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MATRIC NUMBER: 19/ENG03/011

MATH 102 ASSIGNMENT

$$A = 2i - j \quad B = 3i + j - 11k \quad C = 4i + 4j - 5k$$

1.

i)

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

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

$$7B = 7(3i + j - 11k) = 21i + 7j - 77k$$

$$-3A + 7B = 15i + 10j - 77k$$

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

ii)

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

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

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

$$2A + 4B = 16i + 2j - 44k$$

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

$$|K| = \sqrt{12^2 + (-2)^2 + (-39)^2} = \sqrt{1669} = 40.85$$

∴ The direction cosines of K are

$$\cos \alpha = \frac{12}{40.85} = 0.2938 \quad \cos \beta = \frac{-2}{40.85} = -0.0490 \quad \cos \gamma = \frac{-39}{40.85} = -0.9547$$

iii)

$\mathbf{A} \times \mathbf{B} \times \mathbf{C}$

$$\mathbf{A} \times \mathbf{B} = \begin{vmatrix} i & j & k \\ 2 & -1 & 0 \\ 3 & 1 & -11 \end{vmatrix} = i(11-0) - j(-22-0) + k(2+3) = 11i + 22j + 5k$$

$$\mathbf{A} \times \mathbf{B} \times \mathbf{C} = \begin{vmatrix} i & j & k \\ 11 & 22 & 5 \\ 4 & 4 & -5 \end{vmatrix} = i(-110-20) - j(-55-20) + k(44-88) = -130i + 75j - 44k$$

iv)

$$(\mathbf{3A} \times \mathbf{B}) \cdot (\mathbf{A} \times \mathbf{2B})$$

$$\mathbf{3A} = 3(2\mathbf{i} - \mathbf{j}) = \mathbf{-6i - 3j}$$

$$\mathbf{2B} = 2(3\mathbf{i} + \mathbf{j} - 11\mathbf{k}) = \mathbf{6i + 2j - 22k}$$

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

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

$$\therefore (\mathbf{3A} \times \mathbf{B}) \cdot (\mathbf{A} \times \mathbf{2B}) = (33 \times 22) + (66 \times 44) + (15 \times 10) = 3780$$

$$\mathbf{v) A - 2B - C}$$

$$\mathbf{A - 2B = -4i -3j +22k}$$

$$\mathbf{A - 2B - C = -8i -7j +27k}$$

2. 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 $[\mathbf{A} \cdot (\mathbf{B} \times \mathbf{C})]$ is equal to zero.

