

By interval notation: An interval is a connected subset of numbers. **Interval notation** is an alternative to expressing your answer as an inequality. Unless specified otherwise, we will be working with real numbers.

When using interval notation, the symbol:

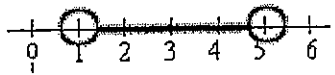
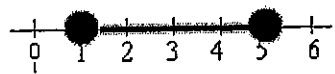
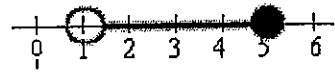
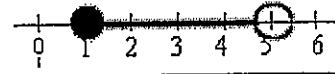
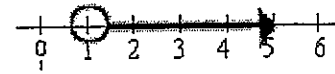
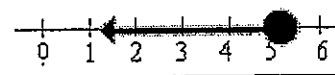
(means "not included" or "open".

[means "included" or "closed".

$2 \leq x < 6$ as an inequality.

$[2, 6)$ in interval notation.

The chart below will show you all of the possible ways of utilizing interval notation.

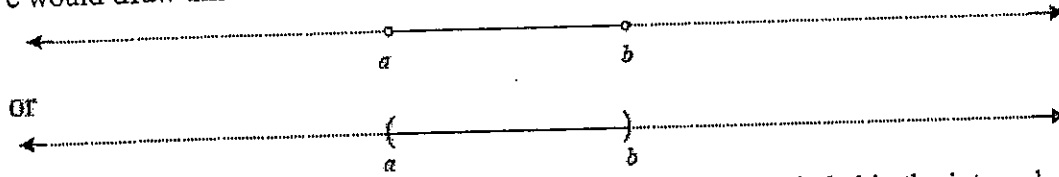
Interval Notation: (description)	(diagram)
Open Interval: (a, b) is interpreted as $a < x < b$ where the endpoints are NOT included. (While this notation resembles an ordered pair, in this context it refers to the interval upon which you are working.)	$(1, 5)$ 
Closed Interval: $[a, b]$ is interpreted as $a \leq x \leq b$ where the endpoints are included.	$[1, 5]$ 
Half-Open Interval: $(a, b]$ is interpreted as $a < x \leq b$ where a is not included, but b is included.	$(1, 5]$ 
Half-Open Interval: $[a, b)$ is interpreted as $a \leq x < b$ where a is included, but b is not included.	$[1, 5)$ 
Non-ending Interval: (a, ∞) is interpreted as $x > a$ where a is not included and infinity is always expressed as being "open" (not included).	$(1, \infty)$ 
Non-ending Interval: $(-\infty, b]$ is interpreted as $x \leq b$ where b is included and again, infinity is always expressed as being "open" (not included).	$(-\infty, 5]$ 

Worksheet: Inequalities and Interval notation

" (a, b) ", the open interval of numbers between a and b , not including a and not including b . Expressed using set notation and inequalities we would say

$(a, b) = \{x: a < x < b\}$. When translated into English, this means "all numbers, x , such that x is greater than a and less than b ."

We would draw this illustration to visualize the set:

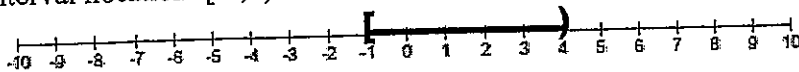


where the $)$ and the $($ symbolize that the end point is not included in the interval.
" $[a, b]$ ", the closed interval of numbers between a and b , including a and including b . Expressed using set notation and inequalities we would say $[a, b] = \{x: a \leq x \leq b\}$. When translated this means "All numbers, x , such that x is greater than or equal to a and less than or equal to b ."

Example 1: The set of all numbers greater than or equal to -1 and less than 4 .

Set notation using inequalities: $\{x: -1 \leq x < 4\}$

Interval notation: $[-1, 4)$

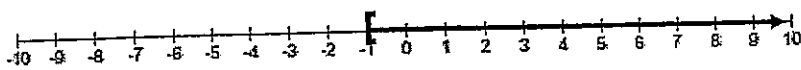


OR



If a set has no end point, then we describe the endpoint as either "infinity" (∞) or "negative infinity" ($-\infty$).

