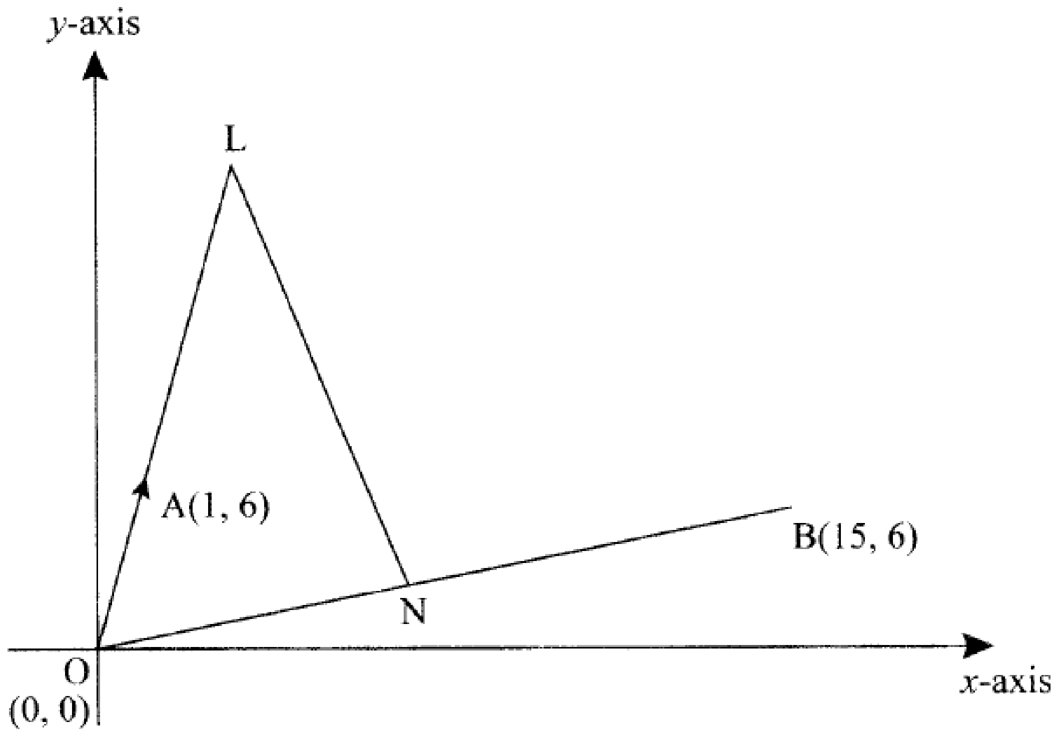
VECTORS II QUESTIONS AND ANSWERS ON COLLINEARITY MODEL26042023 FORM 3 LEVEL

1 Given that OA = 3i+ 4j+ 7k, OB= 4i + 3j + 9k and OC = i + 6j + 3k. Show that points A, B and C are collinear.

2 In the diagram below, the coordinates of points A and B are (1,6) and (15, 6) respectively.



Point N is on OB and that 30N = 2OB. Line OA is produced to L such that OL = 3OA.

a) Find vector LN
b) Given that a point M is on LN such that LM: MN = 3: 4 find the coordinate of M
c) If line OM is produced to T such a that OM: MT= 6:1
  i)Find the position vector of T
  ii) Show that points L, T and B are collinear

3 The position vectors of points P, Q and R are **OP** = $\begin{pmatrix}-3\\6\end{pmatrix}$, **OQ** = $\begin{pmatrix}2\\1\end{pmatrix}$, **OR** = $\begin{pmatrix}4\\-1\end{pmatrix}$. Show that P, Q and R are collinear.

1

$AB = \begin{pmatrix}4\\3\\9\end{pmatrix} - \begin{pmatrix}3\\4\\7\end{pmatrix} = \begin{pmatrix}1\\-1\\2\end{pmatrix}$		
$AC = \begin{pmatrix}1\\6\\3\end{pmatrix} - \begin{pmatrix}3\\4\\7\end{pmatrix} = \begin{pmatrix}-2\\2\\-4\end{pmatrix}$	B1	For **AB** or **AC** or BC Allow if student works in $\underset{\sim}{i}$, $\underset{\sim}{j}$ and $\underset{\sim}{k}$ forms.
AC = - 2 **AB**	B1	or equivalent
AB // **AC** and A is a common point	B1	or equivalent
∴ A, B and C are collinear.	3	*condone omission of vector signs.

2

Answer

$$OL = 3\begin{pmatrix}1\\6\end{pmatrix}$$

$$= \begin{pmatrix}3\\18\end{pmatrix}$$

$$ON = \frac{2}{3}\begin{pmatrix}15\\6\end{pmatrix}$$

$$= \begin{pmatrix}10\\4\end{pmatrix}$$

$$LN = ON - OL$$

$$= \begin{pmatrix}10\\4\end{pmatrix} - \begin{pmatrix}3\\18\end{pmatrix}$$

$$= \begin{pmatrix}7\\-14\end{pmatrix}$$

(b)Given that a point M is on LN such that LM: MN = 3: 4, fin of (2 marks)

Answer

$$OM = OL + \frac{3}{7}LN$$

$$= \begin{pmatrix}3\\18\end{pmatrix} + \frac{3}{7}\begin{pmatrix}7\\-14\end{pmatrix}$$

$$= \begin{pmatrix}3\\18\end{pmatrix} + \begin{pmatrix}3\\-6\end{pmatrix}$$

$$= \begin{pmatrix}6\\12\end{pmatrix}$$

$$= M(6,12)$$

Answer

$$OT = \frac{7}{6}OM$$

$$= \frac{7}{6}\begin{pmatrix}6\\12\end{pmatrix}$$

$$= \begin{pmatrix}7\\14\end{pmatrix}$$

(ii) Show that points L, T and B are collinear

Answer

$$LT = \begin{pmatrix}7\\14\end{pmatrix} - \begin{pmatrix}3\\18\end{pmatrix}$$

$$= \begin{pmatrix}4\\-4\end{pmatrix}$$

$$LB = \begin{pmatrix}15\\6\end{pmatrix} - \begin{pmatrix}3\\18\end{pmatrix}$$

$$= \begin{pmatrix}12\\-12\end{pmatrix}$$

$$LB = 3LT$$

L is the common point.

3

$\mathbf{PQ} = \begin{pmatrix}3\\-6\end{pmatrix} + \begin{pmatrix}2\\1\end{pmatrix} = \begin{pmatrix}5\\-5\end{pmatrix}$	B1
$\mathbf{QR} = \begin{pmatrix}4\\-1\end{pmatrix} - \begin{pmatrix}2\\1\end{pmatrix} = \begin{pmatrix}2\\-2\end{pmatrix}$	B1
$\mathbf{PQ} = \frac{5}{2}\,\mathbf{QR}$ and Q is a common point $\therefore$ P, Q and R are collinear	B1