Readiness Assurance Test

Choose the most appropriate response for each question.

1) Simplify the following vector expression.

$$4\begin{bmatrix}1\\2\\3\end{bmatrix} - 2\begin{bmatrix}1\\2\\3\end{bmatrix}$$

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

2) Express the following system of linear equations as an augmented matrix.

$$\begin{aligned}2x_1 + x_2 + 4x_3 &= 0\\ x_1 + x_2 + x_3 &= 1\\ -3x_1 + 4x_2 + x_3 &= -7\end{aligned}$$

(a) $\left[\begin{array}{cc|c}2 & 1 & -3\\1 & 1 & 4\\4 & 1 & 1\\0 & 1 & -7\end{array}\right]$ (b) $\left[\begin{array}{ccc|c}2 & 1 & 4 & 0\\1 & 1 & 1 & 1\\-3 & 4 & 1 & -7\end{array}\right]$ (c) $\left[\begin{array}{cc|c}1 & 1 & 1\\1 & -2 & 4\\4 & 1 & 1\\0 & 1 & -7\end{array}\right]$ (d) $\left[\begin{array}{cc|c}2 & 1 & 4\\1 & 1 & 1\\-3 & 4 & -7\end{array}\right]$

3) Find RREF $\left[\begin{array}{cc|c}1 & 2 & 3\\3 & 2 & 5\\-2 & 0 & -2\end{array}\right]$.

(a) $\left[\begin{array}{cc|c}1 & 0 & 1\\0 & 1 & 1\\0 & 0 & 0\end{array}\right]$ (b) $\left[\begin{array}{cc|c}1 & 2 & 3\\1 & 3 & 4\\0 & 0 & 0\end{array}\right]$ (c) $\left[\begin{array}{cc|c}1 & 2 & 3\\0 & 1 & 1\\0 & 0 & 0\end{array}\right]$ (d) $\left[\begin{array}{cc|c}1 & 0 & 0\\0 & 1 & 0\\0 & 0 & 1\end{array}\right]$

4) Solve the following system of linear equations.

$$\begin{aligned}2x_1 + x_2 + 4x_3 &= 0\\ x_1 + x_2 + x_3 &= 1\\ -3x_1 + 4x_2 + x_3 &= -7\end{aligned}$$

(a) $\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix} = \begin{bmatrix}2\\0\\-1\end{bmatrix}$

(b) $\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix} = \begin{bmatrix}1\\-6\\1\end{bmatrix}$

(c) $\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix} = \begin{bmatrix}1\\-2\\1\end{bmatrix} + a\begin{bmatrix}1\\0\\3\end{bmatrix}$ for all real numbers a

(d) No solutions

5) Solve the following system of linear equations.

$$\begin{aligned} x_1 + x_2 + x_3 + x_4 &= 4 \\ 2x_1 + 3x_2 + x_4 &= 0 \end{aligned}$$

(a) $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 0 \\ 1 \end{bmatrix}$

(b) $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 4 \\ -5 \end{bmatrix} + a \begin{bmatrix} 0 \\ 3 \\ 1 \\ 1 \end{bmatrix}$ for all real numbers a

(c) $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 12 \\ -8 \\ 0 \\ 0 \end{bmatrix} + a \begin{bmatrix} -3 \\ 2 \\ 1 \\ 0 \end{bmatrix} + b \begin{bmatrix} -2 \\ 1 \\ 0 \\ 1 \end{bmatrix}$ for all real numbers a, b

(d) No solutions

6) How many vectors are required to span all of $\mathbb{R}^4$ (the space of Euclidean vectors with four components)?

(a) 2 (b) 3 (c) 4 (d) 5

7) How many vectors are required to span all of $\mathcal{P}^4$ (the space of polynomials of degree four or less)?

(a) 2 (b) 3 (c) 4 (d) 5

8) Which vector is a linear combination of $\begin{bmatrix} -3 \\ 2 \\ 1 \\ 0 \end{bmatrix}$ and $\begin{bmatrix} -2 \\ 1 \\ 0 \\ 1 \end{bmatrix}$?

(a) $\begin{bmatrix} 1 \\ 2 \\ 4 \\ 0 \end{bmatrix}$ (b) $\begin{bmatrix} 0 \\ 0 \\ 3 \\ -7 \end{bmatrix}$ (c) $\begin{bmatrix} 2 \\ 2 \\ 0 \\ 1 \end{bmatrix}$ (d) $\begin{bmatrix} -5 \\ 3 \\ 1 \\ 1 \end{bmatrix}$

9) Which vector belongs to span $\left\{ \begin{bmatrix} -3 \\ 2 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} -2 \\ 1 \\ 0 \\ 1 \end{bmatrix} \right\}$?

(a) $\begin{bmatrix} 3 \\ -7 \\ 1 \\ 1 \end{bmatrix}$ (b) $\begin{bmatrix} 4 \\ 1 \\ 2 \\ 3 \end{bmatrix}$ (c) $\begin{bmatrix} 0 \\ 1 \\ 2 \\ -3 \end{bmatrix}$ (d) $\begin{bmatrix} -1 \\ -1 \\ 0 \\ 0 \end{bmatrix}$

10) The graphical representation of span $\left\{ \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \right\}$ in three-dimensional Euclidean space $\mathbb{R}^3$ would be which of the following?

(a) a line (b) a plane (c) a sphere (d) all of $\mathbb{R}^3$