VECTOR EQUATION OF A LINE

Draw coordinates labelled from -10 to 15 on both x and y. This area represents a sea on which two ships set sail (the units are kilometres).

(a) The "Anna" sets sail from port P, which is situated at (-8,-9). Label this point P. In each hour she moves by a vector $\begin{pmatrix}4\\3\end{pmatrix}$.

Plot the position of the "Anna" after 1 hour, after 2 hours and after 5 hours, labelling these points A_1 , A_2 and A_5. (Also label the point P as A_0 .)

(b) Explain why the position vector of the "Anna" can be described by the equation:

$\mathbf{a} = \begin{pmatrix}-8\\-9\end{pmatrix} + t\begin{pmatrix}4\\3\end{pmatrix}$ where t is the time (in hours) since she set sail.

(c) Find the length of the vector $\begin{pmatrix}4\\3\end{pmatrix}$. What is the speed of the "Anna" in km/h?

(d) The "Betty" set sail 2 hours later than the "Anna" from port Q. Its course is given by the vector equation:

$\mathbf{b} = \begin{pmatrix}-7\\13\end{pmatrix} + (t\text{-}2)\begin{pmatrix}3\\-2\end{pmatrix}$

Where is port Q? Mark port Q on the map. Also label this point as B_2 . (Why?). Plot and label the points B_4 and B_6 also.

(e) Find the speed of the "Betty" in km/h.

(f) Where will the courses of the ships cross? How many hours after leaving port will the "Anna" arrive at this point? Where will the "Betty" be at this time?

(g) At what value of t will the "Betty" reach the point at which the courses cross? How many hours is this since she left port Q? Where is the "Anna" at this time? (this position of the Anna will not quite fit on the graph.)

(h) How far apart were the ships at time t=3?

(i) On what bearing is the "Anna" sailing? On what bearing is the "Betty" sailing?