Name:_____ **Date:**_____

Irrational Numbers

An **Irrational Number** is a number that **cannot** be written as a simple fraction - the decimal goes on forever without repeating.

Example: **π (Pi)** is an irrational number. The value of Pi is

3.14159265358979323846264338327 95 (and more...)

There is no pattern to the decimals, and you **cannot** write down a simple fraction that equals Pi.

It is called irrational because it cannot be written as a ratio (or fraction), not because it is crazy! HOWEVER –Much like an irrational person irrational numbers are NOT predictable!

Rational vs Irrational

But if a number **can** be written as a simple fraction then it is called a **rational number**:

Example: **9.5** can be written as a simple fraction like this

$$^{19}/_{2} = 9.5$$

So it is **not** an irrational number (and so is a **rational number**)

Here are some more examples:

Number	As a Fraction	Rational or Irrational?
5	5/1	Rational
1.75	7/4	Rational
.001	1/1000	Rational
√2 (square root of 2)	?	**Irrational !**

Name:_____ **Date:**_____

Example: Is the Square Root of 2 an Irrational Number?

My calculator says the square root of 2 is 1.414213562373095048801688724209 7, but this is not the full story! It actually goes on and on, with no pattern to the numbers.

You **cannot** write down a simple fraction that equals the square root of 2. So the square root of 2 is an *irrational number*

When dealing with square roots a lot of them are classified as IRRATIONAL numbers. The special few that are **RATIONAL** are absolutely **PERFECT**!

****The square root of any PERFECT SQUARE is RATIONAL!**

Famous Irrational Numbers

	**Pi** is a famous irrational number. People have calculated Pi to over one million decimal places and still there is no pattern. The first few digits look like this: 3.14159265358979323846264338327 95 (and more ...)
	The number ***e*** (Euler's Number) is another famous irrational number. ***e*** is the base of the Natural Logarithms (invented by John Napier). People have also calculated ***e*** to lots of decimal places without any pattern showing. The first few digits look like this: 2.71828182845904523536028747135 27 (and more ...)
	The Golden Ratio is an irrational number *(symbol is the Greek letter "phi" shown at left).* The first few digits look like this: 1.61803398874989484820... (and more ...)
	Many square roots, cube roots, etc are also irrational numbers. Examples: √3 1.732050807568877293527446341505 9 (etc) √99 9.94987437106619954734479821001 21 (etc) But √4 = 2, and √9 = 3, so **not all** roots are irrational.

Name:_____ **Date:**_____

History of Irrational Numbers

Apparently ***Hippasus*** (one of *Pythagoras'* students) discovered irrational numbers when trying to represent the square root of 2 as a fraction (using geometry, it is thought). Instead he proved you couldn't write the square root of 2 as a fraction and it was *irrational*.

However ***Pythagoras*** could not accept the existence of irrational numbers, because he believed that all numbers had perfect values. But he could not disprove *Hippasus'* "irrational numbers" and so Hippasus was thrown overboard and drowned!

(Retrieved on Mathisfun.com)

Lets Practice!

Identify each of the following as rational (R) or irrational (I) by writing the appropriate letter on the blank space provided next to each number:

a. $\sqrt{81}$ _____

b. $\frac{1}{3}$ _____

c. .171171117… _____

d. $\sqrt{10}$ _____

e. $0.\overline{4}$ _____

f. π _____