

## Warm Up

3/27

A farmer has pigs and chickens together in a pen. There are 60 heads and 162 legs. How many pigs are there?



Let  $x$  = # of chickens

Let  $y$  = # of pigs

$$\begin{aligned} x+y &= 60 && \leftarrow \text{total of heads} \\ 2x+4y &= 162 && \leftarrow \text{total of legs} \end{aligned}$$

3 Ways to Solve!

Eliminate  $y$

$$\begin{aligned} 4 \begin{cases} x+y=60 \\ 2x+4y=162 \end{cases} &\Rightarrow \begin{array}{r} 4x+4y=240 \\ -2x+4y=162 \\ \hline 2x=78 \\ \frac{2x}{2}=\frac{78}{2} \\ x=39 \end{array} \end{aligned}$$

Eliminate  $x$

$$\begin{aligned} 2 \begin{cases} x+y=60 \\ 2x+4y=162 \end{cases} &\Rightarrow \begin{array}{r} 2x+2y=120 \\ -2x+4y=162 \\ \hline -2y=-42 \\ \frac{-2y}{-2}=\frac{-42}{-2} \\ y=21 \end{array} \end{aligned}$$

Substitution

$$x+y=60 \rightarrow x=60-y$$

$$2x+4y=162$$

$$2(60-y)+4y=162$$

$$120-2y+4y=162$$

$$\begin{array}{r} -120 \quad -120 \\ \hline 2y=42 \end{array}$$

$$\frac{2y}{2}=\frac{42}{2}$$

$$y=21$$

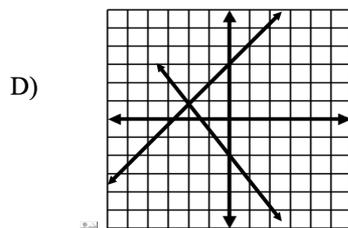
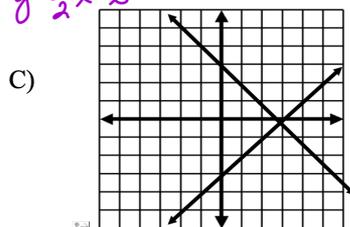
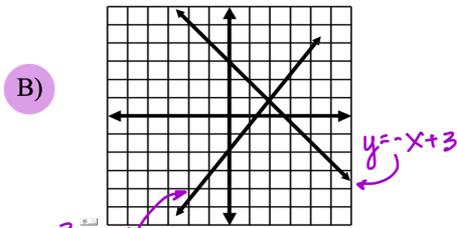
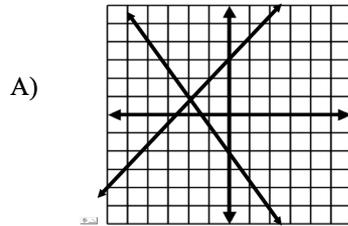
**Solving Systems of Equations Review**

Name: Key

1. Which is the solution to the following system of equations?

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

$$y = -x + 3$$



E) None of the above

2. Solve the system using substitution.

- $x + 2y = -1$
- $y = -3x - 8$

$$\begin{aligned} x + 2(-3x - 8) &= -1 \\ x - 6x - 16 &= -1 \\ -5x - 16 &= -1 \\ +16 \quad +16 & \\ \hline -5x &= 15 \\ \frac{-5x}{-5} &= \frac{15}{-5} \\ x &= -3 \end{aligned}$$

$$\begin{aligned} x + 2y &= -1 \\ -3 + 2y &= -1 \\ +3 \quad +3 & \\ \hline 2y &= 2 \\ \frac{2y}{2} &= \frac{2}{2} \\ y &= 1 \end{aligned}$$

- A) (2, -1)
- B) (-3, -1)
- C) (2, -2)
- D) (-3, -17)
- E) None of the above

**(-3, 1)**

3. The equations of two lines are:  $2[4x + y = 10] \rightarrow 8x + 2y = 20$   
 $3x - 2y = 13$

What is the intersection of these two lines?

$$\begin{aligned} 8x + 2y &= 20 \\ + 3x - 2y &= 13 \\ \hline 11x &= 33 \\ \frac{11x}{11} &= \frac{33}{11} \\ x &= 3 \end{aligned}$$

