Week 6 Conceptual Quiz

full credit by February 18, 2026, 11:59:00 PM MST, closes March 4, 2026, 11:59:00 PM MST

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Problem 1. **(2 points)**
Let $T : \mathbb{R}^4 \to \mathbb{R}^2$ be a linear transformation with

$$T\left(\begin{bmatrix} 0 \\ 1 \\ -9 \\ 8 \end{bmatrix}\right) = \begin{bmatrix} 1 \\ -5 \end{bmatrix} \quad \text{and} \quad T\left(\begin{bmatrix} 9 \\ 1 \\ 0 \\ -2 \end{bmatrix}\right) = \begin{bmatrix} 5 \\ -9 \end{bmatrix}.$$

Notice that

$$\begin{bmatrix} 54 \\ 11 \\ -45 \\ 28 \end{bmatrix} = 5\begin{bmatrix} 0 \\ 1 \\ -9 \\ 8 \end{bmatrix} + 6\begin{bmatrix} 9 \\ 1 \\ 0 \\ -2 \end{bmatrix}$$

What is $T\left(\begin{bmatrix} 54 \\ 11 \\ -45 \\ 28 \end{bmatrix}\right)$?

- A. $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$
- B. $\begin{bmatrix} 35 \\ -79 \end{bmatrix}$
- C. $\begin{bmatrix} 4 \\ 2 \end{bmatrix}$
- D. $\begin{bmatrix} 5 \\ 6 \end{bmatrix}$
- E. We do not have enough information to find this value.

What is $T\left(\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}\right)$?

- A. $\begin{bmatrix} 35 \\ -79 \end{bmatrix}$
- B. $\begin{bmatrix} 4 \\ 2 \end{bmatrix}$
- C. $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$
- D. $\begin{bmatrix} 5 \\ 6 \end{bmatrix}$
- E. We do not have enough information to find this value.

Correct Answers:

- B
- C

Problem 2. **(2 points)**
Suppose that $T : \mathbb{R}^n \to \mathbb{R}^m$ is a linear transformation. Determine whether each of the following statements is true or false.

If we know where T maps all of the standard basis vectors of $\mathbb{R}^n$, we can figure out where T maps any vector in $\mathbb{R}^n$.

- A. False
- B. True

The matrix representing T has m rows and n columns.

- A. True
- B. False

In order for the expression $T(\vec{v}) = \vec{w}$ to make sense, $\vec{w}$ must be a vector in $\mathbb{R}^n$.

- A. True
- B. False

In order for the expression $T(\vec{v}) = \vec{w}$ to make sense, $\vec{v}$ must be a vector in $\mathbb{R}^m$.

- A. True
- B. False

Correct Answers:

- B
- A
- B
- B

Problem 3. **(1 point)**
We saw that the derivative is a linear transformation from $\mathcal{P}_3$ to $\mathcal{P}_2$. Said another way, if we are considering the derivative to be a function with domain $\mathcal{P}_3$, then its image is $\mathcal{P}_2$.

The second derivative is also a linear transformation. What is the image of the second derivative, considered as a function with domain $\mathcal{P}_3$?

- A. $\mathcal{P}_1$
- B. $\mathcal{P}_0$
- C. $\mathcal{P}_3$
- D. $\mathcal{P}_2$

Correct Answers:

- A