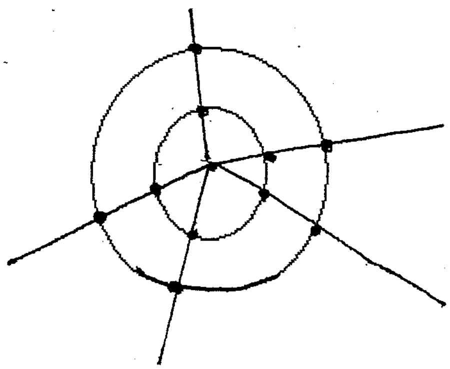
Name ____________________

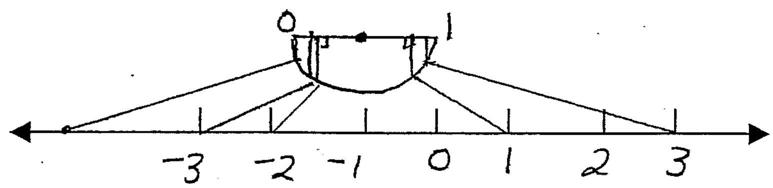
https://www.solidpapers.com/collegepapers/Mathematics/10655.htm

∞'s

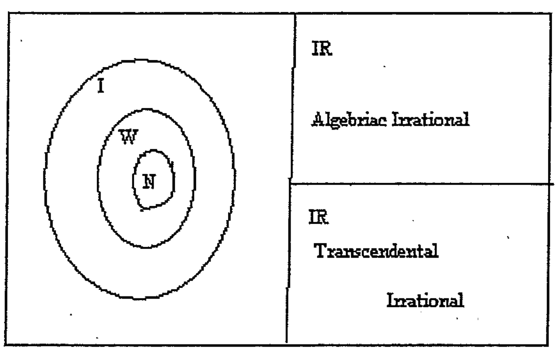
Which circle below has more points on it (smaller or larger)?



Are there more points on the entire number line or between 0 and 1 on the real number line?



Real Numbers



N = 1, 2, 3, 4, 5, ...

W = 0, 1, 2, 3, 4, 5, ...

I = ...-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, ...

Q = Rational #'s (Meaning Fractions)
terminating decimals 1/2 = 0.5 repeating decimals 1/3 = .33333

Georg Ferdinand Ludwig Philipp Cantor
March 3 1845[1] – January 6, 1918

What if we add one number, is ∞ larger?
1, 2, 3, 4, 5, 6, ...

0, 1, 2, 3, 4, 5, 6, ...

What if we add an ∞ amount of #'s, now do we have a larger ∞?
.... 9, 7, 5, 3, 1, 2, 4, 6, 8, ...
...-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, ...

Why were the rational #'s called rational and the irrational #'s called irrational?
How can you find a fraction between any two other fractions on the real number line?
Surely all rational #'s must be a larger ∞?

In mathematics, a **transcendental number** is a number (possibly a complex number) which is not algebraic—that is, it is not a root of a non-constant polynomial equation with rational coefficients. The most prominent examples of transcendental numbers are π and e. Though only a few classes of transcendental numbers are known (in part, because it can be extremely difficult to show that a given number is transcendental) transcendental numbers are not rare: indeed, almost all real and complex numbers are transcendental, since the algebraic numbers are countable while the sets of real and complex numbers are uncountable. All real transcendental numbers are irrational, since all rational numbers are algebraic. The converse is not true: not all irrational numbers are transcendental, eg the square root of 2 is irrational but is an algebraic number (therefore, not transcendental).

In 1882, Ferdinand von Lindemann published a proof that the number π is transcendental. He first showed that e to any nonzero algebraic power is transcendental, and since $e^{i\pi} + 1 = 0$ is algebraic (see Euler's identity), $i\pi$ and therefore π must be transcendental.

	1	2	3	4	5	6	7	8	9	10	11
1	1/1	2/1	3/1	4/1	5/1						
2	½	2/2	3/2	4/2	5/2	6/2	7/2				
3	1/3	2/3	3/3	4/3	5/3	6/3	7/3	8/3			
4	1/4	2/4	¾	4/4	5/4	6/4	7/4	8/4	9/4		

NAME ____________

Comment ____________

... Now lay them out in a pattern: Upper left, down one, up diagonal, right one, down diagonal, down one, up diagonal, right one, down diagonal, ...

1/1, ½, 2/1, 3/1, 2/2, 1/3, ¼, 2/3, 3/2, 4/1, 5/1, 4/2, 3/3, 2/4, ¾, 4/3, ... One could remove the repeats.

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, ...

Algebraic Irrationals: Real numbers that are possible solutions to algebraic equations like $x^2 = 2$

	1	2	3	4	5	6	7	8	9	10	11
2	$\sqrt{1}$	$\sqrt{2}$	$\sqrt{3}$	$\sqrt{4}$	$\sqrt{5}$	...					
3	$\sqrt[3]{1}$	$\sqrt[3]{2}$	$\sqrt[3]{3}$	$\sqrt[3]{4}$	$\sqrt[3]{5}$	...					
4	$\sqrt[4]{1}$	$\sqrt[4]{2}$	$\sqrt[4]{3}$	$\sqrt[4]{4}$	$\sqrt[4]{5}$	...					
5	$\sqrt[5]{1}$	$\sqrt[5]{2}$	$\sqrt[5]{3}$	$\sqrt[5]{4}$	$\sqrt[5]{5}$	...					

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COMMENT ____________

Magnitudes (brightness) of stars. $\sqrt[5]{100}$

... Repeat the same thing with algebraic irrationals that we did with rational #'s. Let's say I asked you to write down all real numbers in a column. After writing down every possible real number would it be possible to find one you missed? (Cantor called this process digitalization.)

.28745102736... Making a real number you missed, go down the diagonal and (lets say) if it is a 5 make it a 3 and if not a 5 make the number a 1. In our case .11131... How do we know that this number is not in our list?

.47648216452...

.33333333333... Can we generate a larger infinity? Power Set { the set of all possible subsets of any set is larger than the original set.}

.656565656565... Aleph null is the same as what we usually call infinity, namely the infinity of the integers.

.250000000000.... The next known distinctly bigger infinity is denoted by C, and it is the "infinity of the continuum" or the infinity of real numbers.

...

The number of elements in a set is called its cardinality. For example, the cardinality of the set {3, 8, 12, 4} is 4.

The subsets of {1,2,3} are {}, {1}, {2}, {3}, {1,2}, {1,3}, {2,3}, {1,2,3} so a cardinality of the power set is 8.