Readiness Assurance Test

Choose the most appropriate response for each question.

11) Simplify the following Euclidean vector expression.

$$2\begin{bmatrix}3\\-1\\0\end{bmatrix} - 3\begin{bmatrix}0\\2\\1\end{bmatrix}$$

(a) $\begin{bmatrix}0\\4\\-8\end{bmatrix}$ (b) $\begin{bmatrix}3\\2\\-5\end{bmatrix}$ (c) $\begin{bmatrix}6\\-8\\-3\end{bmatrix}$ (d) $\begin{bmatrix}-2\\0\\1\end{bmatrix}$

12) Simplify the following Euclidean vector expression.

$$2\left(\begin{bmatrix}1\\1\\-1\end{bmatrix} + \begin{bmatrix}-1\\1\\-3\end{bmatrix}\right)$$

(a) $\begin{bmatrix}0\\4\\-8\end{bmatrix}$ (b) $\begin{bmatrix}6\\-8\\-3\end{bmatrix}$ (c) $\begin{bmatrix}3\\2\\-5\end{bmatrix}$ (d) $\begin{bmatrix}-2\\0\\1\end{bmatrix}$

13) Which of the following vectors is an element of the set $\left\{\begin{bmatrix}x\\y\\z\end{bmatrix} \middle| x^2 - 3y = z\right\}$?

(a) $\begin{bmatrix}2\\1\\1\end{bmatrix}$ (b) $\begin{bmatrix}1\\2\\1\end{bmatrix}$ (c) $\begin{bmatrix}1\\1\\2\end{bmatrix}$ (d) $\begin{bmatrix}1\\1\\1\end{bmatrix}$

14) Which of the following vectors is an element of the set $\left\{\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix} \middle| x_1 + 3x_2 - x_3 = 0\right\}$?

(a) $\begin{bmatrix}1\\2\\5\end{bmatrix}$ (b) $\begin{bmatrix}2\\1\\5\end{bmatrix}$ (c) $\begin{bmatrix}1\\5\\2\end{bmatrix}$ (d) $\begin{bmatrix}5\\1\\2\end{bmatrix}$

15) Simplify $3f(x) - 2g(x)$ where $f(x) = 7 - x^2$ and $g(x) = 2x^3 + x - 1$.

(a) $x^3 + 4x - 5$ (b) $3x^3 + 5x^2 - 3x + 17$ (c) $-4x^3 - 3x^2 - 2x + 23$ (d) $-x^3 + 19x^2 - 4$

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

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

(a) $\left[\begin{array}{c|c} 1 & 0 \\ 2 & 0 \\ 0 & 1 \\ -1 & 4 \\ -2 & 3 \end{array}\right]$ (b) $\left[\begin{array}{c|c} 1 & 2 \\ 0 & -1 \\ 3 & 0 \\ 0 & 1 \\ 4 & -2 \end{array}\right]$ (c) $\left[\begin{array}{cccc|c} 1 & 2 & 0 & -1 & 3 \\ 0 & 0 & 1 & 4 & -2 \end{array}\right]$ (d) $\left[\begin{array}{cccc|c} 1 & 2 & 1 & 4 & 3 \\ -2 & 1 & 3 & 4 & 5 \end{array}\right]$

17) Which of the following matrices is equivalent to the following matrix?

$$\left[\begin{array}{ccc|c} 1 & 2 & 3 & -1 \\ 0 & 4 & -1 & 2 \\ 2 & 3 & 2 & 3 \end{array}\right]$$

(Hint: The correct answer was obtained from a single row operation.)

(a) $\left[\begin{array}{ccc|c} 1 & 2 & 3 & -1 \\ 0 & 4 & -1 & 2 \\ 0 & 0 & 1 & 7 \end{array}\right]$ (b) $\left[\begin{array}{ccc|c} 1 & 2 & 3 & -1 \\ 1 & 3 & 4 & 3 \\ 2 & 3 & 2 & 3 \end{array}\right]$ (c) $\left[\begin{array}{ccc|c} 1 & 2 & 3 & -1 \\ 0 & 1 & 1 & 4 \\ 2 & 3 & 2 & 3 \end{array}\right]$ (d) $\left[\begin{array}{ccc|c} 1 & 2 & 3 & -1 \\ 0 & 4 & -1 & 2 \\ 0 & -1 & -4 & 5 \end{array}\right]$

18) Find RREF $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 4 & -1 \\ 2 & 3 & 2 \end{bmatrix}$.

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

19) What is the solution set of 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) $\emptyset$ (i.e. the system is inconsistent). (b) $\left\{ \begin{bmatrix} 1+a \\ -2 \\ 1+3a \end{bmatrix} \middle| a \in \mathbb{R} \right\}$ (c) $\left\{ \begin{bmatrix} 1 \\ -6 \\ 1 \end{bmatrix} \right\}$ (d) $\left\{ \begin{bmatrix} 2 \\ 0 \\ -1 \end{bmatrix} \right\}$

20) What is the solution set of the following system of linear equations?

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

(a) $\emptyset$ (i.e. the system is inconsistent). (b) $\left\{ \begin{bmatrix} -3a \\ 2a \\ a \end{bmatrix} \middle| a \in \mathbb{R} \right\}$ (c) $\left\{ \begin{bmatrix} 4 \\ 1 \\ -5 \end{bmatrix} \right\}$ (d) $\left\{ \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix} \right\}$