

## Readiness Assurance Outcomes

Before beginning this module, each student should be able to...

- Solve a system of linear equations (including finding a basis of the solution space if it is homogeneous) by interpreting as an augmented matrix and row reducing (**Standard(s) E1, E2, E3, E4**).
- State the definition of linear independence, and determine if a set of vectors is linearly dependent or independent (**Standard(s) V5**).
- State the definition of a spanning set, and determine if a set of vectors spans a vector space or subspace (**Standard(s) V6, V7**).
- State the definition of a basis, and determine if a set of vectors is a basis (**Standard(s) V8, V9**).

## Readiness Assurance Resources

The following resources will help you prepare for this module.

- Review the supporting Standards listed above.

## Readiness Assurance Test

Choose the most appropriate response for each question.

- 1) Which of the following is a solution to the system of linear equations

$$\begin{aligned}x + 3y - z &= 2 \\ 2x + 8y + 3z &= -1 \\ -x - y + 9z &= -10\end{aligned}$$

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

- 2) Find a basis for the solution set of the following homogeneous system of linear equations

$$\begin{aligned}x + 2y + -z - w &= 0 \\ -2x - 4y + 3z + 5w &= 0\end{aligned}$$

- (a)  $\left\{ \begin{bmatrix} 2 \\ 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 2 \\ 0 \\ 3 \\ 1 \end{bmatrix} \right\}$       (b)  $\left\{ \begin{bmatrix} 2 \\ 2 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 3 \\ 0 \end{bmatrix} \right\}$       (c)  $\left\{ \begin{bmatrix} 2 \\ 1 \\ 3 \\ 1 \end{bmatrix} \right\}$       (d) None of these are a basis.

- 3) Determine which property applies to the set of vectors

$$\left\{ \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \right\} \subset \mathbb{R}^3.$$

- (a) It does not span and is linearly dependent  
(b) It does not span and is linearly independent  
(c) It spans but it is linearly dependent  
(d) It is a basis of  $\mathbb{R}^3$ .
- 4) Determine which property applies to the set of vectors

$$\left\{ \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 3 \end{bmatrix} \right\} \subset \mathbb{R}^3.$$

- (a) It does not span and is linearly dependent  
(b) It does not span and is linearly independent  
(c) It spans but it is linearly dependent  
(d) It is a basis of  $\mathbb{R}^3$ .

- 5) Determine which property applies to the set of vectors

$$\left\{ \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} -2 \\ 0 \\ -2 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 3 \\ 3 \\ -3 \end{bmatrix} \right\} \subset \mathbb{R}^3.$$

- (a) It does not span and is linearly dependent
- (b) It does not span and is linearly independent
- (c) It spans but it is linearly dependent
- (d) It is a basis of  $\mathbb{R}^3$ .

- 6) Determine which property applies to the set of vectors

$$\left\{ \begin{bmatrix} 2 \\ 2 \\ -1 \end{bmatrix}, \begin{bmatrix} -3 \\ 1 \\ -2 \end{bmatrix}, \begin{bmatrix} 1 \\ 5 \\ -4 \end{bmatrix} \right\} \subset \mathbb{R}^3.$$

- (a) It does not span and is linearly dependent
- (b) It does not span and is linearly independent
- (c) It spans but it is linearly dependent
- (d) It is a basis of  $\mathbb{R}^3$ .

- 7) Find a basis for the subspace of  $\mathbb{R}^4$  spanned by the vectors ...

- 8) Suppose you know that every vector in  $\mathbb{R}^5$  can be written as a linear combination of the vectors  $\{\vec{v}_1, \dots, \vec{v}_n\}$ . What can you conclude about  $n$ ?

- (a)  $n \leq 5$
- (b)  $n = 5$
- (c)  $n \geq 5$
- (d)  $n$  could be any positive integer

- 9) Suppose you know that every vector in  $\mathbb{R}^5$  can be written uniquely as a linear combination of the vectors  $\{\vec{v}_1, \dots, \vec{v}_n\}$ . What can you conclude about  $n$ ?

- (a)  $n \leq 5$
- (b)  $n = 5$
- (c)  $n \geq 5$
- (d)  $n$  could be any positive integer

- 10) Suppose you know that every vector in  $\mathbb{R}^5$  can be written uniquely as a linear combination of the vectors  $\{\vec{v}_1, \dots, \vec{v}_n\}$ . What can you conclude about the set  $\{\vec{v}_1, \dots, \vec{v}_n\}$ ?

- (a) It does not span and is linearly dependent
- (b) It does not span and is linearly independent
- (c) It spans but it is linearly dependent
- (d) It is a basis of  $\mathbb{R}^3$ .