A2.

a). $X = \begin{pmatrix} -1 \\ 1 \end{pmatrix} + s \cdot \begin{pmatrix} 2 \\ 1 \end{pmatrix} = \begin{pmatrix} -1+2s \\ 1+s \end{pmatrix}$

let the normal form be $ax_0 + by = d$.

let $a = -1$

$b = 2$

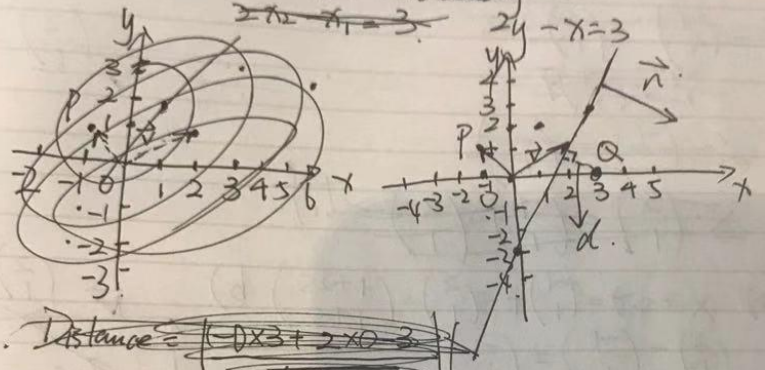
$d = -x_0 + 2y$

$-(-1+2s) + 2(1+s) = -x_0 + 2y$

$1 - 2s + 2 + 2s = -x_0 + 2y$

$2y - x = 3$

b).



c. ~~Distance = $\frac{|(-1)\times 3 + 2\times 0 - 3|}{\sqrt{(-1)^2 + 2^2}}$~~

$= \frac{|-3-3|}{\sqrt{5}} = \frac{6}{\sqrt{5}}$

$\vec{n} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

$\vec{OP} = \begin{pmatrix} -1 \\ 1 \end{pmatrix} - \begin{pmatrix} 3 \\ 0 \end{pmatrix} = \begin{pmatrix} -4 \\ 1 \end{pmatrix}$

$\frac{d(-\langle \vec{n}, Q \rangle}{|\vec{n}|} = \frac{\langle \vec{n}, P \rangle - \langle \vec{n}, OQ \rangle}{|\vec{n}|}$

$= \frac{\langle \vec{n}, \vec{OP} \rangle}{|\vec{n}|}$

$= \frac{4+2}{\sqrt{5}}$

$= \frac{6}{\sqrt{5}}$

$d.\ Q' = \begin{pmatrix} 3 \\ 0 \end{pmatrix} + \frac{3-(-3)}{5} \times \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

$= \begin{pmatrix} 3 \\ 0 \end{pmatrix} + \frac{6}{5} \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

$= \begin{pmatrix} 3 - \frac{6}{5} \\ \frac{12}{5} \end{pmatrix} = \begin{pmatrix} \frac{9}{5} \\ \frac{12}{5} \end{pmatrix}$

e.g. $Q'' = \begin{pmatrix} 3 \\ 0 \end{pmatrix} + 2 \times \frac{3-(-3)}{\sqrt{5}} \cdot \frac{\begin{pmatrix} -1 \\ 2 \end{pmatrix}}{\sqrt{5}}$

$= \begin{pmatrix} 3 \\ 0 \end{pmatrix} + 2 \times \frac{6}{5} \cdot \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

$= \begin{pmatrix} 3 \\ 0 \end{pmatrix} + \frac{12}{5} \cdot \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

$= \begin{pmatrix} 3 \\ 0 \end{pmatrix} + \begin{pmatrix} -\frac{12}{5} \\ \frac{24}{5} \end{pmatrix}$

$= \begin{pmatrix} \frac{3}{5} \\ \frac{24}{5} \end{pmatrix}$.