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C. CODE: MAT 102

MATRIC NO.: 19/SCI18/002

1. velocity = d/t

since we are dealing with position vectors, let $P(x, y, z)$ be any point on the given curve and $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ be the position vector of P relative to O as the origin

Substituting x, y, z in $\vec{r}$

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

So velocity vector $\vec{v}$

will be differential of $\vec{r}$ in respect to t

Differentiating

vector $\vec{v} = \dfrac{d\vec{r}}{dt} = 14t\hat{i} + (12t - 4)\hat{j} + \hat{k}$

2. $A = i + 2j - 4k$

$B = 2i - 3j + k$

$C = 4j - 3k$

Find $A \times (B \times C)$

$= i + 2j - 4k \times [(2i - 3j + k) \times (4j - 3k)]$

$= i + 2j - 4k \times [2i - 12j - 3k]$

$\therefore A \times (B \times C) = 2i - 24j - 12k$

3. $R = 4\sin 3t\,i + 4e^{2t}j + 7t^3 k$

$\int R\,dt = \frac{-4}{3}\cos 3t\,i + \frac{4}{3}e^{3t}j + \frac{7}{4}t^4 k$

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

$B = 2i + j + 4k$

$C = i + j + k$

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

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

$= (8i + 3j)$

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

$= (-5i + 3j + 5k)$

$\therefore (A + C) \cdot (B - A) = -40i + 9j + 5k$

5. $x = t \quad y = t^2 \quad z = t^3$

$r = xi + yj + zk$

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

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

At $t = 1$; $dr/dt = i + 2(1)j + 3(1^2)k$

$dr/dt = i + 2j + 3k$

$|dr/dt| = \sqrt{1^2 + 2^2 + 3^2}$

$= \sqrt{1 + 4 + 9} = \sqrt{14}$

$$T = \frac{dr/dt}{|dr/dt|} = \frac{i + 2j + 3k}{\sqrt{14}}$$