1.1 Intro to Rational Numbers

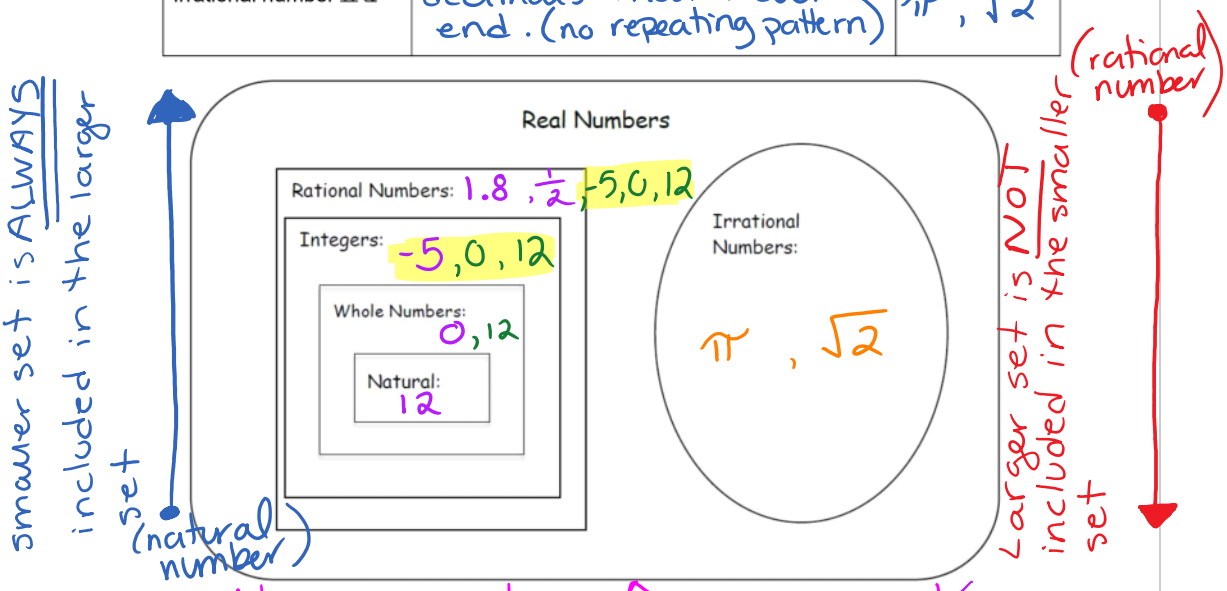
September 6, 2018 6:34 PM

1.1– INTRODUCTION TO RATIONAL NUMBERS

Classification of Numbers (Natural, Whole, Integers, Rational, Irrational, Real) – Nerdstudy
https://www.youtube.com/watch?v=vbPUS-0Wbv4

While watching the video ⇑, complete the following table:

	Definition	Example
Natural numbers $\mathbb{N}$	• counting numbers • no decimals • no zero • no negatives	1, 2, 3, 4 ... etc
Whole numbers $\mathbb{W}$	• all natural numbers • includes zero	0, 1, 2, 3 .....
Integers $\mathbb{Z}$	• includes negatives • no decimals or fractions	... -2, -1, 0, 1, 2 ....
Real numbers $\mathbb{R}$	all rational + irration numbers	all
Rational numbers $\mathbb{Q}$	includes decimals + fractions; eg. $\frac{17}{3}$ must be integers, cannot be ∅	$-2, -1, -\frac{1}{2}, 0$ $\frac{1}{3}, 1, 2.6 ....$
Irrational number $\mathbb{R}$	decimals that never end. (no repeating pattern)	π, $\sqrt{2}$



Place these numbers ↑: ~~-5~~, ~~π~~, ~~½~~, ~~1.8~~, ~~12~~, ~~∅~~, ~~√2~~

Math 9 (Zukowski)

Try THIS ↓ for Homework

For each of the numbers below check all the boxes that describe the number:

