Pre-Algebra
Unit 2

Rational & Irrational Numbers

Mr. Menges

Name _____

Core _____ Table _____

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Pre-Algebra Name: _____

Unit 2 – Rational & Irrational Numbers Core: _____ Table: _____

2.1.1 Define Rational Numbers

Vocabulary:

Real Numbers – the set of rational and irrational numbers

Natural Numbers – the set of counting numbers EX:

Whole Numbers – the set of natural numbers and 0

Integers – {… , -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, …}

Rational Number – a number that **CAN** be written as a RATIO of 2 integers

- repeating decimals
- terminating decimals

Irrational Number – a number that **CANNOT** be written as a RATIO of 2 integers

- Non-repeating & Non-terminating decimals

Square Root – a number that produces a specified quantity when multiplied by itself
"7 is the square root of 49"

Radical Symbol – $\sqrt{\ }$ $\sqrt[3]{\ }$

$\sqrt{\ } \rightarrow positive\ square\ root$

$-\sqrt{\ } \rightarrow negative\ square\ root$

$\pm\sqrt{\ } \rightarrow positive\ and\ negative\ square\ roots$

Perfect Square Number – a number that can be expressed as the product of two equal integers

List of first 15 Perfect Squares

_____, _____, _____, _____, _____, _____, _____, _____,

_____, _____, _____, _____, _____, _____, _____,

Active Instruction:

Provide two examples that show that the statement is **false**.

Lydia said that all square roots are irrational numbers.

Team Huddle:

Classify the numbers as rational or irrational.

2) $\sqrt{77}$ 3) $\sqrt{48}$ 4) Explain why #3 is rational or irrational.

Find the square roots for each number.

5) 121 6) 81 7) Explain why #6

Team Mastery:

Classify the numbers as rational or irrational.

8) -8.875 9) $\sqrt{16}$ 10) 2.67034165508…

11) Provide two examples that show that the statement is **false**.

Sebastian said that if a number is a perfect square, then the number is even.

Find the square roots for each number.

12) 25 13) 49 14) 144

Team Mastery Challenge:

15) Is the product of a rational and irrational number, rational or irrational? **Give an example to support your answer.**

16) Do the expressions $\sqrt{100-64}$ and $\sqrt{100}-\sqrt{64}$ have the same value? **Explain your thinking.**

Pre-Algebra Name: _____

Unit 2 – Rational & Irrational Numbers Core: _____ Table: _____

2.1.1 Practice

Today we defined and explored **irrational numbers**. An irrational number is a number that cannot be written in fractional form. We know a number is irrational if it is a decimal number that is infinitely long and has no repeating pattern. We also learned the difference between rational and irrational numbers.

For example:

Number	Type and Explanation
$\sqrt{2}$	***Irrational***; 2 is not a perfect square.
$\sqrt{9}$	***Rational***; 9 is a perfect square, $\sqrt{9} = 3$.
0.0101010101…	***Rational***; repeating decimal, it has a pattern
0.01001000100001…	***Irrational***; non-repeating, non-terminating decimal

We learned that the square root of a number is a number that, when multiplied by itself, equals the original number. Square roots include both positive and negative numbers. For example: the square root of 25 is ±5 because $(5)^2 = 25$ and $(-5)^2 = 25$. However, if we write it as $\sqrt{25}$, then we are only talking about the positive root, 5.

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1) Provide two examples that show that the statement is **false**. **Explain your thinking**.

Zoe said that an irrational number can be expressed as a terminating decimal.

Classify the numbers as rational or irrational.

2) π **3)** $\sqrt{110}$ **4)** $\sqrt{81}$ **5)** $\sqrt{14}$ **6)** $-\frac{2}{3}$

Find the square root(s) for each number.

7) 100 **8)** 49

Mixed Practice

Evaluate the expression.

9) $2 - 9 \cdot 1 - 3 \cdot 9$

Solve.

10) $6x - 5 = 59$

11) You have a number cube labeled 1–6. What is the probability of rolling an even number?

12) What is the measure of the radius of the circle whose circumference is 21.98 inches? Use 3.14 for π.

Use the formula: $C = 2\pi r$

Word Problem

13) Tell what an irrational number is in your own words.