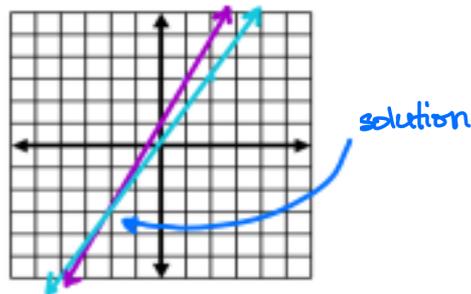
**(3, -2)**

- A) (2, 3)
- B) (3, -2)
- C) (-1, 14)
- D) (3, -6)
- E) None of the above

$$\begin{aligned} 4x + y &= 10 \\ 4(3) + y &= 10 \\ 12 + y &= 10 \\ -12 \quad -12 & \\ \hline y &= -2 \end{aligned}$$

4. Graph the given system and determine which best describes the number of solutions it has

- $y = 2x + 1$
- $y = \frac{3}{2}x$



- A) No solutions
- B) infinite solutions
- C) 1 solution
- D) 2 solutions

5. Which might be your first step if you want to solve the system by elimination?

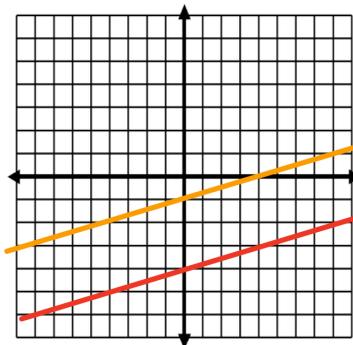
$$\begin{cases} 1^{\text{st}} \text{ equation: } 5x + 4y = 7 \\ 2^{\text{nd}} \text{ equation: } 2x - 3y = 3 \end{cases} \Rightarrow \begin{cases} 15x + 12y = 21 \\ 8x - 12y = 12 \end{cases}$$

- A) Substitute  $-10y + 7$  for  $x$  in the second equation.  
 B) Substitute  $3y + 3$  for  $x$  in the second equation.  
 C) Multiply the first equation by 3, multiply the second equation by 4, then add the resulting equations together.  
 D) Multiply the first equation by 2, multiply the second equation 5, then add the resulting equations together.

7. Graph and determine which is the solution.

$$\begin{aligned} & y = \frac{1}{4}x - 4 \\ & 2x - 8y = 8 \\ & \quad -2x \quad -2x \\ & \quad \underline{-8y = -2x + 8} \\ & \quad \quad -8 \quad -8 \quad -8 \\ & \quad \quad \underline{y = \frac{1}{4}x - 1} \end{aligned}$$

Parallel lines.  
Same slopes  
first equation.



- A) (0, -4) B) (-4, 0) C) No solution D) Infinite Solutions

8. Solve the given system.

$$\begin{cases} 4x - 5y = 40 \\ x = 3y + 24 \end{cases}$$

$$(0, -8)$$

- A) (0, 8)  
 B) (8, 0)  
 C) (-8, 0)  
 D) (0, -8)  
 E) None of the above

$$\begin{aligned} & 4(3y + 24) - 5y = 40 \\ & 12y + 96 - 5y = 40 \\ & 7y + 96 = 40 \\ & \quad -96 \quad -96 \\ & \quad \underline{7y = -56} \\ & \quad \quad \frac{7y}{7} = \frac{-56}{7} \\ & \quad \quad y = -8 \end{aligned}$$

$$\begin{aligned} x &= 3y + 24 \\ x &= 3(-8) + 24 \\ x &= -24 + 24 \\ x &= 0 \end{aligned}$$

6. Which is the solution for the system below.

$$\begin{cases} x = -4y + 10 \\ x = 2y - 14 \end{cases}$$

$$\begin{aligned} -4y + 10 &= 2y - 14 \\ -10 \quad -10 & \\ \hline -4y &= 2y - 24 \\ -2y \quad -2y & \\ \hline -6y &= -24 \\ \frac{-6y}{-6} &= \frac{-24}{-6} \\ y &= 4 \end{aligned}$$

$$\begin{aligned} x &= -4y + 10 \\ x &= -4(4) + 10 \\ x &= -16 + 10 \\ x &= -6 \end{aligned}$$

