

Unit 5

Solving & Graphing Linear Inequalities

ALGEBRA 1

Key Words

OPEN CIRCLE

$< \text{ or } >$



CLOSED CIRCLE

$\leq \text{ or } \geq$



Graph the Way the Arrow Points

GRAPH THE INEQUALITY

$$x < -3$$



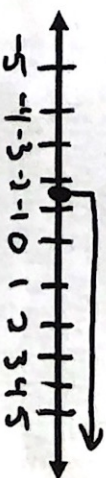
$$v \geq \frac{7}{4} = 1.75$$



Write the Inequality for the Graph



$$x > -3$$



$$x \geq -1.5$$

- insert of x , flip inequality

$\frac{x}{-5} \geq 7$	$\frac{x}{8} < 2$	<u>Solving Inequalities</u>
$x \leq -35$	$x > -16$	• Solving Inequalities is the Same as Solving Equations
$\frac{-4x}{-4} \leq \frac{20}{-4}$	$\frac{-7x}{-7} > \frac{21}{-7}$	• If you MULTIPLY OR DIVIDE by a NEGATIVE NUMBER, you MUST FLIP THE INEQUALITY
$x \geq -5$	$x < -3$	

$w + 6 - 2(w - 14) > 0$	<u>Solving Inequalities</u>
$\sqrt{116} - 2\sqrt{1+24} > 0$	• Solving Inequalities is the Same as Solving Equations
$b + 10 - 2(b - 14) > 0$	• If you MULTIPLY OR DIVIDE by a NEGATIVE NUMBER, you MUST FLIP THE INEQUALITY
$b + 10 - 2b + 28 > 0$	
$-b + 38 > 0$	
$\frac{-b}{-1} > \frac{-38}{-1}$	
$b < 38$	

$6x + 6 < -9$	<u>Solving Inequalities</u>
$6x < -6 - 6$	• Solving Inequalities is the Same as Solving Equations
$6x < -12$	• If you MULTIPLY OR DIVIDE by a NEGATIVE NUMBER, you MUST FLIP THE INEQUALITY
$x < -2$	
$5(k - 6) > 15$	
$5k - 30 > 15$	
$5k > 15 + 30$	
$5k > 45$	
$k > 9$	

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Linear Inequalities with Variables on Both Sides

ALGEBRA 1

$1 + 9w \geq 8(w + 1)$ $1 + 9w \geq 8w + 8$ $9w - 8w \geq 8 - 1$ $w \geq 7$	<u>Solving Inequalities</u> Solving Inequalities is the Same as Solving Equations
$1 + 17n \geq 16(n + 1)$ $1 + 17n \geq 16n + 16$ $17n - 16n \geq 16 - 1$ $n \geq 15$	If you MULTIPLY OR DIVIDE by a NEGATIVE NUMBER, you MUST FLIP THE INEQUALITY

$9p - 15 \leq 12p + 3$ $9p - 12p \leq 3 + 15$ $-3p \leq 18$ $\frac{-3p}{-3} \leq \frac{18}{-3}$ $p \geq -6$	<u>Solving Inequalities</u> - Solving Inequalities is the Same as Solving Equations - If you MULTIPLY OR DIVIDE by a NEGATIVE NUMBER, you MUST FLIP THE INEQUALITY
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$3(3x + 2) \geq 9x - 4$ $9x + 6 \geq 9x - 4$ $9x - 9x \geq -4 - 10$ $0 \geq -14$ $0 \geq -1$	<u>Solving Inequalities</u> - If the variables cancel out, you will be left with either a true or false statement. - If TRUE: The solution is ALL REAL NUMBERS - If FALSE: NO SOLUTION
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True
All Real Numbers

$$10x + 5 - 19x \geq -9x + 7$$

$$-9x + 5 \geq -9x + 7$$

False

$$-9x + 9x \geq 7 - 5$$

$$0 \geq 2$$

No Solution

Solving Inequalities

• If the variables cancel out, you will be left with either a true or false statement.