14) Give an example of an irrational number and rational number

Pre-Algebra Name: _____

Unit 2 – Rational & Irrational Numbers Core: _____ Table: _____

2.1.2 Classification of Numbers

Vocabulary:

Natural Numbers – the set of counting numbers EX: 1, 2, 3, 4, 5, 6, 7, 8, …

Whole Numbers – the set of natural numbers and 0

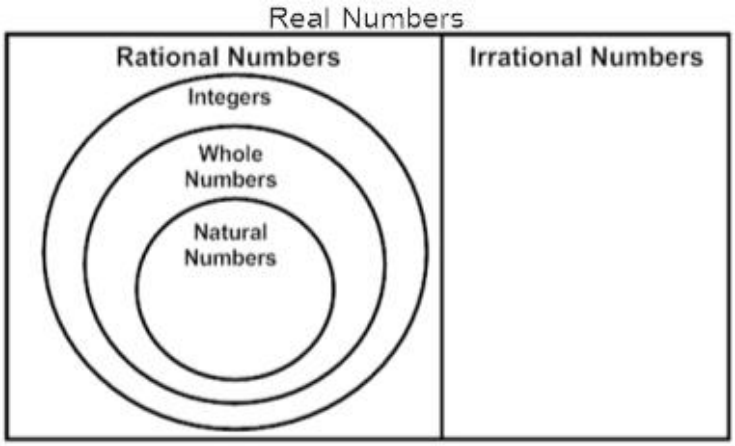
Integers – {… , -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, …}

Simplify – to make less complicated, clearer, or easier. ***Do the math!!!!***

Active Instruction:

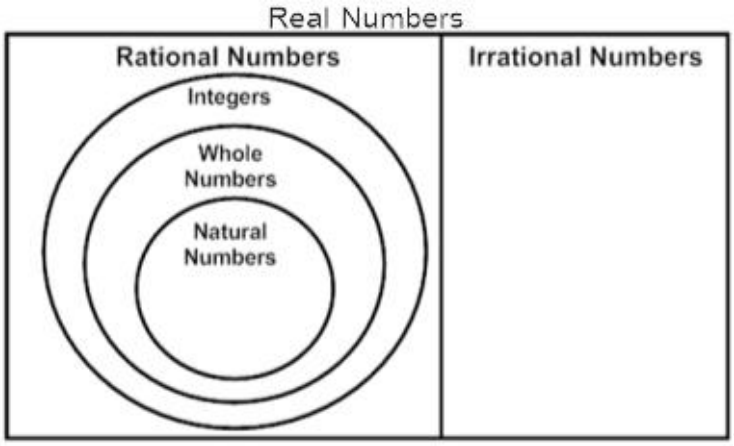
Classify the numbers by writing them in the appropriate section of the Venn Diagram.

1) $-\frac{10}{2}$, $\sqrt{36}$, $\frac{0}{8}$, 7, $\sqrt{140}$, $\frac{4}{9}$, $\sqrt{4}$, $^{-}8$, $\sqrt{8}$, $^{-}2.89$

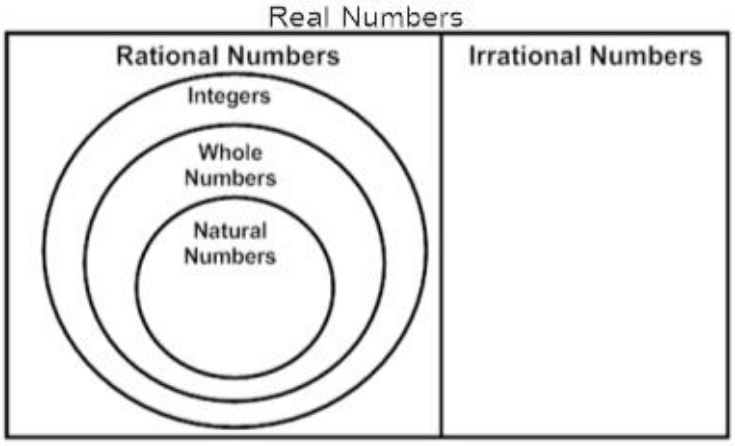


Team Huddle:

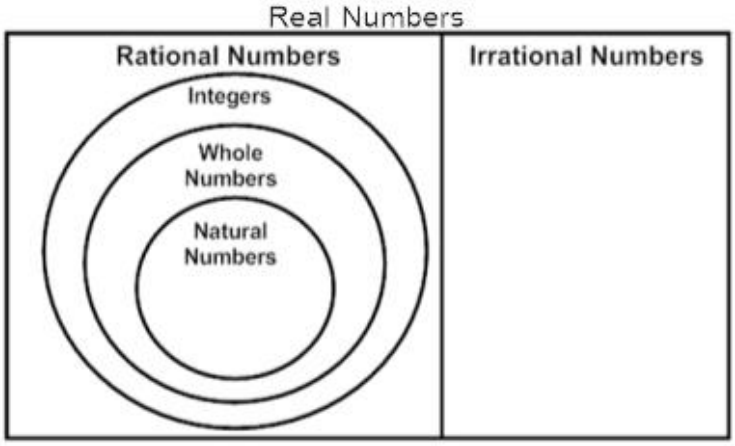
2) $-25,\ \frac{72}{9},\ \sqrt{14},\ 6.5,\ \frac{21}{6},\ \sqrt{81}$