- A) (-6, 4)  
 B) (4, -6)  
 C) (6, -2)  
 D) (-2, 6)  
 E) None of the above

$$(-6, 4)$$

9. Which is the solution to the system shown below.

$$\begin{cases} -3x + 2y = 17 \\ 3x - 7y = -37 \end{cases}$$

$$\begin{aligned} -3x + 2y &= 17 \\ + 3x - 7y &= -37 \\ \hline -5y &= -20 \\ \frac{-5y}{-5} &= \frac{-20}{-5} \\ y &= 4 \end{aligned}$$

$$\begin{aligned} 3x + 2(4) &= 17 \\ -3x + 8 &= 17 \\ \quad -8 \quad -8 & \\ \hline -3x &= 9 \\ \frac{-3x}{-3} &= \frac{9}{-3} \\ x &= -3 \end{aligned}$$

$$(-3, 4)$$

- A) (4, -3)  
 B) (-3, 4)  
 C) (-3, -4)  
 D) (-4, -3)  
 E) None of the above

10. Solve using Substitution

$$4x = -8y + 20$$

$$y = -2x + 7$$

 $(3, 1)$ 

$$4x = -8(-2x + 7) + 20$$

$$4x = 16x - 56 + 20$$

$$4x = 16x - 36$$

$$\frac{-16x \quad -16x}{-12x = -36}$$

$$\frac{-12x}{-12} = \frac{-36}{-12}$$

$$x = 3$$

$$y = -2x + 7$$

$$y = -2(3) + 7$$

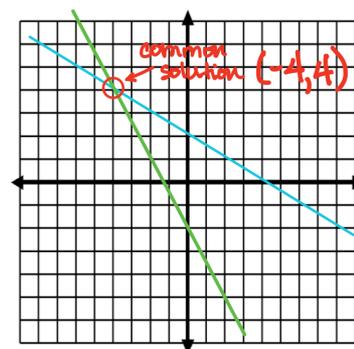
$$y = -6 + 7$$

$$y = 1$$

11. Graph the given system and determine which is the solution.

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

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



- A) (1, 2)  
 B) (2, 1)  
 C) (-4, 4)  
 D) (4, -4)  
 E) None of the above

12. Solve the given systems

$$5x - 10y = 7$$

$$5[x - 2y = 3] \rightarrow - \frac{5x - 10y = 7}{5x - 10y = 15}$$

$$0 = -8$$

$$\frac{5x - 10y = 7}{-5x} \quad \frac{5x - 10y = 7}{-10y = -5x + 7}{-10} \quad y = \frac{1}{2}x - \frac{7}{10}$$

$$\frac{x - 2y = 3}{-x} \quad \frac{x - 2y = 3}{-x} \quad \frac{-2y = -x + 3}{2} \quad y = -\frac{1}{2}x + \frac{3}{2}$$

- A) No Solution  
 B) Infinite Solutions  
 C) (5, 0)  
 D) (1, 2)

They are parallel lines.  
 Same slopes, different y-ints.

13. Which would be a good first step to use to solve this system?

1<sup>st</sup> equation:  $y = 6x + 4$

2<sup>nd</sup> equation:  $5x + 2y = 12$

- A) Multiply the first equation by 2, and add the result to the second equation.  
 B) Substitute  $5x + 12$  for  $y$  in first equation.  
 C) Substitute  $6x + 4$  for  $x$  in the second equation.  
 D) Substitute  $6x + 4$  for  $y$  in the second equation.

