Cross Product

The vector which is perpendicular to both vector a and vector b, the sides of a parallelogram is the cross product, is the cross product of a and b ($a \times b$)

$$a \times b = ||a||\ ||b|| \sin\theta\ n$$

θ is the angle between a and b, and n is the **unit vector** perpendicular to the plane containing a and b.

$$\begin{aligned} a \times b &= \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ u_1 & u_2 & u_3 \\ v_1 & v_2 & v_3 \end{vmatrix} \\ &= \begin{bmatrix} u_2 & u_3 \\ v_2 & v_3 \end{bmatrix}\mathbf{i} - \begin{bmatrix} u_1 & u_3 \\ v_1 & v_3 \end{bmatrix}\mathbf{j} + \begin{bmatrix} u_1 & u_2 \\ v_1 & v_2 \end{bmatrix}\mathbf{k} \end{aligned}$$

Area of a parallelogram

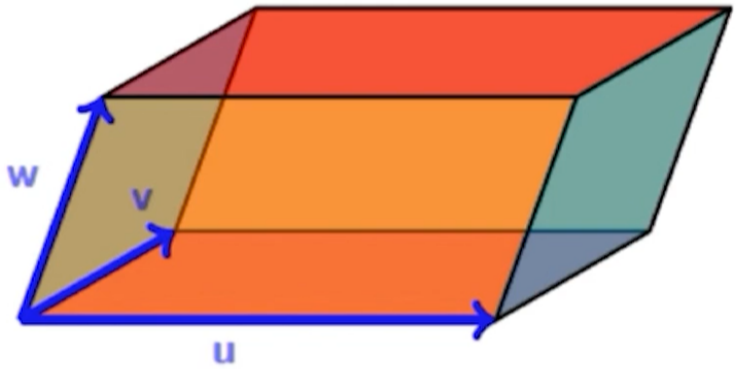
To find it cross 2 parallel sides.
Say you have parallelogram $ABCD$ the area = $|\vec{AB} \times \vec{AD}|$

Area of a parallelepiped

Find the triple scalar product,

$$(\vec{u} \times \vec{v}) \cdot \vec{w} = \begin{vmatrix} u_1 & u_2 & u_3 \\ v_1 & v_2 & v_3 \\ w_1 & w_2 & w_3 \end{vmatrix}$$

$\vec{u}, \vec{v}, \vec{w}$ are given by:



Properties