3) $\sqrt{53},\ -\frac{12}{6},\ \sqrt{19},\ 8,\ \frac{6}{45},\ \pi,\ 0,\ \frac{2}{3}$



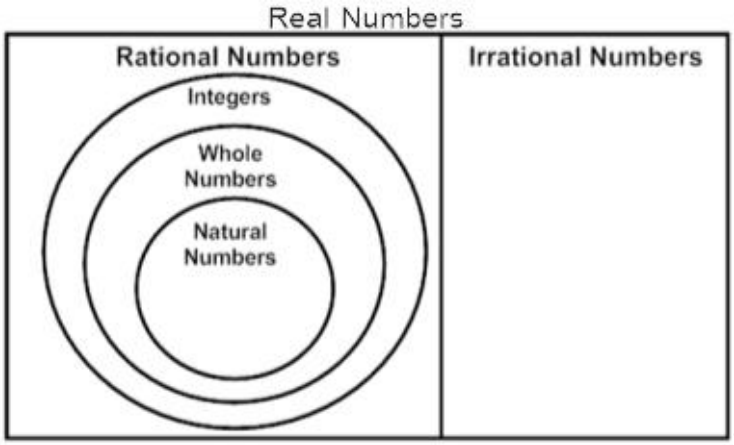
4) $44,\ \frac{7}{3}, \sqrt{144},\ -88,\ \frac{12}{2}, 5.4,\ \sqrt{24}$



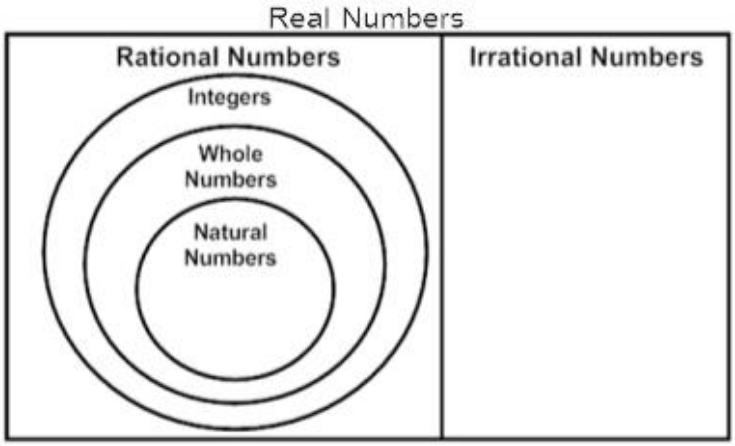
5) How do you know when a radical is a rational or irrational number?

Team Mastery:

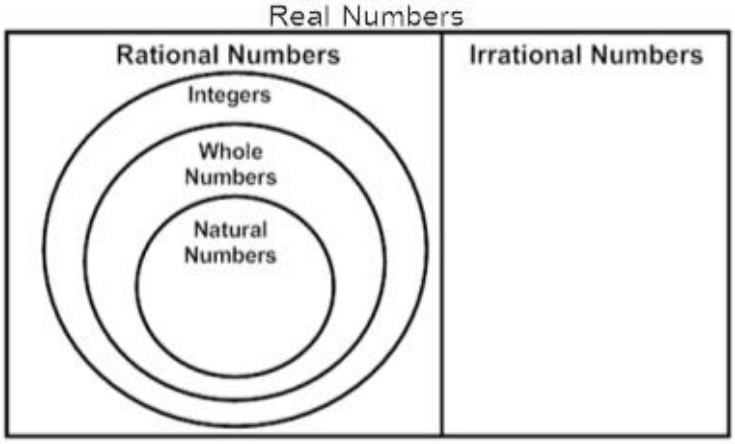
6) $\frac{80}{1},\ \sqrt{72},\ \frac{45}{6}, \sqrt{50},\ \frac{0}{94},\ \sqrt{49}$



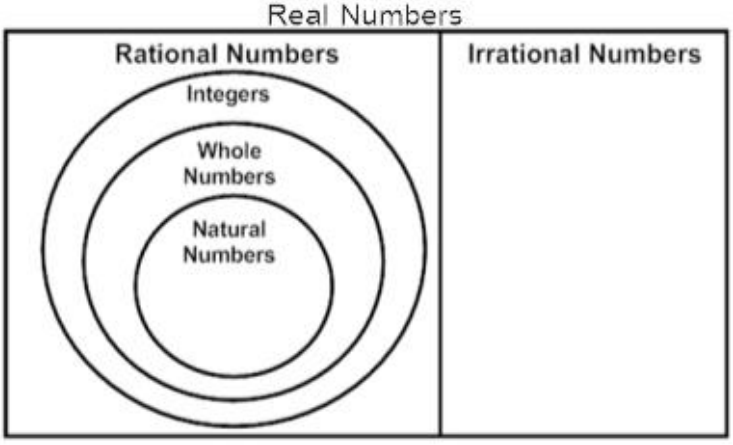
7) $\sqrt{4},\ -7,\ \frac{2}{9},\ \sqrt{97},\ 3,\ \frac{36}{9},\ \sqrt{30}, \pi$



