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If $A = 2i - j$, $B = 3i + j - 11k$, $C = 4i + 4j - 5k$, find the following.

1. $-3A + 7B - 8C$

Solution

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

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

$-17i + 42j - 117k$

2. $K = 2A + 4B - C$ find the direction cosine of K

Solution

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

$= (4i - 2j) + (12i + 4j - 44k) - (4i + 4j - 5k)$

$K = 12i - 2j - 39k$

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

$K = \sqrt{144 + 4 + 1521}$

$K = \sqrt{1669}$

$= 40.9$

$\cos\alpha = \frac{12}{40.9}$

$\cos\beta = \frac{-2}{40.9}$

$\cos\gamma = \frac{-39}{40.9}$

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

Solution

$(B \times C) = \begin{vmatrix} + & - & + \\ i & j & k \\ 3 & 1 & -11 \\ 4 & 4 & -5 \end{vmatrix}$

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

$1(-5 - -44) - j(-15 - -44) k(12 - 4)$

$39i - 29j + 8K$

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

$i\begin{vmatrix} -1 & 0 \\ -29 & 8 \end{vmatrix} - j\begin{vmatrix} 2 & 0 \\ 39 & 8 \end{vmatrix} k\begin{vmatrix} 2 & -1 \\ 39 & -29 \end{vmatrix}$

$i(-8) - j(16-0) k(-58 - -39)$

$-8i - 16j - 39k$

=

4. $(3A \times B) \cdot (A \times 2B)$

SOLUTION

$3(2i - j) = 6i - 3j$

$B = 3i + j - 11k$

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

$i\begin{vmatrix} -3 & 0 \\ 1 & -11 \end{vmatrix} - j\begin{vmatrix} 6 & 0 \\ 3 & -11 \end{vmatrix} k\begin{vmatrix} 6 & -3 \\ 3 & 1 \end{vmatrix}$

$i(33) - j(-66) k(6 - 9)$

$33i + 66j - 3k$

$2(3i + j - 11k) = 6i + 2j - 22k$

$A = 2i - j$

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

$i\begin{vmatrix} 1 & 0 \\ 2 & -22 \end{vmatrix} - j\begin{vmatrix} 2 & 0 \\ 6 & -22 \end{vmatrix} k\begin{vmatrix} 2 & 1 \\ 6 & 2 \end{vmatrix}$

$i(-22) - j(-44) k(4 - 6)$

$-22i + 44j - 2k$

$(3A \times B) \cdot (A \times 2B) = (33i + 66j - 3k)(-22i + 44j - 2k)$

$= -726i + 2904j - 5k$

=

5. $A - 2B - C$

solution

$2i - j - 2(3i + j - 11k) - 4i + 6j - 5k$

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

$-8i - 3j - 17k$

2. What is a co-planar and perpendicular vector

solution

A perpendicular vector is a vector that forms a right angle

A co-planar vector is a vector which are parallel to the same plane.