Rational/Irrational

Math 8

The Real Number System:

Whole Numbers: 0, 1, 2, 3, 4, …

Integers: Positive and negative whole numbers: … -2, -1, 0, 1, …

Rational Numbers: Can be expressed as a fraction.
This includes all repeating or terminating decimals.

Ex. $0.\overline{23}$ $\frac{1}{3}$ 2.25 $5\frac{2}{7}$ 17

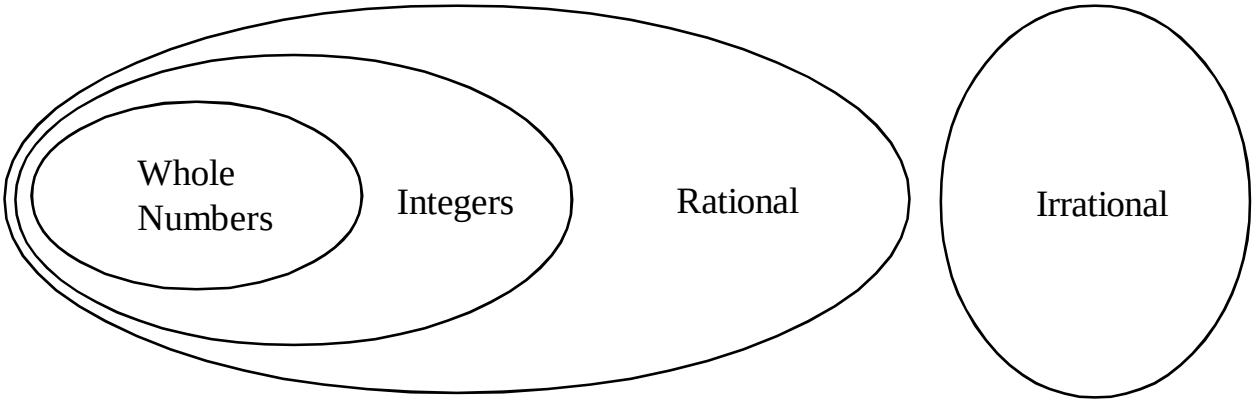
Irrational Numbers: Cannot be expressed as a fraction with integer numerator and denominator. This includes pi and most square roots (that cannot be simplified into fractions).

Ex. π $\frac{\sqrt{13}}{3}$ $2.12345...$ $\sqrt{23}$

Practice:

Place each number where it belongs in the chart below:

$\frac{\pi}{2}$ $\frac{6}{3}$ $5.5555...$ $\sqrt{25}$ $\sqrt{53}$ $\frac{\pi}{3\pi}$



Cube Roots:

A cube roots works similarly to a square root. If $a = b^2$, then b is a square root of a. If $a = b^3$, then b is a **cube root** of a.

Some are rational: $\sqrt[3]{27} = 3$, $\sqrt[3]{125} = 5$, and $\sqrt[3]{1000} = 10$.

Some are irrational: $\sqrt[3]{20} = 2.714...$, $\sqrt[3]{85} = 4.396...$, and $\sqrt[3]{2} = 1.259...$

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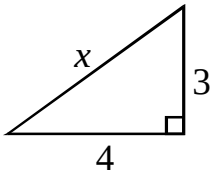
Practice:

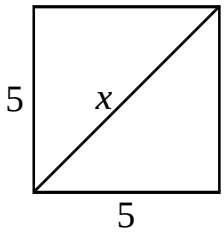
Find the value of x to the nearest thousandth, then classify the numbers below with all that apply: rational, irrational, integer, and/or whole number.

1. $x = \sqrt{20}$ 2. $x = \sqrt[3]{64}$ 3. $x = 2 + \sqrt{3}$

4. (right triangle)



5. (square)



Area:

The term square root comes from the fact that if you know the area of a square, the square root of the area is the side length. For example, if a square has an area of 25cm^2, then the sides must be 5cm long.

Practice: Find the length of the sides of each square (round to the nearest thousandth where necessary) based on the given areas.

1.

Area: 169cm^2

2.

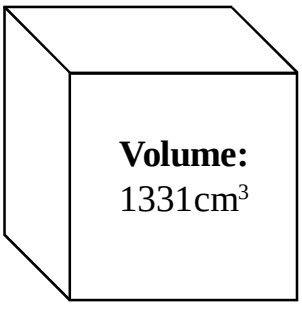
Area: 19cm^2

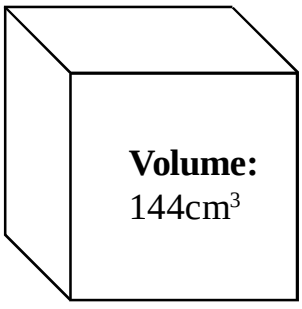
3.