8) $1,\ \frac{7}{45},\ \sqrt{37},\ \frac{3}{19}, \sqrt{23},\ \sqrt{16}$

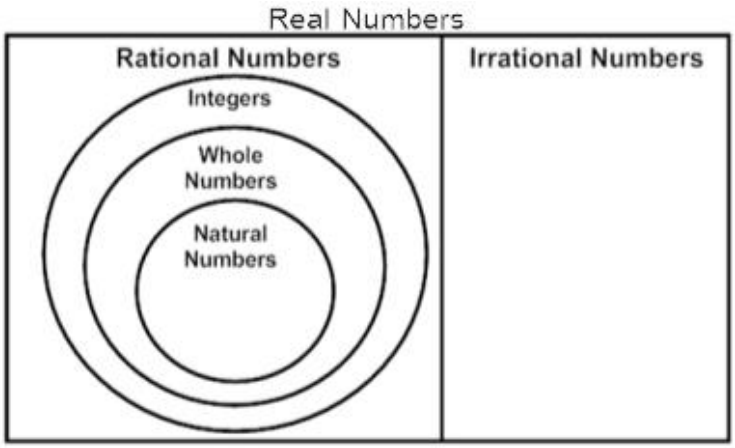


9) $-\frac{9}{1}, -88,\ 9.2,\ 26,\ \sqrt{71}, -67,\ \frac{2}{8},\ \sqrt{10}$



10) $83, -9.3,\ 12,\ \frac{25}{26},\ \sqrt{91},\ 9.8,\ \frac{2}{2},\ \sqrt{63}$

11) How do you determine if a number is irrational?



Team Mastery Challenge:

Find the square roots of:

12) 0.25

13) $\frac{1}{4}$

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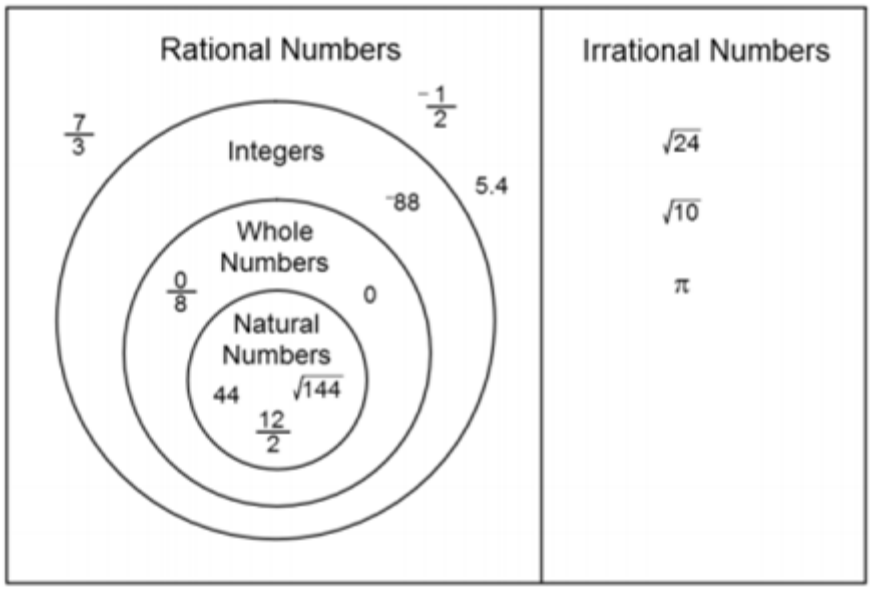
Pre-Algebra Name: _____

Unit 2 – Rational & Irrational Numbers Core: _____ Table: _____

2.1.2 Practice

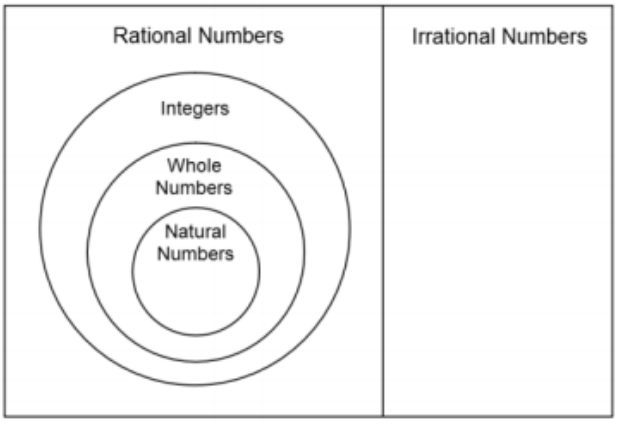
Today we delved further into understanding rational versus irrational numbers. We also used a Venn Diagram to help us classify rational and irrational numbers and see the relationships between classifications.

