Assignment WW-M5-MatrixVectorMultiplication

1. (1 point) Evaluate the following matrix product.

$$\begin{bmatrix} -3 & 4 \\ 2 & -1 \end{bmatrix}\begin{bmatrix} -9 \\ 2 \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$$

Correct Answers:

- $\begin{bmatrix} 35 \\ -20 \end{bmatrix}$

2. (1 point) Suppose that T is a linear transformation such that

$$T\left(\begin{bmatrix} 1 \\ 0 \end{bmatrix}\right) = \begin{bmatrix} -3 \\ 3 \end{bmatrix}, \quad T\left(\begin{bmatrix} 0 \\ 1 \end{bmatrix}\right) = \begin{bmatrix} 3 \\ -4 \end{bmatrix},$$

Write T as a matrix transformation.

For any $\vec{x} \in \mathbb{R}^2$, the linear transformation T is given by $T(\vec{x}) = \begin{bmatrix} \_\_ & \_\_ \\ \_\_ & \_\_ \end{bmatrix}\vec{x}$.

Correct Answers:

- $\begin{bmatrix} -3 & 3 \\ 3 & -4 \end{bmatrix}$

3. (1 point) Let

$$A = \begin{bmatrix} -3 & -6 \\ 6 & 14 \\ 1 & 4 \end{bmatrix} \text{ and } \vec{b} = \begin{bmatrix} -6 \\ 10 \\ 0 \end{bmatrix}.$$

A linear transformation $T : \mathbb{R}^2 \to \mathbb{R}^3$ is defined by $T(x) = Ax$. Find an $\vec{x}$ in $\mathbb{R}^2$ whose image under T is $\vec{b}$.

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$$

Correct Answers:

- $\begin{bmatrix} 4 \\ -1 \end{bmatrix}$

4. (1 point) Let

$$A = \begin{bmatrix} -9 & 3 \\ 2 & -3 \\ 3 & -2 \end{bmatrix}.$$

Define the linear transformation $T : \mathbb{R}^2 \to \mathbb{R}^3$ by $T(\vec{x}) = A\vec{x}$. Find the images of $\vec{u} = \begin{bmatrix} 5 \\ -3 \end{bmatrix}$ and $\vec{v} = \begin{bmatrix} a \\ b \end{bmatrix}$ under T.

$$T(\vec{u}) = \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$$

$$T(\vec{v}) = \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$$

Correct Answers:

- $\begin{bmatrix} -54 \\ 19 \\ 21 \end{bmatrix}$
- $\begin{bmatrix} 3*b-9*a \\ 2*a-3*b \\ 3*a-2*b \end{bmatrix}$