Name: _____ Date: _____ Hour: ____Alg 1__

Unit 5 Day 17: Irrational Numbers

Focus Question: How can I identify an irrational number?

A. Review $\sqrt{\ }$

1. What do you say out loud when you see the symbol above? square root or radical

2. What do you think in your head when you see the symbol above?

what #times itself is...

3. Give the answers to the following problems.

a. $\sqrt{64}$ ±8

b. $\sqrt{c^2} = \sqrt{196}$ c = ±14

c. $\sqrt{m^2} = \sqrt{121}$ m = ±11

4. All the problems above involved what type of squares? "perfect"

B. Estimating "non-perfect" squares.

Joey was asked to estimate $\sqrt{3}$. He answered his teacher by saying that $\sqrt{3}$ is between $\sqrt{1}$ and $\sqrt{4}$ therefore, the $\sqrt{3}$ is between 1 and 2. Since 3 is closer to 4 than it is to 1, I would estimate it to be 1.8.

1. Use a calculator to multiply 1.8 times 1.8. What is the answer? What does it tell you about Joey's estimate?

3.24 b/c 3.24>3, 1.8 is too high

2. Joey decided to change his answer to 1.7. Use a calculator to multiply 1.7 times 1.7. What is the answer? What does it tell you about Joey's second estimate?

2.89 b/c 2.89<3, 1.7 is too small

3. Using your answers to numbers 1 and 2, what would you estimate for $\sqrt{3}$?

2.89 is only 11 hundredths away, 3.24 is 24 hundredths away, so closer to 1.7 like 1.73

4. Using your calculator, multiply your estimate by itself. What was your answer?

(1.73)(1.73) = 2.9929 a little more! (1.732)(1.732) = 2.999824

C. Exact answers for a "non-perfect" square

Joey's teacher finally showed him where the square root button was on his calculator! When he typed in $\sqrt{3}$ his calculator said 1.732050808.

1. Use your smart phone calculator to find $\sqrt{3}$ 1.73205080756

2. Joey's calculator made $\sqrt{3}$ appear to be a repeating decimal. Is it? Explain

His calculator rounded

3. Use a calculator to multiply 1.7320508076 times 1.7320508076. What is the answer?

3.000000011186 (if you just hit squared instead of following directions, your calculator is using its memory)

4. What does your answer to #3 tell you about whether or not $\sqrt{3}$ is terminating?

It doesn't terminate either

5. If you had typed $\sqrt{3}$ and then ans^2 the answer would be 3.

6. The questions above should show your our calculators have limitations! They round and/or truncate. How are those different?

use the rule of 5 or more round up

only hold certain # of digits

D. Irrational Numbers

1. Define rational number.

any # that can be written as a ratio of integers

2. What kind of decimals are rational numbers.

terminating & repeating

3. Under what operations were rational numbers closed?

ALL operations

Now we have a number $\sqrt{3}$ that has a **decimal expansion that does not repeat and does not terminate**. **It can NOT be written as a ratio of two integers. Therefore it is called an irrational number.** Everything that we have seen as square root of a "non-perfect" square is actually an example of an irrational number. Irrational numbers are represented by $\mathbb{Q}'$.

4. Give 5 more examples of irrational numbers.

$\sqrt{37}$, π, $\sqrt{104}$, $\sqrt{211}$, 2π

There are other mathematical terms that are irrational. The one you know right now is π. π is very confusing because its definition is "the **ratio** of a circle's circumference to its diameter" or $\pi = \frac{C}{d}$ which makes it appear rational. But due to the continuous nature of measurement, the decimal expansion goes on forever without repeating. Therefore it is irrational.

6. Tell whether each number below is rational or irrational. If it is rational, then give its **BEST** classification.

a. $8.\overline{12}$ rational — Best rational

b. $\sqrt{42}$ irrational

c. $\frac{13}{8}$ Rational — Rational

d. $\sqrt{169} = 13$ Rational — Natural

e. -0.7 Rational — Rational

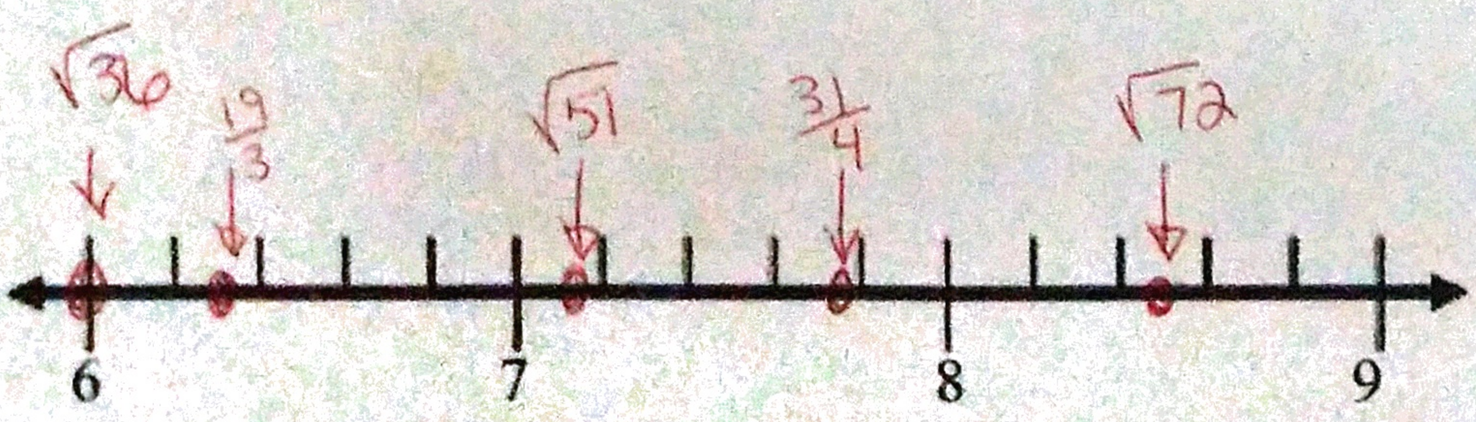
f. 5 Rational — Natural

g. 2π Irrat.

h. $\frac{\sqrt{15}}{2}$ Irr.

7. Place each number in its correct box. Then give an exact decimal value or approximate decimal value. Finally put them in order from least to greatest using the number line.

$\sqrt{72}$ $\sqrt{51}$ $\sqrt{36}$ $\frac{31}{4}$ $\frac{19}{3}$



Rational	Irrational
$\sqrt{36} = 6$ $\frac{31}{4} = 7.75$ $\frac{19}{3} = 6.\overline{3}$	$\sqrt{72} \approx 8.49$ $\sqrt{51} \approx 7.14$

notice they use =

notice they use ≈