The Real Number System Study Guide

All problems should be completed WITHOUT a calculator.

Perfect Squares	To square a number, multiply that number by itself.
	$$4^2 = 4 \text{ x } 4 = 16$$
	WARNING: The exponent of 2 does NOT mean to multiply by 2. Instead, it means to use the number twice in multiplying.
	A **perfect square** is the result of squaring a whole number.

Square Roots of Perfect Squares	The inverse of squaring a number is taking the **square root**.
	$$\sqrt{16} = 4, \text{ because } 4 \text{ x } 4 = 16$$
	The square root of a perfect square will *always* be an integer.
	Taking the square root of a positive number will give two possible roots: one positive and one negative.
	$\sqrt{16} = 4$, because 4 x 4 = 16 $\sqrt{16} = -4$, because -4 x -4 = 16

Fill in the charts below:

Perfect Squares:

1^2	2^2	3^2	4^2	5^2	6^2	7^2	8^2	9^2	10^2	11^2	12^2	13^2	14^2	15^2	16^2	17^2	18^2	19^2	20^2

Square Roots of Perfect Squares:

$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$
1	2	3	4	5	6	7	8	9	10

$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$
11	12	13	14	15	16	17	18	19	20

Square Roots of Fractions	Take the square root of the numerator and the square root of the denominator. $$\sqrt{\frac{1}{9}} = \frac{\sqrt{1}}{\sqrt{9}} = \frac{1}{3}$$
Solving One-step Equations with Square Roots	The inverse of squaring a number is _____. Example: solve $x^2 = 121$ Answer: _____
Solving Multi-step Equations with Square Roots	A "Do/Undo" chart can help decide the order of steps to take. Example: solve $x^2 + 4 = 229$ List what is being done to x using Order of Operations ⬇ <table><tr><td>Do</td><td>Undo</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table> ⬆ What is the inverse operation? Answer: _____
Area of Squares	To find the area of a square, multiply one side length by itself. To find the side length, take the square root of the area. $$\text{side length}^2 = \text{Area}$$ $$\sqrt{\text{Area}} = \text{side length}$$

Perfect Cubes	To cube a number, use that number in multiplication 3 times.
	$$4^3 = 4 \times 4 \times 4 = 64$$
	WARNING: The exponent of 3 does NOT mean to multiply by 3. Instead, it means to use the number three times in multiplying.
	A **perfect cube** is the result of cubing a whole number.

Cube Roots of Perfect Cube	The inverse of cubing a number is taking the **cube root**.
	$$\sqrt[3]{64} = 4, \text{ because } 4 \times 4 \times 4 = 64$$
	The cube root of a perfect cube will *always* be an integer.
	Watch out for the little 3 above the sign. It tells us to use cube root instead of square root.

Fill in the charts below:
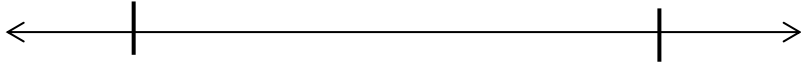
Perfect Cubes:

1^3	2^3	3^3	4^3	5^3	6^3	7^3

Cube Roots of Perfect Cubes:

$\sqrt[3]{}$	$\sqrt[3]{}$	$\sqrt[3]{}$	$\sqrt[3]{}$	$\sqrt[3]{}$	$\sqrt[3]{}$	$\sqrt[3]{}$
1	2	3	4	5	6	7
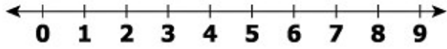
Volume of Cubes	$$\text{side length}^3 = \text{Volume}$$ $$\sqrt[3]{\text{Volume}} = \text{side length}$$

Converting Fractions and Decimals	Fraction → Decimal: divide _____ by _____.
	
	Decimal → Fraction: put decimal over 1, then multiply numerator and denominator by 10 until decimal is gone.
	• Another method: use the place value of the last digit
	    o 10ths place→ put number over 10
	    o 100ths place→ put number over 100
	    o 1,000ths place→ put number over 1,000

Converting Repeating Decimals to Fractions	If the repeating bar is over ALL digits after the decimal: Convert $0.\overline{6}$ If the repeating bar is NOT over all digits after the decimal: Convert $0.4\overline{9}$
Estimating Non-Perfect Square Roots and Cube Roots	Estimate $\sqrt{34}$ to the nearest 10th. Use a number line to decide which two integers the root should fall between. $\longleftarrow \quad | \rule{3cm}{0.4pt} | \longrightarrow$ Guess and Check Shortcut (only for square roots) (works for square roots and cube roots)

Rational Numbers	Rational numbers are numbers that can be written as a fraction of 2 integers. Rational numbers can include: • _____ and _____ decimals • The square roots of _____ • The cube roots of _____
Irrational Numbers	Irrational numbers cannot be written as a fraction of 2 integers. Irrational numbers include: • _____ and _____ decimals • The square roots of _____ • The cube roots of _____
Pi (π)	**Pi** represents the ratio of a circle's circumference to its diameter. π is a _____ and _____ decimal, which makes it a(n) _____ number. **π is approximately 3.14.**

