

1. $\vec{r}_1 = x_1 \vec{e}_1 + y_1 \vec{e}_2 + z_1 \vec{e}_3$ $\vec{r}_2 = x_2 \vec{e}_1 + y_2 \vec{e}_2 + z_2 \vec{e}_3$ $\vec{r}_3 = x_3 \vec{e}_1 + y_3 \vec{e}_2 + z_3 \vec{e}_3$
 $\vec{r}_1 \cdot \vec{r}_2 = x_1 x_2 + y_1 y_2 + z_1 z_2$ $\vec{r}_1 \cdot \vec{r}_3 = x_1 x_3 + y_1 y_3 + z_1 z_3$ $\vec{r}_2 \cdot \vec{r}_3 = x_2 x_3 + y_2 y_3 + z_2 z_3$
 $\vec{r}_1 \cdot (\vec{r}_2 \times \vec{r}_3) = \begin{vmatrix} x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \\ x_3 & y_3 & z_3 \end{vmatrix}$ $\vec{r}_2 \cdot (\vec{r}_1 \times \vec{r}_3) = \begin{vmatrix} x_2 & y_2 & z_2 \\ x_1 & y_1 & z_1 \\ x_3 & y_3 & z_3 \end{vmatrix}$ $\vec{r}_3 \cdot (\vec{r}_1 \times \vec{r}_2) = \begin{vmatrix} x_3 & y_3 & z_3 \\ x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \end{vmatrix}$
 $\vec{r}_1 \times \vec{r}_2 = (y_1 z_2 - z_1 y_2) \vec{e}_1 + (z_1 x_2 - x_1 z_2) \vec{e}_2 + (x_1 y_2 - y_1 x_2) \vec{e}_3$
 $\vec{r}_2 \times \vec{r}_3 = (y_2 z_3 - z_2 y_3) \vec{e}_1 + (z_2 x_3 - x_2 z_3) \vec{e}_2 + (x_2 y_3 - y_2 x_3) \vec{e}_3$
 $\vec{r}_3 \times \vec{r}_1 = (y_3 z_1 - z_3 y_1) \vec{e}_1 + (z_3 x_1 - x_3 z_1) \vec{e}_2 + (x_3 y_1 - y_3 x_1) \vec{e}_3$
 $\vec{r}_1 \times (\vec{r}_2 \times \vec{r}_3) = \begin{vmatrix} x_1 & y_1 & z_1 \\ y_1 z_2 - z_1 y_2 & z_1 x_2 - x_1 z_2 & x_1 y_2 - y_1 x_2 \\ y_2 z_3 - z_2 y_3 & z_2 x_3 - x_2 z_3 & x_2 y_3 - y_2 x_3 \end{vmatrix}$
 $\vec{r}_2 \times (\vec{r}_1 \times \vec{r}_3) = \begin{vmatrix} x_2 & y_2 & z_2 \\ x_1 y_2 - y_1 x_2 & x_1 z_2 - z_1 x_2 & x_1 y_2 - y_1 x_2 \\ x_3 y_1 - y_3 x_1 & x_3 z_1 - z_3 x_1 & x_3 y_1 - y_3 x_1 \end{vmatrix}$
 $\vec{r}_3 \times (\vec{r}_1 \times \vec{r}_2) = \begin{vmatrix} x_3 & y_3 & z_3 \\ x_1 y_2 - y_1 x_2 & x_1 z_2 - z_1 x_2 & x_1 y_2 - y_1 x_2 \\ x_2 y_3 - y_2 x_3 & x_2 z_3 - z_2 x_3 & x_2 y_3 - y_2 x_3 \end{vmatrix}$
 $\vec{r}_1 \times (\vec{r}_2 \times \vec{r}_3) + \vec{r}_2 \times (\vec{r}_1 \times \vec{r}_3) + \vec{r}_3 \times (\vec{r}_1 \times \vec{r}_2) = \vec{0}$

