ADEBAYO AYODEJI CHUKWUEMEKA

19/SCI181001

ARCHITECTURE

If $M = pi - 6j - 3k$, $N = 4i + 3k - k$, $O = i - 3j + 2k$ find the value of p for which (a) M and N are perpendicular to each other

b M, N and O are coplanar

a M and N are perpendicular to each other

Other $M \cdot N = (pi - 6j - 3k) \cdot (4i + 3j - k)$

$= 4p - 18 + 3$

$= 4p - 15$

since they are perpendicular

$4p - 15 = 0$

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

$p = 15/4$

5) k: p
-3) (-4
2, -15)

24-24
4

Date: ....

b M, N and O are coplanar

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

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

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

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

$= 3p + 54 + 45 = 0$

$= 3p + 9p = 0$

$\frac{\cancel{3}p}{\cancel{3}} = \frac{9p}{3}$

$p = -33$

Find the direction cosines and the unit vector along the sum of $3i + 2j + 5k$, $2i - j + 6k$ and $5i + 2j - 3k$

Sum $= 3i + 2j + 5k + 2i - j + 6k + 5i + 2j - 3k$

$= (10i + 4j + 8k)$

$\cancel{\vec{r} \cdot \hat{n} = d}$

unit ~~vector of~~ $\cancel{\vec{n} = \hat{n} = \frac{1}{(\vec{n})}}$

~~equation~~

$\cancel{\vec{r}(10i + 4j + 8k) = 0}$

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

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

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

$= \sqrt{173} = 13.15$

Date: ....

i The direction cosines are

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

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

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

ii unit vector

$$e_v = \frac{v}{|v|} = \frac{10i + 3j + 7k}{13.15}$$

5 = $\bar{r} = 3ui + u^2 j + (u+2)k$

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

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

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

$= \cancel{i\left[u^3 - 2u^2 - [3u^2 - 6u]\right] - j\,[3u^2 - 6u - 2u}$

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

$\int_0^1 (\bar{r} \times v) = \int i[u^3 + u^2 + 6u] - \int j[u^2 - 10u] + \int k[-2u^3 - 9u^2]$

$= i\int u^3 + u^2 + 6u - j\int u^2 - 10u + k\int -2u^3 - 9u^2$

$= \left[\frac{u^4}{4} + \frac{u^3}{3} + \frac{\overset{3}{\cancel{6}}u^2}{\cancel{2}_1}\right] - j\left[\frac{u^3}{3} - \frac{\overset{5}{\cancel{10}}u^2}{\cancel{2}_1}\right] + k\left[-\frac{\overset{1}{\cancel{2}}u^4}{4} - \frac{\overset{3}{\cancel{9}}u^3}{\cancel{3}}\right] + K$

$= \left[\frac{u^4}{4} + \frac{u^3}{3} + 3u^2\right] - j\left[\frac{u^3}{3} - 5u^2\right] + k\left[\frac{-(1)^4}{2} - 3(1)^3\right]k$

$- [0 + C]$

$$\int_0^1 (f \times v) = i\left[\frac{1}{4}+\frac{1}{3}+3\right] - j\left[\frac{1}{3}-5\right] + k\left[\frac{-1}{2}-3\right] +4-4$$

$$\int_0^1 (f \times v) = i\left[\frac{43}{12}\right] - j\left[\frac{-14}{3}\right] + k\left[\frac{-7}{2}\right]$$

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