THIS VIDEO WILL BE IN 3 PARTS
(A) 7.1A SOLVING SYSTEMS NOTES
(B) 7.1B SAMPLE PROBLEMS
(C) 7.1C SPECIAL SYSTEMS NOTES

7.5A NOTES INCLUDED

Date:

7.1 Solve Linear Systems by Graphing

Goal • Graph and solve systems of linear equations.

Your Notes

VOCABULARY

Systems of linear equations Consists of 2 or more LINEAR EQUATIONS WITH THE SAME VARIABLES

EXAMPLE (below) $3x - y = 5$
$-x + 3y = 1$

Solution of a system of linear equations

SOLUTIONS ARE THE POINT (x, y) ordered pair OR POINTS WHERE THE 2 LINES INTERSECT

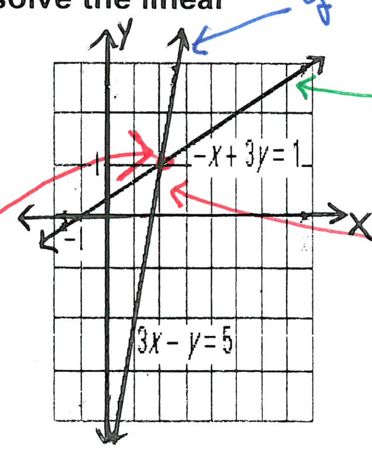
Example

Use the graph to solve the linear system

(L1) $3x - y = 5$

(L2) $-x + 3y = 1$

$y = 3x - 5$



$y = \frac{1}{3}x + \frac{1}{3}$

Solution is (2, 1)

FIND **Solution**

The solution is the point of intersection (POI) FOR THE LINES IN THE SYSTEM.

FOR THIS EXAPLE THE POI is the ordered pair (2, 1)

CHECK ALWAYS CHECK THE SOLUTION IN BOTH ORIGINAL EQUATIONS. FOR EXAMPLE

x y
(2, 1)

C: $3(2) - 1 = 5$
$5 = 5$ ✓

C: $-(2) + 3(1) = 1$
$-2 + 3 = 1$
$1 = 1$ ✓

SOLVING A LINEAR SYSTEM USING THE GRAPH-AND-CHECK METHOD

Step 1 GRAPH both equations in the same coordinate plane. For ease of graphing, you may want to write each equation in SLOPE-INTERCEPT $(y = mx + b)$

Step 2 Estimate the coordinates of the POINT OF INTERSECTION (POI)

Step 3 CHECK the coordinates algebraically by substituting into each equation of the original linear system.

Your Notes

Example 1 *Use the graph-and-check method*

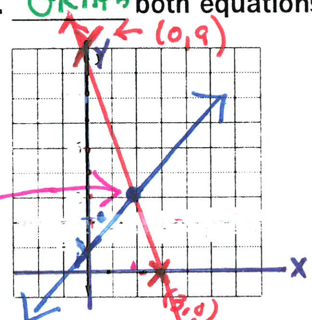
Solve the linear system: $3x + y = 9$ Equation 1

$-x + y = 1$ Equation 2

Solve this system

Solution

1. GRAPH both equations.



EQ1] $3x + y = 9$

x: 3

y: 9

EQ2] $-x + y = 1$

$+x \quad +x$

$y = x + 1$

$m = 1/1$

$b = 1$

To ease graphing, write each equation in slope intercept form.

(2, 3)

→ Solution

2. Estimate the point of intersection. The two lines appear to intersect at (2, 3).

3. Check whether (2, 3) is a solution by substituting 2 for x and 3 for y in each of the original equations.

Equation 1	Equation 2
$3x + y = 9$	$-x + y = 1$
$3(2) + 3 \stackrel{?}{=} 9$	$-(2) + 3 \stackrel{?}{=} 1$
$9 = 9$ ✓	$1 = 1$ ✓

Because (2, 3) is a solution of each equation in the original linear system, it is a solution to our system

Your Notes

Checkpoint Solve the linear system by graphing.

