



To the video!

Write your questions and thoughts here!

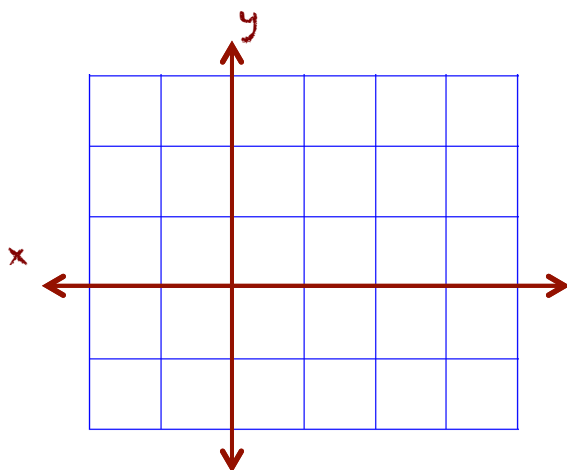
## 4.2 – Solving Linear Systems Algebraically

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**Recall—Solving systems by graphing:**

Ex. 1 Solve the following linear system by graphing:

$$\begin{aligned} 4y &= 8 - 3x \\ y - x &= 1 \end{aligned}$$



We need a different way to do it! This is when our Algebra Skillz will save us!  
We have two algebraic methods:

### Substitution

Best used when 1 variable can be isolated easily

### Elimination

Best used when variables line up easily

Both can be used to solve any system of linear equations, but one method will usually be a "better choice."

### Substitution

Let's try the example above using substitution:

$$\begin{aligned} 4y &= 8 - 3x \\ y - x &= 1 \end{aligned}$$

#### Steps for Solving Linear Systems by Substitution

- Step 1 • Solve one of the equations for one of its variables. When possible, solve for a variable that has a coefficient of 1.
- Step 2 • Substitute the expression from Step 1 into the other equation and solve for the other variable.
- Step 3 • Substitute the value from Step 2 into either original equation and solve for the remaining variable.
- Step 4 • Write your solution as a coordinate point or as a pair of values.

Example 2

$$\begin{aligned} y &= 2x - 9 \\ -3x &= -15 - y \end{aligned}$$

Example 3

$$\begin{aligned} -3x - y &= -30 \\ x + 8y &= 10 \end{aligned}$$

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## 4.2 – Solving Linear Systems Algebraically

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### Elimination

Let's try the an example using elimination:

$$\begin{aligned} 2x - y &= 9 \\ -3x + y &= -15 \end{aligned}$$

#### Steps for Solving Linear Systems by Elimination

- Step 1 • Make sure that all of the variables and the equal sign are "lined up."
- Step 2 • Decide which coefficients you want to cancel out. To cancel out, they must be opposites. You might have to multiply the equations first!
- Step 3 • Add the two equations and solve new equation. (One variable should cancel out!)
- Step 4 • Take your answer to Step 3 and substitute it into either of the original equations.
- Step 5 • Write your solution as a coordinate point or as a pair of values.

Example 5

$$\begin{aligned} -10x + 8y &= -16 \\ 3x + y &= 15 \end{aligned}$$

Example 6

$$\begin{aligned} x + 2y &= 11 \\ 10x &= 2y + 22 \end{aligned}$$

Other tricks:

Example 7

$$\begin{aligned} -x &= -11 - 4y \\ -\frac{2}{3}x - \frac{1}{2}y &= -1 \end{aligned}$$

Example 8

$$\begin{aligned} -4x + 5y &= 1 \\ -5x + 7y &= 5 \end{aligned}$$

Choose the best method to solve these:

Example 9:

$$\begin{aligned} 4x + 5y &= 36.4 \\ 3x + 6y &= 39.9 \end{aligned}$$

Example 10:

$$\begin{aligned} x &= 2y - 2.4 \\ 3x + 6y &= 19.2 \end{aligned}$$

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and thoughts here!

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Example 11:

$$\begin{aligned}x &= 12 - 3y \\ 2x + 6y &= 24\end{aligned}$$

Example 12:

$$\begin{aligned}3x + 2y &= 10 \\ 6x + 4y &= 30\end{aligned}$$

So..If the variables cancel, and each side of the equation is equal, then there is \_\_\_\_\_.

If the variables cancel, and each side of the equation is NOT equal, then there is \_\_\_\_\_.

Now summarize what  
you have learned!

