6/2/2023

Introduction to the course
Real number systems
Place Values

Real number is any number that we can measure (with any level of accuracy).

Numbers that are not real are things like the square of a negative number $\sqrt{-2}$, $\sqrt{-1} = i$, imaginary or complex numbers. Division by 0 is undefined: we can write this as a ratio of numbers, but it's not a real number.

Real numbers can be broken down into two groups: rational numbers, and irrational numbers.
Irrational numbers are anything that is not rational…

Rational numbers: include ratios of whole numbers $\frac{p}{q}$, decimals (terminating or repeating).
$\frac{4}{1}, -\frac{2}{3}, \frac{9}{5}, 0.1, 0.333\overline{3}, 0.\overline{457} = 0.457457457457$ ….

Irrational: any real number where the decimal portion does not repeat exactly.

$$\sqrt{5}, \pi, e, 5.131331333133331333331 \ldots$$

How can we break down rational numbers?

Integers: positive or negative whole numbers.
The rest of the rational numbers, we can just think of as non-integers.

$$\ldots, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, \ldots$$

Integers can be broken down into negative numbers (whole), and whole numbers: $0, 1, 2, 3, 4$ …

Whole numbers break down into 0, and counting numbers or natural numbers: $1, 2, 3, 4, 5, \ldots$

Goal: Identify what kind of number we are working in a particular situation.
Classify numbers.

For each element in the set $\left\{5, -3, \frac{1}{2}, 0, \sqrt{11}, -|-4|, \frac{38}{19}, 4\frac{2}{3}, 0.\overline{389}, \sqrt{64}, 0.4041424344..., \sqrt{-2}, \frac{\pi}{2}, \frac{1}{\sqrt{5}}\right\}$, indicate which set the number belongs to in the table.

Number	Natural Number	Whole Number	Integer	Rational Number	Irrational Number	Real Number	None of these
5	✓	✓	✓	✓		✓	
-3			✓	✓		✓	
1/2				✓		✓	
0		✓	✓	✓		✓	
$\sqrt{11}$					✓	✓	
-|-4| =-4			✓	✓		✓	
38/19							
$4\frac{2}{3}$							
$0.\overline{389}$							
$\sqrt{64}$							

Place values and rounding.

The rightmost digit in a number is the one's place.

306254 that 4 at the end represents 4 copies of 1

The digit to the left of the ones digit is the ten's digit (10), and represents of multiples of 10
As you continue leftward, each digit represents an additional multiple of 10: 100, then 1000, then 10,000, etc.

306,254

$$3 \times 100{,}000 + 0 \times 10{,}000 + 6 \times 1{,}000 + 2 \times 100 + 5 \times 10 + 4 \times 1$$

Three hundred six thousand two hundred fifty-four

Seventy-three million two hundred eleven thousand six hundred forty-five

$$73{,}211{,}645$$

Rounding:
Round 306,25|4 to the nearest 10.
306,250

(round down here because the number after the 10s place is 4 or smaller)

Round 306,2|54 to the nearest hundred (100).
306,300

(rounded up because the number after the 100s place is 5 or larger)

Next time we'll talk about operations on whole numbers.

We will do these calculations by hand. And order of operations.