Example 2: The set of all numbers greater than or equal to -1 , $\{x: x \geq -1\}$ is written in interval notation as $[-1, \infty)$. Since infinity is not a distinct number, we use the open-ended $)$ in the interval notation. However, the left endpoint includes -1 , since the numbers can be greater than or EQUAL to -1 , so we use the $[$ for the left side notation. The illustration of this is a half-line:



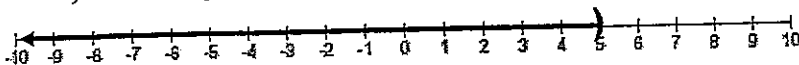
OR



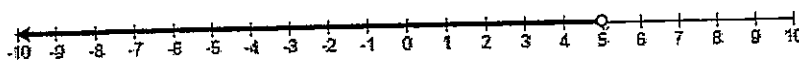
Example 3: The set of all numbers less than 5 , $\{x: x < 5\}$

Interval notation: $(-\infty, 5)$

Since the interval says that the numbers must be less than 5 , the interval does not include 5 as the endpoint, so we use $)$ for the right side notation.



OR



Problems to try:

1. Express the following set in interval notation and draw an illustration for it.

$$\{x: -1 < x < 3\}$$

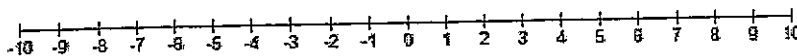
Interval notation: _____



2. Express the following set in interval notation and draw an illustration for it.

$$\{x: -1 \leq x \leq 3\}$$

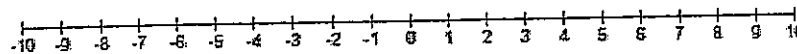
Interval notation: _____



3. Express the following set in interval notation and draw an illustration for it.

$$\{x: -2 \leq x < 1\} =$$

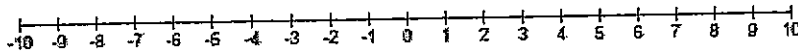
Interval notation: _____



4. Express the following set A in interval notation and using inequalities. Draw an illustration for it. " A is the set of all numbers bigger than 2 but less than or equal to 5".

Set notation: $\{x: \underline{\hspace{2cm}}\}$

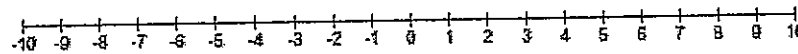
Interval notation: _____



5. Express the following set in interval notation and using inequalities. Draw an illustration for it. " A is the set of all numbers greater than or equal to -1 but less than 2".

Set notation: $\{x: \underline{\hspace{2cm}}\}$

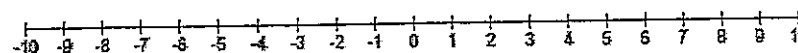
Interval notation: _____



6. Express the following set in interval notation and draw an illustration for it.

$$\{x: -3 < x < \infty\}$$

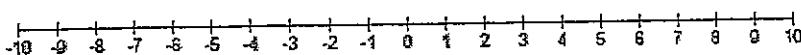
Interval notation: _____



7. Express the following set in interval notation and draw an illustration for it.

$$\{x: -\infty < x \leq 3\}$$

Interval notation: _____

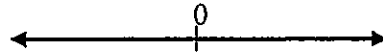


NAME: _____

Practice: Interval Notation

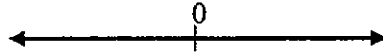
Write each inequality in interval notation AND draw a graph of each inequality.

1. $x \geq 4$



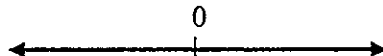
1. _____

2. $x < 6$



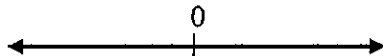
2. _____

3. $x \leq -2$



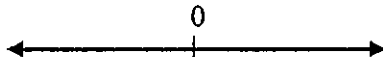
3. _____

4. $x > 8$



4. _____

5. $x < -10$



5. _____

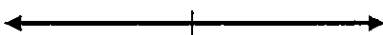
Write each interval as an inequality, and draw a graph for each.