L1

x: 3 y: 6

L2 $2x - y = -10$

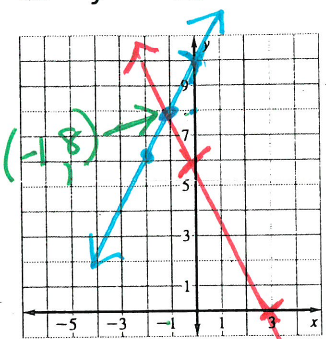
$-2x \qquad -2x$

$\frac{-y}{-1} = \frac{-2x}{-1} \frac{-10}{-1}$

$\boxed{y = 2x + 10}$

1. $2y + 4x = 12$

$2x - y = -10$



(−1, 8)

C: $2(8) + 4(-1) = 12$

$12 = 12$ ✓

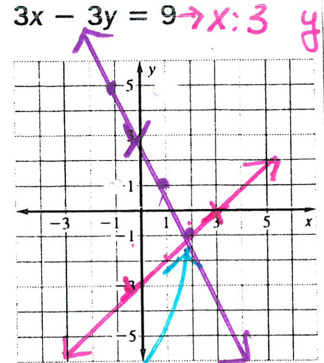
C: $2(-1) - (8) = -10$

$-2 - 8 = -10$

$-10 = -10$ ✓

2. $4x + 2y = 6$

$3x - 3y = 9$ → x: 3 y: −3



(2, −1)

C: $4(2) + 2(-1) = 6$

$6 = 6$ ✓

C: $3(2) - 3(-1) = 9$

$9 = 9$ ✓

$4x + 2y = 6$

$-4x \qquad -4x$

$\frac{2y}{2} = \frac{-4x}{2} + \frac{6}{2}$

$y = -2x + 3$

$3x - 3y = 9$

$-3x \qquad -3x$

$\frac{-3y}{-3} = \frac{-3x}{-3} + \frac{9}{-3}$

$y = x - 3$

L1

$\frac{2y}{2} = \frac{6x}{2} + \frac{8}{2}$

$y = 3x + 4$

L2

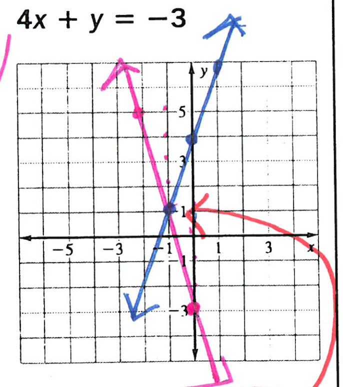
$4x + y = -3$

$-4x \qquad -4x$

$y = -4x - 3$

3. $2y = 6x + 8$

$4x + y = -3$



(−1, 1)

C: $2(1) = 6(-1) + 8$

$2 = 2$ ✓

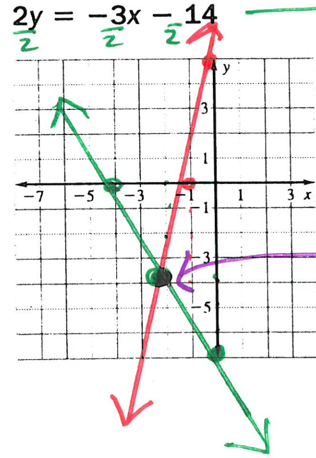
C: $4(-1) + 1 = -3$

$-3 = -3$ ✓

4. $y = 4x + 4$

$\frac{2y}{2} = \frac{-3x}{2} - \frac{14}{2}$

$y = \frac{-3}{2}x - 7$



$\boxed{(-2, -4)}$

C: $-4 = 4(-2) + 4$

$-4 = -4$ ✓

C: $2(-4) = -3(-2) - 14$

$-8 = 6 - 14$

$-8 = -8$ ✓

7.1 HW Review

CHECKING SOLUTIONS **Tell whether the ordered pair is a solution of the linear system.**

4. $(5, 2)$;
$2x - 3y = 4$
$2x + 8y = 11$

C: $2(5) - 3(2) = 4$
$10 - 6 = 4$
$4 = 4$ ✓

C: $2(5) + 8(2) = 11$
$10 + 8 = 11$
$18 \neq 11$ X

(5,2) IS NOT A SOLUTION TO THIS SYSTEM

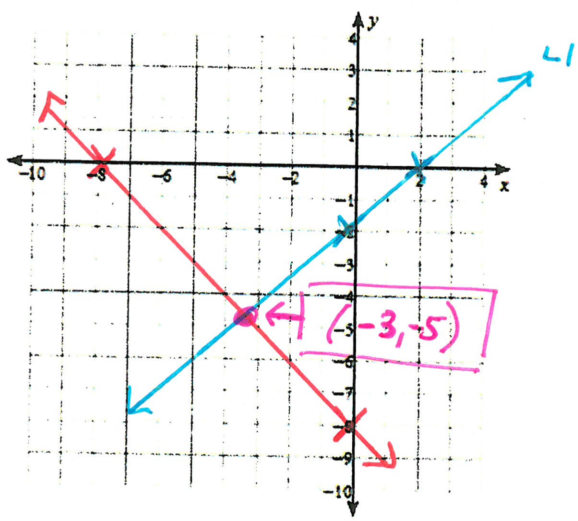
For the following, Make accurate graphs. Check solutionin the original Equations

