Math 215: Calculus 3, HW1

Due date: 1/22 or 1/24

1. Describe in words the region of $\mathbb{R}^3$ represented by $x^2 + z^2 = 25$.

2. Write inequalities to describe the solid left ($x < 0$ is left) hemisphere of a sphere of radius 4 centered at the origin.

3. Given vectors $\mathbf{a}$ and $\mathbf{b}$ as in $\mathbf{b}$, copy the vectors and then draw $\mathbf{a} + \mathbf{b}, \mathbf{a} - \mathbf{b}, \mathbf{a}/2, -4\mathbf{b},$ and $2\mathbf{b} - \mathbf{a}$.

4. If $\mathbf{a}$ and $\mathbf{b}$ are as in the previous problem, sketch vectors $\mathbf{c}$ and $\mathbf{d}$ such that the sum of $\mathbf{c}$ and $\mathbf{d}$ is equal to $\mathbf{a}$ and their difference equal to $\mathbf{b}$.

5. Find the coordinate representation of the vector joining $A : (0, 4)$ and $B : (-3, 2)$. Sketch $\overrightarrow{AB}$ and the same vector with starting point at the origin.

6. Suppose wind is blowing from $N45^\circ W$ at a speed of 50 km/h. A pilot is steering the plane due North at an airspeed (speed relative to air) of 250 km/h. The true course is the direction of the sum of the two vectors and the ground speed is the magnitude of the resultant vector. Find the true course and the ground speed.

7. Find the value of $x$ so that the angle between $\begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix}$ and $\begin{pmatrix} 1 \\ x \\ 0 \end{pmatrix}$ is $45^\circ$.

8. A tow truck drags a stalled car. The chain makes an angle of $30^\circ$ with the road and the tension in the chain is 1500 Newtons. Find the work done by the tow truck in dragging the car for 1 km.
9. Find the angle between a diagonal of a cube and a diagonal of one of its faces.