- If TRUE: The solution is ALL REAL NUMBERS
- If FALSE: NO SOLUTION

$$-7x - 6 + 12x \geq 5x + 9$$

$$5x - 6 \geq 5x + 9$$

$$5x - 5x \geq 9 + 6$$

$$0 \geq 15$$

False

No Solution

Unit 5

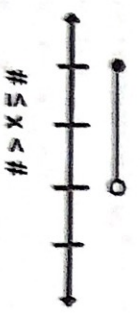
COMPOUND INEQUALITIES

ALGEBRA 1

COMPOUND INEQUALITIES

And
Or

We're shading between the two points.



$$\# \leq x < \#$$

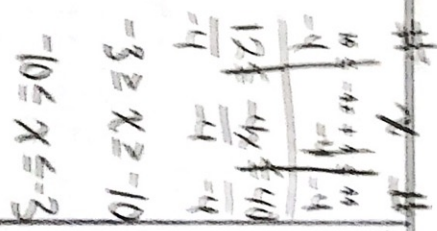
We are shading to the left and right



$$\# < x \text{ or } x > \#$$

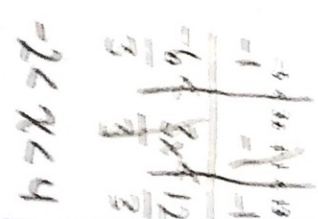
Solve the following inequalities

- A. $-7 \leq x \leq 0$
- B. $12 \leq x \leq 40$
- C. $-12 \leq x \leq -6$
- D. $-10 \leq x \leq -3$

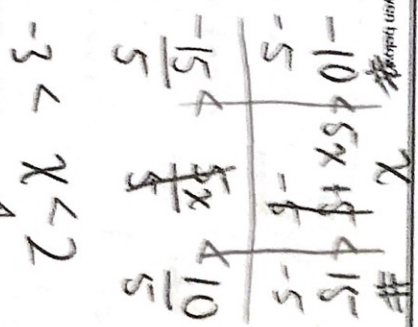


Solve the following inequalities

- A. $-2 \leq x \leq 4$
- B. $-3 \leq x \leq 1/2$
- C. $-3 \leq x \leq 1/2$
- D. $-2 \leq x \leq 1/2$



Which of the following number lines shows the solution to the compound inequality given below?



Open

Solve the following compound inequality.

- A. $x \geq 8$
 B. $-4 \leq x \leq 8$
 C. $x \geq -4$
 D. $x \leq -4$ OR $x \geq 8$

$$3x - 7 > -19 \text{ OR } -3x \leq -24$$

Skipped

Solve the following compound inequality.

- A. $-4 \leq x < 3$
 B. $x \leq -4$ OR $x \geq 3$
 C. $x \leq -5$ OR $x \geq 4$
 D. $x \leq -4$

$$2x + 6 \leq 4 \text{ OR } 5x \leq 10$$

$$\begin{aligned} 2x + 6 &\leq 4 & 5x &\leq 10 \\ 2x &\leq -2 & 5x &\leq 2 \\ x &\leq -1 & x &\leq \frac{2}{5} \end{aligned}$$

$x \leq -1$ OR $x \leq \frac{2}{5}$

Absolute Value Inequalities

Solve the following inequality.

- A. $x \geq 10$ OR $x \leq 4$
 B. $x \leq 10$ OR $x \geq 4$
 C. $4 \leq x \leq 10$
 D. $x \leq 4$

$$|x - 11| \leq -6$$

$$|7 - x| \geq 3$$

$$\begin{aligned} 7 - x &\geq 3 & \text{OR} & 7 - x \leq -3 \\ -x &\geq -4 & & -x \leq -10 \\ x &\leq 4 & & x \geq 10 \end{aligned}$$

- A. $-\frac{1}{3} < x < 4$
 B. $x < 4$
 C. $x < -\frac{1}{3}$ OR $x > 4$
 D. $-13 < x < 4$

$$|4x - 3| < 9$$

$$\begin{aligned} |4x - 3| &< 9 + 4 \\ 4x - 3 &< 13 \\ 4x &< 16 \\ x &< 4 \end{aligned}$$

$$\begin{aligned} 4x - 3 &> -13 \\ 4x &> -10 \\ x &> -\frac{5}{2} \end{aligned}$$

$$\begin{aligned} -x &\geq -4 & & -x \leq -10 \\ x &\leq 4 & & x \geq 10 \end{aligned}$$

$$-\frac{5}{2} < x < 4$$

Solve the following inequality.

