

$$\begin{aligned}
 \vec{v}_1 \times \vec{v}_2 &= \begin{pmatrix} x_1 \\ y_1 \\ z_1 \end{pmatrix} \times \begin{pmatrix} x_2 \\ y_2 \\ z_2 \end{pmatrix} = \begin{pmatrix} y_1 z_2 - z_1 y_2 \\ z_1 x_2 - x_1 z_2 \\ x_1 y_2 - y_1 x_2 \end{pmatrix}
 \end{aligned}$$

Diagram illustrating the components of the cross product as determinants of 2x2 matrices:

- First component:  $\begin{vmatrix} y_1 & z_1 \\ y_2 & z_2 \end{vmatrix} = y_1 z_2 - z_1 y_2$
- Second component:  $-\begin{vmatrix} x_1 & z_1 \\ x_2 & z_2 \end{vmatrix} = -(x_1 z_2 - z_1 x_2)$
- Third component:  $\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix} = x_1 y_2 - y_1 x_2$

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