Name - Odiwari Efe Paul Olamide
Computer Science : Matric no - [illegible]

(1) $M = Pi - 6j - 3k$
$N = 4i + 3j - k$
$O = i - 3j + 2k$

(a) M and N are Perpendicular to each other

$M \cdot N = (Pi - 6j - 3k) \cdot (4i + 3j - k)$
$= 4P - 18 + 3$
$= 4P - 15$

Since they are perpendicular,
$4P - 15 = 0$
$\frac{4P}{4} = \frac{15}{4} \quad \therefore P = \frac{15}{4}$

(b) M, N and O are Coplanar

$$M \cdot (N \times O) = \begin{vmatrix} P & -6 & -3 \\ 4 & 3 & -1 \\ 1 & 3 & 2 \end{vmatrix}$$

$$= P\begin{vmatrix} 3 & -1 \\ -3 & 2 \end{vmatrix} + 6\begin{vmatrix} 4 & -1 \\ 1 & 2 \end{vmatrix} - 3\begin{vmatrix} 4 & 3 \\ 1 & -3 \end{vmatrix}$$

$= P(6-3) + 6(8+1) - 3(-12-3)$

$= 3p + 6(9) - 3(-15) = 0$

$= 3p + 54 + 45 = 0$

$= 3p + 99 = 0$

$\frac{3p}{3} = \frac{-99}{3} \therefore P = -33$

② $\overline{V} = (3i + 2j + 5k) + (i - j + 6k) + (5i + 2j - 3k)$

$\overline{U}$ $= 10i + 3j + 8k$

$a_x = 10, a_y = 3$ and $a_z = 8$

$|V| = \sqrt{10^2 + 3^2 + 8^2}$

$= \sqrt{100 + 9 + 64}$

$= \sqrt{173} = 13.15$

The direction Cosines are

$\cos\alpha = \frac{a_x}{|V|} = \frac{10}{13.15} = 0.761$

$\cos\beta = \frac{a_y}{|V|} = \frac{3}{13.15} = 0.228$

$$\therefore \int (F \cdot dv) = \left[i \int (u^3 + u^2 + 6u) \right] - \left[j \int (u^4 - 10u) \right] + \left[k \int (-3u^2 + 9u^2) \right]$$

$$= i \left[\int u^3 + u^2 + 6u - j \int u^4 - 10u + k \right] - 3u^2 \, 9x$$

$$= \left[\frac{u^4}{4} + \frac{u^3}{3} + \frac{{}^3\cancel{6}u^2}{\cancel{2}_1} \right] - j \left[\frac{u^5}{3} - \frac{{}^5\cancel{10}u^2}{\cancel{2}} \right] + k \left[\frac{-3u^4}{4} \ldots \right]$$

$$= \left[\frac{u^4}{4} + \frac{u^3}{3} + 3u^2 \right] - j \left[\frac{u^5}{3} - 5u^2 \right] + k \left[\frac{-u^4}{2} - 3u^2 \right]$$

~~∴ ∫(F·dv) = ∫ i (u³ + u² + 6u] - ∫ j (u⁴ - 10u] + ∫ k [-3u²~~

$$\therefore \int (F \cdot dv) = i \left[\frac{(1)^4}{4} + \frac{(1)^3}{3} + 3(1)^2 \right] - j \left(\frac{1^5}{3} - 5(1)^2 \right) + k \left[\frac{-(1)^4}{2} - 3(1)^3 \right] + C$$

$$\therefore \int (F \cdot dv) = i \left[\frac{1}{4} + \frac{1}{3} + 3 \right] + j \left[\frac{1}{3} - 5 \right] + k \left[\frac{-1}{2} - 3 \right] + C$$

$$\therefore \int (F \cdot dv) = i \left[\frac{43}{12} \right] - j \left[\frac{-14}{3} \right] + k \left[\frac{-7}{2} \right]$$

$$= \frac{43}{12} i + \frac{14}{3} j - \frac{7k}{2}$$

$\cos\theta = \frac{32}{|u|} \cdot \frac{8}{8.15} = 0.628$

(iv) Unit vector

$\hat{u} = \frac{v}{|v|} = \frac{10i + 3j + 2k}{13.15}$

(3) $F = 3ui + u^2 j + (u+2)k$

$V = 2ui - 3uj + (u-2)k$

$$(F \times V) = \begin{vmatrix} i & j & k \\ 3u & u^2 & [u+2] \\ 2u & -3u & (u-2) \end{vmatrix}$$

$$= i\begin{vmatrix} u^2 & (u+2) \\ -3u & (u-2) \end{vmatrix} - j\begin{vmatrix} 3u & (u+2) \\ 2u & (u-2) \end{vmatrix} + k\begin{vmatrix} 3u & u^2 \\ 2u & -3u \end{vmatrix}$$

$= i(u^2(u-2)) - [3u(u+2)] - j[3u[u-2] - 2u(u+2)]$
$+k(-9u^2 - 2u^3)$

$= i(u^3 - 2u^2 - (-3u^2 - 6u)] - j(3u^2 - 6u - 2u^2 - 4u] + k[$
$-9u^2]$

$= i(u^3 - 2u^2 + 3u^2 + 6u] - j(u^2 - 10u] + k[-2u^3 - 9u$

$= i[u^3 + u^2 + 6u] - j[u^2 - 10u] + k[-2u^3 - 9$