

Readiness Assurance Test

Choose the most appropriate response for each question.

- 31) Suppose $f(x)$ and $g(x)$ are real-valued functions satisfying

$$\begin{array}{ll} f(2) = 4 & g(2) = 4 \\ f(3) = 5 & g(3) = 5 \\ f(4) = 3 & g(4) = 2 \end{array}$$

Compute $(f \circ g)(2)$.

- (a) 3 (b) 4 (c) 5 (d) 6

- 32) Let $f(x) = x^2 - 2$ and $g(x) = x^2 + 1$. Compute the composition function $(f \circ g)(x)$.

- (a) $x^2 - 1$ (b) $x^4 - 4x^2 + 5$ (c) $x^4 + 2x^2 - 1$ (d) $x^4 - x^2 - 2$

- 33) What is the standard matrix corresponding to the linear transformation $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ given by $T \left(\begin{bmatrix} x \\ y \\ z \end{bmatrix} \right) =$

$$\begin{bmatrix} x + 2y - z \\ y + 3z \\ x + 7y \end{bmatrix} ?$$

- (a) $\begin{bmatrix} 1 & 2 & -1 \\ 1 & 3 & 0 \\ 1 & 7 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 3 & 7 \\ -1 & 0 & 0 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 2 & -1 \\ 0 & 1 & 3 \\ 1 & 7 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & 0 & 1 \\ 2 & 1 & 7 \\ -1 & 3 & 0 \end{bmatrix}$

- 34) Let $T : \mathbb{R}^3 \rightarrow \mathbb{R}^2$ be the linear map corresponding to the standard matrix $\begin{bmatrix} 2 & 1 & -1 \\ 0 & 1 & 3 \end{bmatrix}$. Compute

$$T \left(\begin{bmatrix} 1 \\ -1 \\ 3 \end{bmatrix} \right).$$

- (a) $\begin{bmatrix} -2 \\ 8 \end{bmatrix}$ (b) $\begin{bmatrix} -2 \\ -8 \end{bmatrix}$ (c) $\begin{bmatrix} 2 \\ -4 \end{bmatrix}$ (d) $\begin{bmatrix} 2 \\ 4 \end{bmatrix}$

- 35) Let $T : \mathbb{R}^2 \rightarrow \mathbb{R}^3$ be the linear transformation corresponding to the standard matrix $A = \begin{bmatrix} 2 & 3 \\ -1 & -1 \\ 0 & 4 \end{bmatrix}$.

Compute $T \left(\begin{bmatrix} 2 \\ -1 \end{bmatrix} \right)$.

- (a) $\begin{bmatrix} 2 \\ -1 \\ 0 \end{bmatrix}$ (b) $\begin{bmatrix} 5 \\ 7 \\ 4 \end{bmatrix}$ (c) $\begin{bmatrix} 4 \\ -1 \\ 8 \end{bmatrix}$ (d) $\begin{bmatrix} 1 \\ -1 \\ -4 \end{bmatrix}$

- 36) Let $T : \mathbb{R}^4 \rightarrow \mathbb{R}^2$ be the linear transformation corresponding to the standard matrix $\begin{bmatrix} 3 & -1 & 0 & 2 \\ -2 & -4 & -1 & 1 \end{bmatrix}$.

What are the domain and codomain of T ?

- (a) The domain is \mathbb{R}^2 and the codomain is \mathbb{R}^4
- (b) The domain and codomain are both \mathbb{R}^2
- (c) The domain is \mathbb{R}^4 and the codomain is \mathbb{R}^2
- (d) The domain and codomain are both \mathbb{R}^4

- 37) Which of the following is true of the linear transformation $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ given by

$$T\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} x + 3y - 4z \\ x + y \\ 3z \end{bmatrix}?$$

- (a) T is neither injective nor surjective
- (b) T is both injective and surjective
- (c) T is injective but not surjective
- (d) T is surjective but not injective

- 38) Which of the following is true of the linear transformation $T : \mathbb{R}^3 \rightarrow \mathbb{R}^2$ given by

$$T\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} x - y \\ x + z \end{bmatrix}?$$

- (a) T is injective but not surjective
- (b) T is both injective and surjective
- (c) T is surjective but not injective
- (d) T is neither injective nor surjective

- 39) Let $T : \mathbb{R}^n \rightarrow \mathbb{R}^m$ be a linear transformation with standard matrix A . Which of the following is **not** a characterization of the statement “ T is injective”?

- (a) If $T(\vec{v}) = T(\vec{w})$ for some $\vec{v}, \vec{w} \in \mathbb{R}^n$, then $\vec{v} = \vec{w}$.
- (b) T has a non-trivial kernel
- (c) The columns of A are linearly independent
- (d) $\text{RREF}(A)$ has a pivot in every column

- 40) Let $T : \mathbb{R}^n \rightarrow \mathbb{R}^m$ be a linear transformation with standard matrix A . Which of the following is **not** a characterization of the statement “ T is surjective”?

- (a) $\text{RREF}(A)$ has a pivot in every row
- (b) $\text{Im } T = \mathbb{R}^m$
- (c) The columns of A span \mathbb{R}^m
- (d) $\text{RREF}(A)$ has a pivot in every column