14. Solve using Elimination

$$4[3x - 3y = -9] \quad 12x - 12y = -36$$

$$3[-4x + 5y = 8] \quad + \quad -12x + 15y = 24$$

$$\frac{3y = -12}{3} \quad \frac{3y}{3} = \frac{-12}{3}$$

$$y = -4$$

 $(-7, -4)$ 

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

$$3x - 3(-4) = -9$$

$$3x + 12 = -9$$

$$\frac{-12 \quad -12}{3x = -21}$$

$$\frac{3x}{3} = \frac{-21}{3}$$

$$x = -7$$

15. Solve the given system.

$$3y = -4x - 22$$

$$y = -5x - 11$$

$$3(-5x - 11) = -4x - 22$$

$$-15x - 33 = -4x - 22$$

$$\frac{+33 \quad +33}{-15x = -4x + 11}$$

$$\frac{+4x \quad +4x}{-11x = 11}$$

$$\frac{-11x}{-11} = \frac{11}{-11}$$

$$x = -1$$

 $(-1, -6)$ 

- A) (1, 16)  
 B) (16, 1)  
 C) (-6, -1)  
 D) (-1, -6)  
 E) none of the above

$$y = -5x - 11$$

$$y = -5(-1) - 11$$

$$y = 5 - 11$$

$$y = -6$$

16. Solve by graphing

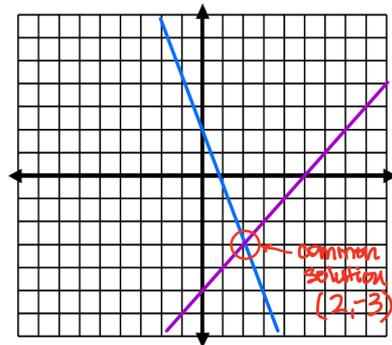
$$\begin{aligned} 5x + 2y &= 4 \\ 4x - 4y &= 20 \end{aligned}$$

$$\begin{array}{r} 5x + 2y = 4 \\ -5x \quad -5x \\ \hline 2y = -5x + 4 \\ \frac{2y}{2} = \frac{-5x + 4}{2} \\ y = -\frac{5}{2}x + 2 \end{array}$$

$$\begin{array}{r} 4x - 4y = 20 \\ 4(0) - 4y = 20 \\ -4y = 20 \\ \frac{-4y}{-4} = \frac{20}{-4} \\ y = -5 \end{array}$$

$$\begin{array}{r} 4x - 4(0) = 20 \\ 4x = 20 \\ \frac{4x}{4} = \frac{20}{4} \\ x = 5 \end{array}$$

Intercepts  
(0, -5)  
(5, 0)



Solution: (2, -3)

17. Solve the given system.

$$\begin{array}{r} 5[3x + 7y = 5] \\ 3[5x + 2y = -11] \\ \hline 15x + 35y = 25 \\ 15x + 6y = -33 \\ \hline 29y = 58 \\ \frac{29y}{29} = \frac{58}{29} \\ y = 2 \end{array}$$

(-3, 2)

$$\begin{array}{r} 3x + 7y = 5 \\ 3x + 7(2) = 5 \\ 3x + 14 = 5 \\ -14 \quad -14 \\ \hline 3x = -9 \\ \frac{3x}{3} = \frac{-9}{3} \\ x = -3 \end{array}$$

- A) (-2, -3)
- B) (-3, -2)
- C) (3, -5)
- D) (-5, 3)
- E) none of the above**

18. How many solutions does the given system have?

$$\begin{aligned} y &= 3x - 1 \\ 6x - 2y &= 2 \end{aligned}$$

$$\begin{aligned} 6x - 2(3x - 1) &= 2 \\ 6x - 6x + 2 &= 2 \\ 2 &= 2 \end{aligned}$$

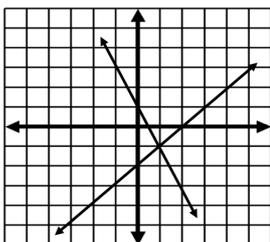
For infinite solutions the equations must be the same. Let's check:

$$\begin{array}{r} bx - 2y = 2 \\ -bx \quad -bx \\ \hline -2y = -bx + 2 \\ \frac{-2y}{-2} = \frac{-bx + 2}{-2} \\ y = 3x - 1 \end{array}$$

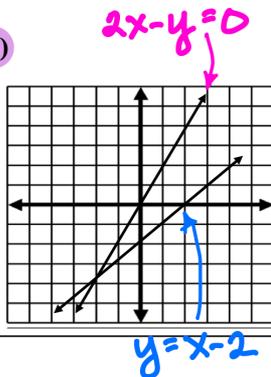
- A) one solution
- B) two solutions
- C) infinite solutions**
- D) no solution

19. Which two lines represent the solution for the given system:  $2x - y = 0$   
 $y = x - 2$

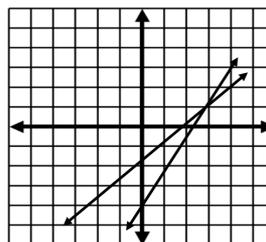
A)



