

**Vectors – The Basics**

1. Explain the difference between  $(-2, 4)$  and  $\langle -2, 4 \rangle$ . Illustrate the difference with a sketch.

**Vector Arithmetic**

For problems 2 & 3 find  $\|\vec{a}\|$ ,  $7\vec{b}$  and  $4\vec{b} - 6\vec{a}$ .

2.  $\vec{a} = \langle -5, 2 \rangle$   $\vec{b} = \langle -3, -10 \rangle$

3.  $\vec{a} = 8\vec{i} - 2\vec{j} + \vec{k}$   $\vec{b} = 7\vec{j} - 4\vec{k}$

4. Find a unit vector that is in

(a) the same direction as  $\vec{w} = \langle 9, 0, -7 \rangle$

(b) the opposite direction as  $\vec{v} = 2\vec{i} + 3\vec{j} - 10\vec{k}$

**Dot Product**

For problems 5 & 6 compute  $\vec{a} \cdot \vec{b}$ .

5.  $\vec{a} = \langle -1, 2, 6 \rangle$ ,  $\vec{b} = 9\vec{i} + 4\vec{j} + 2\vec{k}$

6.  $\|\vec{a}\| = 14$ ,  $\|\vec{b}\| = 3$  and the angle between  $\vec{a}$  and  $\vec{b}$  is  $\theta = \frac{\pi}{6}$ .

For problems 7 & 8 find the angle between the two vectors and determine if the two vectors are parallel, orthogonal or neither.

7.  $\vec{p} = \langle 4, -2, 1 \rangle$ ,  $\vec{q} = \langle 15, 7, -3 \rangle$

8.  $\vec{x} = 2\vec{i} - 2\vec{j} + 3\vec{k}$ ,  $\vec{y} = -\vec{i} + 5\vec{j} + 4\vec{k}$

For problems 9 & 10 find the vector projection of  $\vec{b}$  onto  $\vec{a}$ .

9.  $\vec{a} = \langle 0, 2, -1 \rangle$ ,  $\vec{b} = \langle 1, -2, -5 \rangle$

10.  $\vec{a} = \langle 1, -2, -5 \rangle$ ,  $\vec{b} = \langle 0, 2, -1 \rangle$

**Cross Product**

11. Find  $\vec{v} \times \vec{w}$  and  $\vec{w} \times \vec{v}$  for  $\vec{v} = \langle 2, -6, 1 \rangle$  and  $\vec{w} = \langle 0, 1, -1 \rangle$

12. Find a vector that is orthogonal to the plane containing  $(9, 0, 1)$ ,  $(-1, 1, 4)$  and  $(7, 0, 4)$ .

13. Determine if  $\langle 3, 0, 0 \rangle$ ,  $\langle 1, -4, 2 \rangle$  and  $\langle 2, -4, 1 \rangle$  all lie in the same plane.