For example,
The Venn Diagram shows how we classify numbers.

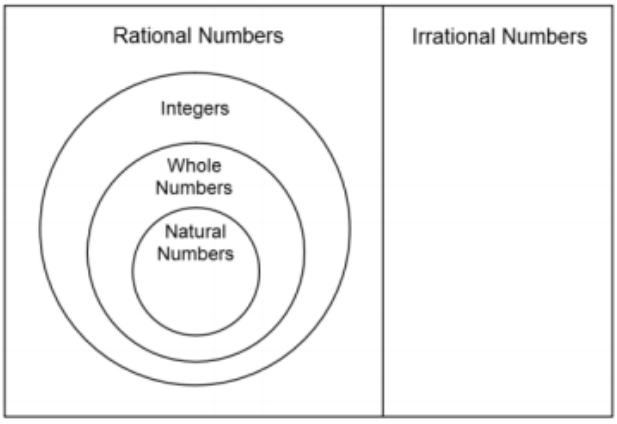


Directions for questions 1–5: Classify the numbers by writing them in the appropriate section of the Venn Diagram.

1) $\frac{8}{3}, \sqrt{48}, ^{-}7, \frac{9}{3}, \sqrt{81}, 10.6, \sqrt{2}$



2) $\frac{14}{27}, ^{-}63, 2.8, 0, \sqrt{25}, ^{-}3.9, \frac{4}{9}, \sqrt{75}, 24$

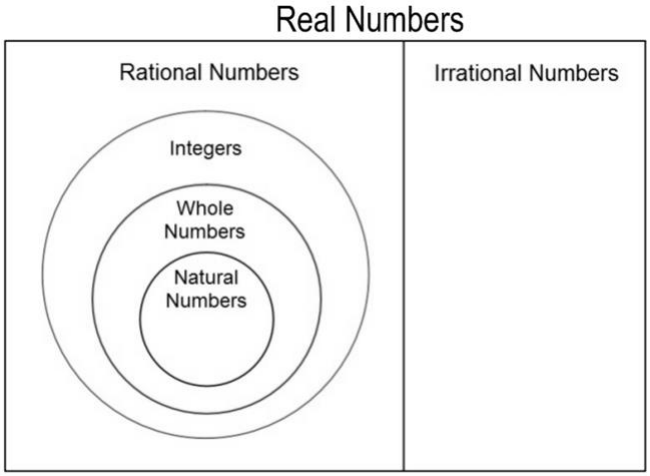


Classify the numbers by writing them in the appropriate section of the Venn Diagram.

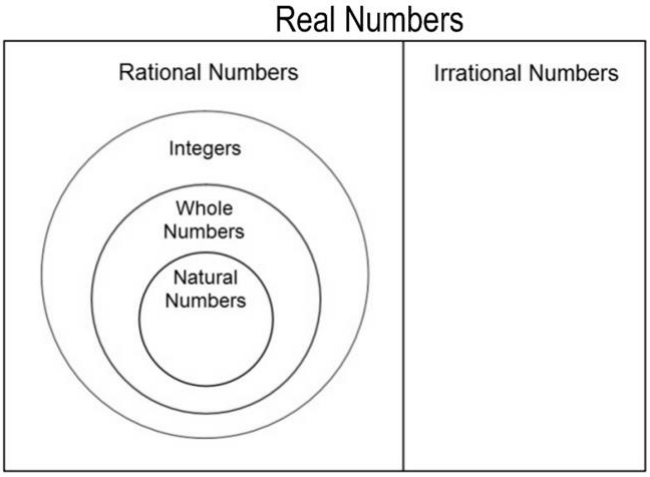
3) $\frac{8}{7}, -80, \sqrt{5}, \frac{0}{16}, 55, \frac{24}{6}, \sqrt{67}, -48, \frac{2}{6}, \sqrt{91}$