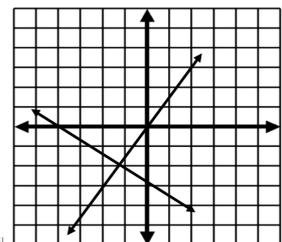
**B)**



C)



D)



20. Solve the given system.

$$\begin{array}{r} 4x - 4y = 20 \\ 3x - 4y = 15 \end{array}$$

$$x = 5$$

$$(5, 0)$$

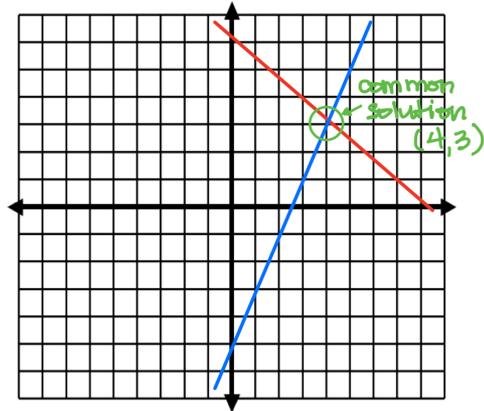
- A) (5, 0)  
 B) (-4, 7)  
 C) (5, 10)  
 D) (-4, 4)  
 E) none of the above

$$\begin{array}{r} 4x - 4y = 20 \\ 4(5) - 4y = 20 \\ 20 - 4y = 20 \\ \underline{-20} \quad \underline{-20} \\ -4y = 0 \\ \underline{-4} \quad \underline{-4} \\ y = 0 \end{array}$$

21. Solve by graphing:

$$y = -\frac{3}{4}x + 6$$

$$y = 2x - 5$$



Solution  $(4, 3)$

22. A) Graph the given system of equations and explain what your answer means.

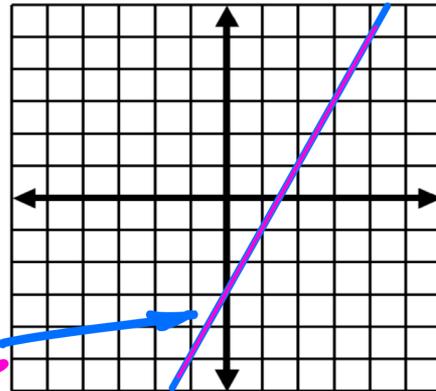
$$\begin{array}{l} 6x + 3y = -9 \\ 2x + y = -3 \end{array}$$

$$\begin{array}{r} 2x + y = -3 \\ -2x \quad -2x \\ \hline y = -2x - 3 \end{array}$$

$$\begin{array}{r} 6x + 3y = -9 \\ -6x \quad -6x \\ \hline 3y = -6x - 9 \\ \quad \quad 3 \quad \quad 3 \\ \hline y = -2x - 3 \end{array}$$

Infinite Solutions

Same Lines



B) Solve your system mathematically and explain how you got your answer.

$$\begin{array}{r} 6x + 3y = -9 \\ -3(2x + y = -3) + -6x - 3y = 9 \\ \hline 0 = 0 \end{array}$$

Using elimination, both variables were eliminated and I ended up with a true statement ( $0=0$ ). Because the resulting statement is true, the equations must be equal which means there are infinite solutions.

Solve the following systems of equations. Don't forget to define variables! Feel free to use extra paper if needed.

1. The senior classes at High School A and High School B planned separate trips to the indoor climbing gym. The senior class at High School A rented and filled 3 vans and 13 buses with 612 students. High School B rented and filled 3 vans and 6 buses with 297 students. Each van and each bus carried the same number of students. Find the number of students in each van and in each bus

Let  $x$  = # of students in a van  
 Let  $y$  = # of students in a bus

$$\begin{array}{r} 3x + 13y = 612 \\ - \quad 3x + 6y = 297 \\ \hline 7y = 315 \\ \underline{7} \quad \underline{7} \\ y = 45 \end{array}$$

$$\begin{array}{r} 3x + 6y = 297 \\ 3x + 6(45) = 297 \\ 3x + 270 = 297 \\ \underline{-270 \quad -270} \\ 3x = 27 \\ \underline{3} \quad \underline{3} \\ x = 9 \end{array}$$

9 students/van and 45 students/bus

2. Alberto and Ryan each improved their yards by planting hostas and geraniums. They bought their supplies from the same store. Alberto spent \$13 on 2 hostas and 1 geranium. Ryan spent \$83 on 10 hostas and 7 geraniums. Find the cost of one hosta and the cost of one geranium.

