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MAT 102

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Assignment

1. A Particle moves along a curve, $x = 7t^2$, $y = 6t^2 - 4t$, $z = t - 5$, where t is time. Find its Velocity

Solution

$$\text{Velocity} = \frac{dr}{dt}$$

Position Vector $r = xi + yj + zk$

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

$$\frac{dr}{dt} = (14t)i + (12t - 4)j + k$$

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

Solution

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

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

$$= i(9 - 4) - j(-6 - 0) + k(8 + 0)$$

$$B \times C = 5i + 6j + 8k$$

Hence

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

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

$$= i(16 + 24) - j(8 + 20) + k(6 - 10)$$

$$= 40i - 28j - 4k$$

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

Solution

$R = 4\sin 3t i + 4e^{3t} j + 7t^3 K$

$\int R\,dt = -\frac{1}{12}\cos 3t i + \cancel{12e}\frac{1}{12}e^{3t} j + \frac{7t^4}{4} K + C$

4. If $A = 7i + 2j - K$, $B = 2i + j + 4K$, $C = i + j + K$, find $(A+C)\cdot(B-A)$

Solution

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

$= 8i + 3j$.

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

$= -5i - j + 5K$

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

$= -40i - 3j$

5. Find a unit vector tangent to the space curve $x = t, y = t^2, Z =$ at the Point where $t = 1$

Solution

$T = \frac{dr/dt}{|dr/dt|}$

$r = ti + t^2 j + t^3 K$

$\frac{dr}{dt} = i + 2tj + 3t^2 K$

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

$\left|\frac{dr}{dt}\right|_{t=1} = \sqrt{1^2 + 2^2 + 3^2} = 3.7$

Then; $T = \frac{i + 2j + 3K}{3.7}$