

## Lesson 9: Introduction to Inequalities

Opening Exercise - [adapted from MARS Evaluating Statements About Number Operations]

1. Abigail is thinking of a number.



If I subtract three from my number then my answer is less than four.

- A. Could Abigail be thinking of 8? Explain your answer.

No

$$8 - 3 = 5$$

- B. What numbers could she be thinking of? Describe them all.

Any number less than 7

- C. Which of the following means the same as Abigail's statement? Circle all that apply.

$$x - 3 < 4$$

$$3 - x < 4$$

$$x - 3 > 4$$

$$3 - x > 4$$

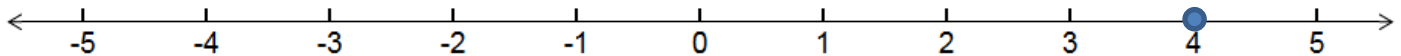
Here are some statements expressed in words and in algebra. The last column explains when the statements are true. Complete the table. An example is shown in the first row.

	Statement in Words	Statement in Algebra	What numbers would make the statement true?
Ex:	When I add three to my number the answer is equal to seven.	$x + 3 = 7$	Only the number 4 will make this true.
2.	When I add four to my number the answer is greater than six.	$x + 4 > 6$	Anything larger than 2
3.	When I multiply my number by six, the answer is less than nine.	$6x < 9$	Anything less than $\frac{3}{2}$
4.	When I divide my number by 3, the answer is less than 4	$\frac{x}{3} < 4$	Anything less than 12
5.	When I subtract my number from 7, the answer is greater than 6.	$\begin{array}{r} 7 - x > 6 \\ -7 \quad -7 \\ \hline -x > -1 \\ \hline x < 1 \end{array}$	Anything less than 1.

## Graphing Inequalities

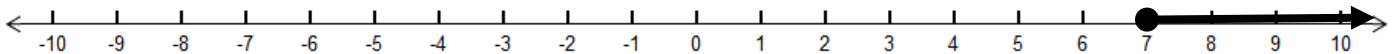
Since these inequalities are with one variable, we can graph their solution on a number line. The example on the previous page would be a single dot on 4 as shown below.

Ex:	When I add three to my number the answer is equal to seven.	$x + 3 = 7$	Only the number 4 will make this true.
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6. Which of the graphs below show the solutions to Abigail's number from the Opening Exercise? Explain your thinking. Then explain what is wrong with the other graphs.

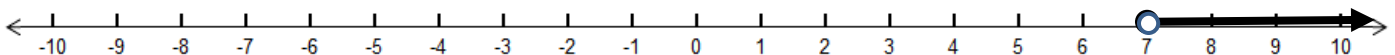
A.



B.



C.



D.



**Practice Graphing Inequalities**

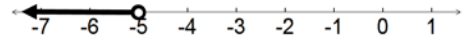
For each inequality below, graph the solution on the number line.

7. $x > -6$	
8. $x \geq -6$	
9. $x < -6$	
10. $x \leq -6$	
11. $x \leq 0$	
12. $-1 < x < 2$	<p style="margin-left: 20px;"><math>-1 &lt; x</math>   <math>x &lt; 2</math></p>
13. $x > 2$ or $x < -1$	

### Interval Notation

Besides drawing a number line showing all possible solutions, mathematicians use *interval notation* to describe the set of solutions.

For example,  $x < -5$  is written  $(-\infty, -5)$ . On a number line it would like this:



14. How do you think  $x \leq -5$  would be written?

$$(-\infty, -5]$$

15. What would  $[5, 6]$  look like as an inequality?

$$5 \leq x \leq 6$$

Match each inequality below with its interval notation.

16.  $3 < x \leq 4$

B

17.  $3 < x$

D

18.  $x \leq 4$

C

19.  $x < 3$  or  $x > 4$

A

A. $(-\infty, 3)$ or $(4, \infty)$	B. $(3, 4]$	C. $(-\infty, 4]$	D. $(3, \infty)$
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Below are the inequalities from the previous page. Write the interval notation that describes the solutions.

