Math 95: Notes on functions.

1. Writing Domain and Range

Earlier this week we mentioned that the domain referred to the valid set of inputs and the range referred to valid set of outputs. Additionally, we learned that domain refers to x-values and the range to y-values. We did not cover how to write the domain and range with the correct syntax; we only used words in class.

We mainly use Interval Notation because we are looking at intervals of valid numbers. Here is a section from the Index of our book.

Definition 1.3.11. Interval Notation. Interval notation describes a collection of numbers by telling you where the collection "starts" and "stops". For example, in Figure 1.3.9, the interval starts at 18. To the right, the interval extends forever and has no end, so we use the ∞ symbol (meaning "infinity"). This particular interval is denoted:

$$[18, \infty)$$

Why use "[" on one side and ")" on the other? The square bracket tells us that 18 ***is*** part of the interval and the round parenthesis tells us that ∞ is ***not*** part of the interval. (And how could it be, since ∞ is not even a number?)

There are four types of infinite intervals. Take note of the different uses of round parentheses and square brackets.

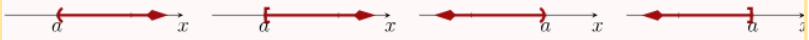


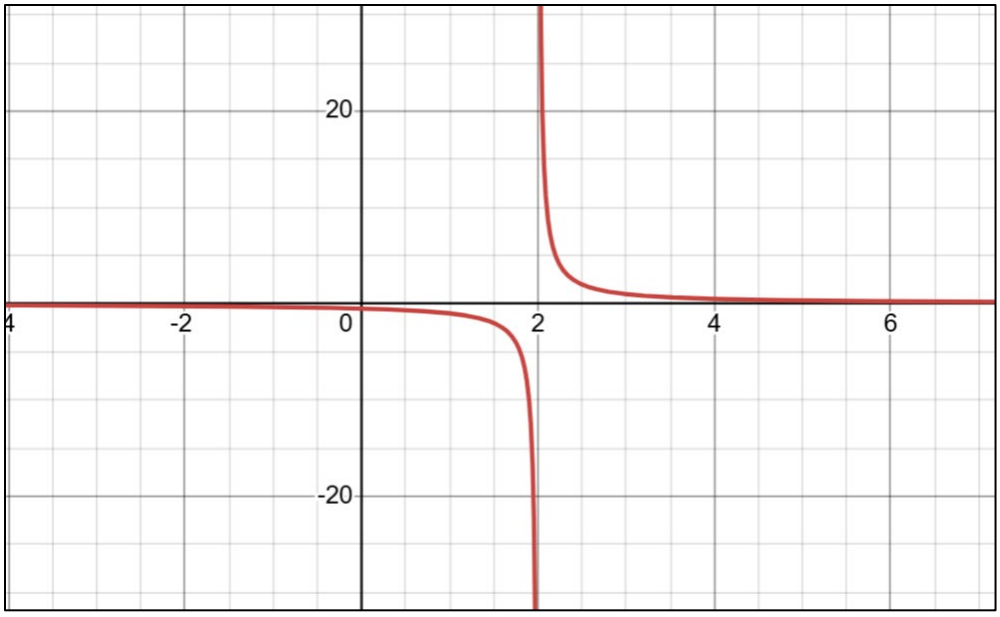
Figure 1.3.12. An ***open, infinite*** interval denoted by (a, ∞) means all numbers a or larger, *not* including a.

Figure 1.3.13. A ***closed, infinite*** interval denoted by $[a, \infty)$ means all numbers a or larger, *including* a.

Figure 1.3.14. An ***open, infinite*** interval denoted by $(-\infty, a)$ means all numbers a or smaller, *not* including a.

Figure 1.3.15. A ***closed, infinite*** interval denoted by $(-\infty, a]$ means all numbers a or smaller, *including* a.

If we two intervals, we use the symbol, $\cup$, for union. Let us now apply this interval notation to some graphs. The following problems are similar to those in 11.6.



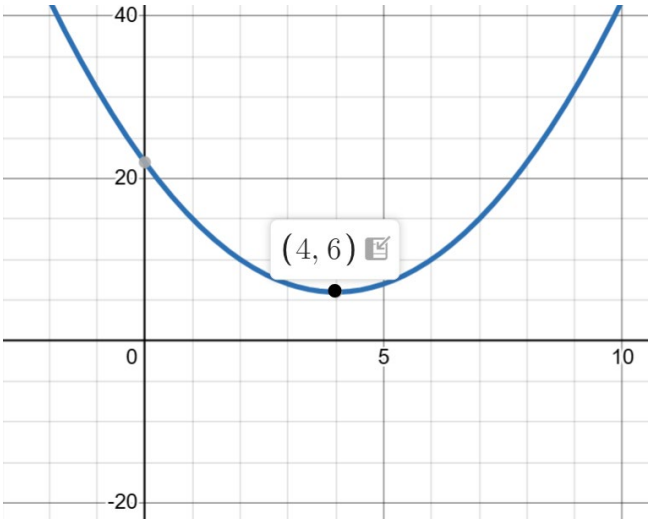
In regards to ***x values*** or the domain we see that ***x*** is never a 2. We also see that the ***x values*** keep going and going to left and right. In math we use the term ***infinity*** when describing "going and going" or "going on forever". The term for infinity is ∞ . We see that ***y values*** or the range keep going upward and downward, but never hit zero (or the x-axis). Here is how we write both the Domain and Range.

Domain: $(-\infty, 2) \cup (2, \infty)$

Range: $(-\infty, 0) \cup (0, \infty)$

In the last example both of the intervals had a (or). We use parenthesis or (and) to describe the boundary of an interval when the curve DOES NOT touch the boundary. In the next example, the curve does touch the boundary.

The next graph has a parabola opening upwards and has a vertex of (4, 6). The x values can on infinitely in both directions. The y values only exist from y = 6 and upwards.



Domain: $(-\infty, \infty)$

Range: $[6, \infty)$

In this example we see a [, because the point at the y value of 6 is included.

2. Using function notation on algebraic expressions.

The other questions in 11.6 have you working with functions. The following problem is from section 11.4.

42. Let f be a function given by $f(x) = -4x - 1$. Find and simplify the following:

a. $f(x) + 3 =$ _____

b. $f(x + 3) =$ _____

c. $3f(x) =$ _____

d. $f(3x) =$ _____

When we see, $f(x)$, and this means we will just use the definition or expression for the function. For example, on 42 c. we see, ***3f(x)***. This means we will multiply three times the function. All of the steps look like the following:

$$3f(x) = 3[-4x - 1]$$
$$= -12x - 3$$

If we see something in the parenthesis of function, that is, ***f***("in here"), this means we want to substitute and entire contents of the ( ) for ***x*** in the expression using a ( ).

42 b. would look like the following where we will put in ***x + 3*** into every occurrence of ***x*** on the right side.

$$f(x + 3) = -4(x + 3) - 1$$
$$= -4x - 12 - 1$$
$$= -4x - 13$$

s

Some of the problems ask for domain and range on HW #9.