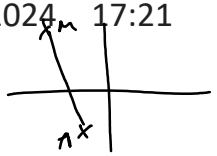
5 Vector problems

DONE

21 December 2024 17:21

$A = 4\underline{i} - 8\underline{j}$

$M = -8\underline{i} + 17\underline{j}$



$B = \begin{pmatrix} -(8+\lvert -8-4\rvert) \\ 17+\lvert 17+8\rvert \end{pmatrix} = \begin{pmatrix} -20 \\ 42 \end{pmatrix}$

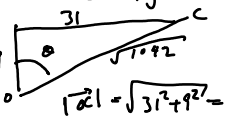
$\overrightarrow{OA} = 5\underline{i} - 7\underline{j}$

$\overrightarrow{AB} = 10\underline{i} + 18\underline{j}$

$\overrightarrow{BC} = 16\underline{i} - 2\underline{j}$

$\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AB} + \overrightarrow{BC}$

$= 31\underline{i} + 9\underline{j}$



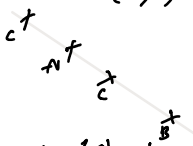
$\theta = \arctan\left(\frac{31}{9}\right)$

$= 73.8° \therefore 074°$

$|\overrightarrow{OC}| = \sqrt{31^2 + 9^2} = \sqrt{1042}$

A (2, 5)

B (8, 1)



$\overrightarrow{AB} = \begin{pmatrix} 8 \\ 1 \end{pmatrix} - \begin{pmatrix} 2 \\ 5 \end{pmatrix} = \begin{pmatrix} 6 \\ -4 \end{pmatrix}$

$\overrightarrow{AC} = k\begin{bmatrix} 6 \\ -4 \end{bmatrix} = \begin{bmatrix} 6k \\ -4k \end{bmatrix}$

$|\overrightarrow{AC}| = 4 = \sqrt{36k^2 + 16k^2}$

$\therefore k = \pm\frac{2}{\sqrt{13}} = \frac{\pm 2\sqrt{13}}{13}$

$\overrightarrow{OC} = \begin{bmatrix} 2 \\ 5 \end{bmatrix} + \overrightarrow{AC}$

$= \begin{pmatrix} 2 \\ 5 \end{pmatrix} \pm \begin{pmatrix} \frac{12\sqrt{13}}{13} \\ -\frac{8\sqrt{13}}{13} \end{pmatrix} = \begin{pmatrix} 5.31 \\ 2.78 \end{pmatrix}$ or $\begin{pmatrix} -1.33 \\ 7.22 \end{pmatrix}$

$F_1 + F_2 + F_3 = 0$

$8\underline{i} + \underline{j} - 6\underline{i} + 2\underline{j} + p\underline{i} + q\underline{j} = 0$

$2\underline{i} + 3\underline{j} = -p\underline{i} - q\underline{j}$

$\Rightarrow p = -2, \; q = -3$

a) $\underline{s} = ?$

$\underline{u} = 2\underline{i} + 9\underline{j}$

$\underline{v} = ?$

$\underline{a} = -9.8\underline{j}$

$t = 0.2$

a) $\underline{s} = \underline{u}t + \frac{1}{2}\underline{a}t^2$

$= 0.4\underline{i} + 1.8\underline{j} - 0.196\underline{j}$

$\underline{s} = 0.4\underline{i} + 1.604\underline{j}$

$\therefore$ Position $= (0.4\underline{i} + 3.60\underline{j})$

(b) $\underline{v} = \underline{u} + \underline{a}t$

$= 2\underline{i} + 9\underline{j} - 1.96\underline{j}$

$= 2\underline{i} + 7.04\underline{j}$ ms^{-1}

A (3, 2, 1)

B (8, −1, −1)

C (4, −7, 2)

$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = \begin{pmatrix} 5 \\ -3 \\ -2 \end{pmatrix}$

$\overrightarrow{OD} = \overrightarrow{OA} + \overrightarrow{AD} = \begin{pmatrix} 17 \\ -2 \\ -3 \end{pmatrix}$

$\overrightarrow{DE} = \begin{pmatrix} -8 \\ -12 \\ 6 \end{pmatrix}$

$\therefore |\overrightarrow{DE}| = 2\sqrt{61}$

$\overrightarrow{DE} : \overrightarrow{BC}$

$\therefore 2\sqrt{61} : \sqrt{61}$

$\therefore 2 : 1$

$\overrightarrow{AC} = \overrightarrow{OC} - \overrightarrow{OA} = \begin{pmatrix} 1 \\ -9 \\ 1 \end{pmatrix}$

$\overrightarrow{AE} = 2\overrightarrow{AC} = \begin{pmatrix} 2 \\ -18 \\ 2 \end{pmatrix}$

$\overrightarrow{OE} = \overrightarrow{OA} + \overrightarrow{AE} = \begin{pmatrix} 5 \\ -16 \\ 3 \end{pmatrix}$

$\overrightarrow{BC} = \begin{pmatrix} -4 \\ -6 \\ 1 \end{pmatrix}$

$\therefore |\overrightarrow{BC}| = \sqrt{61}$