20.  $x > -6$

21.  $x \geq -6$

22.  $x < -6$

23.  $x \leq -6$

24.  $x \leq 0$

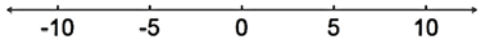
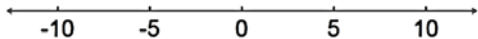
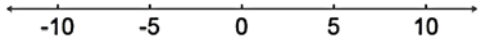
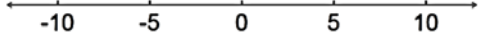
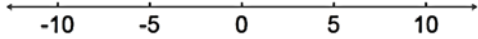
25.  $-1 < x < 2$

26.  $x > 2$  or  $x < -1$

## Exploration – Card Matching

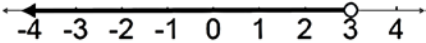
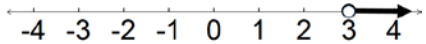
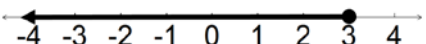
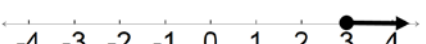
You will need: a set of Written Solution cards and Description cards, glue stick, scissors

Directions: Cut out the cards and match them to the given inequalities in the table below. Then glue the cards into the appropriate spaces. Finally draw in the correct graph for each solution.

	Inequality Statement	Description	Written Solution	Graph
27.	$10 + x > 10$			
28.	$x + 10 < x$			
29.	$10x > x$			
30.	$\frac{10}{x} < 10$			
31.	$x - 2 < 8$			

## Lesson Summary

## Graphing Inequalities on a Number Line

Inequality Symbol	How it is said	On the Number Line	Example: Algebra	Example: Interval Notation	Example: Graph
$<$	Less than	$\circ$	$x < 3$	$(-\infty, 3)$	
$>$	Greater than	$\circ$	$x > 3$	$(3, \infty)$	
$\leq$	Less than or equal to	$\bullet$	$x \leq 3$	$(-\infty, 3]$	
$\geq$	Greater than or equal to	$\bullet$	$x \geq 3$	$[3, \infty)$	

## Homework Problem Set

1. Shamara is thinking of a number.

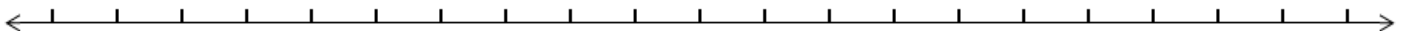


If I subtract my number from 10 the answer is greater than 2.

A. Could Shamara be thinking of 8? Explain.

B. How is Sharmara's statement written using algebra?

C. Graph the solution to possibilities for Sharmara's number and give the solution in interval notation.



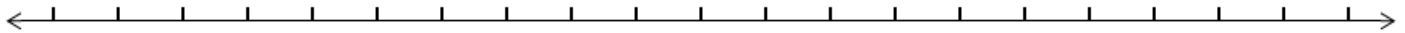
2. Benjamin is also thinking of a number.



If I multiply my number by four,  
then my answer is greater than ten.

A. Write Benjamin's statement using algebra.

B. Graph the solution to possibilities for Benjamin's number and give the solution in interval notation.

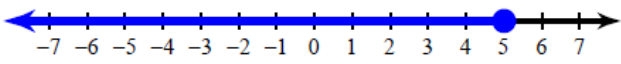
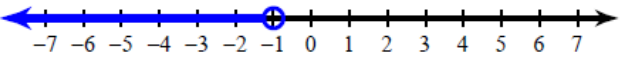
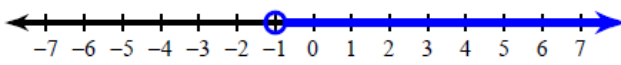
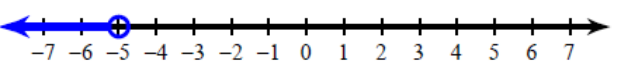
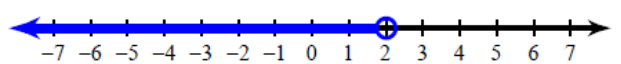
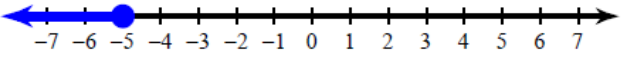


