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Vector geometry and dynamics

Assignment Ans.

① If $A=2i-j$; $B=3i+j-11k$ and $C=4i+4j-5k$ find the following

A $-3A+7B-8C$

$$-3(2i-j) + 7(3i+j-11k) - 8(4i+4j-5k)$$
$$= -6i + 3j + 21i + 7j - 77k - 32i - 32j + 40k$$
$$= -17i - 22j - 37k$$

B $K=2A+4B-C$

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

$$4i - 2j + 12i + 4j - 44k - 4i - 4j + 5k$$

$$12i + 6j - 39k$$

$$|K| = \sqrt{12^2 + 6^2 + (-39)^2}$$

$$= \sqrt{144 + 36 + 1521}$$

$$= \sqrt{1701}$$

$$|K| = 41.2$$

$$L = \cos \alpha = \frac{12}{41.2} = 0.29$$

$$m = \cos \beta = \frac{6}{41.2} = 0.15$$

$$n = \cos \gamma = \frac{-39}{41.2} = -0.95$$

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

	i	j	k
A	2	-1	0
B	3	1	-11
C	4	4	-5

$$e \quad A - 2B - C$$

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

$$2i - j - 6i - 2j + 22k - 4i - 4j + 3k$$

$$= 8i - 7j + 27k$$

① A perpendicular vectors are two vectors whose dot product is equal to zero

$$\text{e.g. } A \cdot B = 0$$

Co-planar vectors are when three vectors A, B and C scalar triple product is zero

$$\text{e.g. } A \cdot (B \times C) = 0$$

$$i[(61 \times 5) - (4 \times 15)] - j[(63 \times 5) - (4 \times 11)] + k[(63 \times 4) - (4 \times 1)]$$

$$i(39) - j(29) + k(8)$$

$$39i - 29j + 8k$$

$$A \times (B \times C) = \begin{vmatrix} + & - & + \\ i & j & k \\ 2 & -1 & 0 \\ 39 & -29 & 8 \end{vmatrix}$$

$$i[(2 \times 8) - (-1 \times 0)] - j[(2 \times 8) - (39 \times 0)] + k[(2 \times -29) - (39 \times -1)]$$

$$i(16) - j(16) + k(-19 + 39)$$

$$16i - 16j + 19k$$

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

$$3A = 6i - 3j$$

$$3A \times B = \begin{vmatrix} + & - & + \\ i & j & k \\ 6 & -3 & 0 \\ 3 & 1 & -11 \end{vmatrix}$$

$$i[(6 \times -11) - (-3 \times 0)] - j[(6 \times -11) - (0 \times 33)] + k[(6 \times 1) - (-3 \times 3)]$$

$$i(-66) - j(-66) + k(15)$$

$$-66i + 66j + 15k$$

$$26 = 6i + 2j - 22k$$

$$A \times 2B = \begin{vmatrix} + & - & + \\ i & j & k \\ 2 & -1 & 0 \\ 6 & 2 & -22 \end{vmatrix}$$

$$i[(2 \times -22) - (-1 \times 0)] - j[(2 \times -22) - (6 \times 0)] + k[(2 \times 2) - (6 \times -1)]$$

$$i(-44) - j(-44) + k(10)$$

$$-44i + 44j + 10k$$

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

$$(-66i + 66j + 15k) \cdot (-44i + 44j + 10k)$$

$$726 + 2904 + 150 = 3780$$