rational

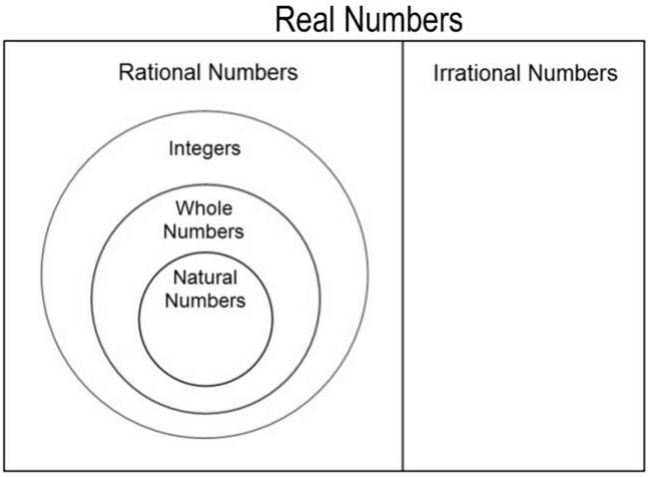
4) How do we determine if a number is a number or irrational number?



5) $14, \frac{5}{6}, \sqrt{96}, -87, \frac{12}{2}, -8.4, \sqrt{49}$



6) $\frac{4}{4}, -2.6, 11, \sqrt{2}, -82, \frac{4}{9}, \sqrt{32}$



Mixed Practice

7) Write 0.35 as a fraction in simplest form.

8) $\frac{7}{8} \cdot \frac{10}{21}$

9) $\frac{3}{5} \div \frac{3}{10}$

10) Siddiquah said that zero is not a rational number because you cannot write zero in fractional form. Is Siddiquah correct? Explain your thinking

Pre-Algebra Name: _____

Unit 2 – Rational & Irrational Numbers Core: _____ Table: _____

2.1.3 Convert a Decimal Expansion

Active Instruction:

1) Write 0.4141… as a fraction

Let x =

Write your let statement.

Write your equation.

There are _____ repeating decimal, so multiply each side by $10^{\square}$ = _____

Simplify.

Subtract the original equation.

Simplify.

Solve for x.

Team Huddle:

Find the fractional equivalent. Show your work.

2) $0.\overline{4}$

3) $0.\overline{91}$

4) $0.\overline{234}$

5) $0.\overline{45}$

Team Mastery:

Find the fractional equivalent. Show your work.

6) $0.\overline{5}$

7) $0.\overline{37}$

8) $0.\overline{21}$

9) $0.\overline{372}$

Team Mastery Challenge:

Find the fractional equivalent. Show your work.

$1.23\overline{45}$

Pre-Algebra Name: _____

Unit 2 – Rational & Irrational Numbers Core: _____ Table: _____

2.1.3 Practice

Today we explored why repeating decimals are rational numbers and how to convert them from repeating decimals to their fractional equivalents.

For example,

To find the fractional equivalent of $0.\overline{158}$, Let $x = 0.\overline{158}$

$$x = 0.\overline{158}$$

$$1000 \bullet x = 0.\overline{158} \bullet 1000$$

$$1{,}000x = 158.\overline{158}$$
$$-\ x = \quad 0.\overline{158}$$

$$\frac{999x}{999} = \frac{159}{999}$$

$$x = \frac{159}{999}$$

Find the fractional equivalent. Show your work.

1) $0.\overline{57}$

2) $0.\overline{238}$

3) $0.\overline{63}$

4) $0.\overline{7}$

5) $0.\overline{374}$

Explain your thinking on #5

Mixed Practice

Simplify the expression.

6) $3t + 4t + 5t$

Evaluate the expression.

7) $4 + 9 \div 4 - 5 - 8$

8) Classify $\sqrt{120}$ as rational or irrational.

9) Find the surface area of a cube whose side length is 1.85 inches.

10) In your own words, describe how to convert a repeating decimal into a fraction.

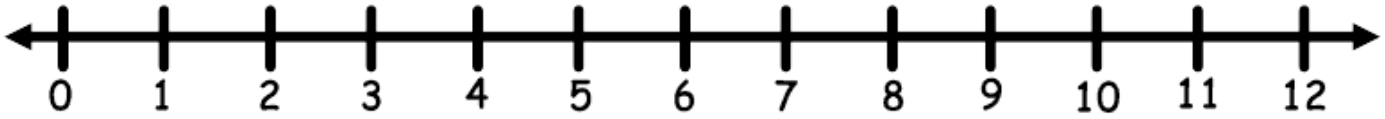
Pre-Algebra Name: _____

Unit 2 – Rational & Irrational Numbers Core: _____ Table: _____

2.1.4 Order Rational & Irrational Numbers

Active Instruction:

