

$$2) \vec{r} = (3\hat{i} + 9\hat{j} + 8\hat{k}) + (2\hat{i} + 16\hat{k}) + (5\hat{i} + 2\hat{j} - 3\hat{k})$$

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

$$a_x = 10 \quad a_y = 3 \quad a_z = 8$$

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

$$= \sqrt{173} = 13.15$$

The direction cosines are

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

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

$$\cos \gamma = \frac{a_z}{|\vec{v}|} = \frac{8}{13.15} = 0.608$$

ii) unit vector

$$\vec{e}_v = \frac{\vec{v}}{|\vec{v}|} = \frac{10\hat{i} + 3\hat{j} + 8\hat{k}}{13.15}$$

$$3) \vec{F} = 3u\hat{i} + u^2\hat{j} + (u+2)\hat{k} \text{ and } \vec{V} = 2u\hat{i} - 3u\hat{j} + (u-2)\hat{k}$$

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

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

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

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

$$2) \vec{v} = (3\hat{i} + 2\hat{j} + 5\hat{k}) + (2\hat{i} + 1\hat{k}) + (5\hat{i} + 0\hat{j} - 3\hat{k})$$

$$10\hat{i} + 2\hat{j} + 2\hat{k}$$

$$a_x = 10 \quad a_y = 2 \quad a_z = 2$$

$$|\vec{v}| = \sqrt{10^2 + 2^2 + 2^2}$$

$$= \sqrt{112} = 10.58$$

The direction cosines are

$$\cos \alpha = \frac{a_x}{|\vec{v}|} = \frac{10}{10.58} = 0.945$$

$$\cos \beta = \frac{a_y}{|\vec{v}|} = \frac{2}{10.58} = 0.189$$

$$\cos \gamma = \frac{a_z}{|\vec{v}|} = \frac{2}{10.58} = 0.189$$

ii) unit vector

$$\hat{e}_v = \frac{\vec{v}}{|\vec{v}|} = \frac{10\hat{i} + 2\hat{j} + 2\hat{k}}{10.58}$$

$$3) \vec{F} = 3u\hat{i} + u^2\hat{j} + (u+2)\hat{k} \text{ and } \vec{v} = 2u\hat{i} - 3u\hat{j} + (u-2)\hat{k}$$

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

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

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

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

$$\int \sqrt{u^2 - 2u^2 + 3u^2 + 6u} + \int \left[u^2 - 10u \right] + k \int \left[-2u^3 - 9u^2 \right]$$

$$+ \int \left[u^3 + u^2 + 6u \right] - \int \left[u^2 - 10u \right] + k \int \left[-2u^3 - 9u^2 \right]$$

$$\int_0^1 (F_{xv}) dx = \int_1^2 \left[u^3 + u^2 + 6u \right] - \int_2^4 \left[u^2 - 10u \right] + \int k \int \left[-2u^3 - 9u^2 \right]$$

$$= \int_1^2 \left[u^3 + u^2 + 6u \right] - \int_2^4 \left[u^2 - 10u \right] + k \int \left[-2u^3 - 9u^2 \right]$$

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

$$\int_0^1 (F_{xv}) = \left[\frac{4^4}{4} + \frac{4^3}{3} + 3 \cdot 4^2 \right] - \left[\frac{2^3}{3} - 5 \cdot 2^2 \right] + k \left[-\frac{4^4}{2} - 3 \cdot 4^3 \right] + c \left[0 + 0 \right]$$

$$= \left[\frac{4^3}{12} \right] - \left[\frac{-4}{3} \right] + k \left[\frac{-7}{2} \right]$$

$$\int_0^1 (F_{xv}) = \frac{4^3}{12} + \frac{4}{3} - \frac{7}{2} k$$