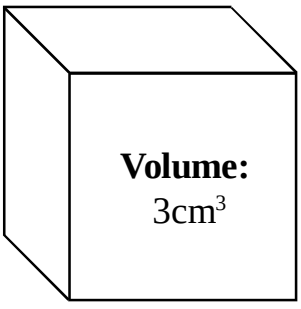
Area: 2.25cm^2

Practice:

Can you find the edge length of each cube below given the volume?







Name_____ Period _____

Irrational Numbers

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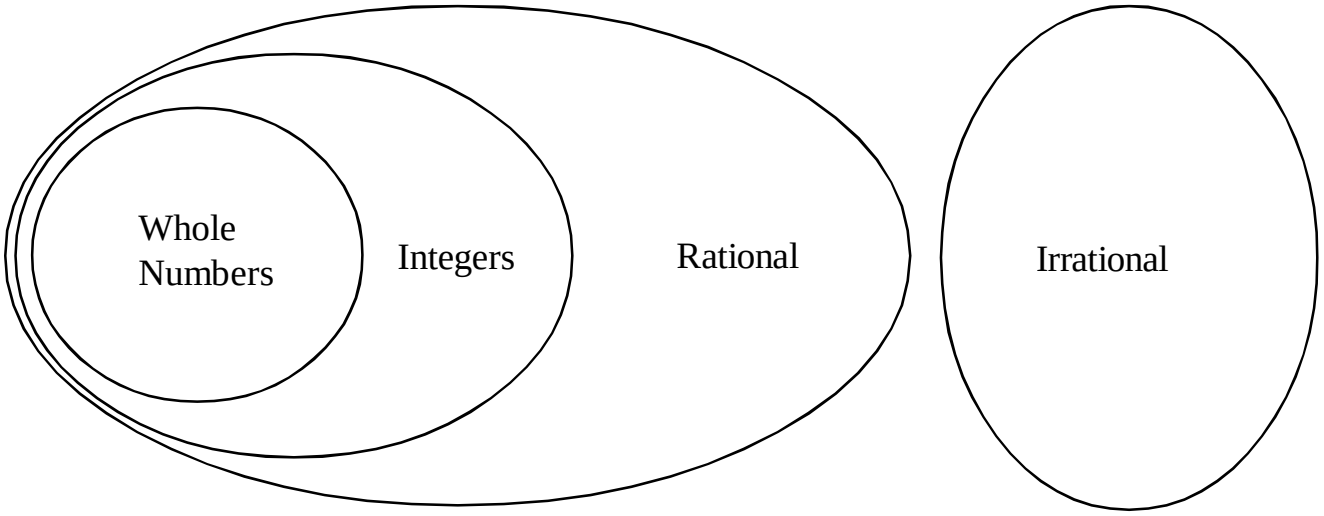
Write each number below in the appropriate part of the diagram. DO NOT change the way the numbers are written, leave them as they are.

$\frac{\sqrt{2}}{2}$ $\frac{25}{12}$ $4.567...$ $2.\overline{5}$ $\sqrt[3]{125}$ $\frac{\pi}{3.14}$



1. The square root of a number is equal to 5.5. What is the number?

1._____

2. The area of a square is 150cm^2. The side length of the same square is between what two integers?

2._____

3. What is the length of the diagonal of a square that has 3-inch sides? Round your answer to the thousandth.

3._____

4. On a test question, Mick was asked to find the square root of a number. Instead, he squared the number and got 49. What is the correct answer to the test question? Round your answer to the thousandth.

4._____

5. How many of the numbers from 1 to 100 have a square root that is an irrational number?

5._____

Name_____ Period _____

Irrational Numbers

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Think you can learn this material without practicing? THAT is irrational.

Practice:
Find the side length of each square below based on the given area. Round to the thousandth where necessary.

6.

Area:
144cm^2

7.

Area:
22cm^2

8.

Area:
5.76cm^2

Practice:
Find each cube root. ALL of these answers are rational.

9. $\sqrt[3]{1.331}$

10. $\sqrt[3]{195{,}112}$

11. $\sqrt[3]{-27}$

Solve:

12. The volume of a cube is 64cm^3. What is the length of the cube's edges?

12._____

13. A square has 10cm sides. The diagonal length of the same square is between what two integers?

13._____

14. Order these three values from least to greatest: $\sqrt[3]{1.5}$, $1.12345\ldots$, $\sqrt{1.4}$.

14._____

15. Solve: $1^3+2^3+3^3+4^3+5^3-(1+2+3+4+5)^2=$

15._____

Ordering Rationals and Irrationals

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To be able to order rational numbers, you must be able to order decimals.