	8	-100	4.31 (repeating)	$\frac{2}{3}$	0	π	-1.7	$-5\frac{1}{4}$
Natural Number	✓	×	×	×	×	×	×	×
Whole Number	✓	×	×	×	✓	×	×	×
Integers	✓	✓	×	×	✓	×	×	×
Rational Number	✓	✓	✓	✓	✓	×	✓	✓
Real Number	✓	✓	✓	✓	✓	✓	✓	✓

Rational Number	✓	✓	✓	✓	✓	✗	✓	✓
Real Number	✓	✓	✓	✓	✓	✓	✓	✓
Irrational Number	✗	✗	✗	✗	✗	✓	✗	✗

Remember the analogy from the video…

If a person is in Tokyo, does that mean that person is also in Japan? Yes

And if this person is in Japan, does that mean they are also in Asia? Yes

(Tokyo) (Asia)

This means that numbers in a *smaller set* are always included in the *larger set*
Ex. A natural number like 3, is also an integer.

Again…remember the analogy from the video…

If a person is in Japan, does that mean they are only in Tokyo? No, they could be in Osaka, or anywhere else!

BUT! A number in the *larger set* is NOT necessarily included in the *smaller set*.
Ex. And rational number like $\frac{2}{3}$ is NOT an integer.

TRY THIS:

Reason why?

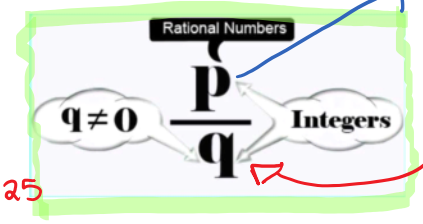
True or False? A real number is always a whole number. — real numb. could be irrational, integer
True or False? A natural number is always a rational number. — nat. number 1, 2, 3, etc = rational numb.
True or False? An integer is always a rational number. — integers are included in rational numb.
True or False? A real number is always an integer.
True or False? An integer is always a natural number. — natural numb. DO NOT include 0 or ⊖ neg.
True or False? An irrational number is always a real number.

Math 9 (Zukowski)

1st category that includes decimals + fractions.

Rational Numbers:

- *any number that can be written as a fraction with an integer numerator and non-zero integer denominator.*
- *Decimals that repeat or terminate* (stop)
  eg. 2.1616 or 1.25



p = variable that represents any integer

q = any integer except 0

⇒ since every integer can be written as a fraction with denominator 1, all integers are also considered rational numbers.

eg. $4 = \frac{4}{1} \neq \frac{1}{4}$ (does not equal)

Just as ***integers*** have a pairing numbers of ***opposite sign*** (ie. 5 and -5), ***rational numbers*** have pairing numbers (ie. $\frac{1}{3}$ and $\frac{-1}{3}$)

⊖

Negative fractions can have the negative sign appear 3 different ways:

$$\frac{-2}{3}, \frac{-2}{3}, \frac{2}{-3}$$

Reviewing Place Value

dred millions	millions	ons	dred thousands	thousands	sands	dreds	s (ones)	mal	ns	dredths	sandths	thousandths	dred thousandths	onths	millionths	dred millionths

hundred millions	ten millions	millions	hundred thousands	ten thousands	thousands	hundreds	tens	units (ones)	decimal	tenths	hundredths	thousandths	ten thousandths	hundred thousandths	millionths	ten millionths	hundred millionths
6	5	4	9	2	8	1	3	7	.	5	4	3	5	6	2	7	8

Place values show us what each number is worth: a 3 in the tens spot means you have 3 tens, or 30. A 5 in the tenths position means there are 5 tenths, or $\frac{5}{10}$ or 0.5. zeros are used to fill spaces between the digits we have and the decimal place, both before and after the decimal. Notice that going up from zero we have units (ones), tens, hundreds… going down from the decimal there is no "units" place, and all the places end with "ths": tenths, hundredths, thousandths.

