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Solving One-Variable Equations and Inequalities

Elaborate – Answer Key

Directions: For each problem situation below, write an inequality you can use to solve the problem. Use cups and counters to solve the inequality. Represent the solution on a number line and use substitution to verify your solution.

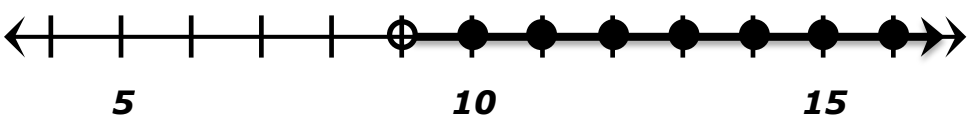
Part 1: Solving One-Variable Inequalities with Addition or Multiplication

1. Jacob has 16 baseball trading cards. His sister, Bonita, has some trading cards and his sister, Madison, has 7 trading cards. Bonita and Madison together have more trading cards than their brother, Jacob. How many trading cards, x, could Bonita have?

   a) Write the inequality.
   $x + 7 > 16$

   b) Solve the inequality using properties of operations.
   $x + 7 > 16$
   $x + 7 - 7 > 16 - 7$
   $x > 9$

   c) Represent the solution(s) on a number line.



   d) Use substitution to determine whether 8, 9, 12, or 15 are solutions to the inequality.

$(8) + 7 > 16$ $15 \not> 16$	$(9) + 7 > 16$ $16 \not> 16$	$(12) + 7 > 16$ $19 > 16$	$(15) + 7 > 16$ $22 > 16$
8 is not a solution.	***9 is not a solution.***	***12 is a solution.***	***15 is a solution.***

2. Last month, there was 3.2 inches of rain in Centerville. The total rainfall so far, including last month's rain, is no more than 5.5 inches. How many inches of rain, x, could have fallen since last month?

   a) Write the inequality.
   $x + 3.2 \leq 5.5$

   b) Solve the inequality using properties of operations.
   $x + 3.2 \leq 5.5$
   $x + 3.2 - 3.2 \leq 5.5 - 3.2$
   $x \leq 2.3$

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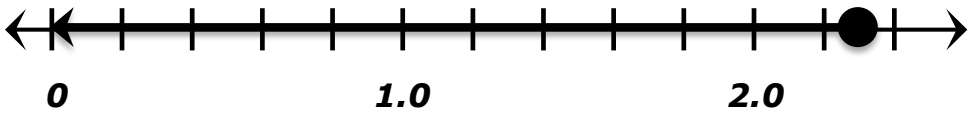
c) Represent the solution(s) on a number line.



d) Use substitution to determine whether 1, 1.5, 2, or 2.5 are solutions to the inequality.

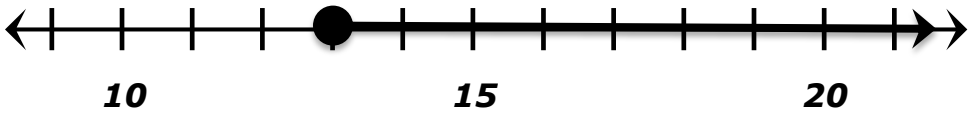
(1) + 3.2 ≤ 5.5	***(1.5) + 3.2 ≤ 5.5***	***(2) +3.2 ≤ 5.5***	***(2.5) + 3.2 ≤ 5.5***
4.2 ≤ 5.5	***4.7 ≤ 5.5***	***5.2 ≤ 5.5***	***5.7 ≤ 5.5***
1 is a solution.	***1.5 is a solution.***	***2 is a solution.***	***2.5 is not a solution.***

3. Frederick has at least five times as many books on his e-reader as his cousin, Elena. If Frederick has 65 books on his e-reader, how many books, *x*, could Elena have?

a) Write the inequality.
5x ≥ 65

b) Solve the inequality using properties of operations.
5x ≥ 65
5x ÷ 5 ≥ 65 ÷ 5
x ≥ 13

c) Represent the solution(s) on a number line.



d) Use substitution to determine whether 12, 13, 14, or 15 are solutions to the inequality.

