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19/ENG05/051

Mechatronics Engineering

MAT 102

a. $M.N = 0$

$$P \times 4 - 6 \times 3 - 3 \times (-1) = 0$$

$$4P - 18 + 3 = 0$$

$$4P - 15 = 0$$

$$4P = 15$$

$$P = \frac{15}{4}$$

b. $M.(N \times O)$

$$\begin{vmatrix} P & -6 & -3 \\ 4 & 3 & -1 \\ 1 & -3 & 2 \end{vmatrix} = 0$$

$$P \begin{vmatrix} 3 & -1 \\ -3 & 2 \end{vmatrix} - 6 \begin{vmatrix} 4 & -1 \\ 1 & 2 \end{vmatrix} - 3 \begin{vmatrix} 4 & 3 \\ 1 & -3 \end{vmatrix} = 0$$

$$P(6 + 3) + 6(8 + 1) - 3(-12 - 3) = 0$$

$$9P + 54 + 45 = 0$$

$$\frac{9P}{9} = \frac{-99}{9}$$

$$P = -11$$

② $\text{Sum} = 3i + 2j + 5i + 2j - j + 2j + 5k + 6k - 3k$
 $= 10i + 3j + 8k$

$$\vec{C} = 10i + 3j + 8k$$

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

$$|C| = \sqrt{(10)^2 + (3)^2 + (8)^2}$$

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

$$|C| = \sqrt{173}$$

$$\cos \beta = \frac{3}{13.15} = 0.2281$$

$$\cos \gamma = \frac{8}{13.15} = 0.6084$$

$$r_c = \frac{10i + 3j + 8k}{\sqrt{175}}$$

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

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

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

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

$$\int_0^1 (u^3 + u^2 + 6u)i + \int_0^1 (-u^2 + 10u)j + \int_0^1 (-9u^2 - 2u^3)k$$

$$i \left[\frac{u^4}{4} + \frac{u^3}{3} + 3u^2 \right]_0^1 + j \left[-\frac{u^3}{3} + 5u^2 \right]_0^1 + k \left[-3u^2 - \frac{2u^4}{2} \right]_0^1 + C$$

$$= \left[\frac{1}{4} + \frac{1}{3} + 3 \right] i - \left[\frac{1}{3} + 5 \right] j + \left[-3 - \frac{1}{2} \right] k + C$$

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