13.3: More with Dot Products
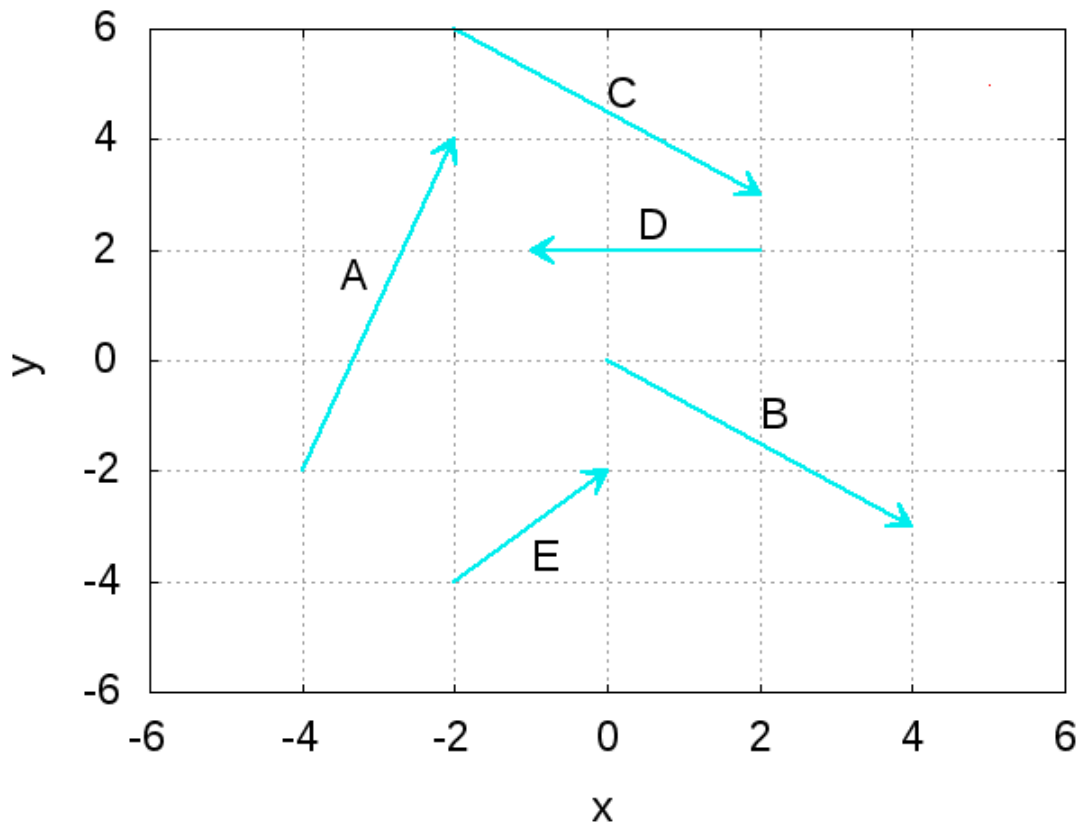
Calculus III

College of the Atlantic

Figure 1: Some Vectors.

A bunch of vectors are shown in Fig. 1. Without doing a calculation determine if the following quantities are positive, negative, or zero:

1. $\vec{E} \cdot \vec{B}$
2. $\vec{B} \cdot \vec{E}$
3. $\vec{D} \cdot \vec{D}$
4. $\vec{A} \cdot \vec{C}$
5. $\vec{A} \cdot \vec{E}$
6. $\vec{E} \cdot \vec{A}$

1. Consider the following three-dimensional vectors:

   - $\vec{u} = \vec{i} + \sqrt{3}\vec{k}$
   - $\vec{v} = \vec{i} + \sqrt{3}\vec{j}$
   - $\vec{w} = \sqrt{3}\vec{i} + \vec{j} - \vec{k}$

   Which, if any, of the vectors $\vec{u}$, $\vec{u}$, $\vec{w}$ are perpendicular to each other?

2. What is $\vec{w} \cdot \vec{i}$?

3. What is $\vec{w} \cdot \vec{j}$?

4. In words, what does $\vec{w} \cdot \vec{j}$ mean?

5. Let $\vec{v} = 3\vec{i} - 2\vec{j} + \vec{k}$. Find the equation of a plane that is perpendicular to $\vec{v}$ and which goes through the point $(1, 2, 3)$.

6. Find a vector normal to the plane $z = 0.5x + 1.2y$.

7. Let $\vec{u} = 4\vec{i} + 3\vec{j}$ and $\vec{v} = 3\vec{i} + 3\vec{j}$. What is the projection of $\vec{u}$ onto $\vec{v}$?