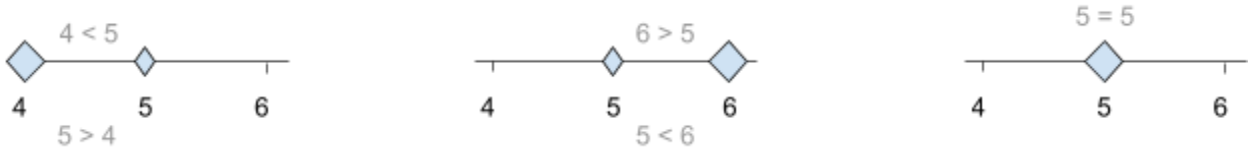
Number Lines

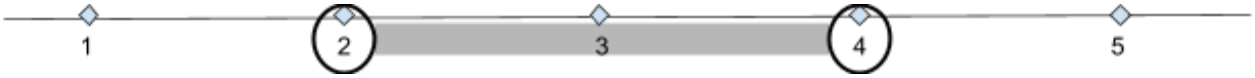
Imagine that all numbers are connected together, in order, like beads on a string. This string is the number line. Because it goes on forever, we can only ever look at a small part of it, but we can look at any part we want. A number line looks a lot like a ruler.

Because the numbers are in counting order, every number has one and only one place that it can go on the number line. All numbers to the right are Greater Than it, all numbers to the left are Less Than it. Mathematicians use the number line to compare the size of two numbers.

Let's compare five to its neighbors. If we compare 4 and 5, 4's place is to the left of 5, so we can say that 4<5. Because 5 is to the right of 4, we can also say that 5>4. With 5 and 6, 6 is to the right of 5, so 6>5. Because 5 is left of 6, we can also say 5<6. We can try to compare a number to itself if we want -- in that case we would say that 5 = 5. More on this later.



Mathematicians can also use the number line to talk about a range of numbers -- meaning the dots where whole numbers fall on the line, but also the gaps between them. If I need to buy a table, and I want to put it in a four foot wide space in my house, but I want to a two foot wide box on it, I can say that my table must be more than two feet wide, but less than four feet wide.



If I find a desk that is exactly 3 feet wide, or one that is 2½ feet, or a 3¼ foot desk, all of them are more than two feet wide, but less than four feet wide. Their places on the number line are inside the shaded area. Meanwhile, a desk that is 1 foot or 1⅓ feet is too small -- off to the left of our shaded area. A desk that is 4⅛ or 5 feet is slightly too big, and off to the right.

But what about a desk that is ***exactly*** two feet wide, or ***exactly*** four feet wide? Will those work? When we measured the house, did we leave a little bit of extra space so we can push the table into position, or will a four foot wide table scrape against the walls and other furniture? Math has a way to write that down. If the number in the circle is included, we fill in the circle too.

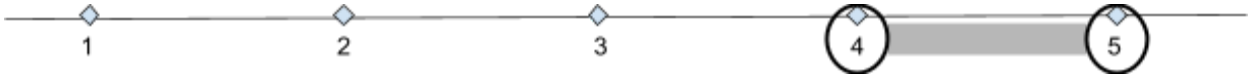
Let's say that two feet is okay, but four feet is not. So we say the desk must be greater than or equal to two (≥ 2), but strictly less than four (< 4).

Number Lines

REFERENCE SHEET

The circled number **IS INCLUDED**	The circled number is **NOT INCLUDED**
	
Greater Than Or Equal To, $\geq$	Strictly Greater Than, >
Less Than Or Equal To, $\leq$	Strictly Less Than, <
Equal To, =	Not Equal To, $\neq$
"Closed interval"	"Open interval"
≥ 2 and ≤ 4 can be shown as [2,4]	>2 and <4 can be shown as (2,4)
Inclusive	Exclusive

EXAMPLE 1: These statements all describe this picture.



- The open interval between 4 and 5.
- The interval strictly greater than 4 and strictly less than 5.
- All numbers between 4 and 5, exclusive.
- The space between 4 and 5, excluding the end points.
- The interval 4<x<5.
- (4,5)

EXAMPLE 2: These statements all describe this picture.

- The closed interval between one and five.
- The interval greater than or equal to 1, and less than or equal to five.
- The interval between 1 and 5, including both end points.
- The interval between 1 and 5, inclusive.
- The interval x=1, x=2, or $1 \leq x \leq 5$.
- [1,5]

EXAMPLE 3: These statements all describe this picture.

- The interval greater than or equal to two, but strictly less than four.
- The interval between 2 and 4, including two but not four.
- The interval where x=2, or x is between 2 and 4.
- $2 \leq x < 4$
- [2,4)

Number Lines

SAMPLE PROBLEMS:

1. Please color in the area > 3 but < 10.

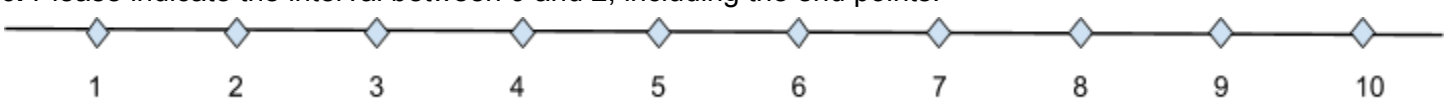
2. Please show the interval greater than or equal to four, but less than or equal to six.

3. Please indicate (5,9).

4. (Tricky) Please show the interval ≤ 7, but ≥ 1

5. $1 \leq x \leq 10$

6. Please indicate the interval between 9 and 2, including the end points.

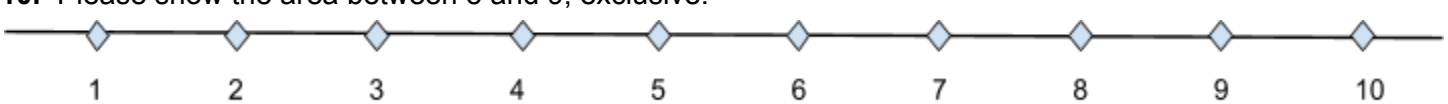


7. Please indicate 2<x<9.

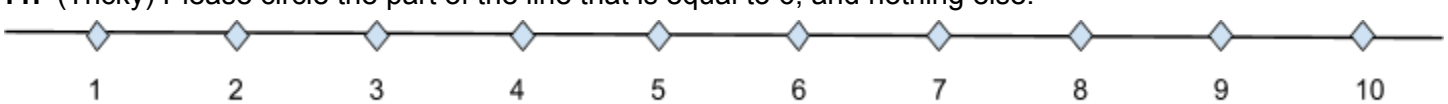
8. Please indicate a closed interval between 7 and 8.

9. Please show the area between 4 and 8 inclusive.

10. Please show the area between 5 and 9, exclusive.



11. (Tricky) Please circle the part of the line that is equal to 6, and nothing else.



12. (Tricky) Please shade in the areas that are strictly LESS THAN 3, or GREATER THAN 8.