

VICTOR SIMON I-LIYA
 Computer Engineering
 19/ENG021025.

Name: VICTOR SIMON I-LIYA
 Department: CEE
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~~1/1~~ $A = 2i - j, B = 3i + j - 11k$ and $C = 4i + 4j - 5k$

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

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

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

$$-8C = -8(4i + 4j - 5k) = -32i - 32j + 40k$$

$$-3A + 7B - 8C = (-6i + 3j + 0k) + (21i + 7j - 77k) + (-32i - 32j + 40k)$$

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

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

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

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

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

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

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

$$|K| = \sqrt{12^2 + (-2)^2 + (-39)^2} = \sqrt{144 + 4 + 1521}$$

$$|K| = \sqrt{1669} = 40.85$$

$$\cos \alpha = \frac{12}{40.85} = 0.2938; \alpha = \cos^{-1}(0.2938) = \underline{\underline{72.9^\circ}}$$

$$\cos \beta = \frac{-2}{40.85}; \beta = \cos^{-1}\left(\frac{-2}{40.85}\right) = \underline{\underline{92.8^\circ}}$$

$$\cos \gamma = \frac{-39}{40.85}; \gamma = \cos^{-1}\left(\frac{-39}{40.85}\right) = \underline{\underline{162.69^\circ}}$$

1. Two vectors, A and B, are said to be perpendicular
if $A \cdot B = 0$

II. Three vectors, A, B and C, are said to be coplanar
if $A \cdot (B \times C) = 0$

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

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

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

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

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

$$3A \times B = i(33) - j(-66) + k(6+9)$$

$$3A \times B = 33i + 66j + 15k$$

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

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

$$A \times 2B = i(22) + j(-44) + k(4+6)$$

$$A \times 2B = 22i + 44j + 12k$$

$$(3A \times B) \cdot (A \times 2B) = (33i + 66j + 15k) \cdot (22i + 44j + 12k)$$

$$(3A \times B) \cdot (A \times 2B) = 726 + 2904 + 180$$

$$(3A \times B) \cdot (A \times 2B) = 3810$$

2. iii. $A \times (B \times C)$

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

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

$$B \times C = i(-5 - (-44)) - j(-15 - (-44)) + k(12 - 4)$$

$$B \times C = i(39) - j(29) + k(8)$$

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

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

$$A \times (B \times C) = i(-8) - j(16) + k(-58 + 39)$$

$$A \times (B \times C) = -8i - 16j - 19k$$

V. $A - 2B - C$

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

$$A - 2B - C = (2i - j + 0k) + (-6i - 2j + 22k) - (4i + 4j - 5k)$$

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