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### Practice 4.2

Solve the following systems of linear equations using substitution:

1. 
$$\begin{aligned}5x + 3y &= -1 \\ y &= -3x - 3\end{aligned}$$

2. 
$$\begin{aligned}8x - y &= 16 \\ y &= -8x\end{aligned}$$

3. 
$$\begin{aligned}x + 8y &= -18 \\ -6x + 3y &= 6\end{aligned}$$

4. 
$$\begin{aligned}9x + 3y &= -4 \\ y &= -8 - 3x\end{aligned}$$

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

6. 
$$\begin{aligned}x &= 12.5 + 2y \\ 3x + 6y &= -47.7\end{aligned}$$

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Solve the following systems of linear equations using elimination:

7. 
$$\begin{aligned} -7x + 2y &= 4 \\ 7x - y &= -2 \end{aligned}$$

8. 
$$\begin{aligned} 4x &= 24 + 2y \\ -4x - 4y &= -12 \end{aligned}$$

9. 
$$\begin{aligned} 2x - 8y &= 8 \\ -2x + 8y &= 2 \end{aligned}$$

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

11. 
$$\begin{aligned} x + y &= 7 \\ -2x - 2y &= -14 \end{aligned}$$

12. 
$$\begin{aligned} 8x + 4y &= 8 \\ 4x + 8y &= 6.4 \end{aligned}$$

13. 
$$\begin{aligned} 5x - 6y &= 18 \\ -8x + 8y &= -24 \end{aligned}$$

14. 
$$\begin{aligned} 2x + 7y &= -16 \\ -7x + 5y &= -3 \end{aligned}$$

Choose the best method for solving:

15. 
$$\begin{aligned} 2y &= 10 + x \\ 7x &= 4y \end{aligned}$$

16. 
$$\begin{aligned} x + 2y &= 11.4 \\ -2x + 6y &= 18.5 \end{aligned}$$

# 4.2 – Solving Linear Systems Algebraically

## SAT Review

### MULTIPLE CHOICE

Three consecutive integers are listed in increasing order. If the three numbers have a sum of 102, what is the second largest integer?

- (A) 28
- (B) 29
- (C) 33
- (D) 34
- (E) 35

### GRID IN

If  $a + b = 7$  and  $b = 3$ , then  $4a = ?$

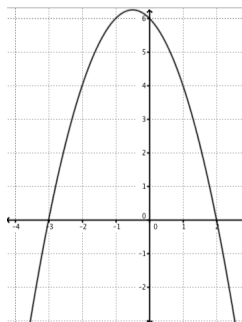
•	•	•	•
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

### ALGEBRA SKILLZ!

#### GRAPH

a.  $f(-2) =$

b. y-intercept =



c.  $f(x) = 4$   
when  $x =$

d. x-intcepts =

#### SIMPLIFY

Simplify the radical

a.  $\sqrt{52}$

b.  $4\sqrt{12}$

#### SOLVE:

Solve for x.

Hint: Use the LCM!!

a.  $\frac{3x}{7} + \frac{x}{4} = 76$

#### FACTOR:

b.  $x^2 + 4x - 45$

## Application 4.2

Solve by choosing the best method:

1.  $9x + 3y = -4$   
 $3x + y = -8$

2.  $-7x - y = -22$   
 $y = 4 - 2x$

## 4.2 – Solving Linear Systems Algebraically

3. Lyndzee and Tina love chips and cotton candy— especially on 20-hour bus trips to Rota! At one rest stop, Lyndzee bought 5 bags of chips ( $x$ ) and 3 tubs of cotton candy ( $y$ ) for 20.25€. Tina, more of a sugar feign, bought 2 bags of chips and 7 tubs of cotton candy for 25.50€. Find the cost of the bag of chips ( $x$ ) and the tub of cotton candy ( $y$ ) by setting up a system of equations and solving.

4. Bean is selling tickets to his annual Fear Factor competition where contestants factor expressions for prizes. On the first day of ticket sales he sold 4 adult tickets and 12 child tickets for a total of \$80. He then took in \$92 on the second day by selling 10 adult tickets and 3 child tickets. Find the price of an adult ticket and the price of a child ticket.

5. A plane traveled 1512 miles to Jacksonville and back. The trip there was with the wind. It took 12 hours. The trip back was into the wind. The trip back took 18 hours. What is the speed of the plane in still air ( $x$ )? What is the speed of the wind ( $y$ )?