- A. $x \geq 7$ OR $x \leq -1$
 B. $x \geq 5$ OR $x \leq 1$
 C. $x \leq 7$ OR $x \geq -1$
 D. $x \leq 5$ OR $x \geq 1$

$$-3|3 - x| + 3 \leq -9$$

$$-3|3 - x| \leq -12$$

$$\begin{aligned} |3 - x| &\geq 4 \\ 3 - x &\geq 4 & \text{OR} & 3 - x \leq -4 \\ -x &\geq 1 & & -x \leq -7 \\ x &\leq -1 & & x \geq 7 \end{aligned}$$

$$|x - 4| \geq 4$$

$$\begin{aligned} x - 4 &\geq 4 & \text{OR} & x - 4 \leq -4 \\ x &\geq 8 & & x \leq 0 \end{aligned}$$

$$|x + 1| < 4$$

AND

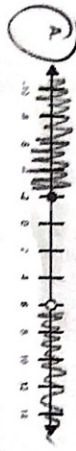
$$|x - 1| > 4$$

OR

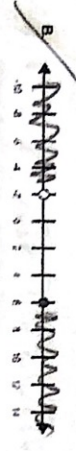
AND

Which of the following number lines shows the solution to the inequality given below?

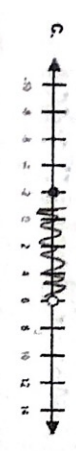
$$5x + 3 \leq -7 \text{ OR } 4x - 9 > 15$$



$$\begin{aligned} 5x + 3 &\leq -7 & \text{OR} & 4x - 9 > 15 \\ 5x &\leq -10 & & 4x > 24 \\ x &\leq -2 & & x > 6 \end{aligned}$$



$$\begin{aligned} x &\leq -2 & & x > 6 \end{aligned}$$



$$\begin{aligned} x &\leq -2 & & x > 6 \end{aligned}$$

closed

open

$$x \leq -1 \text{ OR } x \geq 7$$

$$x \geq 7 \text{ OR } x \leq -1$$

$$\begin{aligned} -x &\geq 4 - 3 \\ -x &\geq 1 \\ x &\leq -1 \end{aligned}$$

$$\begin{aligned} -x &\leq -7 - 1 \\ -x &\leq -8 \\ x &\geq 8 \end{aligned}$$

$\leq$
 At
 Most
 $\geq$
 At
 Least

Sofia wants to create 24 ounces of new hand lotion, with a minimum 15% concentration of beeswax, from a mixture of two lotions. One lotion has a 21% concentration of beeswax, and the second lotion has a concentration of 5% beeswax. Based on the inequality below, how much of the 21% lotion, x , will she need?

$$0.21x + 0.05(24 - x) \geq 3.5$$

- A. Sofia will need at most 16 ounces of the 21% lotion to make 24 ounces of the new hand lotion with a minimum of 15% beeswax.
- ☒ B. Sofia will need at least 15 ounces of the 21% lotion to make 24 ounces of the new hand lotion with a minimum of 15% beeswax.
- C. Sofia will need at most 15 ounces of the 21% lotion to make 24 ounces of the new hand lotion with a minimum of 15% beeswax.
- D. Sofia will need at most 12 ounces of the 21% lotion to make 24 ounces of the new hand lotion with a minimum of 15% beeswax.

$$\begin{aligned}
 0.21x + 0.05(24 - x) &\geq 3.5 \\
 0.21x + 1.2 - 0.05x &\geq 3.5 \\
 0.16x &\geq 2.3 \\
 x &\geq 15
 \end{aligned}$$

Ben's business averages \$3,500 per month in internet sales plus another \$200 per salesperson per month. Based on the inequality below, how many salespeople, s , need to be working in order for Ben's business to generate at least \$4,100 in monthly revenue?

