Concepts and Examples
Interval and Set-Builder Notation

Based on power point presentations by Pearson Education, Inc.
Revised by Ingrid Stewart, Ph.D.

Learning Objectives

1. Use Interval Notation to express a set of numbers.
2. Use Set-Builder Notation to express a set of numbers.

1. Interval Notation (1 of 4)

Previously we learned that sets of numbers can be expressed using inequality signs. For example, the set $-2 \leq x \leq 1$ contains all numbers between – 2 and 1 with – 2 and 1 included.

Interval Notation can also be used to express a set of numbers. In in this notation, we use brackets [ ], parentheses ( ), the positive infinity symbol ∞, the negative infinity symbol $-\infty$, and sometimes the "union" symbol $\cup$.

Brackets [ ]: A bracket next to a number indicates that the number is included in the set.

For example, [– 2, 1] is *Interval Notation* for a set of numbers that contains all values between – 2 and 1, including – 2 and 1. **We call this a CLOSED INTERVAL!**

[– 2, 1] is equivalent to $-2 \leq x \leq 1$.

Interval Notation (2 of 4)

Parentheses ( ): A parenthesis next to a number indicates that the number is NOT included in the set.

For example, (– 2, 1) is *Interval Notation* for a set of numbers that contains all values between – 2 and 1, NOT including – 2 and 1. **We call this an OPEN INTERVAL!**

(– 2, 1) is equivalent to $-2 < x < 1$.

WARNING: Since we use the notation (– 2, 1) also for an ordered pair determining the location of a point in the coordinate system, always be aware in what context you are using (– 2, 1).

Interval Notation (3 of 4)

Negative and Positive Infinity Symbols: Negative and positive infinity always start and/or end with a parenthesis.

For example, $(-\infty, 1)$ is *Interval Notation* for a set of numbers that contains ALL values that are less than 1, NOT including 1.

$(-\infty, 1)$ is equivalent to $x < 1$.

On the other hand, $[1, \infty)$ is *Interval Notation* for a set of numbers that contains ALL values that are greater than or equal to 1, including 1.

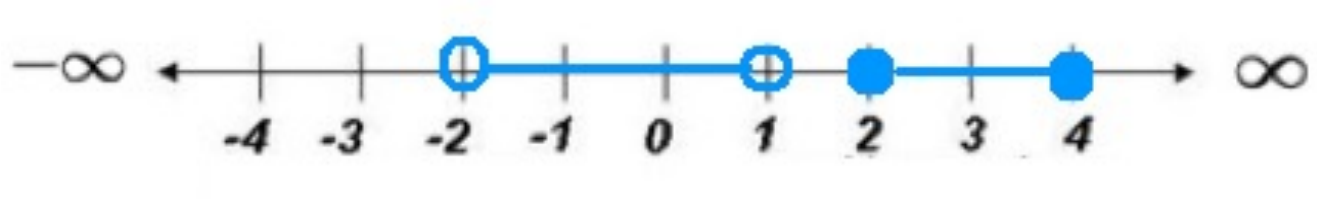
$[1, \infty)$ is equivalent to $x \geq 1$.

Interval Notation (4 of 4)

Union of Intervals: The symbol ∪ joins separate sets of items. The union symbol is usually read as "or".

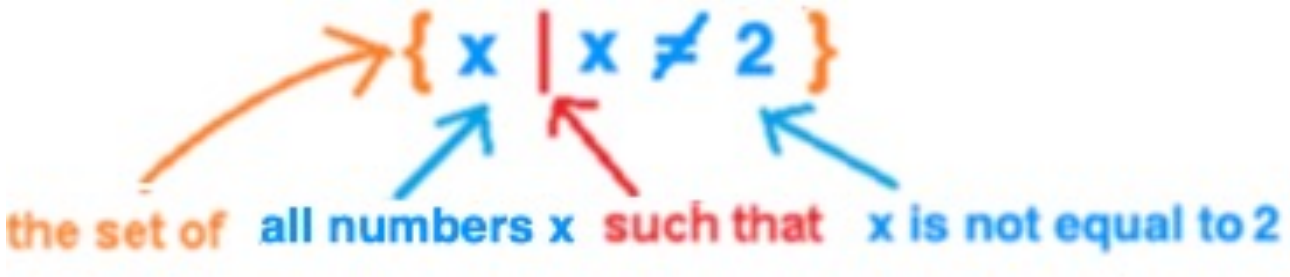
For example, (– 2, 1) ∪ [2, 4] is *Interval Notation* for a set of numbers that is a union of two separate intervals.

We can graph this set on a number line as follows:



2. Set-Builder Notation (1 of 2)

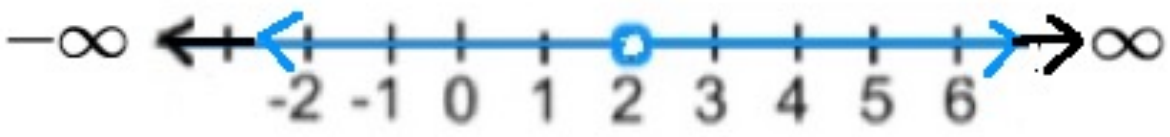
Set-Builder Notation can also be used to express a set of numbers. Here, we use braces { } and the vertical separator |. We are going to use an example to illustrate *Set-Builder Notation*.



In the example above, the *Set-Builder Notation* means that we want to include ALL numbers in the set except the number 2.

Set-Builder Notation (2 of 2)

We can graph the set $\{ x \mid x \neq 2\}$ on a number line as follows:



The blue line indicates the numbers included to the right and left of the circle. The arrows indicate that there are infinitely many numbers in the set. There is a CIRCLE at 2 which indicates that the number 2 is NOT included in the set!