

**Section 13.1 Displacement Vectors**

- Addition and subtraction of displacement vectors; scalar multiplication of displacement vectors.
- Resolving a vector into components; magnitude of a vector in components (unit vectors); addition and scalar multiplication in components.
- Components of a displacement vector  $\overrightarrow{P_1P_2}$ ;

**Section 13.1, Exercises and Problems:** 1 - 6, 7 - 25 (odd), 26 - 31, 33 - 40, 42, 43

**Section 13.2 Vectors in General**

- Velocity versus Speed
- Vectors in  $n$ -dimensions

**Section 13.2, Exercises and Problems:** 7 - 11, 13, 15, 16, 18, 19, 21, 25, 26

**Section 13.3 The Dot Product**

- Two definitions give the same result: for any vectors

$$\vec{v} = v_1 \vec{i} + v_2 \vec{j} + v_3 \vec{k} \quad \text{and} \quad \vec{w} = w_1 \vec{i} + w_2 \vec{j} + w_3 \vec{k}$$

with an angle  $\theta$  between them

$$\vec{v} \cdot \vec{w} = \|\vec{v}\| \|\vec{w}\| \cos \theta = v_1 w_1 + v_2 w_2 + v_3 w_3.$$

- $\vec{v}$  and  $\vec{w}$  are perpendicular (orthogonal, normal) if and only if  $\vec{v} \cdot \vec{w} = 0$ .
- $\vec{v} \cdot \vec{v} = \|\vec{v}\|^2$ .
- Orthogonal vectors and the equation of a plane
- Projections; Work.

**Section 13.3, Exercises and Problems:** 1 - 17, 18 - 27 (odd), 28, 30, 31, 33, 35, 38, 40, 43, 44, 48, 55, 61, 63

**Section 13.4 The Cross Product**

- For vectors  $\vec{v} = v_1 \vec{i} + v_2 \vec{j} + v_3 \vec{k}$  and  $\vec{w} = w_1 \vec{i} + w_2 \vec{j} + w_3 \vec{k}$

$$\vec{v} \times \vec{w} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ v_1 & v_2 & v_3 \\ w_1 & w_2 & w_3 \end{vmatrix} \quad \text{and} \quad \|\vec{v} \times \vec{w}\| \text{ is the area of a parallelogram with edges } \vec{v} \text{ and } \vec{w}.$$

- $\vec{a} \cdot (\vec{b} \times \vec{c}) = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$  The absolute value of this determinant is the volume of the parallelepiped with edges  $\vec{a} = a_1 \vec{i} + a_2 \vec{j} + a_3 \vec{k}$ ,  $\vec{b} = b_1 \vec{i} + b_2 \vec{j} + b_3 \vec{k}$ ,  $\vec{c} = c_1 \vec{i} + c_2 \vec{j} + c_3 \vec{k}$ .

**Section 13.4, Exercises and Problems:** 1 - 25, 29, 36, 41, 44, 45

**Chapter 13, Review Exercises and Problems:** 48, 49, 50, 51, 52, 57.