- $|\vec{a}\times\vec{b}|$ is the area of the parallelogram formed by $\vec{a}$ and $\vec{b}$.
- **Triple Scalar Product**: $\vec{a}\cdot(\vec{b}\times\vec{c})$
  - Let $\vec{a}=\langle a_1,\, a_2,\, a_3\rangle$, $\vec{b}=\langle b_1,\, b_2,\, b_3\rangle$, and $\vec{c}=\langle c_1,\, c_2,\, c_3\rangle$.
  - $\vec{a}\cdot(\vec{b}\times\vec{c})=\begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$
  - Represents the volume of the **parallelopiped** formed by $\vec{a}$, $\vec{b}$, and $\vec{c}$.
  - The tetrahedron formed by $\vec{a}$, $\vec{b}$, and $\vec{c}$ has one-sixth of this volume.
- **Lines** in three-space:
  - Let $\vec{r}_o$ be the position vector of a point on a line $\vec{r}$ in three-space, and let the direction vector $\vec{L}$ be parallel to $\vec{r}$.
  - Parametric equation: $\vec{r}(t)=\vec{r}_o+t\vec{L}$
  - Symmetric equation: $\dfrac{x-x_o}{a}=\dfrac{y-y_o}{b}=\dfrac{z-z_o}{c}$
    - Note: Three variables and two constraints. One degree of freedom.
- **Planes** in three-space:
  - Let $\vec{r}_o$ be the position vector of a point on a plane in three-space, and let the vectors $\vec{a}$ and $\vec{b}$ lie in the plane.
  - $\vec{n}=\vec{a}\times\vec{b}=\langle a,b,c\rangle$ is normal to the plane
  - Vector equation: $\vec{r}(s,t)=\vec{r}_o+s\vec{a}+t\vec{b}$
  - Parametric equation: $\vec{r}(s,t)=\langle x(s,t),\ y(s,t),\ z(s,t)\rangle$
  - $ax+by+cz=d$, where $\vec{r}_o\cdot\vec{n}=d$ and $\vec{n}=\langle a,b,c\rangle$
    - Note: Three variables and one constraint. Two degrees of freedom.
- Basic Matrices and Linear Algebra:
  - Very useful in representing linear transformations.
    - This is seen in change of variables when transformations are needed.
  - Any systems of linear equations can be appropriately written as a matrix
  - **Reduced-row echelon form**
  - Perform **Gaussian elimination** to find the reduced-row echelon form of a matrix to find the intersection of planes (i.e. solving the system of linear equations).
  - **Determinant**
    - Only applies to square matrices
    - Useful in computing cross products and triple scalar products
    - Very useful in multivariable analysis