Let  $x$  = cost of 1 hosta  
 Let  $y$  = cost of 1 geranium

$$\begin{array}{r} -5[2x + y = 13] \rightarrow -10x - 5y = -65 \\ + 10x + 7y = 83 \\ \hline 2y = 18 \\ \underline{2} \quad \underline{2} \\ y = 9 \end{array}$$

$$\begin{array}{r} 2x + y = 13 \\ 2x + 9 = 13 \\ \underline{-9 \quad -9} \\ 2x = 4 \\ \underline{2} \quad \underline{2} \\ x = 2 \end{array}$$

\$2/hosta and \$9/geranium

3. Shawna and Mark each improved their yards by planting rose bushes and ornamental grass. They bought their supplies from the same store. Shawna spent \$16 on 1 rose bush and 6 bunches of ornamental grass. Mark spent \$36 on 4 rose bushes and 10 bunches of ornamental grass. What is the cost of one rose bush and the cost of one bunch of ornamental grass?

Let  $x$  = cost of a rose bush

Let  $y$  = cost of an ornamental grass

$$\begin{array}{r} 4[x + 6y = 16] \rightarrow 4x + 24y = 64 \\ 4x + 10y = 36 \\ \hline 14y = 28 \\ 14 \quad 14 \\ \hline y = 2 \end{array}$$

$$\begin{array}{r} x + 6y = 16 \\ x + 6(2) = 16 \\ x + 12 = 16 \\ -12 \quad -12 \\ \hline x = 4 \end{array}$$

\$4/rose bush and \$2/bunch of grass

4. Jack and Shanice are selling flower bulbs for a school fundraiser. Customers can buy bags of windflower bulbs and packages of crocus bulbs. Jack sold 4 bags of windflower bulbs and 10 packages of crocus bulbs for a total of \$166. Shanice sold 13 bags of windflower bulbs and 2 packages of crocus bulbs for a total of \$82. Find the cost each of one bag of windflower bulbs and one package of crocus bulbs.

Let  $x$  = cost of a bag of windflower bulbs

Let  $y$  = cost of a package of crocus bulbs

$$\begin{array}{r} 4x + 10y = 166 \\ 5[13x + 2y = 82] \rightarrow 65x + 10y = 410 \\ \hline -61x = -244 \\ -61 \quad -61 \\ \hline x = 4 \end{array}$$

$$\begin{array}{r} 4x + 10y = 166 \\ 4(4) + 10y = 166 \\ 16 + 10y = 166 \\ -16 \quad -16 \\ \hline 10y = 150 \\ 10 \quad 10 \\ \hline y = 15 \end{array}$$

Windflower Bulbs = \$4  
Crocus Bulbs = \$15

How would you solve the following system of equations?

If the signs are the same  
SUBTRACT!

$$\begin{cases} 4x - 5y = 15 \\ 2x - 5y = -11 \end{cases}$$

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$$\frac{2x}{2} = \frac{26}{2}$$

$$x = 13$$

## Symbol Review:

 $>$ 

greater than  
larger than  
more than

 $<$ 

less than  
smaller than  
fewer than

 $\geq$ 

greater than or = to  
at least  
a minimum of

 $\leq$ 

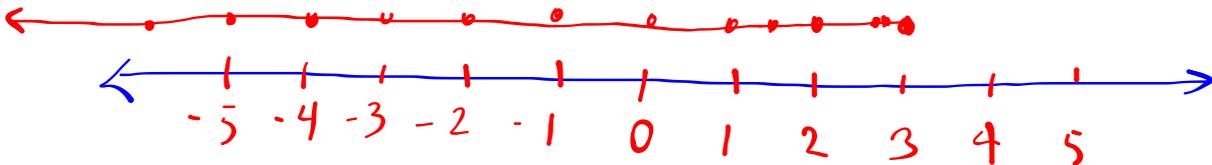
less than or = to  
at most  
a maximum of

What are some values of  $x$  that would satisfy (make it true) the following inequality?

