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MATH 108
Spring 2023
HW 13: Due 05/01

"There is hardly any theory which is more elementary [than linear algebra], in spite of the fact that generations of professors and textbook writers have obscured its simplicity by preposterous calculations with matrices."

–Jean Dieudonné

Problem 1. (10pt) Define $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$ to be the vectors given below:

$$\mathbf{u} = \begin{pmatrix} 1 \\ -3 \\ 5 \end{pmatrix}, \qquad \mathbf{v} = \begin{pmatrix} 0 \\ 2 \\ -3 \end{pmatrix}, \qquad \mathbf{w} = \begin{pmatrix} 2 \\ -1 \\ 4 \end{pmatrix}$$

Compute the following:

(a) $-3\mathbf{v}$

(b) $\mathbf{w} - \mathbf{u}$

(c) $2\mathbf{u} + \mathbf{v}$

(d) $\mathbf{v} \cdot \mathbf{w}$

Solution.

(a)

$$-3\mathbf{v} = -3 \begin{pmatrix} 0 \\ 2 \\ -3 \end{pmatrix} = \begin{pmatrix} 0 \\ -6 \\ 9 \end{pmatrix}$$

(b)

$$\mathbf{w} - \mathbf{u} = \begin{pmatrix} 2 \\ -1 \\ 4 \end{pmatrix} - \begin{pmatrix} 1 \\ -3 \\ 5 \end{pmatrix} =$$

(c)

$$2\mathbf{u} + \mathbf{v} = 2 \begin{pmatrix} 1 \\ -3 \\ 5 \end{pmatrix} + \begin{pmatrix} 0 \\ 2 \\ -3 \end{pmatrix} =$$

(d)

$$\mathbf{v} \cdot \mathbf{w} = \begin{pmatrix} 0 \\ 2 \\ -3 \end{pmatrix} \cdot \begin{pmatrix} 2 \\ -1 \\ 4 \end{pmatrix} =$$

Problem 2. (10pt) Define the following:

$$A = \begin{pmatrix} 1 & 0 & -3 \\ 2 & -1 & 1 \\ 0 & 5 & 2 \end{pmatrix}, \qquad B = \begin{pmatrix} 2 & 1 & 1 \\ 0 & 3 & 0 \\ -1 & 4 & -2 \end{pmatrix}, \qquad \mathbf{u} = \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}$$

Compute the following:

(a) $2B$

(b) AB

(c) BA

(d) $A\mathbf{u}$