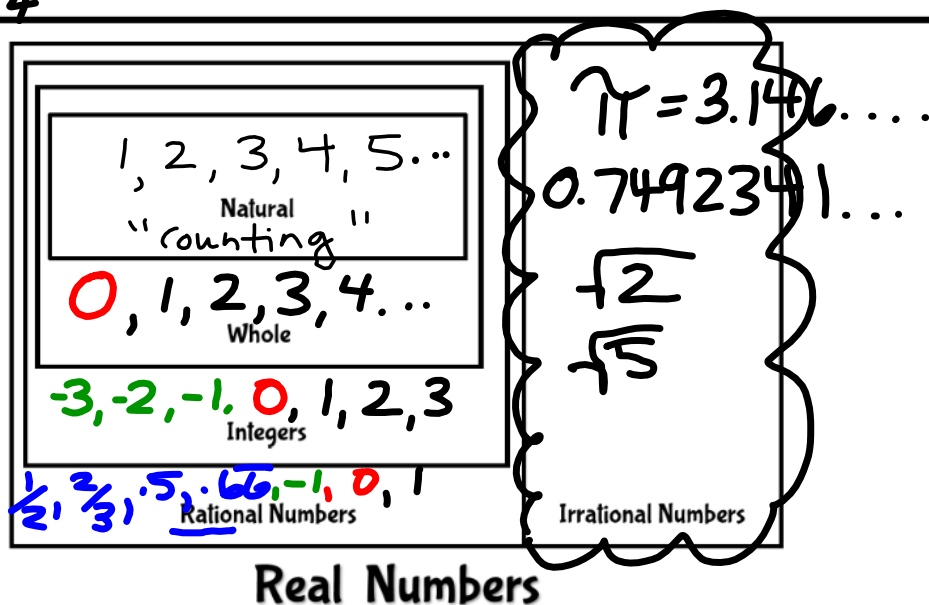


Get out 2.1 Notes - we are going to jump right into notes today so you have plenty of time to practice and ask questions before your test tomorrow.

## Day 4: Classifying & Comparing Rational & Irrational Numbers



### Rational Numbers:

- o Can be expressed as the quotient of two integers (i.e. a [fraction](#)) with a denominator that is not zero.
- o Counting/Natural, Integers, Fractions, and Terminating & Repeating decimals are rational numbers.
- o Many people are surprised to know that a repeating decimal is a rational number.
- o  $\sqrt{9}$  is rational - you can simplify the square root to 3 which is the quotient of the integers 3 and 1.

Examples:  $-5, 0, 7, 3/2, 0.\overline{26}$

### Irrational Numbers:

- o Can't be expressed as the quotient of two integers (i.e. a [fraction](#)) such that the denominator is not zero.
- o If your number contains  $\pi$ , a radical (not a perfect square), or a decimal that goes on forever (does not repeat), it is an irrational number.

Examples:  $\sqrt{7}, \sqrt{5}, \pi, 4.569284\dots$

Adding Rational and Irrational Numbers

		<u>Rational</u>		
		+	5	$\frac{1}{2}$
<u>Rational</u>	5	$10^R$	$5\frac{1}{2}^R$	$5^R$
	$\frac{1}{2}$	$5\frac{1}{2}^R$	$1^R$	$\frac{1}{2}^R$
	0	$5^R$	$\frac{1}{2}^R$	$0^R$

Adding Two Rational Numbers

Conclusion:  
The sum of two rational numbers is ALWAYS rational.

		<u>Rational</u>		
		+	5	$\frac{1}{2}$
<u>Irrational</u>	$\sqrt{2}$	$5+\sqrt{2}$	$\frac{1}{2}+\sqrt{2}$	$-\sqrt{2}$
	$-\sqrt{2}$	$5-\sqrt{2}$	$\frac{1}{2}-\sqrt{2}$	$-\sqrt{2}$
	$\pi$	$5+\pi$	$\frac{1}{2}+\pi$	$\pi$

Adding Rational and Irrational Numbers

Conclusion:  
The sum of a rational and irrational is ALWAYS irrational.

