

Math 20
§2.8 Subspaces of \mathbb{R}^n

Question 1: Which of the following subsets of \mathbb{R}^2 is *not* a subspace of \mathbb{R}^2 ?

1. The line through the origin with slope 3
2. The line passing through the points $(0, 4)$ and $(3, 0)$
3. $\text{Span} \left\{ \begin{bmatrix} 3 \\ 4 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \end{bmatrix} \right\}$
4. $\text{Span} \left\{ \begin{bmatrix} 2 \\ -3 \end{bmatrix}, \begin{bmatrix} -6 \\ 9 \end{bmatrix} \right\}$

Question 2: Which of the following subsets of \mathbb{R}^2 is a subspace of \mathbb{R}^2 ?

1. $\{\mathbf{0}\}$
2. $\left\{ \begin{bmatrix} x \\ y \end{bmatrix} : x \geq 0, y \geq 0 \right\}$
3. $\left\{ \begin{bmatrix} x \\ y \end{bmatrix} : xy \geq 0 \right\}$
4. $\left\{ \begin{bmatrix} x \\ y \end{bmatrix} : x \geq 0, y \text{ is real} \right\}$

Question 3: Which of the following sets is *not* a subspace of \mathbb{R}^3 ?

1. The set of all linear combinations of the columns of the matrix $A = \begin{bmatrix} 1 & 8 & -2 \\ 2 & -8 & 4 \\ 4 & 8 & 0 \end{bmatrix}$
2. The set of all solutions to the homogeneous equation

$$\begin{bmatrix} 1 & 8 & -2 \\ 2 & -8 & 4 \\ 4 & 8 & 0 \end{bmatrix} \mathbf{x} = \mathbf{0}$$

3. \mathbb{R}^2
4. \mathbb{R}^3

Question 4: Which of the following sets is a basis for \mathbb{R}^3 ?

1. $\begin{bmatrix} 4 \\ 2 \\ -1 \end{bmatrix}, \begin{bmatrix} 3 \\ 3 \\ 1 \end{bmatrix}, \begin{bmatrix} 7 \\ 5 \\ 0 \end{bmatrix}$
2. $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}, \begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix}, \begin{bmatrix} 10 \\ 0 \\ 7 \end{bmatrix}$
3. $\begin{bmatrix} 2 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 3 \\ -2 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 3 \end{bmatrix}$
4. $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} 4 \\ 7 \\ 1 \end{bmatrix}$