Rational and Irrational Numbers

Learning Target:

Students can identify numbers as being rational or irrational.

All REAL numbers are made up of RATIONAL & IRRATIONAL numbers…

Rational Numbers

- A rational number is a number that can be written as a ratio. That means it can be written as a fraction, in which both the numerator (the number on top) and the denominator (the number on the bottom) are whole numbers.

All rational numbers can be written as a fraction.

Examples of Rational Numbers

Rational Numbers are "Nice & Neat!"

Fractions	$\frac{2}{3}$ $\frac{-9}{2}$	$1\frac{1}{4}$	
Terminating Decimals (stop / end)		-6.23	17.1
Repeating Decimals (decimal goes on forever)		$7.\overline{23}$	$-621.\overline{5}$
Whole Numbers	3	$1,267$	-6
Perfect Squares	$\sqrt{9}$	$\sqrt{100}$	$\sqrt{400}$

Irrational Numbers

- All numbers that are not rational are considered irrational. An irrational number can be written as a decimal, but not as a fraction.

Irrational numbers can NOT be written as a fraction!!

Examples of Irrational Numbers

Non-terminating and Non-repeating decimals
(go on and on and on but don't repeat)

65.65971059893… 0.363765489965…

π = 3.141592653589… π = 3.141592653589…

Non- Perfect Squares

Irrational Numbers are "CRAZY!"

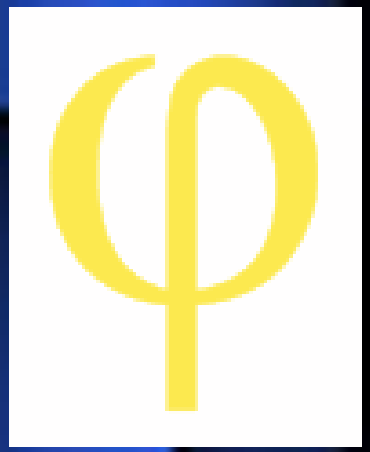
$\sqrt{73} \approx 8.54400374531753116\ldots$

$\sqrt{2} \approx 1.41421356237309504\ldots$

$\sqrt{5} \approx 2.23606797749789696\ldots$

Pi is a famous irrational number. People have calculated Pi to over a quadrillion decimal places and still there is no pattern. The first few digits look like this:
3.14159265358979323846264338327 95…

The number **e** (Euler's Number) is another famous irrational number. People have also calculated ***e*** to lots of decimal places without any pattern showing. The first few digits look like this:
2.71828182845904523536028747135 27…



The **Golden Ratio** is an irrational number. The first few digits look like this:
1.61803398874989484820...

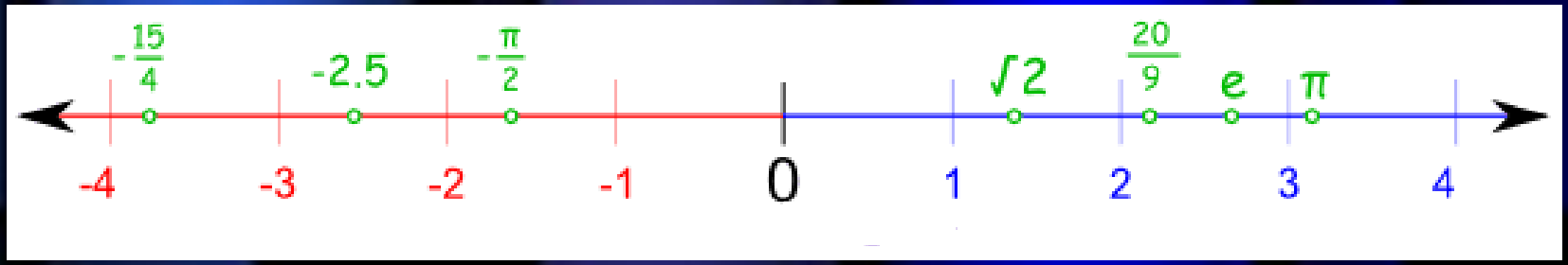
$1.5 = \frac{3}{2}$ Ratio

Rational

$\pi = 3.14159... = \frac{?}{?}$ (No Ratio)

Irrational

Both rational and irrational numbers show up on the number line. This is why all "REAL" numbers include rational and irrational numbers.



Non-Real Numbers

- A non real number is a number that does not exist on a number line.

They don't show up on the number line!!

Non-Real Numbers

Imaginary Numbers:

If there is a negative inside the radical, then it is a

NON-REAL NUMBER

$\sqrt{-25} = 5i$

$\sqrt{-9} = 3i$

$\sqrt{-18} = 3\sqrt{2}i$

Radicals can't have a negative number (only $\sqrt{+x}$)

Infinity:

Infinity is the idea of something that has no end.

∞ $-\infty$

These are **ok** (the negative is outside of the radical)

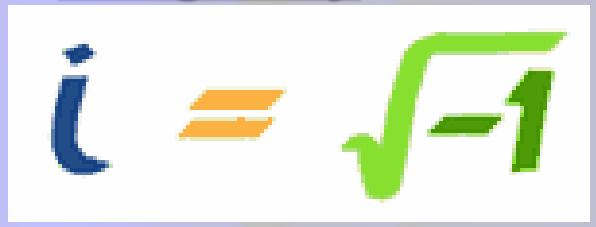
$-\sqrt{25}$ $-\sqrt{6}$ $-\sqrt{100}$

Real Numbers

- Rational Numbers (like 3/4, 0.125, 0.333..., 1.1, etc)
- Irrational Numbers (like **π**, √3, etc)

Non-Real Numbers

- $\sqrt{-\#}$ (the square root of any negative number) is not a Real Number, it is an **Imaginary** Number



- Infinity is not a Real Number