

By the end of this unit, here are the skills you should have in relation to vectors:

Create vectors

- in component form $\langle u_x, u_y \rangle$
- as a linear combination of the standard unit vectors $u_x\mathbf{i} + u_y\mathbf{j}$

Perform vector operations

- add
- subtract
- scalar multiplication
- dot product
- cross product

Find

- the length (magnitude) of a vector \mathbf{u}
- the direction angle of a vector \mathbf{u}
- a unit vector in the direction of \mathbf{u}
- the projection of \mathbf{u} on vector \mathbf{v}
- the angle between vectors
- the angle between planes
- the angle between a vector and a plane
- a vector perpendicular to a plane
- the distance between a point and a line
- the distance between a point and a plane
- equations of lines in vector form (2D and 3D)
- equations of planes (rectangular and vector)
- parametric equations representing vector motion in space
- vectors parallel and perpendicular to vector \mathbf{u}
- planes parallel and perpendicular to plane M

Vector Proofs

Use the Cross Product Properties

- $\mathbf{u} \times \mathbf{v}$ perpendicular to \mathbf{u} and \mathbf{v}
- $\mathbf{v} \times \mathbf{u} = -(\mathbf{u} \times \mathbf{v})$
- $|\mathbf{u} \times \mathbf{v}| = |\mathbf{u}| |\mathbf{v}| \sin\theta = \text{area of a parallelogram}$
- determinant = volume of a parallelepiped