6. $(-\infty, -8]$



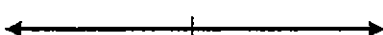
6. _____

7. $[5, \infty)$



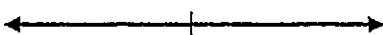
7. _____

8. $(-2, \infty)$



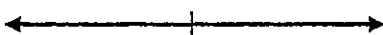
8. _____

9. $[-10, \infty)$



9. _____

10. $(-\infty, 6)$



10. _____

Introducing Interval Notation

Instructions: Fill in the missing parts in the chart below.

	Inequality	Interval Notation	Graph
Ex.	$-3 \leq x < 5$	$[-3, 5)$	
Ex.	$x > 2$	$(2, \infty)$	
1.	$x \leq 3$		
2.		$(-\infty, 4)$	
3.			
4.		$[5, \infty)$	
5.			
6.	$x < 1$ or $x \geq 5$		
7.			
8.	x is any real #		
9.			
10.		$(1, 4)$	
11.	$x > 7$		
12.		$[-2, 2]$	

Name: _____

Date: _____

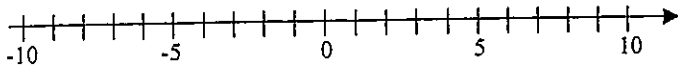
INTERVAL NOTATION COMMON CORE ALGEBRA I



We will often want to talk about **continuous segments** of the **real number line**. We've already done work with this in the last lesson using what is known as **inequality or set-builder notation**. Today we will see a very simple way of showing these segments.

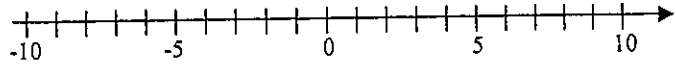
Exercise #1: For each of the following, graph the portion of the number line described by the inequality and then write the equivalent using **interval notation**.

(a) $-3 \leq x \leq 5$



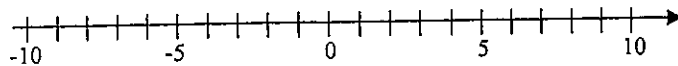
Equivalent Interval Notation: _____

(b) $-6 < x < 4$



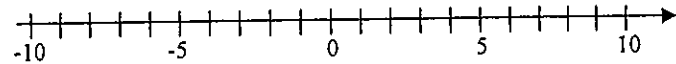
Equivalent Interval Notation: _____

(c) $-4 < x \leq 8$



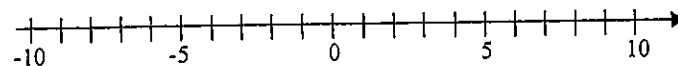
Equivalent Interval Notation: _____

(d) $x \geq 4$



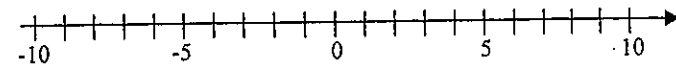
Equivalent Interval Notation: _____

(e) $x < 5$



Equivalent Interval Notation: _____

(f) $-4 < x$



Equivalent Interval Notation: _____

One of the great advantages of **interval notation** is that we essentially need to know a starting value, an ending value and then whether they are included or not.

Exercise #2: Which of the following represents the equivalent interval to $-12 \leq x < 4$?

(1) $(-12, 4)$

(3) $[-12, 4)$

(2) $(-12, 4]$

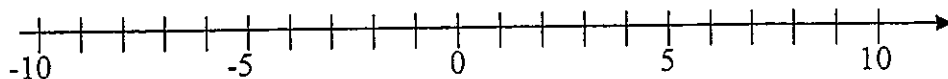
(4) $[-12, 4]$



Eventually, we will use **interval notation** to express solutions sets to inequalities as well as to describe sets of interest to us.

Exercise #3: Solve the inequality given below for all values of x . Graph the solution on the number line given and state the solution set using interval notation.

$$12 - 4x > 0$$



Interval Notation: _____

Intervals express information about particular values of a variable. We can look at the same types of problems from the last lesson, where intervals combine in various ways.

