

בתרון גרפיקלי 1

$$\vec{V}_1 + \vec{V}_2 = (-1, 1, 2)$$

$$\vec{V}_1 - \vec{V}_2 = (-3, 5, 0)$$

$$(\vec{V}_1 + \vec{V}_2) \times (\vec{V}_1 - \vec{V}_2) = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ -1 & 1 & 2 \\ -3 & 5 & 0 \end{vmatrix} \quad (1)$$

$$= (-10, -6, -2)$$

$$\vec{V}_1 \cdot ((\vec{V}_1 + \vec{V}_2) \times (\vec{V}_1 - \vec{V}_2)) = \cancel{10} \cdot \cancel{10} + \cancel{6} \cdot \cancel{6} + \cancel{2} \cdot \cancel{2} = \cancel{100} + \cancel{36} + \cancel{4} = \cancel{140} = \cancel{324} \cdot 0$$

$$(\vec{V}_2 \times (\vec{V}_1 + \vec{V}_2)) = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ 1 & -2 & 1 \\ -1 & 1 & 2 \end{vmatrix} \quad (2)$$

$$= (-5, -3, -1)$$

$$\vec{V}_1 \times (\vec{V}_2 \times (\vec{V}_1 + \vec{V}_2)) = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ -2 & 3 & 1 \\ -3 & -3 & 3 \end{vmatrix} = (6, 15, 18) \\ (0, -7, 21)$$

$$\vec{V}_1 \times (\vec{V}_1 - \vec{V}_2) = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ -2 & 3 & 1 \\ -3 & 5 & 0 \end{vmatrix} \quad (2)$$

$$= (-5, -3, -4)$$

$$\vec{V}_2 \times (\vec{V}_1 \times (\vec{V}_1 - \vec{V}_2)) = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ 1 & -2 & 1 \\ -5 & -3 & -4 \end{vmatrix} =$$

$$= (5, -4, -13)$$

$$|\vec{r}_1 \times \vec{r}_2| = |\vec{r}_1| |\vec{r}_2| \sin \alpha_{12} \quad \text{प्रमाण (2)}$$

$$\vec{r}_1 \times \vec{r}_2 = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ r_1 \sin \theta_1 \cos \phi_1 & r_1 \sin \theta_1 \sin \phi_1 & r_1 \cos \theta_1 \\ r_2 \sin \theta_2 \cos \phi_2 & r_2 \sin \theta_2 \sin \phi_2 & r_2 \cos \theta_2 \end{vmatrix} \quad \text{DE 73N}$$

$$= r_1 r_2 \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \sin \theta_1 \cos \phi_1 & \sin \theta_1 \sin \phi_1 & \cos \theta_1 \\ \sin \theta_2 \cos \phi_2 & \sin \theta_2 \sin \phi_2 & \cos \theta_2 \end{vmatrix}$$