VECTORS IN TWO DIMENSIONS

1 If vector $\underset{\sim}{a}$ is represented by the ordered pair (2, −6), specify an ordered pair for each of the following vectors.

(a) $3\underset{\sim}{a}$ **(b)** $\frac{1}{2}\underset{\sim}{a}$ **(c)** $-\underset{\sim}{a}$ **(d)** $0.4\underset{\sim}{a}$

2 If vector $\underset{\sim}{b}$ is represented by the column vector $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$, specify a column vector for each of the following vectors.

(a) $-2\underset{\sim}{b}$ **(b)** $5\underset{\sim}{b}$ **(c)** $\frac{1}{3}\underset{\sim}{b}$ **(d)** $-\frac{5}{4}\underset{\sim}{b}$

4 If $\underset{\sim}{c}$ is the position vector of (6, −3), represent each of the vectors as a column vector.

(a) $-\underset{\sim}{c}$ **(b)** $2\underset{\sim}{c}$ **(c)** $-\frac{1}{3}\underset{\sim}{c}$ **(d)** $1.5\underset{\sim}{c}$

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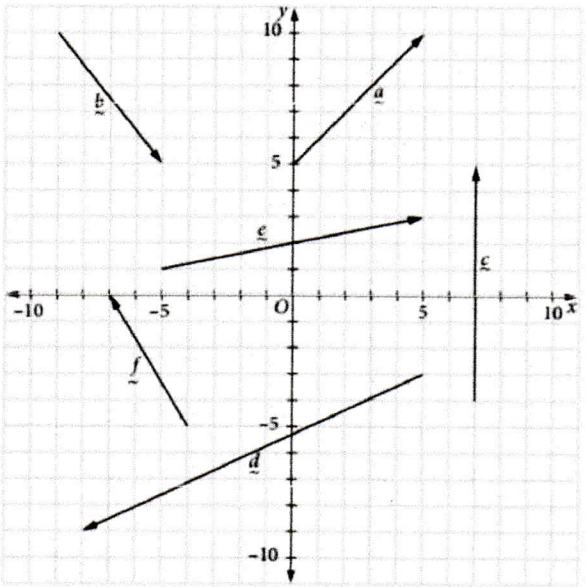
Represent

5 Menu resent each of the vectors in the plane shown as an ordered pair.

(a) $\underset{\sim}{a}$ (b) $\underset{\sim}{b}$ (c) $\underset{\sim}{c}$

(d) $\underset{\sim}{d}$ (e) $\underset{\sim}{e}$ (f) $\underset{\sim}{f}$



8 Which of the following represents the vector from the point (2, 6) to the point (−1, 8)?

A $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ B $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ C $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ D $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$

10 Draw the following vectors on the Cartesian plane.

(a) $\underset{\sim}{a}$, the position vector of $\begin{pmatrix}1\\3\end{pmatrix}$ **(b)** $\underset{\sim}{b}$, the position vector of $\begin{pmatrix}-2\\2\end{pmatrix}$ **(c)** $\underset{\sim}{c}$, the position vector of $\begin{pmatrix}-3\\-4\end{pmatrix}$

(d) $\overrightarrow{OD}$, where D is $\begin{pmatrix}1\\-2\end{pmatrix}$ **(e)** $\overrightarrow{OE}$, where E is $\begin{pmatrix}0\\-5\end{pmatrix}$ **(f)** $\overrightarrow{OF}$, where F is $\begin{pmatrix}-2\\-5\end{pmatrix}$

12 The points A, B and C have coordinates $(-2, -3)$, $(2, 3)$ and $(8, -1)$ respectively.

(a) Find the vectors $\overrightarrow{AB}$, $\overrightarrow{BC}$ and $\overrightarrow{AC}$ and express them in column vector form.

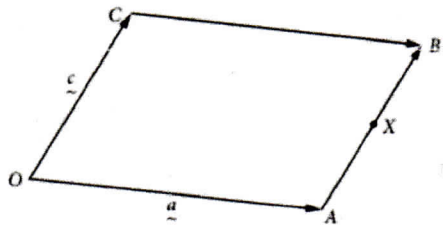
(b) Find $\left|\overrightarrow{AB}\right|$, $\left|\overrightarrow{BC}\right|$ and $\left|\overrightarrow{AC}\right|$.

(c) Use Pythagoras' theorem to prove that ΔABC is a right-angled triangle.

(d) Find the coordinates of a point D such that $ABCD$ forms a square.

(e) Find the coordinates of the point of intersection of the diagonals of the square $ABCD$.

13 $OABC$ is a parallelogram with $\overrightarrow{OA} = \underset{\sim}{a}$ and $\overrightarrow{OC} = \underset{\sim}{c}$. X is the midpoint of $\overrightarrow{AB}$ as shown.



(a) Find the vectors $\overrightarrow{OB}$ and $\overrightarrow{OX}$ in terms of $\underset{\sim}{a}$ and $\underset{\sim}{c}$.

(b) Find the vector $\overrightarrow{CX}$ in terms of $\underset{\sim}{a}$ and $\underset{\sim}{c}$.

(c) If Y is a point on $\overrightarrow{CX}$, such that $\overrightarrow{CY} = \frac{2}{3}\overrightarrow{CX}$, find $\overrightarrow{CY}$ in terms of $\underset{\sim}{a}$ and $\underset{\sim}{c}$.

(d) Find $\overrightarrow{OY}$ and hence show that Y lies on $\overrightarrow{OB}$.

(e) Find the ratio $\overline{OY} : \overline{YB}$.

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14 a) The coordinates of points A and B are respectively $(-\ 3, 6)$ and $(2, 9)$. Find the position vector of the midpoint M of $\overline{AB}$.

b) The coordinates of points C and D are respectively $(1, 7)$ and $(5, 3)$. Find the position vectors of the points P_1 and P_2 trisecting $\overline{CD}$ in three equal parts.

c) Let the position vectors of A and B be respectively $\vec{a}$ and $\vec{b}$. Let P be a point which divides $\overline{AB}$ in the ratio $m: n$, so that $\frac{\overline{AP}}{\overline{AB}} = \frac{m}{m+n}$. Show that the position vector of point P is $\frac{n}{m+n}\vec{a} + \frac{m}{m+n}\vec{b}$.