Example: Place the following decimals in order from least to greatest.

$5.\overline{3}$

$5.3456...$

5.25

$5.\overline{25}$

Practice:
List each set in order from least to greatest.

1. $41.2 \quad 41.\overline{2} \quad 4.1234... \quad 40.9$

2. $9.4 \quad 9.345 \quad 9.543 \quad 9.34$

3. $\sqrt{45} \quad 6.\overline{78} \quad 6.7\overline{89} \quad 6\frac{7}{9}$

To order a list of numbers, it is easiest to write them all in the same form (usually decimal form) first. Line-up the decimal points and compare.

Example: Order from least to greatest.

$\sqrt{40}$
6.321
$6.\overline{321}$
$\sqrt[3]{250}$

becomes

6.32455
6.32100
$6.32132..$
6.29960

and we order these:

$6.29960 = \sqrt[3]{250}$
$6.32100 = 6.321$
$6.32132... = 6.\overline{321}$
$6.32455 = \sqrt{40}$

Ordering Rationals and Irrationals

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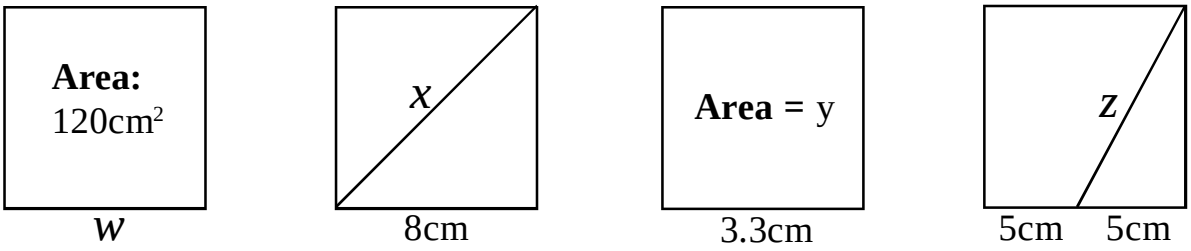
Practice:
List each set in order from least to greatest.

1. $4.5 \quad \frac{17}{4} \quad 4.\overline{4} \quad \sqrt{20}$

2. $\frac{\sqrt{2}}{2} \quad 0.\overline{70} \quad 0.7 \quad \sqrt[3]{0.35}$

Practice:
List the values *w* through *z* from least to greatest (all figures are squares).



Name_____ Period _____

Ordering Numbers

Math 8

Practice:
Order each set of three numbers from least to greatest.

1. _____

A. $\sqrt[3]{25}$

B. $\sqrt{10}$

C. $3.\overline{1}$

2. _____

A. $4.567...$

B. $\sqrt[3]{94}$

C. $\sqrt{21}$

3. _____

A. $\frac{5}{9}$

B. $2-\sqrt{2}$

C. $\sqrt[3]{0.2}$

4. _____

A. $\frac{\sqrt{2}}{2}$

B. $\sqrt{0.5}$

C. $\frac{1}{\sqrt{2}}$

5. _____

A. $97\frac{1}{3}$

B. $\sqrt{9{,}475}$

C. $68\sqrt{2}$

6. _____

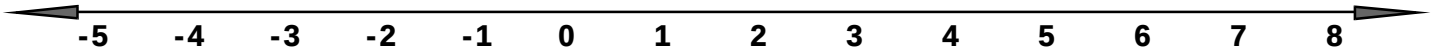
A. $12.345...$

B. $\sqrt{\frac{762}{5}}$

C. 4π

Place each value below in its approximate place on the number line drawn:

7. **A.** $\frac{27}{7}$ **B.** $\sqrt{19}$ **C.** $\sqrt[3]{-14}$ **D.** $1-\sqrt{2}$ **E.** $\frac{2\sqrt{7}}{3}$ **F.** $\sqrt{1+\sqrt{64}}$



8. **A.** $\frac{7}{13}$ **B.** $1-\sqrt{3}$ **C.** $\sqrt[3]{0.73}$ **D.** $\sqrt{\frac{2}{9}}$ **E.** $\frac{\sqrt{5}-4}{3}$ **F.** $\sqrt{1-\sqrt{2-\sqrt{3}}}$