$$3x + 4 \leq 13$$

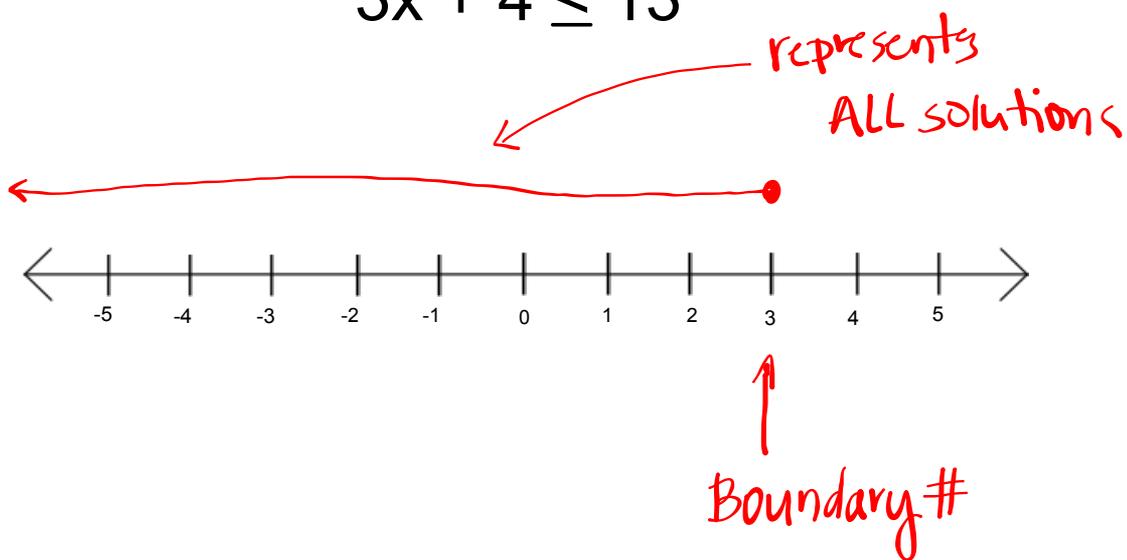
Find at least 5.

(Remember not all solutions need to be whole numbers or positive!)



Let's put all our solutions on a number line!

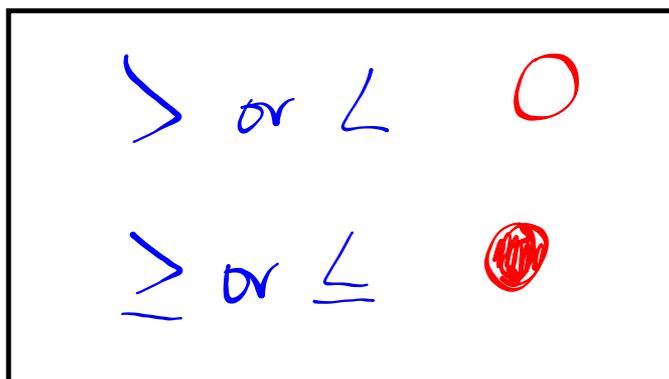
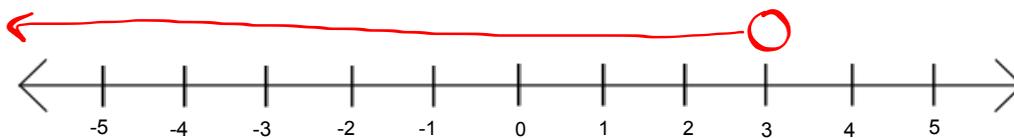
$$3x + 4 \leq 13$$



What if our inequality changed to:

$$3x + 4 < 13$$

What is the difference?



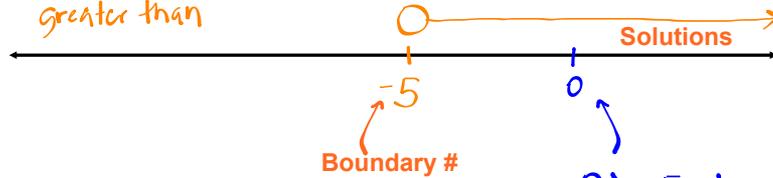
Some practice:

Graph all possible values of  $x$  on a number line.

