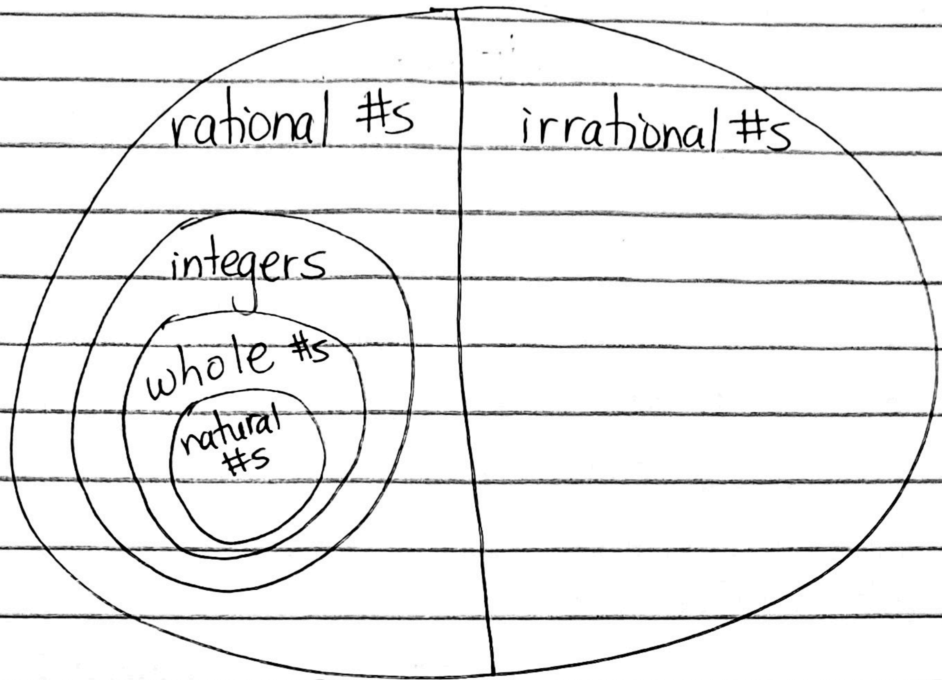
Section 7-5 Real Numbers



Real Numbers

What Kind of numbers aren't real #s?
Imaginary (or Complex) Numbers

Rational #s are terminating or repeating decimals.

Irrational #s are non-terminating, non-repeating decimals.

In short, irrational #s are not rational.

Examples of Irrational Numbers:

$\pi \approx 3.14159$
$\sqrt{2} \approx 1.4142136$
$\sqrt{10} \approx 3.16228$..

* The square root of any number that is not a perfect square, is irrational.

ex 1 Label the following as either rational or irrational.

a) 0.333 terminates = rational

b) 0.01020304... irrational

c) 0.24795555... repeats = rational

d) 0.538912121212... repeats = rational

e) 0.909009000900009... irrational

* The irrational numbers are not closed for multiplication.

Counterex: $\sqrt{2} \cdot \sqrt{2} = 2$

Defn: The <u>square root</u> of a number c is a number b such that $b^2 = c$.

So, what is the square root of 4?

By the above definition, 2 and -2 bc $2^2 = 4$ and $(-2)^2 = 4$.

* The symbol $\sqrt{}$ denotes the principal (or positive) square root.

So, $\sqrt{4} = 2$

What is $\sqrt{-4}$? There is no real number that when squared will give you -4. So we say $\sqrt{-4}$ is not defined for the real numbers.

Defn The <u>cube root</u> of a number c is a number b such that $b^3 = c$.

Recall: The square root of any number other than a perfect square is irrational. Similarly, the cube root of any number other than a perfect cube is irrational.

In general $\sqrt[n]{a}$ denotes the n^{th} root of a. If there is no number in the n location, it is assumed to be 2.

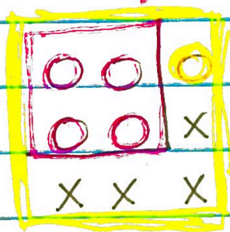
Note: We cannot take the n^{th} root of a negative number when n is even. Why? You can't have $(\text{neg}\#)^{\text{even}}$ and get a negative answer.

Estimating Square Roots

ex 2

a) $\sqrt{5}$

full 2×2 square

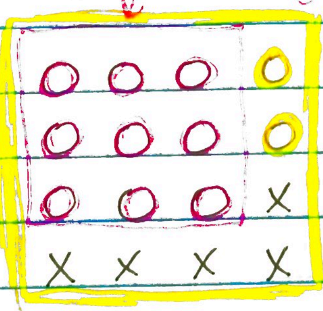


$\approx 2\frac{1}{5}$

1/5 of the way to a 3×3 square

b) $\sqrt{11}$

full 3×3 square



$\approx 3\frac{2}{7}$

full 1×1 square

c) $\sqrt{3}$ $\quad \begin{array}{cc} O & O \\ X & O \end{array} \approx 1\frac{2}{3}$

full 4×4

d) $\sqrt{20}$ $\quad \begin{array}{ccccc} O & O & O & O & O \\ O & O & O & O & O \\ O & O & O & O & O \\ O & O & O & O & O \\ X & X & X & X & X \end{array} \approx 4\frac{4}{9}$

end 7-5