.5 → 0.5 ✓

ths → part of a whole

Example 1: In the number 63,407.218; find the place value of each of the following digits:

a) 7 units (ones)
b) 0 tens
c) 1 hundredths
d) 6 ten thousand
e) 3 thousands
f) 8 thousandths

3

Math 9 (Zukowski)

Mixed Fractions ↔ Improper Fractions

top larger / bottom smaller

Example #1: Write each mixed fraction as an **improper fraction**

a) $3\frac{2}{3}$ → $\frac{11}{3}$ (9+2; 3×3=9)

b) $4\frac{1}{2}$ → $\frac{9}{2}$ (8+1; 2×4=8)

c) $2\frac{6}{7} = \frac{20}{7}$

How do you convert a fraction to a decimal? (write each number to 3 decimal places)

*Divide the numerator by the denominator (Top ÷ Bottom)

a) $\frac{7}{16}$ 7 ÷ 16 = 0.4375 = 0.438 (look beside)

b) $\frac{3}{5}$ 3 ÷ 5 = 0.600

c) $\frac{10}{16}$ 10 ÷ 16 = 0.625 ✓

0, 1, 2, 3, 4 stay the same < 5, 6, 7, 8, 9 round up.

Example #2: Write each improper fraction as a mixed fraction.

How many 2's go into 5?

a) $\frac{5}{2} = 2\frac{1}{2}$ (2 remainder 1)

b) $\frac{9}{4} = 2\frac{1}{4}$ (2 remainder 1)

c) $\frac{17}{3} = 5\frac{2}{3}$

Example #3: Write 3 **rational numbers** between each pair of numbers.

…, −2, −1, 0, 1, 2, …

- fractions
- decimals
  - repeat
  - stop/terminate

a) 1.25 and −3.26 (−3.26, 1.25; 0, 1, 2/3)

b) −0.25 and −0.26 (−0.27, −0.260, −0.250, 0; −0.259, −0.251, −0.249)

c) −½ and ¼ (−1, −½, 0, ¼, ½, 1; −2/3, −1/4, 0)

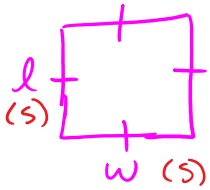
d) −½ and −¼ (−1, −½, −¼, 0; −0.50, −0.25; −2/3, −1/3, −0.4, −0.1, −0.3)

Homework Section 1.1 pg 11 Questions #1-4

HW Help M + W 3:10-4 rm 104

Example #4:

How do we calculate the area of a square?



Area = length × width

$A = l \cdot w$

or

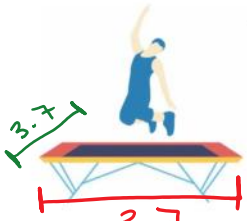
$A = s \cdot s = s^2$

A square trampoline has a **side length of 3.7 m.**

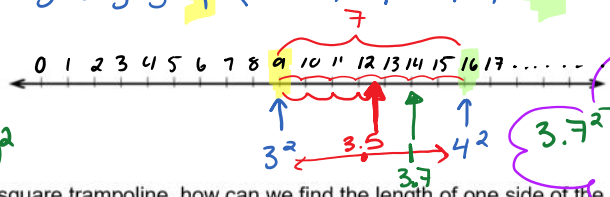
Estimate and then **calculate** the **area of the trampoline.**

between 3 and 4

$3^2 = 3 \times 3 = 9$ ⟷ $4^2 = 4 \times 4 = 16$



Area = $(3.7)^2$



Estimate:

3.7^2 is approx. = 14

Calculate:

$(3.7)^2 = 13.69$

If we know the area of a square trampoline, how can we find the length of one side of the trampoline?

If $A = s^2$, then $s = \sqrt{A}$

"squared" "square root"

because $\sqrt{A} = \sqrt{s^2}$

Estimate: which perfect square is the area closest to?