All values of  $x$

$$x > -5 \quad \leftarrow -5$$

greater than

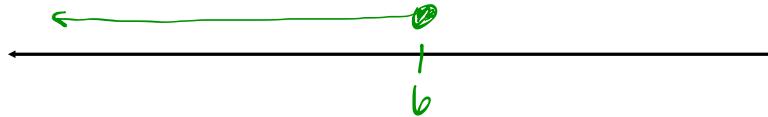


$$0 > -5 \text{ true}$$

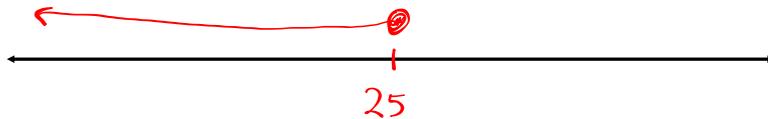
so it's a solution

$$2x \leq 12$$

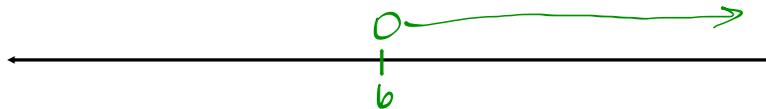
$$x \leq 6$$



$$25 \geq x \rightarrow x \leq 25$$



$$6 < x$$



$$9 < x + 5$$

$$\begin{array}{r} -5 \quad -5 \\ \hline 4 < x \end{array}$$

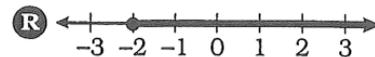
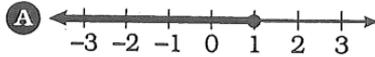


# Where Do Airline Pilots Keep Their Uniforms?

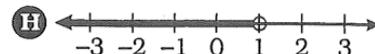
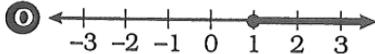
✈ For each exercise, write the letter of the answer in the box containing the exercise number.

In Exercises 1-6, match the inequality with its graph.

1  $x < 1$



2  $x \leq 1$

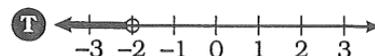
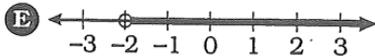


3  $x > -2$

4  $x \geq -2$

5  $-2 > x$

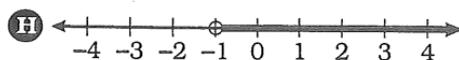
6  $1 \leq x$



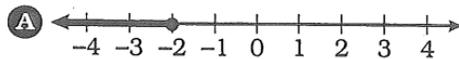
In Exercises 7-18, solve the inequality. Then graph the solution.

7  $4n + 1 < 9$

8  $7a - 2 \geq 5$



$$\begin{array}{r} -1 \quad -1 \\ \hline 4n < 8 \quad n < 2 \end{array}$$



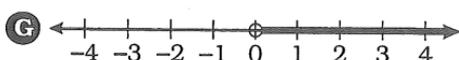
9  $3y + 10 \leq 4$

10  $8k - 3 > -27$



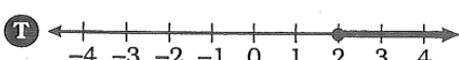
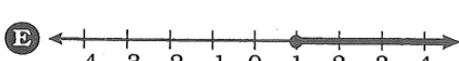
11  $\frac{x}{2} + 9 < 11$

12  $\frac{d}{6} - 4 \geq -5$



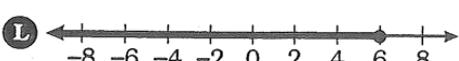
13  $\frac{u}{15} - 2 \leq -2$

14  $5p - 14 < 26$



15  $18 \leq 7b + 4$

16  $-9 < 12y + 3$



17  $-14 \geq \frac{x}{3} - 16$

18  $5 < \frac{m}{8} + 5$



|   |    |   |    |   |    |    |   |    |   |   |    |    |   |    |    |   |   |
|---|----|---|----|---|----|----|---|----|---|---|----|----|---|----|----|---|---|
| 7 | 11 | 5 | 13 | 3 | 10 | 17 | 6 | 15 | 1 | 8 | 12 | 16 | 2 | 14 | 18 | 9 | 4 |
|---|----|---|----|---|----|----|---|----|---|---|----|----|---|----|----|---|---|

Inequalities:  
Graphing the Solution Set of an Inequality

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# Homework

Finish classwork