Mini-Lecture 4.1

Solving Systems of Linear Equations in Two Variables

Learning Objectives:

1. Determine whether an ordered pair is a solution of a system of two linear equations.
2. Solve a system by graphing.
3. Solve a system by substitution.
4. Solve a system by elimination.

Examples:

1. Determine whether the given ordered pair is a solution of the system.

a) $\begin{cases} x+y=4 \\ x-y=2 \end{cases}$; (3,1) b) $\begin{cases} y=4 \\ x=-3y \end{cases}$; (−6,4) c) $\begin{cases} 2x+y=4 \\ -3x=2y+8 \end{cases}$; $\left(\frac{1}{2},3\right)$

2. Solve each system by graphing.

a) $\begin{cases} x+y=4 \\ x-y=2 \end{cases}$ b) $\begin{cases} 2x+4y=10 \\ 4x+3y=10 \end{cases}$ c) $\begin{cases} y=-x+3 \\ 2x+2y=-1 \end{cases}$

3. Use the substitution method to solve each system of equations.

a) $\begin{cases} x+y=4 \\ x-y=2 \end{cases}$ b) $\begin{cases} \frac{1}{4}x+\frac{1}{4}y=2 \\ x-y=2 \end{cases}$ c) $\begin{cases} y=-3x+8 \\ 12x+4y=32 \end{cases}$

4. Use the elimination method to solve each system of equations.

a) $\begin{cases} x+y=4 \\ x-y=2 \end{cases}$ b) $\begin{cases} x-6y=-9 \\ 8x-6y=-30 \end{cases}$ c) $\begin{cases} x-4y=-8 \\ -6x-3y=-6 \end{cases}$

d) $\begin{cases} 3x+6y=3 \\ 2x+9y=-8 \end{cases}$ e) $\begin{cases} 6x-8y=8 \\ 12x=16y+24 \end{cases}$ f) $\begin{cases} -6x-4y=-2 \\ -12y=-6+18x \end{cases}$

Teaching Notes:

- Help students visualize a system by graphing examples of the three possible results: one solution, no solution, ∞ solutions.
- Some students have trouble with the substitution method when fractions are involved.
- Most students prefer the addition method.
- Encourage students to check final answers.
- Many students have trouble drawing the conclusion of "no solution" or "infinite solutions" from the non-graphing methods.
- Refer students to the ***Possible Solutions to Systems of Two Linear Equations***, and ***Solving a System of Two Equations Using the Substitution/Elimination Method*** charts in the text.

Answers: (graphing answers at end of mini-lectures) 1a) yes; b) no; c) no; 2a) (3,1); b) (1,2); c) ∅ ; 3a) (3,1); b) (5,3); c) {(x,y)|y=−3x+8}; 4a) (3,1); b) (−3,1); c) (0,2); d) (5,−2); e) ∅ ; f) {(x,y)|−6x−4y=−2}

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Mini-Lecture 4.2

Solving Systems of Linear Equations in Three Variables

Learning Objectives:

1. Solve a system of three linear equations in three variables.

Examples:

1. Solve each system.

a) $\begin{aligned} x+y+z&=3\\ x-y+2z&=-1\\ 4x+y+z&=15 \end{aligned}$

b) $\begin{aligned} 5x+3y+z&=25\\ 3x-3y-z&=7\\ 4x+y+4z&=14 \end{aligned}$

c) $\begin{aligned} x+4y+2z&=-7\\ 5y+4z&=-15\\ z&=-5 \end{aligned}$

d) $\begin{aligned} x-y+4z&=3\\ 5x+z&=0\\ x+3y+z&=-9 \end{aligned}$

e) $\begin{aligned} \frac{2}{3}x-\frac{1}{2}y+2z&=-18\\ x-\frac{2}{3}y-\frac{1}{2}z&=-12\\ x-\frac{1}{2}y-z&=-8 \end{aligned}$

Teaching Notes:

- Students need to be extremely neat and organized to succeed with these.
- Most students prefer to use the elimination method repeatedly.
- Some students prefer to use the substitution method to eliminate the first variable whenever it is possible to do so without generating fractions.
- Most students have trouble visualizing these systems. Refer them to the figures of intersecting planes in the text.
- Refer students to the ***Solving a System of Three Linear Equations by the Elimination Method*** chart in the text.

Answers: 1a) (4,1,−2); b) (4,2,−1); c) (−1,1,−5); d) (0,−3,0); e) (−6,12,−4)

Mini-Lecture 4.5

Systems of Linear Inequalities

Learning Objectives:

1. Graph a system of linear inequalities.

Examples:

1. Graph the solutions of each system of two linear inequalities.

a) $\begin{cases} y \geq 2x - 4 \\ y \leq -x + 1 \end{cases}$ b) $\begin{cases} y \leq 2x - 1 \\ x + y > -4 \end{cases}$ c) $\begin{cases} y \leq 2x + 1 \\ y < -3x \end{cases}$

d) $\begin{cases} x + 3y > -6 \\ y < -2 \end{cases}$ e) $\begin{cases} x \geq -2 \\ y \geq 6 \end{cases}$

Graph the solutions of each system of three linear inequalities.

f) $\begin{cases} x + y \geq 1 \\ x - y \geq 1 \\ x \leq 4 \end{cases}$ g) $\begin{cases} 2x + 3y \geq 6 \\ x - y \leq 3 \\ y \leq 2 \end{cases}$ h) $\begin{cases} 2x + 3y \leq 6 \\ x - y \geq 3 \\ x \geq 1 \end{cases}$

Teaching Notes:

- Remind students to use a dashed line for $<$ or $>$ and a solid line for $\leq$ or $\geq$.
- Encourage students to use different colors for each line.
- Encourage students to check their graphs using a test point from the solution region.
- Refer students to the ***Graphing the Solutions of a System of Linear Inequalities*** chart in the text.

Answers: (graphing answers at end of mini−lectures)

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