15) Graph with x and y intercepts

15. $x - y = 2$ L1
$x + y = -8$ L2

L1: x: 2
y: −2

L2 x: −8
y: −8



Checks

L1: $-3 - (-5) = 2$
$2 = 2$ ✓

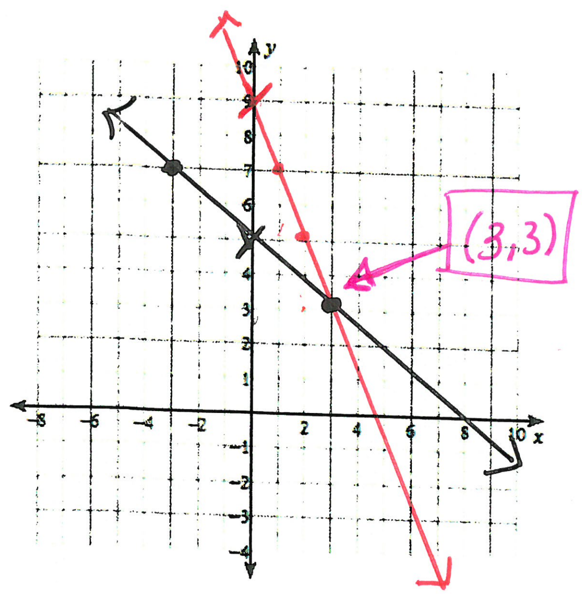
L2: $-3 + (-5) = -8$
$-8 = -8$ ✓

22) Graph using slope intercept form → $y = mx + b$

22. $2x + y = 9$ L1
$2x + 3y = 15$ L2

L1
$2x + y = 9$
$-2x \quad -2x$
$y = -2x + 9$
$m = -2/1 \qquad b = 9$

L2
$2x + 3y = 15$
$-2x \quad -2x$
$\frac{3y}{3} = \frac{-2x}{3} + \frac{15}{3}$
$y = -\frac{2}{3}x + 5$
$m = -2/3 \qquad b = 5$



C: $2(3) + 3 = 9$
$9 = 9$ ✓

C: $2(3) + 3(3) = 15$
$6 + 9 = 15$
$15 = 15$ ✓

35. MULTIPLE REPRESENTATIONS It costs \$15 for a yearly membership to a movie club at a movie theater. A movie ticket costs \$5 for club members and \$8 for nonmembers.

a. **Writing a System of Equations** Write a system of equations that you can use to find the number x of movies viewed after which the total cost y for a club member, including the membership fee, is the same as the cost for a nonmember.

b. **Making a Table** Make a table of values that shows the total cost for a club member and a nonmember after paying to see 1, 2, 3, 4, 5, and 6 movies.

c. **Drawing a Graph** Use the table to graph the system of equations. Under what circumstances does it make sense to become a movie club member? *Explain* your answer by using the graph.

Key Info: (KI)

Members
- \$15 annual membership
- \$5/movie

Non Members
- \$8/movie

Define variables: remember UNITS

x = # of movies viewed

y = total cost spent (\$'s)

Define equations:

Members: $y = 15 + 5x$

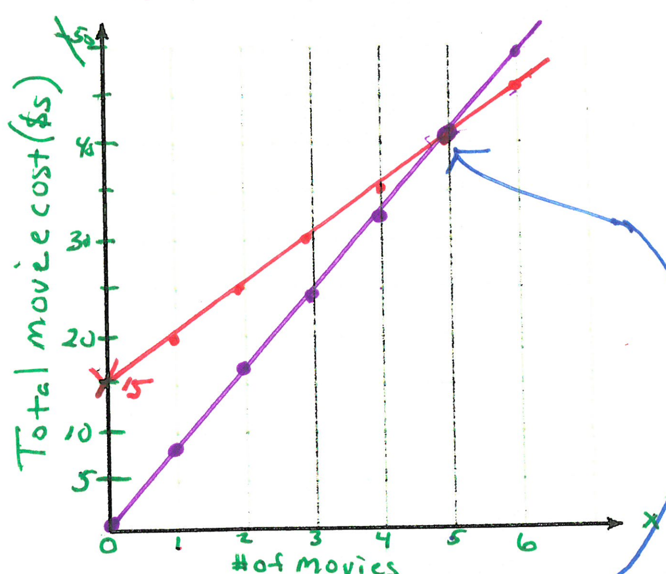
Nonmembers: $y = 8x$

Solve: Create a table and then graph both lines.

Tickets (x)	1	2	3	4	5	6
Members (y)	20	25	30	35	40	45

Tickets (x)	1	2	3	4	5	6
Non-members (y)	8	16	24	32	40	48

Clearly label scales and axes



IF someone goes to 5 movies they spend \$40. (member or not a member)

Identify the solution: (5 , 40)

Check: Does the answer make sense?

