Chapter 1

TYPES of NUMBERS and the NUMBER LINE

There are many different types of numbers with different names. Here are the types of numbers used most often:

WHOLE NUMBERS: A number with no fractional or decimal part. Cannot be negative.

EXAMPLES: 0, 1, 2, 3, 4...

NATURAL NUMBERS: Whole numbers from 1 and up. Some teachers say these are all the "counting numbers."

EXAMPLES: 1, 2, 3, 4, 5...

INTEGERS: All whole numbers (including positive and negative whole numbers).

EXAMPLES: ... −4, −3, −2, −1, 0, 1, 2, 3, 4...

RATIONAL NUMBERS: Any number that can be written by dividing one integer by another—in plain English, any number that can be written as a fraction or ratio. (An easy way to remember this is to think of rational's root word "ratio.")

EXAMPLES: $\frac{1}{2}$, (which equals 0.5), 0.25 (which equals $\frac{1}{4}$), −7 (which equals $\frac{-7}{1}$), 4.12 (which equals $\frac{412}{100}$), $\frac{1}{3}$ (which equals $0.\overline{3}$)

THE LINE OVER THE 3 MEANS THAT IT REPEATS FOREVER!

$-0.3333333333333333\ldots$

IRRATIONAL NUMBERS: A number that cannot be written as a simple fraction (because the decimal goes on forever without repeating).

("..." MEANS THAT IT CONTINUES ON FOREVER)

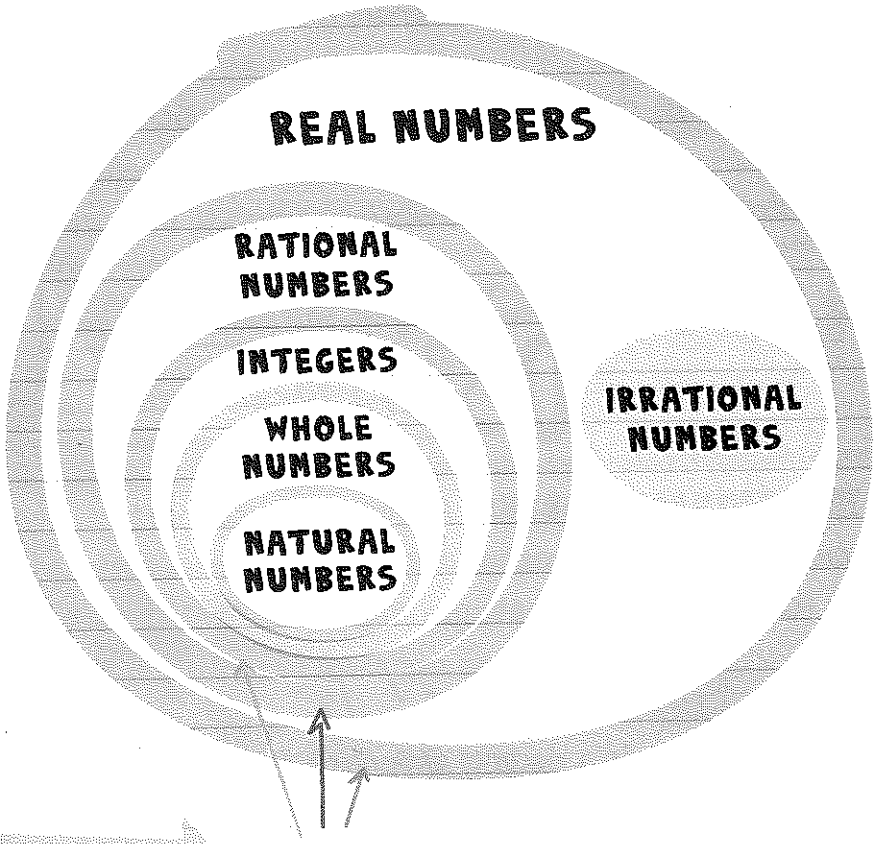
EXAMPLES: 3.14159265..., $\sqrt{2}$

Every number has a decimal expansion. For example, 2 can be written 2.000... However, you can spot an irrational number because the decimal expansion goes on forever without repeating.

REAL NUMBERS: All the numbers that can be found on a number line. Real numbers can be large or small, positive or negative, decimals, fractions, etc.

EXAMPLES: 5, −17, 0.312, $\frac{1}{2}$, π, $\sqrt{2}$, etc.

Here's how all the types of numbers fit together:



EXAMPLE: −2 is an integer, a rational number, and a real number!

SOME OTHER EXAMPLES:

46 is natural, whole, an integer, rational, and real.

0 is whole, an integer, rational, and real.

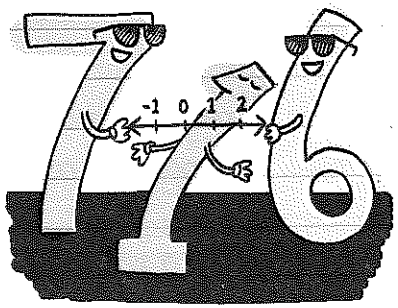
$\frac{1}{4}$ is rational and real.

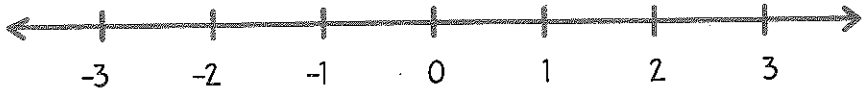
6.675 is rational and real. (TERMINATING DECIMALS or decimals that end are rational.)

$\sqrt{5}$ = 2.2360679775... is irrational and real. (Nonrepeating decimals that go on forever are irrational.)

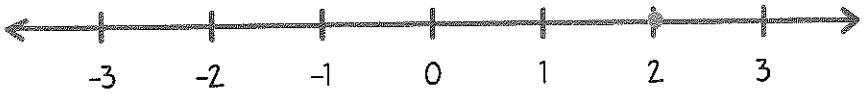
RATIONAL NUMBERS AND THE NUMBER LINE

All rational numbers can be placed on a **NUMBER LINE**. A number line is a line that orders and compares numbers. Smaller numbers are on the left, and larger numbers are on the right.

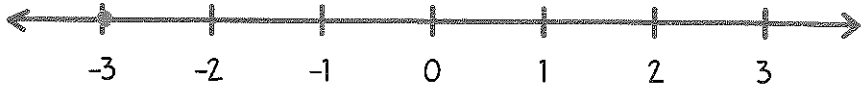




EXAMPLE: Because 2 is larger than 1 and also larger than 0, it is placed to the right of those numbers.



EXAMPLE: Similarly, because −3 is smaller than −2 and also smaller than −1, it is placed to the left of those numbers.



EXAMPLE: Not only can we place integers on a number line, we can put fractions, decimals, and all other rational numbers on a number line, too: