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

$V = 10\hat{i} + 3\hat{j} + 8k$

$ax = 10$, $ay = 3$ and $az = 8$

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

$= \sqrt{173} = 13.15$

(i) Direction Cosines are

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

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

$\cos\gamma = \frac{az}{|V|} = \frac{8}{13.15} = \underline{\underline{0.608}}$

(ii) Unit vector

$e_v = \frac{V}{|V|} = \frac{10\hat{i} + 3\hat{j} + 7k}{13.18}$

(3) $F = 3u\hat{i} + u^2\hat{j} + (u+2)k$

$= 2u\hat{i} - 3u\hat{j} + (u-2)k$

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

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

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

$= \hat{i}[u^3 - 2u^2 - [-3u^2 - 6u]] - \hat{j}[3u^2 - 6u - 2u^2 - 4u] + k[-2u^3$
$9u^2]$

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

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

$\int_0^1 (f \times v) = \int i[u^3 + u^2 + 6u] - \int i[u^2 - 10u] + \int k[-2u^3$

$= i\int u^3 + u^2 + 6u - \hat{j}\int u^2 - 10u + k\int -2u^3 -$

$= \left[\frac{u^4}{4} + \frac{u^3}{3} + \frac{6u}{2}\right] - \hat{j}\left[\frac{u^3}{3} - \frac{10u}{2}\right] + k\left[\frac{-2u}{4}\right.$

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

$\int_0^1 (f \times v) = i\left(\frac{(1)^4}{4} + \frac{(1)^3}{3} + 3(1)^2\right] - \hat{j}\left[\frac{(1)^3}{3}\right.$

$+ k\left[\frac{-(1)^4}{2} - 3(1)^3\right] + c - [0 + c]$

$\int_0^1 (f \times v) = i\left[1/4 + 1/3 + 3\right] - \hat{j}\left[1/3 - 5\right] - k[$

$+ 4 - 4$

$\int_0^1 (f \times v) = \hat{i}\left[43/12\right] - \hat{j}\left[14/3\right] + k[$

$\int_0^1 (k \times v) = \frac{43}{12}\hat{i} + \frac{14}{3}\hat{j} - 7/2\, k$

Agboola Gbolahan Collins

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(1) $M = p\hat{i}\ 6\hat{j} - 3k$

$N = 4\hat{i} + 3\hat{j} - k$

$O = \hat{i} - 3\hat{j} + 2k$

(a) M and N are perpendicular to eachother

$M \cdot N = (p\hat{i} - 6\hat{j} - 3k) \cdot (4\hat{i} + 3\hat{j} - k)$

$= 4p - 18 + 3$

$= 4p - 15$

$\therefore\ 4p - 15 = 0$

$\frac{\cancel{4}p}{\cancel{4}} = \frac{15}{4} \qquad p = \frac{15}{4}$

(b) M and N and O are coplaner

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

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

$= p(6-3) + 6(9+1) - 3(-12-$

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

$= 3p + 99 = 0$

$\frac{\cancel{3}p}{\cancel{3}} = \frac{-99}{3} \qquad p = -33$