		<u>Irrational</u>		
		+	$\sqrt{2}$	$-\sqrt{2}$
<u>Irrational</u>	$\sqrt{2}$	$2\sqrt{2}$	0	$\pi+\sqrt{2}$
	$-\sqrt{2}$	0	$-2\sqrt{2}$	$\pi-\sqrt{2}$
	$\pi$	$\sqrt{2}+\pi$	$-\sqrt{2}+\pi$	$2\pi$

Adding Two Irrational Numbers

Conclusion:  
The sum of two irrational numbers is mostly irrational.  
Except when: adding opposites (sign) (=0)

$$\frac{1\sqrt{2} + 1\sqrt{2}}{2\sqrt{2}}$$

$$-1\sqrt{2} + -1\sqrt{2} = -2\sqrt{2}$$

$$x+x=2x$$

$$\pi+\pi=2\pi$$

## Multiplying Rational and Irrational Numbers

		<u>Rational</u>		
		x	5	1/2
Rational	5	25 <sup>R</sup>	5/2 <sup>R</sup>	-5 <sup>R</sup>
	1/2	5/2 <sup>R</sup>	1/4 <sup>R</sup>	-1/2 <sup>R</sup>
	-1	-5 <sup>R</sup>	-1/2 <sup>R</sup>	1 <sup>R</sup>

$$-5 \cdot \frac{1}{2} = \frac{-5}{2}$$

Multiplying Two Rational Numbers

Conclusion:

The product of two rational numbers is ALWAYS rational.

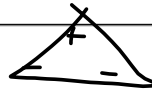
		<u>Rational</u>		
		x	5	1/2
Irrational	√2	5√2	1/2√2	-√2
	-√2	-5√2	-1/2√2	√2
	π	5π	π/2	-π

$$5 \cdot \sqrt{2} = 5\sqrt{2}$$

Multiplying Rational and Irrational Numbers

Conclusion:

The product of a rational and irrational is ALWAYS irrational.



		Irrational		
		x	√2	-√2
Irrational	√2	2	-2	π√2
	-√2	-2	2	-π√2
	π	π√2	-π√2	π²

Multiplying Two Irrational Numbers

Conclusion:

The product of two irrational numbers is mostly irrational.

Except when:  
multiplying 2 √# of same #

$$\begin{aligned} x \cdot x &= x^2 \\ \pi \cdot \pi &= \pi^2 \end{aligned}$$

\*If you ever multiply an irrational number by 0 (which is a rational number), your outcome will always be 0, which is a rational number. Most of the time, when multiplying, it will say a nonzero rational number, which means 0 is excluded from the rational number set.

Ex.  $\sqrt{2} \cdot 0 = 0$

Ex.  $\pi \cdot 0 = 0$

Foundations of Algebra

Unit 2: Complex Number Systems

Notes

**Practice:** Classify each number as rational or irrational and explain why.

a.  $\sqrt{15}$   
**I**

b.  $\frac{1}{4}$   
**R**

c.  $\sqrt{2} \cdot \sqrt{18}$   
 $\sqrt{36}$   
 $6$  **R**

$\frac{18}{36}$

d.  $\sqrt{25} + \sqrt{1}$

e.  $\sqrt{7} + \sqrt{28}$

f.  $\pi + (-\pi)$

g.  $\sqrt{6(2+5)}$   
 $7\sqrt{6}$  **I**

h.  $\sqrt{2(\sqrt{18} + \sqrt{8})}$   
 $\sqrt{2(3\sqrt{2} + 2\sqrt{2})}$   
 $\sqrt{2(5\sqrt{2})}$   
 $5\sqrt{2} = 10$  **R**

i.  $4(\sqrt{9} + \sqrt{2})$   
 $12 + 4\sqrt{2}$  **I**

**Critical Thinking:**

Let the following variables represent a certain type of number:

A = 5 **R**      B = -5 **R**      C =  $\sqrt{9}$  **R**  
D =  $\sqrt{6}$  **I**      E =  $\sqrt{6}$  **I**      F =  $\sqrt{\frac{3}{5}}$  **R**

Determine if the following sums or products will result in a rational or irrational number.

a. A + B  
**R**

b. A + C  
**R**

c. C + D  
**I**

d. C + E  
**R**

e. A x B  
**R**

f. B x C  
**R**

g. C x D  
**I**

h. C x E  
**R**

i. D + E  
 $1\sqrt{6} + 1\sqrt{6}$   
 $2\sqrt{6}$  **I**

j. D x E  
 $\sqrt{6} \cdot \sqrt{6}$   
 $\sqrt{36}$   
 $6$  **R**

k. E + F  
**I**

l. B x F  
**R**

## Homework:

- Day 4 HW
- Radical Study Guide
- Study for your Radical Test!