Draw a graph for each inequality and give the solution in interval notation. [source: Kuta software]

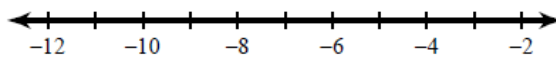
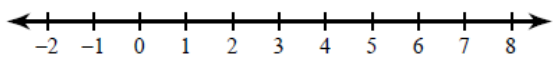
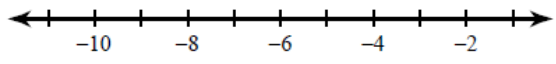
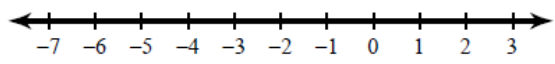
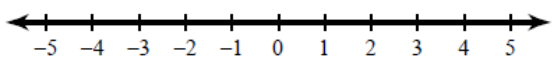
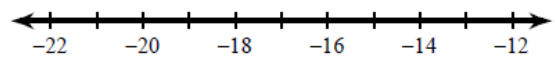
3. $n \leq -5$	4. $n \leq 5$
5. $r > 2$	6. $r \leq -2$
7. $x \geq 2$	8. $-2 \geq v$
9. $5 > -b$	10. $a \geq 2$

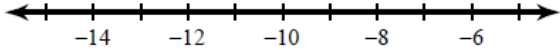
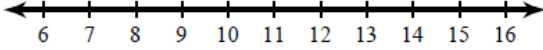
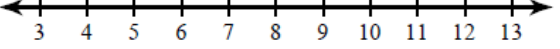
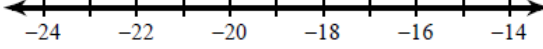
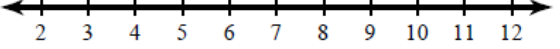
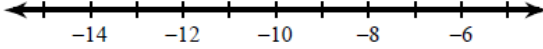


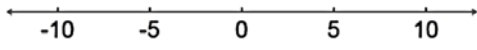
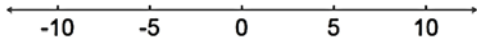
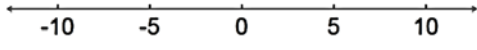
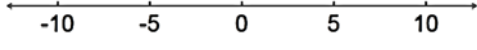
Write an inequality for each graph and give the solution in interval notation. [source: Kuta software]

<p>11.</p> 	<p>12.</p> 
<p>13.</p> 	<p>14.</p> 
<p>15.</p> 	<p>16.</p> 

Use mental math to solve and graph each inequality. Then and give the solution in interval notation.

<p>17. <math>-12 &gt; x - 7</math></p> 	<p>18. <math>-1 + r \geq 4</math></p> 
<p>19. <math>n - 6 \leq -14</math></p> 	<p>20. <math>b - 7 &lt; -12</math></p> 
<p>21. <math>a - 17 = 16</math></p> 	<p>22. <math>15 + x \leq 0</math></p> 

<p>23. <math>3 + v \leq -9</math></p> 	<p>24. <math>8 \geq n - 6</math></p> 
<p>25. <math>\frac{n}{3} &gt; 3</math></p> 	<p>26. <math>\frac{k}{4} &lt; -4</math></p> 
<p>27. <math>12n \geq 84</math></p> 	<p>28. <math>-22 &gt; -10 + b</math></p> 

	Inequality Statement	Simplified Inequality Statement	Interval Notation of Solution	Graph of Solution
29.	$10 - x > 10$			
30.	$x - 10 > x$			
31.	$2x > 10$			
32.	$\frac{x}{5} < 2$			
33.	$\frac{x}{2} > 5$			