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MARTIC NUMBER: 19/ENG03/005

MAT 102 ASSIGNMENT

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✓ Civil Engineering
✓ 19/ENG03/005
✓ MAT 102 Assignment

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

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

soln

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

$= -6i + 3j$

$7B = 7(3i + j - 11k)$

$= 21i + 7j - 77k$

$8C = 8(4i + 4j - 5k)$

$= 32i + 32j - 40k$

$-3A + 7B - 8C = -17i - 22j - 37k$

II. If $k = 2A + 4B - C$, find the direction cosine of k

soln

$k = 2A + 4B - C$

$2A = 2(2i - j) = 4i - 2j$

$4B = 4(3i + j - 11k) = 12i + 4j - 44k$

$C = 4i + 4j - 5k$

$2A + 4B - C = 12i - 2j - 39k$

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

$K = \sqrt{1669}$

$K = 40.85$

∴ The direction of K are

$\cos\alpha = \frac{12}{40.85}$

$\cos\beta = \frac{-2}{40.85}$

$\cos\gamma = \frac{-39}{40.85}$

III. $A \times B \times C$

$$A \times B = \begin{vmatrix} i & j & K \\ 2 & -1 & 0 \\ 3 & 1 & -11 \end{vmatrix} = i(11-0) - j(-22-0) + K(2+3)$$

$$= 11i + 22j + 5K$$

$$A \times B \times C = \begin{vmatrix} i & j & K \\ 11 & 22 & 5 \\ 4 & 4 & -5 \end{vmatrix} = i(110-20) - j(-55-20) + K(44-88)$$

$$= -130i + 75j - 44K$$

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

soln

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

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

$$3A \times B = \begin{vmatrix} i & j & k \\ 6 & -3 & 0 \\ 3 & 1 & -11 \end{vmatrix} = i(33-0) - j(-66-0) + k(6+9)$$
$$= 33i + 66j + 15k$$

$$A \times 2B = \begin{vmatrix} i & j & k \\ 2 & -1 & 0 \\ 6 & 2 & -22 \end{vmatrix} = i(22-0) - j(-44-0) + k(4+6)$$
$$= 22i + 44j + 10k$$

$(3A \times B) \cdot (A \times 2B) = (33 \times 22) + (66 \times 44) + (15 \times 10)$

$= 3780$

3)

v. $A - 2B - C$

soln

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

$A = 2i - j$

$C = 4i + 4j - 5k$

$A - 2B - C = -8i - 7j + 27$

2. Define perpendicular and co-planar vectors.

Two vectors A and B are said to be perpendicular if their scalar product is equal to zero.

Three vectors A, B and C are said to be coplanar if their triple scalar product $[A \cdot (B \times C)]$ is equal to zero.