Assignment 1. Chapter 1.

Due date: June 3

Section 1.1. 4 – 10

Section 1.2. 2, 3, 5

Section 1.3. 1 – 5, 7, 9 – 12, 15, 17 – 19

Section 1.4. 2, 3, 6 – 10, 13, 15, 19, 21

Problems to be turned in for grading.

1. Find all scalars k such that $||(k, 5)|| = 13$.
2. Find all scalars k such that $||(1,\ k+1,\ -5,\ -1)|| = 6$.
3. A vector $\mathbf{x}$ is a *unit vector* if $||\mathbf{x}|| = 1$. Let $\mathbf{x} = (\,-5,\ 1,\ 2\,)$. Find a unit vector that has the same direction as $\mathbf{x}$. Find a unit vector that has direction opposite to the direction of $\mathbf{x}$.
4. Let $\mathbf{x} = (\,2,\ -1,\ 6\,)$, $\mathbf{y} = (\,-2,\ -3,\ 1\,)$ and $r = 3$. Compute:
   (a) $(r\ \mathbf{x}) \cdot (\mathbf{y})$ (b) $\mathbf{x} \cdot (r\ \mathbf{y})$ (c) $r(\mathbf{x} \cdot \mathbf{y})$
   (d) How do your results in (a), (b) and (c) compare? State a general result.
5. Suppose $\mathbf{x}$ is a vector and $\mathbf{x} \cdot \mathbf{x} = 0$. What can you say about $\mathbf{x}$?
6. Draw the vectors $\mathbf{x}$ and $\mathbf{y}$. Then compute $\mathbf{x} \cdot \mathbf{y}$ and the angle between $\mathbf{x}$ and $\mathbf{y}$.
   (a) $\mathbf{x} = (2,\ 3)\,,\ \mathbf{y} = (4,\ 1)$ (b) $\mathbf{x} = (2,\ 3)\,,\ \mathbf{y} = (-3,\ 2)$ (c) $\mathbf{x} = (2,\ 3)\,,\ \mathbf{y} = (-3,\ 1)$
7. The dot product of two vectors $\mathbf{x}$ and $\mathbf{y}$ is a number α. Based on your graphs and your numerical results in Problem 6, make a conjecture about the measure of the angle θ between $\mathbf{x}$ and $\mathbf{y}$ when $\alpha > 0,\ \alpha = 0$ and $\alpha < 0$.
8. (a) Find all the numbers r such that the angle between $\mathbf{x} = (r, 1, 1)$ and $\mathbf{y} = (1, r, 1)$ is $\frac{\pi}{3}$.
   (b) Find all the numbers r such that the vectors $\mathbf{x} = (r, 11, -3)$ and $\mathbf{y} = (2r, r, -5)$ are perpendicular.
9. Determine whether the given sets of points are the vertices of a right triangle.
   (a) $A : (0, 0),\ B : (2, 1),\ C : (-2, 4)$ (b) $A : (0, 0, 0),\ B : (2, -1, 3),\ C : (-2, 1, -2)$
   (c) $A : (0, 0, 0),\ B : (5, 4, 1),\ C : (1, -2, 3)$
10. Show that if $\mathbf{x}$ is perpendicular to both $\mathbf{y}$ and $\mathbf{z}$, then $\mathbf{x}$ is perpendicular to $\mathbf{y} + \mathbf{z}$.