LIST of Perfect Squares

$\sqrt{1} = 1$ since $1^2 = 1$
$\sqrt{4} = 2$ since $2^2 = 4$
$\sqrt{9} = 3$ since $3^2 = 9$
$\sqrt{16} = 4$ since $4^2 = 16$
$\sqrt{25} = 5$ since $5^2 = 25$
$\sqrt{36} = 6$ since $6^2 = 36$
$\sqrt{49} = 7$ since $7^2 = 49$
$\sqrt{64} = 8$ since $8^2 = 64$
$\sqrt{81} = 9$ since $9^2 = 81$
$\sqrt{100} = 10$ since $10^2 = 100$

13.388

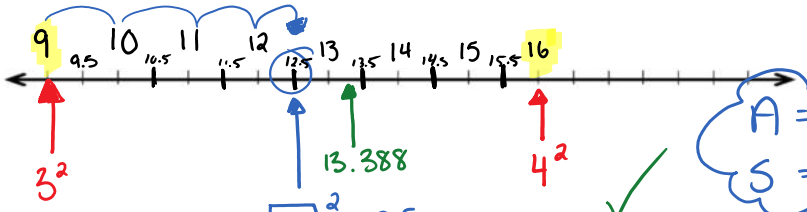
if $A = 49 m^2$, then $s = 7$

Button $\sqrt{\ }$

If a square trampoline has an **area of 13.388 m²**, *what is the length of one side* of the trampoline?

$3^2 = 9$ $4^2 = 16$

estimate that the side length is between 3 and 4



$3.5^2 = 12.5$

approx $3.6^2 = 13.388$

calc: $3.6 \times 3.6 = 12.96$

$A = s^2$

$s = \sqrt{A}$

check: $s = \sqrt{13.388}$

$s = 3.66$

Example #5:

Order the following numbers from **least to greatest**.

Record the numbers on a number line.

a) 0.35, 2.5, −0.6, 1.7, −3.2, −0.6, −0.67

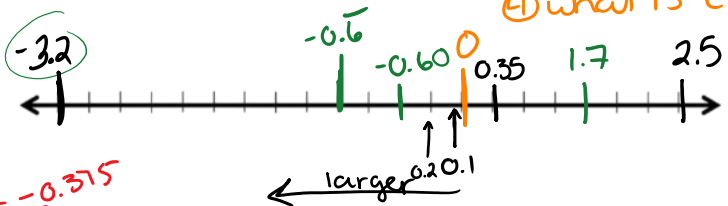
smallest → biggest.

① largest ⊕? 2.5

② smallest number (largest ⊖)? -3.2

③ place 0 zero for help

④ what is closest to 0? 0.35



b) $\frac{-3}{8}, \frac{5}{9}, \frac{-10}{4}, -1\frac{1}{4}, \frac{7}{10}, \frac{8}{3}$

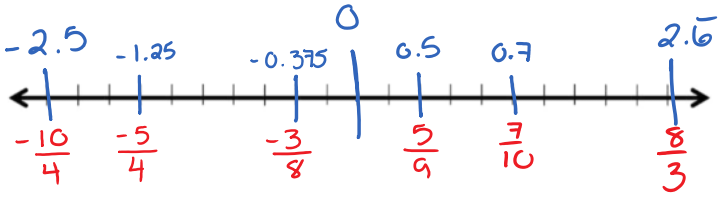
$-3 \div 8 = -0.375$; $\frac{5}{9} = 0.5$; $\frac{-10}{4} = -2.5$; $-1\frac{1}{4} = -1.25$; $\frac{7}{10} = 0.7$; $\frac{8}{3} = 2.6$

two methods: (i) get common denominator and then compare (more work)

(ii) change to decimal form then compare

② largest ⊕? 2.66

② largest ⊖? -2.5

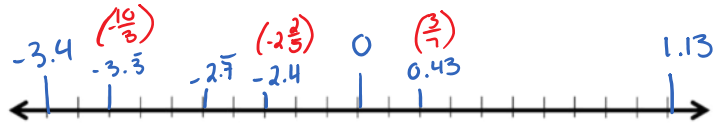


c) $1.13, -\frac{10}{3}, -3.4, -2.\overline{7}, \frac{3}{7}, -2\frac{2}{5}$ (*change fractions to decimals)

$-\frac{10}{3} = -3.\overline{3}$; $\frac{3}{7} = 0.43$; $-2\frac{2}{5} = -2.4$

largest ⊕ : 1.13

largest ⊖ : -3.4



Today HW

Homework

Section 1.1 pg. 11-13

Questions # 5ab, 6cd, 7ab, 8, 9ab, 10a, 13, 18, 20, 21 **extension 23 & 24**

R+20min Wed class