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Course: Linear Algebra I (Spring 2020)

Assignment: Section 3.3 Homework

1. Use Cramer's rule to compute the solutions of the system.

$$3x_1 + 6x_2 = 9$$

$$4x_1 + 7x_2 = 14$$

What is the solution of the system?

$x_1 =$ 7

$x_2 =$ -2

2. Use Cramer's rule to compute the solutions of the system.

$$5x_1 + 3x_2 = 1$$
$$2x_1 + 4x_2 = -2$$

What is the solution of the system?

$x_1 = \frac{5}{7}$ $\quad x_2 = -\frac{6}{7}$

(Type integers or simplified fractions.)

3. Determine the values of the parameter s for which the system has a unique solution, and describe the solution.

$$5sx_1 + 6x_2 = 6$$
$$9x_1 + 4sx_2 = -3$$

Choose the correct answer below.

- **A.** $s \neq \pm 3\sqrt{\frac{3}{10}}$; $x_1 = \frac{3(-5s-18)}{2(10s^2-27)}$; $x_2 = \frac{3(4s+3)}{10s^2-27}$
- **B.** $s \neq \pm 3\sqrt{\frac{3}{10}}$; $x_1 = \frac{3(4s+3)}{10s^2-27}$; $x_2 = \frac{3(-5s-18)}{2(10s^2-27)}$
- **C.** $s \neq 0$; $x_1 = \frac{3(4s+3)}{10s^2-27}$; $x_2 = \frac{3(-5s-18)}{2(10s^2-27)}$
- **D.** $s \neq 0$; $x_1 = \frac{3(-5s-18)}{2(10s^2-27)}$; $x_2 = \frac{3(4s+3)}{10s^2-27}$

4. Determine the values of the parameter s for which the system has a unique solution, and describe the solution.

$$sx_1 - 4sx_2 = 3$$
$$3x_1 - 12sx_2 = 5$$

Choose the correct answer below.

- **A.** $s \neq -1$; $x_1 = \frac{4}{3(s+1)}$ and $x_2 = \frac{9-5s}{12s(s+1)}$
- **B.** $s \neq \pm 1$; $x_1 = \frac{4}{12(s-1)(s+1)}$ and $x_2 = \frac{9-5s}{12(s-1)(s+1)}$
- **C.** $s \neq -1$; $x_1 = \frac{14}{3(s+1)}$ and $x_2 = \frac{9+5s}{12s(s+1)}$
- **D.** $s \neq 0, 1$; $x_1 = \frac{4}{3(s-1)}$ and $x_2 = \frac{9-5s}{12s(s-1)}$

5. Compute the adjugate of the given matrix, and then use the Inverse Formula to give the inverse of the matrix.

$$A = \begin{bmatrix} 0 & -4 & -1 \\ 4 & 0 & 0 \\ -2 & 1 & 1 \end{bmatrix}$$

The adjugate of the given matrix is $\text{adj } A = \begin{bmatrix} 0 & 3 & 0 \\ -4 & -2 & -4 \\ 4 & 8 & 16 \end{bmatrix}$.

The inverse of the given matrix is $A^{-1} = \begin{bmatrix} 0 & \frac{1}{4} & 0 \\ -\frac{1}{3} & -\frac{1}{6} & -\frac{1}{3} \\ \frac{1}{3} & \frac{2}{3} & \frac{4}{3} \end{bmatrix}$

(Simplify your answers.)

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6. Compute the adjugate of the given matrix, and then use the Inverse Formula to give the inverse of the matrix.

$$A = \begin{bmatrix} 2 & 3 & 4 \\ 1 & 0 & 1 \\ 3 & 1 & 1 \end{bmatrix}$$

The adjugate of the given matrix is $\text{adj } A = \begin{bmatrix} -1 & 1 & 3 \\ 2 & -10 & 2 \\ 1 & 7 & -3 \end{bmatrix}$.

The inverse of the given matrix is $A^{-1} = \begin{bmatrix} -\frac{1}{8} & \frac{1}{8} & \frac{3}{8} \\ \frac{1}{4} & -\frac{5}{4} & \frac{1}{4} \\ \frac{1}{8} & \frac{7}{8} & -\frac{3}{8} \end{bmatrix}$.

(Simplify your answers.)

7. Compute the adjugate of the given matrix, and then use the Inverse Formula to give the inverse of the matrix.

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

The adjugate of the given matrix is $\text{adj } A = \begin{bmatrix} -2 & 0 & 0 \\ 2 & 2 & -2 \\ -8 & -6 & 2 \end{bmatrix}$.

The inverse of the given matrix is $A^{-1} = \begin{bmatrix} \frac{1}{2} & 0 & 0 \\ -\frac{1}{2} & -\frac{1}{2} & \frac{1}{2} \\ 2 & \frac{3}{2} & -\frac{1}{2} \end{bmatrix}$.

(Simplify your answers.)

8. Find the area of the parallelogram whose vertices are listed.

(0,0), (4,7), (9,4), (13,11)

The area of the parallelogram is 47 square units.

9. Find the area of the parallelogram whose vertices are listed.

(−2,−3), (0,3), (6,−5), (8,1)

The area of the parallelogram is 52 square units.

10. Find the volume of the parallelepiped with one vertex at the origin and adjacent vertices at (4,0,−2), (1,2,6), and (7,1,0).

The volume of the parallelepiped is 2. (Type an integer or a decimal.)

11. Let S be the parallelogram determined by the vectors $\mathbf{b}_1 = \begin{bmatrix} -4 \\ 4 \end{bmatrix}$ and $\mathbf{b}_2 = \begin{bmatrix} -4 \\ 7 \end{bmatrix}$, and let $A = \begin{bmatrix} 3 & -3 \\ -6 & 3 \end{bmatrix}$. Compute the area of the image of S under the mapping $\mathbf{x} \mapsto A\mathbf{x}$.

The area of the image of S under the mapping $\mathbf{x} \mapsto A\mathbf{x}$ is 108. (Type an integer or a decimal.)