

# Linear Systems

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## Key Ideas:

### 1. Types of Systems

- independent (different slopes, one solution – a point)
- inconsistent (same slope, different  $y$ -intercept - no solution)
- dependent (same slope and  $y$ -intercept - infinite solutions)

### 2. Solving Systems

- graphing
- substitution strategy (isolate a variable)
- elimination strategy (cancel out one of the variables)

### 3. Word Problems

- write 2 equations (system) and solve

**\*Note: Watch your positive and negative signs!!**

#### 1. State the **type of system**:

a)  $x + y = 3$   
 $-2x - y = 2$

$$y = -x + 3$$

$$-2x - 2 = y$$

independent  
since slopes  
are different

b)  $3x + y = 9$   
 $6x + 2y = 12$

$$\div 2 \quad 3x + y = 6$$

same slope,  
parallel line

$\therefore$  dependent



2. Determine whether the point is a solution to the system.

a)  $-3x + 2y = 8$ ;  $(-4, -2)$   
 $x + 2y = -8$

$$-3(-4) + 2(-2)$$

$$12 - 4 = 8$$

$$8 = 8 \checkmark$$

$$-4 + 2(-2) = -8$$

$$-4 - 4 = -8$$

$$-8 = -8 \checkmark$$

$\therefore$  point is a solution

b)  $x - 2y = 4$ ;  $(-2, 1)$   
 $3x + y = 5$

$$-2 - 2(1) = 4$$

$$-2 - 2 = 4$$

$\therefore$  point is not a solution

3. Solve by **graphing**. What type of system is it?

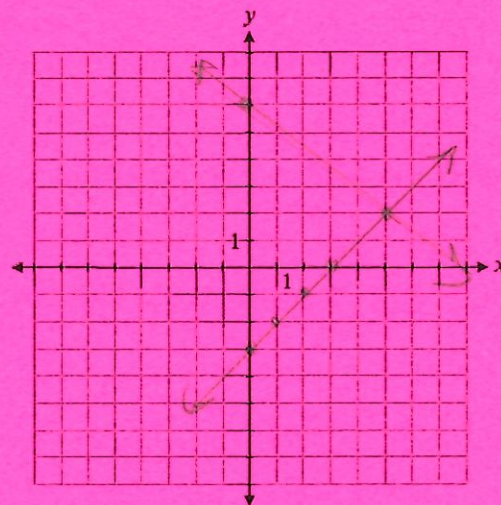
$x - y = 3$   
 $4x + 5y = 30$

$$x - 3 = y$$

$$5y = -4x + 30$$

$$y = -\frac{4}{5}x + 6$$

sol'n  $(5, 2)$



4. Solve by graphing. What type of system is it?

$2y + x - 4 = 0$   
 $2y = -x + 4$

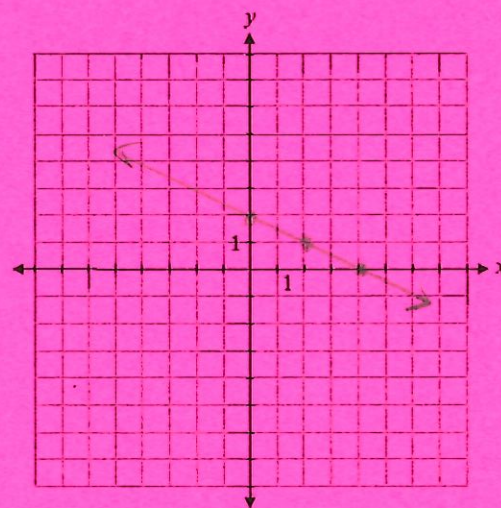
$$2y = -x + 4$$

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

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

same line

$\therefore$  infinite # of solutions along the line  $2y = -x + 4$





5. Solve by **substitution**:

$$2x + 3y = 11$$

$$4x - y = -13$$

$$\hookrightarrow 4x + 13 = y$$

$$2x + 3y = 11$$

$$2x + 3(4x + 13) = 11$$

$$2x + 12x + 39 = 11$$

$$14x = -28$$

$$x = -2$$

$$y = 4(-2) + 13$$

$$y = 5$$

6. Solve by **substitution**:

$$-7x - 2y = -13$$

$$x - 2y = 11$$

$$x = 2y + 11$$

$$-7x - 2y = -13$$

$$-7(2y + 11) - 2y = -13$$

$$-14y - 77 - 2y = -13$$

$$-16y = 64$$

$$-4 = y$$

$$x = 2(-4) + 11$$

$$x = 3$$

7. Solve by **elimination**:

$$5x + 4y = -30$$

$$3x - 9y = -18$$

$$\begin{array}{r} \times 3 \\ 15x + 12y = -90 \end{array}$$

$$\begin{array}{r} \times 5 \\ 15x - 45y = -90 \end{array}$$

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$$57y = 0$$

$$y = 0$$

$$5x + 4(0) = -30$$

$$x = -6$$



8. Solve by **elimination**:

$$\begin{aligned} 2x + 3y &= 6 \\ 5x + 10y &= 20 \end{aligned}$$

$$\begin{array}{r} \phantom{2x + 3y = 6} \times 5 \\ 10x + 15y = 30 \\ \underline{10x + 20y = 40} \\ -5y = -10 \\ y = 2 \end{array}$$

$$\begin{aligned} 2x + 3(2) &= 6 \\ 2x + 6 &= 6 \\ 2x &= 6 - 6 \\ 2x &= 0 \\ x &= 0 \end{aligned}$$

9. Edward has a jar containing **nickels** and **dimes**. The **total number** of coins is 300, and their **value** is \$23.25. How many of each coin is in the jar?

$$\begin{aligned} n + d &= 300 && \rightarrow n = 300 - d \\ 0.05n + 0.10d &= 23.25 \\ 0.05(300 - d) + 0.10d &= 23.25 \\ 15 - 0.05d + 0.10d &= 23.25 \\ 0.05d &= 8.25 \\ d &= 165 \\ n &= 300 - 165 \\ n &= 135 \end{aligned}$$

165 dimes, 135 nickels

10. Castel and Gabriella are selling pies for a school fundraiser. Customers can buy apple pies and lemon meringue pies. Castel sold 6 apple pies and 4 lemon meringue pies for a total of \$80. Gabriella sold 6 apple pies and 5 lemon meringue pies for a total of \$94. What is the cost each of one apple pie and one lemon meringue pie?

$$\begin{array}{r} 6a + 4l = 80 \\ 6a + 5l = 94 \\ \hline -l = -14 \\ l = 14 \end{array}$$

$$\begin{aligned} 6a + 4(14) &= 80 \\ 6a + 56 &= 80 \\ 6a &= 24 \\ a &= 4 \end{aligned}$$

apple pies cost \$4 and  
lemon pies cost \$14