5(12) ≥ 65 ***5(13) ≥ 65*** ***5(14) ≥ 65*** ***5(15) ≥ 65***

60 ≥ 65 ***65 ≥ 65*** ***70 ≥ 65*** ***75 ≥ 65***

12 is NOT a solution ***13, 14, 15 ARE solutions***

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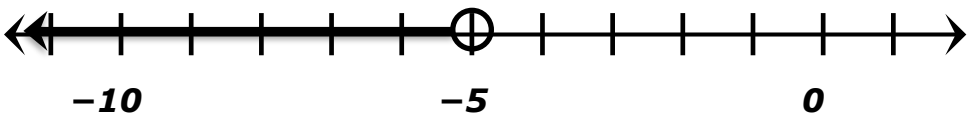
Part 2: Inequalities with Negative Multipliers

1. $-2x > 10$

   a) Complete the table below. Compare the columns and use the correct inequality symbol to compare the values in each row.

x	$-2x$	<, =, or >	10
−7	***−2(−7) = 14***	>	***10***
−6	***−2(−6) = 12***	>	***10***
−5	***−2(−5) = 10***	=	***10***
−4	***−2(−4) = 8***	<	***10***
−3	***−2(−3) = 6***	<	***10***
−2	***−2(−2) = 4***	<	***10***
−1	***−2(−1) = 2***	<	***10***
0	***−2(0) = 0***	<	***10***

   b) Plot the values that solve the inequality on the number line below.



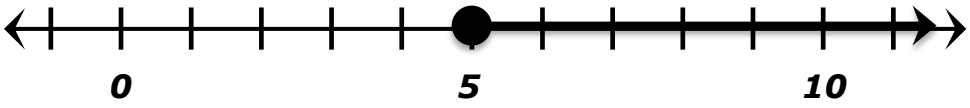
   c) Use the properties of operations to solve the inequality and use the number line and table to identify and use the correct inequality symbol.
   x < −5

2. $-15x \leq -75$

   a) Complete the table below. Compare the columns and use the correct inequality symbol to compare the values in each row.

x	$-15x$	<, =, or >	-75
2	***−15(2) = −30***	>	***−75***
3	***−15(3) = −45***	>	***−75***
4	***−15(4) = −60***	>	***−75***
5	***−15(5) = −75***	=	***−75***
6	***−15(6) = −90***	<	***−75***
7	***−15(7) = −105***	<	***−75***
8	***−15(8) = −120***	<	***−75***
9	***−15(9) = −135***	<	***−75***

b) Plot the values that solve the inequality on the number line below.



c) Use the properties of operations to solve the inequality and use the number line and table to identify and use the correct inequality symbol.
x ≥ 5

3. $x \div -6 \geq -3$

a) Complete the table below. Compare the columns and use the correct inequality symbol to compare the values in each row.

x	$x \div -6$	<, =, or >	-3
0	***0 ÷ −6 = 0***	>	***−3***
6	***6 ÷ −6 = −1***	>	***−3***
12	***12 ÷ −6 = −2***	>	***−3***
18	***18 ÷ −6 = −3***	=	***−3***
24	***24 ÷ −6 = −4***	<	***−3***
30	***30 ÷ −6 = −5***	<	***−3***
36	***36 ÷ −6 = −6***	<	***−3***
42	***42 ÷ −6 = −7***	<	***−3***

b) Plot the values that solve the inequality on the number line below.

c) Use the properties of operations to solve the inequality and use the number line and table to identify and use the correct inequality symbol.
x ≤ 18

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Debriefing Questions

1. Why does an inequality have multiple solutions but an equation has only one solution?
   An equation with one variable and no exponent has one solution because there is only one value that, when substituted back into the equation, makes the equation true. An inequality has multiple solutions because there are many values that, when substituted back into the inequality, make the inequality true.

2. When you solve an inequality by multiplying or dividing by a negative number, what happens to the inequality symbol? Why do you think that is the case?
   Then inequality symbol reverses; i.e., less than becomes greater than and greater than becomes less than. This is because when you multiply or divide by a negative number, you are taking the opposite of the number. Along a number line, when you take the opposite, you reverse direction.

3. How is solving an inequality like solving an equation? How is it different?
   When using the properties of operations, the solution process is very similar. Additive and multiplicative inverses can be used to determine the value of x. However, when you are solving an inequality and you multiply or divide by a negative number, you must reverse the inequality symbol.