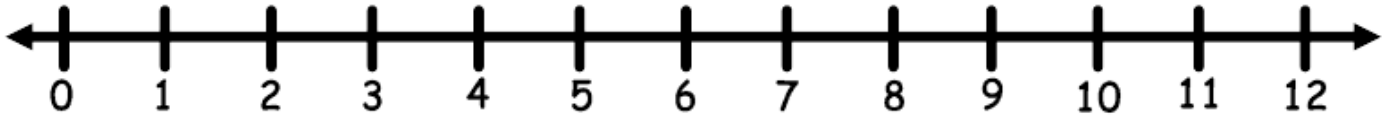
1A) Graph the numbers on the number line: $6.09,\ \frac{35}{7},\ \sqrt{80},\ \frac{9}{2},\ \sqrt{16}$



1B) Use <, > or = to compare: $\sqrt{17}$ ____ $\frac{29}{7}$

Team Huddle:

2) Graph the numbers on the number line: $2.55,\ \frac{9}{5},\ \sqrt{24},\ \pi,\ \sqrt{9}$



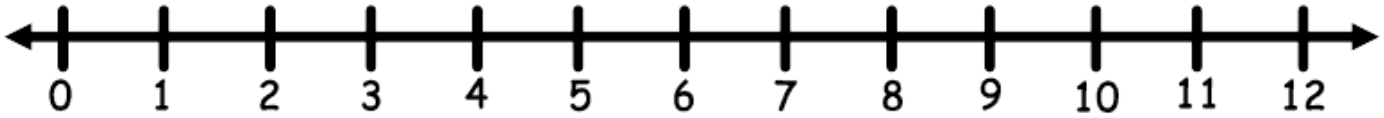
3) Use <, > or = to compare: $\sqrt{55}$ ____ $7.874007874\ldots$

4) Write in order from least to greatest: $-\frac{9}{6},\ 8.9,\ -\sqrt{12},\ \frac{6}{3},\ \sqrt{7},\ -8.3$

5) Write in order from greatest to least: $-2.3,\ 0,\ \frac{23}{7},\ \pi,\ -7\frac{1}{5}$

Team Mastery:

6) Graph the numbers on the number line: $\frac{10}{4}$, $\sqrt{10}$, 4.75, $\sqrt{16}$

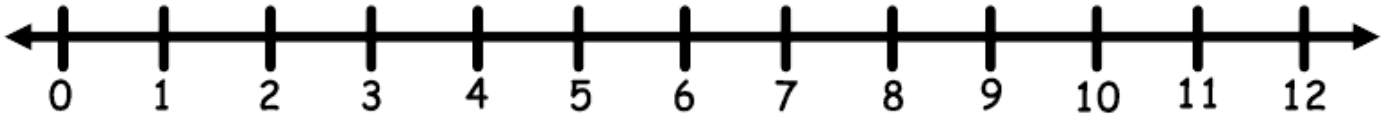


7) Use <, > or = to compare: $\sqrt{40}$ ____ 5.916079783 ...

8) Write in order from least to greatest: $-\frac{3}{9}$, 6.6, $-\sqrt{54}$, $\frac{9}{5}$, $\sqrt{75}$, π

9) Write in order from greatest to least: $\sqrt{34}$, -4.2, 9.6, $\frac{9}{9}$, $-\sqrt{85}$, $-7\frac{2}{5}$

10) Graph the numbers on the number line: $\sqrt{85}$, $\frac{24}{3}$, 8.85, $\sqrt{100}$



11) Use <, > or = to compare: $\sqrt{99}$ ____ 9.38083152 ...

Team Mastery Challenge:

12) Find 5 irrational numbers and 5 rational numbers between 5 and 6.

Pre-Algebra Name: _____

Unit 2 – Rational & Irrational Numbers Core: _____ Table: _____

2.1.4 Practice

Today we arranged rational and irrational numbers in order from least to greatest and/or from greatest to least. We also compared numbers, determining which value was the least and which was the greatest. We used a number line to approximate an irrational number's location.

For example,

We can **compare** $\frac{9}{5}$ to $\sqrt{9}$ by approximating their locations on a number line.

So $\frac{9}{5} > \sqrt{9}$.

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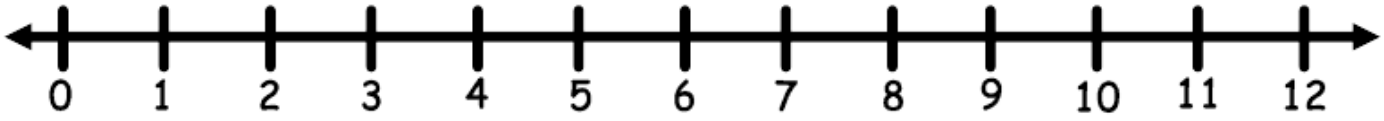
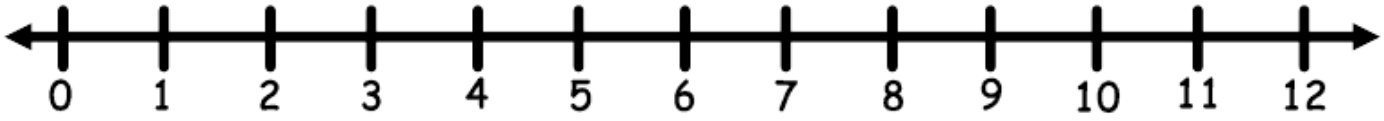
1) Graph the numbers on the number line: $5.5, \sqrt{40}, \frac{17}{4}, \sqrt{55}$