$$\$3,500 + \$200s \geq \$4,100$$

- A. Ben needs at most 3 salespeople working.
- ☒ B. Ben needs at least 3 salespeople working.
- C. Ben needs at most 13 salespeople working.
- D. Ben needs at most 8 salespeople working.

$$\begin{aligned}
 200s &\geq 4100 - 3500 \\
 200s &\geq 600 \\
 s &\geq 3
 \end{aligned}$$

Unit 5

Interpreting Inequalities

ALGEBRA 1

Kevin is baking bread for a family function. The initial temperature of the oven is twice the room temperature. He knows that yeast, a key ingredient, thrives within the temperature range of 90° F to 95° F. So to facilitate yeast growth, Kevin decreases the temperature of the oven by 44° F.

Which inequality represents the given situation?

- ☒ A. $90 \leq 2x - 44 \leq 95$
- B. $90 \geq 2x - 44 \leq 95$
- C. $90 \leq 2x + 44 \leq 95$
- D. $90 \geq 2x + 44 \leq 95$

$$90 \leq 2x - 44 \leq 95$$

An insurance company is considering implementing a plan based on mileage. The current plan, Plan A, charges a flat rate of \$299.70 per month. Plan B charges a flat rate of \$200.70 per month plus an additional \$0.09 per mile driven the previous month. Using the inequality below, find the number of miles, x , where the cost of Plan B is less than the cost of Plan A.

$$200.70 + 0.09x < 299.70$$

- A. The mileage must be less than 5,560 miles.
- B. The mileage must be greater than 2,200 miles.
- C. The mileage must be greater than 1,100 miles.
- D. The mileage must be less than 1,100 miles.

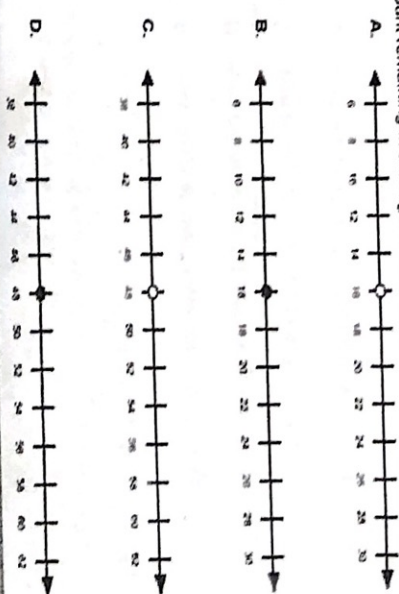
$$0.09x < 299.70 - 200.70$$

$$\frac{0.09x}{0.09} < \frac{99}{0.09}$$

$$x < 1100$$

Stephanie has two bottles of liquid that she is going to pour down the drain. One bottle contains regular soda and the other bottle contains diet soda. The amount remaining in the regular soda bottle after x seconds can be modeled by the expression $120 - 4.5x$. The amount remaining in the diet soda bottle after x seconds can be modeled by the expression $240 - 12x$.

Which graph represents the time when the amount remaining in the diet soda bottle is less than the amount remaining in the regular soda bottle?



The junior class has been selling roses as an ongoing fundraiser. Roses sell for \$3.50 each and, to date, they have raised \$2,005.22. They would like to raise a total of \$3,030.72 by the end of the year. If this situation is modeled by the inequality below, how many more roses, x , do they need to sell to raise at least \$3,030.72?

$$2,005.22 + 3.50x \geq 3,030.72$$

- A. The junior class would need to sell at most 293 roses.
- B. The junior class would need to sell at most 866 roses.
- C. The junior class would need to sell at most 573 roses.
- D. The junior class would need to sell at least 293 roses.

$$3.50x \geq 3030.72 - 2005.22$$

$$\frac{3.50x}{3.50} \geq \frac{1025.5}{3.50}$$

$$x \geq 293$$

Marcus planted two trees in his backyard, an oak tree and a pecan tree. The height, in feet, of the oak tree after x years can be modeled by the expression $4x + 9$. The height, in feet, of the pecan tree after x years can be modeled by the expression $3x + 12$.

Which graph represents the time when the height of the oak tree is greater than or equal to the height of the pecan tree?

