# Reading Assignment 3 (Due Wednesday 6/30/21 by 12:55 PM)

**Basic learning objectives:** These are the tasks you should be able to perform with reasonable fluency **when you arrive at our next class meeting**. Important new vocabulary words are indicated in italics.

1. Compute the *cross product* of any two of the standard unit vectors $\mathbf{i}, \mathbf{j}$, and $\mathbf{k}$ using the right hand rule.

2. Compute the cross product of two vectors using the *algebraic* definition. Write the definition using determinants.

3. Describe various properties of the cross product.

4. State a formula for the magnitude $|\mathbf{u} \times \mathbf{v}|$ of the cross product two vectors $\mathbf{u}$ and $\mathbf{v}$.

5. Compute the *vector equation* of a line given a point contained in the line and the direction of the line. Compute the *parametric equations* of a line.

**Advanced learning objectives:** In addition to mastering the basic objectives, here are the tasks you should be able to perform **after class, with sufficient practice:**

1. State a *geometric* definition of the cross product $\mathbf{u} \times \mathbf{v}$ by specifying its magnitude and direction (relative to $\mathbf{u}$ and $\mathbf{v}$).

2. Utilize vectors, the dot product, and the cross product to compute areas of triangles and parallelograms, and volumes of tetrahedrons and parallelepipeds. Understand why the cross product is related to areas and volumes. Describe various similarities and differences between the dot product and cross product.

3. Determine when two nonzero vectors are parallel. Determine when three points in $\mathbb{R}^3$ are collinear. Determine when three vectors in $\mathbb{R}^3$ are coplanar. Understand the geometric intuition behind the solutions to these types of problems.

4. Describe geometrically the vector equation of a line.

5. State the definition of a *plane* and understand why a plane can be specified uniquely by a point in the plane and a vector perpendicular to the plane.

6. Understand several different ways to describe the equation of a plane. Compute the equation of a plane given various geometric parameters.

**Directions:** Read the following sections of the book:

- Sections 9.3.3, 9.3.4, and 9.3.5 (we covered the main ideas in class).

- Sections 9.4.1, 9.4.2, and 9.4.3.

- Sections 9.5.1 and 9.5.2.

and complete the following tasks along the way. If an Activity is not listed, you do not need to complete it (although you are welcome to read it). Turn your write up in via gradescope. You do not need to write the questions down, as long as you clearly indicate the question number.

1. Complete Preview Activity 9.4.1

2. Complete Activity 9.4.2

3. Play around with this GeoGebra applet for a few minutes. Drag the points $A$ and $B$ to move the black vectors $\mathbf{u}$ and $\mathbf{v}$. The orange vector is the cross product $\mathbf{u} \times \mathbf{v}$. Write down any observations you make or patterns you notice.

4. Complete Preview Activity 9.5.1

5. Complete Activity 9.5.2