Math 2050 Assignment 1, Due September 20, 2017

[3] 1. If $B = (1, -4, 3)$ and $\vec{AB} = \begin{bmatrix} -1 \\ 2 \\ 5 \end{bmatrix}$, find A.

[4] 2. Given $\vec{u} = \begin{bmatrix} -2 \\ 2 \end{bmatrix}$ and $\vec{v} = \begin{bmatrix} 1 \\ -4 \end{bmatrix}$, find $\vec{u} - \vec{v}$ and illustrate the subtraction with a picture.

[6] 3. Let $\vec{u}_1 = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$, $\vec{u}_2 = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$, $\vec{u}_3 = \begin{bmatrix} 2 \\ 0 \\ -2 \end{bmatrix}$ and $\vec{u}_4 = \begin{bmatrix} 5 \\ 10 \\ 3 \end{bmatrix}$

Are $\vec{u}_1$ and $\vec{u}_2$ parallel? $\vec{u}_1$ and $\vec{u}_3$? $\vec{u}_1$ and $\vec{u}_4$?

[5] 4. Let $P_1(2, -3, 6)$ and $P_2(2, 2, -4)$. Find the coordinates of the point P on the line segment from P_1 to P_2 such that $\overrightarrow{P_1P} = \frac{2}{5}\overrightarrow{PP_2}$.

[6] 5. Express each of the following as a single vector.

(a) $3\begin{bmatrix} 1 \\ 0 \\ -2 \end{bmatrix} - 4\begin{bmatrix} 6 \\ 1 \\ 5 \end{bmatrix} + 2\begin{bmatrix} -1 \\ 1 \\ 2 \end{bmatrix}$ (b) $a\begin{bmatrix} -1 \\ 5 \end{bmatrix} - 3\begin{bmatrix} -a \\ 2 \end{bmatrix}$

[6] 6. In each of the following cases, either express $\vec{p}$ as a linear combination of $\vec{u}, \vec{v}, \vec{w}$ or explain why there is no such linear combination.

(a) $\vec{p} = \begin{bmatrix} -4 \\ 7 \\ 5 \\ 0 \end{bmatrix}$, $\vec{u} = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$, $\vec{w} = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$

(b) $\vec{p} = \begin{bmatrix} -1 \\ 2 \\ 4 \end{bmatrix}$, $\vec{u} = \begin{bmatrix} 3 \\ 7 \\ 0 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix}$, $\vec{w} = \begin{bmatrix} 3 \\ 1 \\ 0 \end{bmatrix}$

[4] 7. Suppose $\vec{u} = \begin{bmatrix} a \\ -5 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} 1 \\ 6-b \end{bmatrix}$ and $\vec{w} = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$. Find a and b such that $2\vec{u} - 3\vec{v} + 5\vec{w} = \vec{0}$.

[5] 8. Use vectors to show that the mid-point of the line joining $A(x_1, x_2, x_3)$ to $B(y_1, y_2, y_3)$ is the point $C(\frac{x_1+y_1}{2}, \frac{x_2+y_2}{2}, \frac{x_3+y_3}{2})$.

[6] 9. Given three points $A(-1, 0)$, $B(2, 3)$, $C(4, -1)$ in the plane, find all points D such that ABCD are the vertices of a parallelogram. (hint: three possible locations for D).

[5] 10. Let $\vec{u} = \begin{bmatrix} -3 \\ 2 \\ 1 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} 5 \\ 0 \\ -3 \end{bmatrix}$ and $\vec{w} = \begin{bmatrix} 6 \\ 1 \\ -4 \end{bmatrix}$. Is it possible to find a scalar t such that $\vec{u} + t\vec{v}$ is parallel to $\vec{w}$.

[50]