2. $\vec{r}_1 = x_1 \vec{e}_1 + y_1 \vec{e}_2 + z_1 \vec{e}_3$ $\vec{r}_2 = x_2 \vec{e}_1 + y_2 \vec{e}_2 + z_2 \vec{e}_3$ $\vec{r}_3 = x_3 \vec{e}_1 + y_3 \vec{e}_2 + z_3 \vec{e}_3$
 $\vec{r}_1 \cdot \vec{r}_2 = x_1 x_2 + y_1 y_2 + z_1 z_2$ $\vec{r}_1 \cdot \vec{r}_3 = x_1 x_3 + y_1 y_3 + z_1 z_3$ $\vec{r}_2 \cdot \vec{r}_3 = x_2 x_3 + y_2 y_3 + z_2 z_3$
 $\vec{r}_1 \cdot (\vec{r}_2 \times \vec{r}_3) = \begin{vmatrix} x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \\ x_3 & y_3 & z_3 \end{vmatrix}$ $\vec{r}_2 \cdot (\vec{r}_1 \times \vec{r}_3) = \begin{vmatrix} x_2 & y_2 & z_2 \\ x_1 & y_1 & z_1 \\ x_3 & y_3 & z_3 \end{vmatrix}$ $\vec{r}_3 \cdot (\vec{r}_1 \times \vec{r}_2) = \begin{vmatrix} x_3 & y_3 & z_3 \\ x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \end{vmatrix}$
 $\vec{r}_1 \times \vec{r}_2 = (y_1 z_2 - z_1 y_2) \vec{e}_1 + (z_1 x_2 - x_1 z_2) \vec{e}_2 + (x_1 y_2 - y_1 x_2) \vec{e}_3$
 $\vec{r}_2 \times \vec{r}_3 = (y_2 z_3 - z_2 y_3) \vec{e}_1 + (z_2 x_3 - x_2 z_3) \vec{e}_2 + (x_2 y_3 - y_2 x_3) \vec{e}_3$
 $\vec{r}_3 \times \vec{r}_1 = (y_3 z_1 - z_3 y_1) \vec{e}_1 + (z_3 x_1 - x_3 z_1) \vec{e}_2 + (x_3 y_1 - y_3 x_1) \vec{e}_3$
 $\vec{r}_1 \times (\vec{r}_2 \times \vec{r}_3) = \begin{vmatrix} x_1 & y_1 & z_1 \\ y_1 z_2 - z_1 y_2 & z_1 x_2 - x_1 z_2 & x_1 y_2 - y_1 x_2 \\ y_2 z_3 - z_2 y_3 & z_2 x_3 - x_2 z_3 & x_2 y_3 - y_2 x_3 \end{vmatrix}$
 $\vec{r}_2 \times (\vec{r}_1 \times \vec{r}_3) = \begin{vmatrix} x_2 & y_2 & z_2 \\ x_1 y_2 - y_1 x_2 & x_1 z_2 - z_1 x_2 & x_1 y_2 - y_1 x_2 \\ x_3 y_1 - y_3 x_1 & x_3 z_1 - z_3 x_1 & x_3 y_1 - y_3 x_1 \end{vmatrix}$
 $\vec{r}_3 \times (\vec{r}_1 \times \vec{r}_2) = \begin{vmatrix} x_3 & y_3 & z_3 \\ x_1 y_2 - y_1 x_2 & x_1 z_2 - z_1 x_2 & x_1 y_2 - y_1 x_2 \\ x_2 y_3 - y_2 x_3 & x_2 z_3 - z_2 x_3 & x_2 y_3 - y_2 x_3 \end{vmatrix}$
 $\vec{r}_1 \times (\vec{r}_2 \times \vec{r}_3) + \vec{r}_2 \times (\vec{r}_1 \times \vec{r}_3) + \vec{r}_3 \times (\vec{r}_1 \times \vec{r}_2) = \vec{0}$