I. Reviewed Area of a Parallelogram and Triangle from yesterday's activities.

II. §12.4 - Torque: (p. 860)

A. Magnitude of the Torque (vector) is \( ||\vec{PQ} \times \vec{F}|| \)

\[ \vec{PQ} \times \vec{F} \text{ points "down" through this page (plane).} \]

III. Box Product: (p. 861). Volume of a parallelepiped.

1. \((\vec{u} \times \vec{v}) \cdot \vec{w} \text{ Triple Product / Box Product.} \)

(See next page for drawing.)

IV. §12.5: Lines & Planes (p. 864)

A. Need: Vector \( \vec{v} \) and a point \( P_0(x_0, y_0, z_0) \)

\(-\infty < t < \infty \)

\[ \vec{r} = \overrightarrow{OP_0} + t\vec{v} \text{ for } t \in \mathbb{R}. \]

Call \( \overrightarrow{OP_0} = \vec{r}_0 \)

We have created a vector function of \( t \) which gives us the equation of a line.

\[ \vec{r}(t) = \vec{r}_0 + t\vec{v} \quad (t \in \mathbb{R}) \]
Component Form
\[ \vec{r}(t) = \vec{r}_0 + t\vec{v} \]
\[ \vec{v} = \langle a, b, c \rangle \]
\[ \vec{r}_0 = \langle x_0, y_0, z_0 \rangle \]
\[ \vec{r}(t) = \langle x, y, z \rangle \]
\[ \langle x, y, z \rangle = \langle x_0, y_0, z_0 \rangle + \langle ta, tb, tc \rangle \]
\[ = \langle x_0 + ta, y_0 + tb, z_0 + tc \rangle \]

Parameter Form:
\[ \begin{cases} 
  x = x_0 + ta \\
  y = y_0 + tb \\
  z = z_0 + tc
\end{cases} \]
is a set of parametric functions for the line through \( P_0(x_0, y_0, z_0) \) which is parallel to the vector \( \vec{v} = \langle a, b, c \rangle \).

Drawing of \((\vec{u} \times \vec{v}) \cdot \vec{w}\) — from previous page.