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.

$$x_1 + 2x_2 - x_4 = 3$$
$$x_3 + 4x_4 = -2$$

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

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

(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?

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

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