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## Worksheet 2

### The Dot & Cross Products

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MATH 2210, Fall 2018

#### The Dot Product

1. Determine whether  $\mathbf{u}$  and  $\mathbf{v}$  are parallel, orthogonal or neither.

(a)  $\mathbf{u} = \langle 4, 0 \rangle, \mathbf{v} = \langle 1, 1 \rangle$

(b)  $\mathbf{u} = \langle 2, 18 \rangle, \mathbf{v} = \langle \frac{3}{2}, -\frac{1}{6} \rangle$

2. Consider the vectors  $\mathbf{u} = \langle 8, 2, 0 \rangle$  and  $\mathbf{v} = \langle 2, 1, -1 \rangle$ .

(a) Find the projection of  $\mathbf{u}$  onto  $\mathbf{v}$ .

(b) Find the vector component of  $\mathbf{u}$  orthogonal to  $\mathbf{v}$ .

**The Cross Product**

3. Given  $\mathbf{u} = \langle 2, -3, 1 \rangle$  and  $\mathbf{v} = \langle 1, -1, 1 \rangle$

(a) Find  $\mathbf{u} \times \mathbf{v}$ .

(b) Show that  $\mathbf{u} \times \mathbf{v}$  is orthogonal to both  $\mathbf{u}$  and  $\mathbf{v}$ .

4. Find the area of the triangle with the vertices  $(2, -3, 4)$ ,  $(0, 1, 2)$ ,  $(-1, 2, 0)$ . Note that area of a triangle is given by  $\frac{1}{2} \|\mathbf{u} \times \mathbf{v}\|$ .