1 A and B are points on the Cartesian plane such that $\overrightarrow{OA} = 2\boldsymbol{i} + \boldsymbol{j}$ and $\overrightarrow{OB} = 3\boldsymbol{i} + 4\boldsymbol{j}$. Find $\overrightarrow{AB}$.

2 In the triangle OAB, $\overrightarrow{OA} = 3\boldsymbol{i} + 5\boldsymbol{j}$ and $\overrightarrow{OB} = -4\boldsymbol{i} + \boldsymbol{j}$. M is the midpoint of AB.

a Find $\overrightarrow{OM}$ in terms of $\boldsymbol{i}$ and $\boldsymbol{j}$.

b Find $|\overrightarrow{OM}|$.

3 $A = (-1, 2)$, $B = (3, 3)$ and O is the origin. Express the following vectors in the form $\begin{bmatrix} a \\ b \end{bmatrix}$.

a $\overrightarrow{OA}$

b $\overrightarrow{AB}$

c $\overrightarrow{BA}$

4 Let $\boldsymbol{a} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$, $\boldsymbol{b} = \begin{bmatrix} -3 \\ 1 \end{bmatrix}$ and $\boldsymbol{c} = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$.

a Find:

i $\boldsymbol{a} + \boldsymbol{b}$

ii $2\boldsymbol{c} + \boldsymbol{b} - 3\boldsymbol{a}$

b Show that $\boldsymbol{a} + \boldsymbol{b}$ is parallel to $\boldsymbol{c}$.

5 Find the values of m and n such that $m\begin{bmatrix} 2 \\ 4 \end{bmatrix} + n\begin{bmatrix} 3 \\ -3 \end{bmatrix} = \begin{bmatrix} -19 \\ 61 \end{bmatrix}$.

6 A (1, 1), B (4, 5) and C (5, –2) are the vertices of the triangle ABC. Show that triangle ABC is an isosceles right-angled triangle.

7 Find the unit vector in the direction of each of the following vectors.

a $\boldsymbol{a} = 3\boldsymbol{i} - 4\boldsymbol{j}$

b $\boldsymbol{b} = 3\boldsymbol{i} - \boldsymbol{j} + 2\boldsymbol{k}$

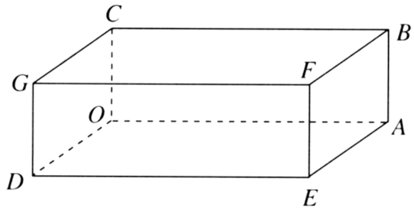
8 Let $\boldsymbol{a} = 2\boldsymbol{i} - 3\boldsymbol{j} + \boldsymbol{k}$ and $\boldsymbol{b} = -\boldsymbol{i} - \boldsymbol{j} + 3\boldsymbol{k}$. Find:

a $\boldsymbol{a} - \boldsymbol{b}$

b $3(\boldsymbol{a} - \boldsymbol{b})$

c $|\boldsymbol{a} - \boldsymbol{b}|$

9 *OABCDEFG* is a cuboid with $\overrightarrow{OA} = 4\boldsymbol{j}$, $\overrightarrow{OC} = 2\boldsymbol{k}$ and $\overrightarrow{OD} = \boldsymbol{i}$.



M is such that $\overrightarrow{OM} = \frac{2}{3}\overrightarrow{OE}$ and *N* is the midpoint of *BF*. Find:

a $\overrightarrow{MN}$

b $|\overrightarrow{MN}|$.

10 Triangle *OAB* has one vertex at the origin *O*. Vertices *A* and *B* are given by the position vectors $\overrightarrow{OA} = \begin{bmatrix} 5 \\ 3 \end{bmatrix}$ and $\overrightarrow{OB} = \begin{bmatrix} 2 \\ -5 \end{bmatrix}$. Find the perimeter of the triangle *OAB*, correct to two decimal places.

11 The quadrilateral *PQRS* is a parallelogram. The point *P* has coordinates (5, 8), the point *R* has coordinates (32, 17) and the vector $\overrightarrow{PQ}$ is given by $\overrightarrow{PQ} = \begin{bmatrix} 20 \\ -15 \end{bmatrix}$.

a Find the coordinates of *Q* and write down the vector $\overrightarrow{QR}$.

b Write down the vector $\overrightarrow{RS}$ and show that the coordinates of *S* are (12, 32).