2) Graph the numbers on the number line: $7.25, \sqrt{45}, \frac{78}{8}, \sqrt{70}$



3) Use <, > or = to compare:
$-\sqrt{104}$ ____ -10

4) Use <, > or = to compare:
$\sqrt{33}$ ____ 5.19615242 ...

5) Write in order from least to greatest: $-\frac{1}{5}, \frac{9}{5}, -\sqrt{9}, \frac{5}{6}, \sqrt{24}, \pi$

6) Write in order from greatest to least: $-6.3, 0, \frac{8}{7}, 7.1, -6\frac{4}{5}$

Mixed Practice

7) Find the unit rate: 15 books in 3 days

8) -68.86 + 85.15

9) What is 75% of 96?

10) Multiply $3\frac{4}{7} \cdot 8\frac{2}{5}$

Word Problem

11) A local television station recorded the daily low temperatures for a week in January.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
⁻15℃	⁻16.7℃	⁻17.8℃	⁻21.1℃	⁻20.6℃	⁻18.9℃	⁻17.8℃

Which temperature is the highest? Which is the lowest?

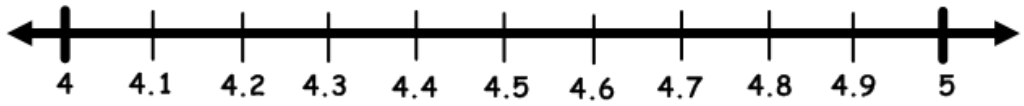
Pre-Algebra Name: _____

Unit 2 – Rational & Irrational Numbers Core: _____ Table: _____

2.1.5 Approximate Irrational Numbers

Active Instruction:

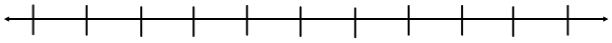
Approximate the value of $\sqrt{20}$ to the nearest tenth.



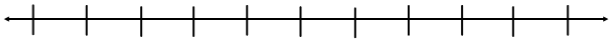
Team Huddle:

Approximate the square root to the nearest tenth.

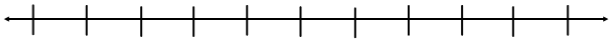
1) $\sqrt{77}$



2) $\sqrt{59}$



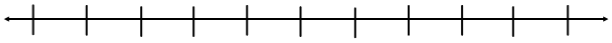
3) $\sqrt{99}$



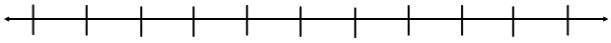
Team Mastery:

Approximate the square root to the nearest tenth.

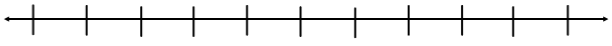
4) $\sqrt{52}$



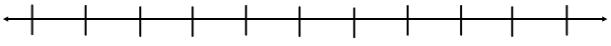
5) $\sqrt{18}$



6) $\sqrt{42}$



7) $\sqrt{24}$



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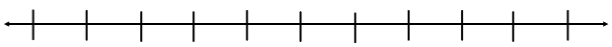
Pre-Algebra Name: _____

Unit 2 – Rational & Irrational Numbers Core: _____ Table: _____

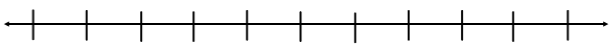
2.1.5 Practice

Approximate the square root to the nearest tenth.

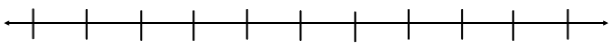
5) $\sqrt{45}$



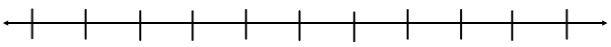
2) $\sqrt{93}$



3) $\sqrt{79}$



4) $\sqrt{61}$



5) Explain your thinking with #4.

Mixed Practice

6) The ratio of boys to girls in the 8th grade at Robinson Middle School is 5:7. If there are 600 students in the 8th grade, how many are girls?

7) Find both square roots for 81.

8) Find the area of a square whose side is 8.82 centimeters.

8) Classify 100 as: natural number, whole number, integer, rational number, irrational number. (Use all that apply.)

Word Problem

9) A square-shaped pool has an area of 234 square meters. Find the approximate length of each side of the pool.