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COURSE TITLE: GENERAL MATHEMATICS II

1. A particle moves along a curves $x = 7t^2$, $y = 6t^2 - 4t$, $z = t - 5$, where t is time, find it's velocity.

The position vector, $r = xi + yj + zk$

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

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

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

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

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

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

$$= 5i + 6j + 8k$$

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

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

$$A \times (B \times C) = i(16 + 24) - j(20 + 8) + k(6 - 10)$$

$$A \times (B \times C) = 40i - 28j - 4k$$

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

$(A+C) = 7i + i + 2j + j - k + k$
$= 8i + 3j$

$(B-A) = 2i - 7i + j + 2j + 4k - k$
$= -5i - j + 3k$

$(A+C) = 8i + 3j$
$(B-A) = -5i - j + 3k$
$(A+C)\cdot(B-A) = (8i \times -5i) + (3j \times -j) + (0 \times 3k)$
$= -40 - 3$
$= -43$

5. Find a unit vector tangent the space curve $x = t$, $y = t^2$, $z = t^3$ at point where $t = 1$

$F(t) = (t)i + (t^2) + (t^3)k$

Tangent vector

$F'(t) = i + (2t)j + (3t^2)k$
$F'(1) = i + (2(1))j + (3(1)^2)k$
$F'(1) = i + 2j + 3k$

Unit tangent vector $= \dfrac{r}{|r|}$

$|r| = \sqrt{(1)^2 + (2)^2 + (3)^2}$
$= \sqrt{1 + 4 + 9}$
$= \sqrt{14}$

Unit tangent vector $= \dfrac{i + 2j + 3k}{\sqrt{14}}$