M \$40 = 15+5(5)
\$40 = \$40 ✓

NM: \$40 = 8(5)
\$40 = 40 ✓

ANSWER: in a complete sentence

IF YOU GO TO MORE THAN 5 (6+) movies, You should become a member.

7.5 A Solve Special Types of Linear Systems

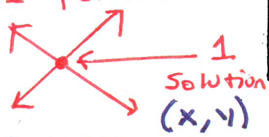
Goal • Identify the number of solutions of a linear system.

Your Notes

3 TYPES OF SYSTEMS:

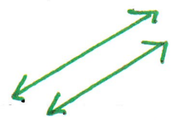
1 ONE SOLUTION

The lines intersect at 1 point.



2 NO SOLUTION

// lines never intersect



3 INFINITE SOLUTIONS:

∞ SOLUTIONS

When the lines are the same

Solutions are all points on the line

Example 1 *A linear system with no solutions*

Show that the linear system has no solution.

$-2x + y = 1$ **Equation 1**

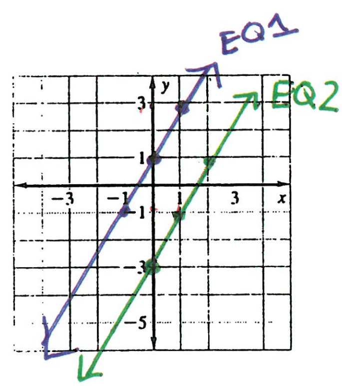
$-2x + y = -3$ **Equation 2**

Solution

Method 1 Graphing

Graph the linear system.

The lines are Parallel (//) because they have the same slope but different y-intercepts. Parallel lines do NOT INTERSECT, so the system has NO SOLUTION.



To ease graphing, write each equation in slope intercept form. $y = mx + b$

STEP I

GRAPH BOTH LINES

EQ1: $-2x + y = 1$
$+2x \quad +2x$
$y = 2x + 1$
$b = 1 \quad m = 2/1$

EQ2: $-2x + y = -3$
$+2x \quad +2x$
$y = 2x - 3$

SOLUTION: $\boxed{\text{NO SOLUTION}}$

STEP II

FIND POI

STEP III

CHECK

Your Notes

EQ1: $\cancel{x} + 3y = -3$

$\cancel{-x} \qquad -x$

$\frac{\cancel{3}y}{\cancel{3}} = \frac{-x}{3} - \frac{3}{3}$

$y = -\frac{1}{3}x - 1$

EQ2: $\cancel{3x} + 9y = -9$

$\cancel{-3x} \qquad -3x$

$\frac{\cancel{9}y}{\cancel{9}} = \frac{-3x}{9} - \frac{9}{9}$

$y = -\frac{1}{3}x - 1$

Example 2 ***A linear system with infinitely many solutions***

Show that the linear system has infinitely many solutions.

$x + 3y = -3$ **Equation 1** $\longrightarrow$ $y = -\frac{1}{3}x - 1$ $m = -\frac{1}{3}$ $b = -1$

$3x + 9y = -9$ **Equation 2** $\longrightarrow$ $y = -\frac{1}{3}x - 1$

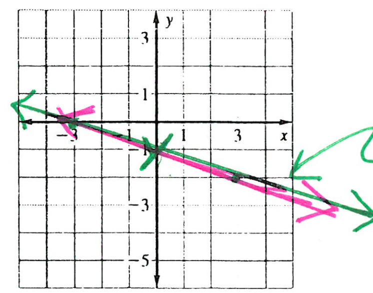
Solution

Method 1 Graphing

Graph the linear system.

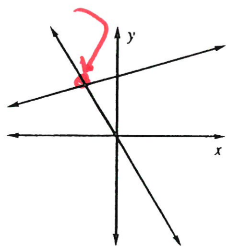
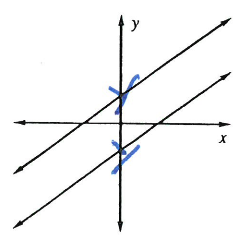
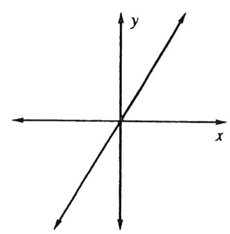
The equations represent the Same line, so any point on the line is a solution.

So, the linear system has INFINITE Solutions.



∞ SOLUTIONS

NUMBER OF SOLUTIONS OF A LINEAR SYSTEM

One solution	No solution	Infinitely many solutions
		
The lines INTERSECT. The lines have DIFFERENT slopes.	The lines are Parallel. The lines have the same slope and different y-intercepts.	The lines are the same. The lines have the same slope and the Same y intercept.