Exercise #4: Two inequalities have solution sets given in interval notation below.

Inequality #1: $[-3, 2)$

Inequality #2: $(0, 4)$

(a) Write an interval that represents all values that are solutions to both inequalities (AND). Draw number lines to help you think about the solution set.

(b) Write an interval that represents all values that are solutions to either of the inequalities (OR). Draw number lines to help you think about the solution set.

Exercise #5: At a hydroelectric plant, Pump #1 is on for all times on the interval $[0, 8)$ and Pump #2 is on for all times in the interval $[4, 18)$. Which of the following represents all times, t , when both pumps are on?

(1) $4 \leq t < 8$

(3) $4 < t < 8$

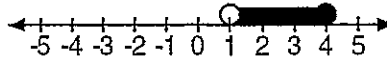
(2) $0 \leq t < 18$

(4) $8 \leq t \leq 18$



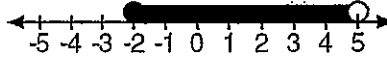
Name: Homework 01/02

1) What interval notation represents the data graphed below?



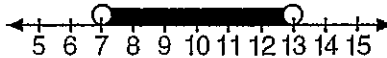
- A) $(4,1)$ B) $(1,4]$ C) $[4,1)$ D) $(1,4)$

2) What interval notation represents the data graphed below?



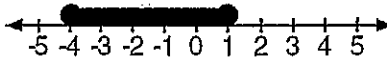
- A) $[-2,5]$ B) $[-2,5)$ C) $(-2,5]$ D) $(-2,5)$

3) What interval notation represents the data graphed below?



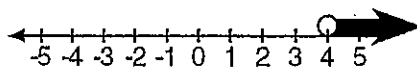
- A) $(7,13]$ B) $(7,13)$ C) $[7,13)$ D) $[7,13]$

4) What interval notation represents the data graphed below?



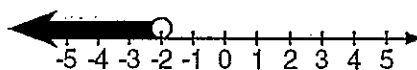
- A) $[-4,1)$ B) $(-4,1]$ C) $[-4,1]$ D) $(-4,1)$

5) What interval notation represents the data graphed below?

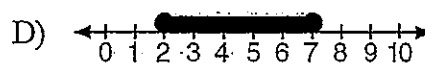
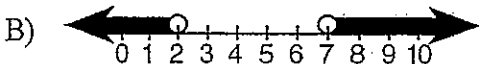
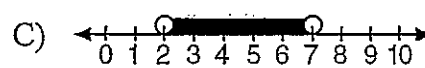
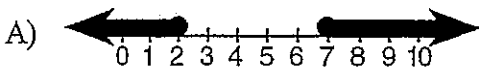


- A) $(4,\infty]$ B) $(4,\infty)$ C) $(\infty,4]$ D) $(\infty,4)$

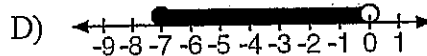
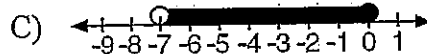
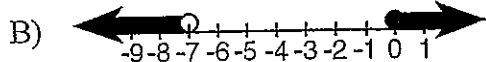
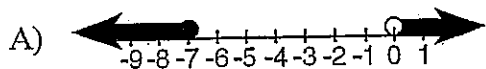
6) What interval notation represents the data graphed below?



- A) $(-\infty,-2)$ B) $[-\infty,-2]$ C) (-2) D) $(-2,\infty)$

7) Which of the graphs below shows the solution set of $[2,7]$?

8) Which of the graphs below shows the solution set of $(-7, 0]$?



Questions 9 through 12 refer to the following:

Express the given set of numbers in either inequality notation or interval notation:

9) The set of real numbers greater than or equal to four and less than ten.

10) The set of real numbers greater than negative three and less than or equal to two.

11) The set of real numbers greater than five and less than eleven.

12) The set of real numbers greater than or equal to nine and less than or equal to sixteen.