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Department → Aeronautical & Astronautical Engineering

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Assignment Title → Assignment for Mr Olaunlola and Dr Oyelami's groups

(1) A Particle moves along a curve $x = 7t^2$, $y = 6t^2 - 4t$

$z = t - 5$, where t = time. find the velocity.

Solution

The position vector $r = x\hat{i} + y\hat{j} + z\hat{k}$

i.e $r = (7t^2)\hat{i} + (6t^2 - 4t)\hat{j} + (t - 5)k$

velocity $\frac{dr}{dt}$

$$\frac{dr}{dt} = 14t\hat{i} + (2t - 4)\hat{j} + k$$

ans.

(2) If $\bar{A} = \hat{i} + 2\hat{j} - 4k$, $\bar{B} = 2\hat{i} + 3\hat{j} + k$, $\bar{C} = 4\hat{j} - 3k$,

find $\bar{A} \times (\bar{B} \times \bar{C})$

solution

$$\bar{B} \times \bar{C} = \begin{vmatrix} \hat{i} & \hat{j} & k \\ 2 & -3 & 1 \\ 0 & 4 & -3 \end{vmatrix}$$

$$= \hat{i}\begin{vmatrix} -3 & 1 \\ 4 & -3 \end{vmatrix} - \hat{j}\begin{vmatrix} 2 & 1 \\ 0 & -3 \end{vmatrix} + k\begin{vmatrix} 2 & -3 \\ 0 & 4 \end{vmatrix}$$

$$\bar{B} \times \bar{C} = \hat{i}(9-4) - \hat{j}(-6-0) + k(8-0)$$

$$= 5\hat{i} + 6\hat{j} + 8k$$

Hence

$$\bar{A} \times (\bar{B} \times \bar{C}) = \begin{vmatrix} \hat{i} & \hat{j} & k \\ 1 & 2 & -4 \\ 5 & 6 & 8 \end{vmatrix}$$

$$= \hat{i}\begin{vmatrix} 2 & -4 \\ 6 & 8 \end{vmatrix} - \hat{j}\begin{vmatrix} 1 & -4 \\ 5 & 8 \end{vmatrix} + k\begin{vmatrix} 1 & 2 \\ 5 & 6 \end{vmatrix}$$

$$= \hat{i}(16-(-24)) - \hat{j}(8-(-20)) + k(6-10)$$

$$= 40\hat{i} - 28\hat{j} - 4k$$

ans

(3) Given $R = 4\sin 3t\,\hat{i} + 4e^{3t}\,\hat{j} + 7t^{3}\,\hat{k}$. find the integral of R with respect to t

solution

$$\frac{dR}{dt} = 12\cos 2t\,\hat{i} + 3e^{2t}\,\hat{j} + 2t^{2}\,\hat{k}$$

ans-

(vi) If $A = 7i + 2j - k$, $B = 2i + j + 4k$, $C = i + j + k$,

find $(A + C)\cdot(B - A)$

Solution

$$(A + C) = (7i + 2j - k) + (i + j + k)$$

$$= 8i + 3j$$

$$(B - A) = (2i + j + 4k) - (7i + 2j - k)$$

$$= 2i + j + 4k - 7i - 2j + k$$

$$= -5i - j + 5k$$

$$\therefore (A + C)\cdot(B - A) = (8i + 3j)(-5i - j + 5k)$$

$$= \cancel{4}0 - 3$$

$$= 37$$

ans.

(5) find ~~a~~ unit vector tangent to the space curve $x = t$, $y = t^2$, $z = t^3$ at the point where $t = 1$

Solution

$$r = t\,i + t^2 j + t^3 k$$

$$\frac{dr}{dt} = i + 2t\,j + 3t^2 k$$

at $t = 1$, $\dfrac{dr}{dt} = i + 2j + 3k$

$$\left|\frac{dr}{dt}\right|, t = 1 = \sqrt{1^2 + 2^2 + 3^2}$$

$$= \sqrt{1+4+9}$$

$$= \sqrt{14}$$

$$= 3.7$$

Hence $T = \dfrac{i + 2j + 3k}{3.7}$

ans.