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191ENG04/039

MAT102 Assignment

v) Vectors, geometry and dynamic

Answers

1) $A = 2i - j$, $B = 3i - j + 11k$ $C = 4i + 4j - 5k$

i.) $-3A + 7B - 8C$

$$= -3(2i - j) + 7(3i + j - 11k) - 8(4i + 4j - 5k)$$

$$= -6i + 3j + 21i + 7j - 77k - 32i - 32j + 40k$$

$$= -17i - 17j - 22k - 33$$

$$= -72$$

ii.) $A \times (B \times C)$

$B \times C$	i	j	k
	3	-1	11
	4	4	-5

$$i \begin{vmatrix} -1 & 11 \\ 4 & -5 \end{vmatrix} - j \begin{vmatrix} 3 & 11 \\ 4 & -5 \end{vmatrix} + k \begin{vmatrix} 3 & -1 \\ 4 & 4 \end{vmatrix}$$

$$i(-5 - 44)$$

$$-j(3(-5) - (11 \times 4)) - k((3 \times 4) - (-1 \times 4))$$

$$i(5 - 44) - j(-15 - 44) - k(12 + 4)$$

$$-39i + 59j - 18k$$

$$A \times (B \times C) = \begin{vmatrix} i & j & k \\ 2 & -1 & 0 \\ 39 & 59 & -18 \end{vmatrix}$$

$$i \begin{vmatrix} -1 & 0 \\ 59 & -18 \end{vmatrix} - j \begin{vmatrix} 2 & 0 \\ 39 & -18 \end{vmatrix} + k \begin{vmatrix} 2 & -1 \\ 39 & 59 \end{vmatrix}$$

$$i(18 - 0) - j(-36 - 0) + k(118 - (-39))$$

$$18i + 36j + 215k$$

iii.) $(3A \times B) \cdot (A \times C)$ If $k \geq 2A + 4B + C$

If $k \geq 2A + 4B + C$

$$2(2i - j) + 4(3i - j + 11k) + 4i + 4j - 5k$$

$$4i - 2j + 12i - 4j + 4k \rightarrow 4i + 4j - 5k$$

$$20i + 2j + 4k \quad 20i + 2j + 4k$$

$$r = xi + yj + zk \quad r = xi + yj + zk$$

$$r = \sqrt{20^2 + 2^2 + 4^2} \quad r = \sqrt{20^2 + 2^2 + 4^2}$$

$$r = \sqrt{400 + 4 + 16} \quad r = \sqrt{400 + 4 + 16}$$

$$r = 45.65 \quad r = 45.65 \text{ or } \sqrt{2085}$$

$$l = xi + yj + zk$$

$$l = \cos \alpha = x = \frac{20}{r}$$

$$l = \frac{20}{\sqrt{2085}}$$

$$\cos \beta = \frac{y}{r} = \frac{2}{\sqrt{2085}}$$

$$\cos \gamma = \frac{z}{r} = \frac{4}{\sqrt{2085}}$$

V.) $A - 2B - C$

$$2i - j - 2(3i + j - 11k) - 4i + 4j - 5k$$

$$2i - j - 6i - 2j + 22k - 4i + 4j - 5k$$

$$-6i + j + 17k = 24$$

IV.) $3(A \times B) \cdot (A \times 2B)$

$$3(2i - j) \times (3i + j - 11k) \cdot 2i - j \times 2(3i + j + 11k)$$

$$(6i - j \times 3i + j - 11k) \cdot (2i - j \times 6i + 2j - 22k)$$

$(3A \times B)$	i	j	k
	6	-1	0
	3	1	-11

i	$-j$	k
-11	0	6
1	-11	3

$$i(-11 - 0) - j(66 - 0) + k(6 - (-3))$$

$$-11i + 66j + 9k$$

$$(A \times 2B) \begin{vmatrix} 1 & J & K \\ 2 & -1 & 0 \\ 6 & 2 & -22 \end{vmatrix}$$

$$1 \begin{vmatrix} -1 & 0 \\ 2 & -22 \end{vmatrix} - J \begin{vmatrix} 2 & 0 \\ 6 & -22 \end{vmatrix} + K \begin{vmatrix} 2 & -1 \\ 6 & 2 \end{vmatrix}$$

$$1(22-0) - J(44-0) + K(4-6)$$

$$22i + 44J + 10K$$

$$3(A \times B) \cdot (A \times 2B)$$

2. Perpendicular vectors can be defined as two vectors

$$(-11i + 66J + 9K) \cdot (22i + 44J + 10K)$$

$$-242 + 2904 + 90$$

$$= 2,752$$

2.) Perpendicular vectors can be defined as two vectors

\vec{A} and \vec{B} are perpendicular if and only if their scalar product is equal to zero.

Coplanar vectors can be defined as vectors which are parallel to the same plane, or lie on the same plane.