

7  $A$  and  $B$  are fixed points in the  $x$ - $y$  plane. The position vectors of  $A$  and  $B$  are  $\mathbf{a}$  and  $\mathbf{b}$  respectively.

State, with reference to points  $A$  and  $B$ , the geometrical significance of

(a) the quantity  $|\mathbf{a} - \mathbf{b}|$ , [1]

(b) the vector  $\frac{1}{2}(\mathbf{a} + \mathbf{b})$ . [1]

The circle  $P$  is the set of points with position vector  $\mathbf{p}$  in the  $x$ - $y$  plane which satisfy

$$\left| \mathbf{p} - \frac{1}{2}(\mathbf{a} + \mathbf{b}) \right| = \frac{1}{2} |\mathbf{a} - \mathbf{b}|.$$

(c) State, in terms of  $\mathbf{a}$  and  $\mathbf{b}$ ,

(i) the position vector of the centre of  $P$ , [1]

(ii) the radius of  $P$ . [1]

It is now given that  $\mathbf{a} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$ ,  $\mathbf{b} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$  and  $\mathbf{p} = \begin{pmatrix} x \\ y \end{pmatrix}$ .

(d) Find a cartesian equation of  $P$ . [4]