0$$

(b) The perpendicular bisector of $CD$ is $x = 4.5$ and the perpendicular bisector of $BD$ is $y = 4.5$, so Tomasz is at $(4.5, 4.5)$.

(c) (i) $B$

(ii) distance$= \sqrt{2^2 + 1^2} = \sqrt{5}$

(iii) we have $\tan\theta = 2$, so $\theta = 63.4°$