

## Exercise 2B

In these questions  $\mathbf{i}$  and  $\mathbf{j}$  are unit vectors in the direction of the positive  $x$  and  $y$  axes respectively.

- Given that  $\mathbf{a} = 5\mathbf{i} - \mathbf{j}$  and  $\mathbf{b} = 6\mathbf{i} + 3\mathbf{j}$  find in terms of  $\mathbf{i}$  and  $\mathbf{j}$ :
  - $3\mathbf{b}$
  - $\frac{1}{3}\mathbf{b}$
  - $2\mathbf{a}$
  - $3\mathbf{b} + 2\mathbf{a}$
  - $\mathbf{a} + \mathbf{b}$
  - $-\mathbf{a} + \mathbf{b}$
  - $2(\mathbf{b} + \mathbf{a})$
  - $-4\mathbf{a}$
  - $\mathbf{b} + \mathbf{b}$
- Find the magnitude of the following vectors:
  - $15\mathbf{j} + 20\mathbf{i}$
  - $\mathbf{i} + 2\mathbf{j}$
  - $24\mathbf{i} - 7\mathbf{j}$
  - $\mathbf{i} + \mathbf{i} + \mathbf{i}$
  - $\sqrt{2}\mathbf{i} - \sqrt{2}\mathbf{j}$
  - $\mathbf{i} + \sqrt{15}\mathbf{j}$
- Find the acute angle between vectors  $\mathbf{a}$  and  $\mathbf{b}$ , where  $\mathbf{a} = \mathbf{i} + \mathbf{j}$  and  $\mathbf{b} = 2\mathbf{i}$ .
- Find a unit vector in the direction of the vector  $-3\mathbf{i} - 4\mathbf{j}$ .
  - Find  $\lambda$  if  $3\mathbf{i} - \mathbf{j}$  is parallel to  $\lambda\mathbf{i} - 4\mathbf{j}$ .
- Find in the form  $a\mathbf{i} + b\mathbf{j}$ :
  - a vector of magnitude 15 in the direction of  $4\mathbf{i} + 3\mathbf{j}$
  - a vector of magnitude 26 in the direction of  $12\mathbf{i} - 5\mathbf{j}$
  - a vector of magnitude 50 in the direction of  $7\mathbf{i} + 24\mathbf{j}$
  - a vector of magnitude 1 (a unit vector) in the direction of  $4\mathbf{i} + 3\mathbf{j}$
  - a vector of magnitude 82 in the direction of  $-9\mathbf{i} - 40\mathbf{j}$
- Four points have the following co-ordinates:  $A(4, 1)$ ,  $B(2, 5)$ ,  $C(1, -3)$  and  $D(0, 5)$ . Find in the form  $\mathbf{r} = a\mathbf{i} + b\mathbf{j}$  the following vectors:
  - $\vec{OA}$ ,
  - $\vec{OB}$ ,
  - $\vec{AB}$ ,
  - $\vec{OC}$
  - $\vec{AC}$ ,
  - $\vec{OD}$ ,
  - $\vec{DA}$ ,
  - $\vec{BC}$
- Find the distance of each of the following points from the origin:
  - $A(8, 6)$
  - $B(12, -5)$
  - $C(1, -1)$
  - $D(-3, -4)$
  - $E(-6, 0)$
  - $C(15, 12)$
- Points  $P$  and  $Q$  are given by  $\vec{OP} = (-3\mathbf{i} + \mathbf{j})$  and  $\vec{OQ} = 6\mathbf{i} + 3\mathbf{j}$ . Find:
  - the distance  $OP$
  - $\vec{PQ}$  in vector form
  - the distance  $PQ$ .