The Real Number System
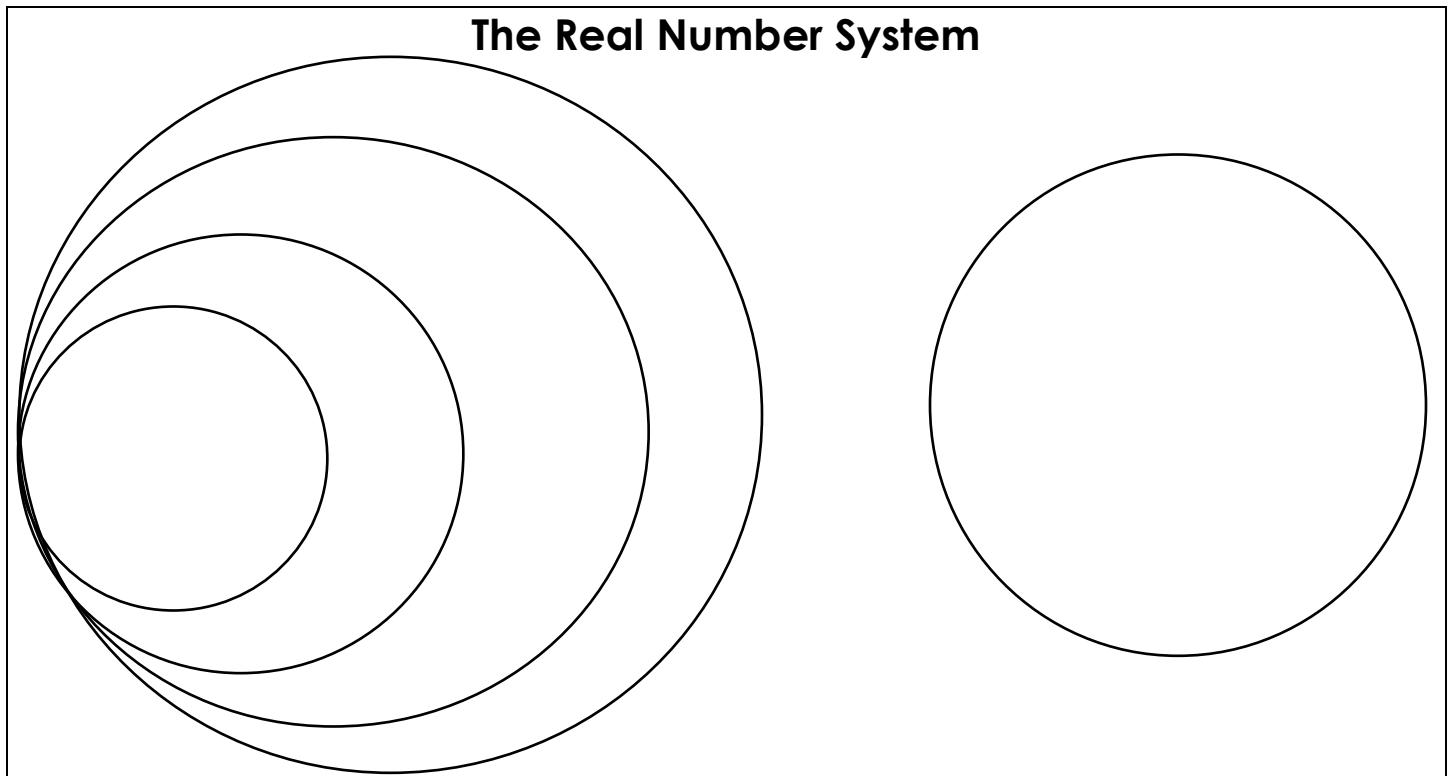
Homework: You may want to do your work on a separate piece of paper.

1) Tara cut out a square piece of paper with an area of 200 square inches. Which expression could be used to find the side length of the paper? a. $200 \div 4$ b. $\sqrt{200} + 4$ c. $200 \div 2$ d. $\sqrt{200}$	2) What is the solution to $x^2 = 196$? a. $x = 13 \text{ or } x = -13$ b. $x = 98 \text{ or } x = -98$ c. $x = 14 \text{ or } x = -14$ d. $x = 392 \text{ or } x = -392$
3) Which expression has a value of 11? a. $\sqrt[3]{14}$ b. $\sqrt{5.5}$ c. $\sqrt[3]{33}$ d. $\sqrt{121}$	4) Which number is irrational? a. $\frac{7}{5}$ b. $-5.\overline{87}$ c. $\sqrt[3]{64}$ d. $\sqrt[3]{80}$
5) Which choice has a rational value? a. $\sqrt{2}$ b. $\sqrt{\frac{2}{5}}$ c. $\sqrt{\frac{25}{9}}$ d. $\sqrt[3]{4}$	6) Which set of numbers are ALL rational? a. $\pi, \frac{1}{8}, -12$ b. $-5.234, 2.\overline{34}, 6\sqrt{2}$ c. $\sqrt[3]{125}, 45, -\frac{8}{9}$ d. $\sqrt{36}, \pi^2, 0.7$
7) Which value is closest to $10\sqrt{40}$? a. 6 b. 30 c. 60 d. 400	8) Estimate $\sqrt{76}$ to the nearest 10th.
9) Between which pairs of numbers is $\sqrt{149}$? a. 11 and 12 b. 144 and 169 c. 74 and 75 d. 12 and 13	10) Between which two consecutive points does $\sqrt[3]{131}$ lie?
11) Which integers, when placed in the blanks below, make the inequality true? ____$< -\sqrt{44} <$ _____ a. 6 and 7 b. 7 and 8 c. -7 and -6 d. -8 and -7	12) How much greater is $\sqrt{17}$ than $\sqrt{7}$? a. Exactly 10 b. Exactly 1 c. A little more than 1 d. A little more than 3
13) To which set of numbers does $3.\overline{2}$ belong? a. Rational only b. Irrational only c. Rational and an integer d. Irrational and an integer	14) To which set of numbers does $-\sqrt{23}$ belong? a. Rational only b. Irrational only c. Rational and an integer d. Irrational and an integer
15) Which exponent can be substituted for x to make the equation true? $$12^x = 144$$	16) What is $1.\overline{4} + 2.2\overline{3}$?