*Number*Zoo*

MathHappens develops programming that is very much in sync with the advice from keynote speaker Dr. Kenneth Wesson

- Can we find ways to:
- Get our “hands on” math
- Offer opportunities to “ponder math”
- Use “qualia" or characteristics allow us to help “understand the pieces that make up the whole” number system
- Help learners feel safe.

MATHHAPPENS.ORG

Mission: Promote math literacy by inspiring and supporting mathematical exhibitions in our public places and spaces.

Ransom Center, Austin TX

Parking Day
San Marcos TX

Oakwood Cemetary
Austin TX

We tend to aim really high: 3 Major Unproven Conjectures in Number Theory

***Goldbach's Conjecture** states that*

Every even number is the sum of 2 prime #s

***Twin Prime Conjecture** says*

There are an infinite number of twin Primes

Riemann Hypothesis

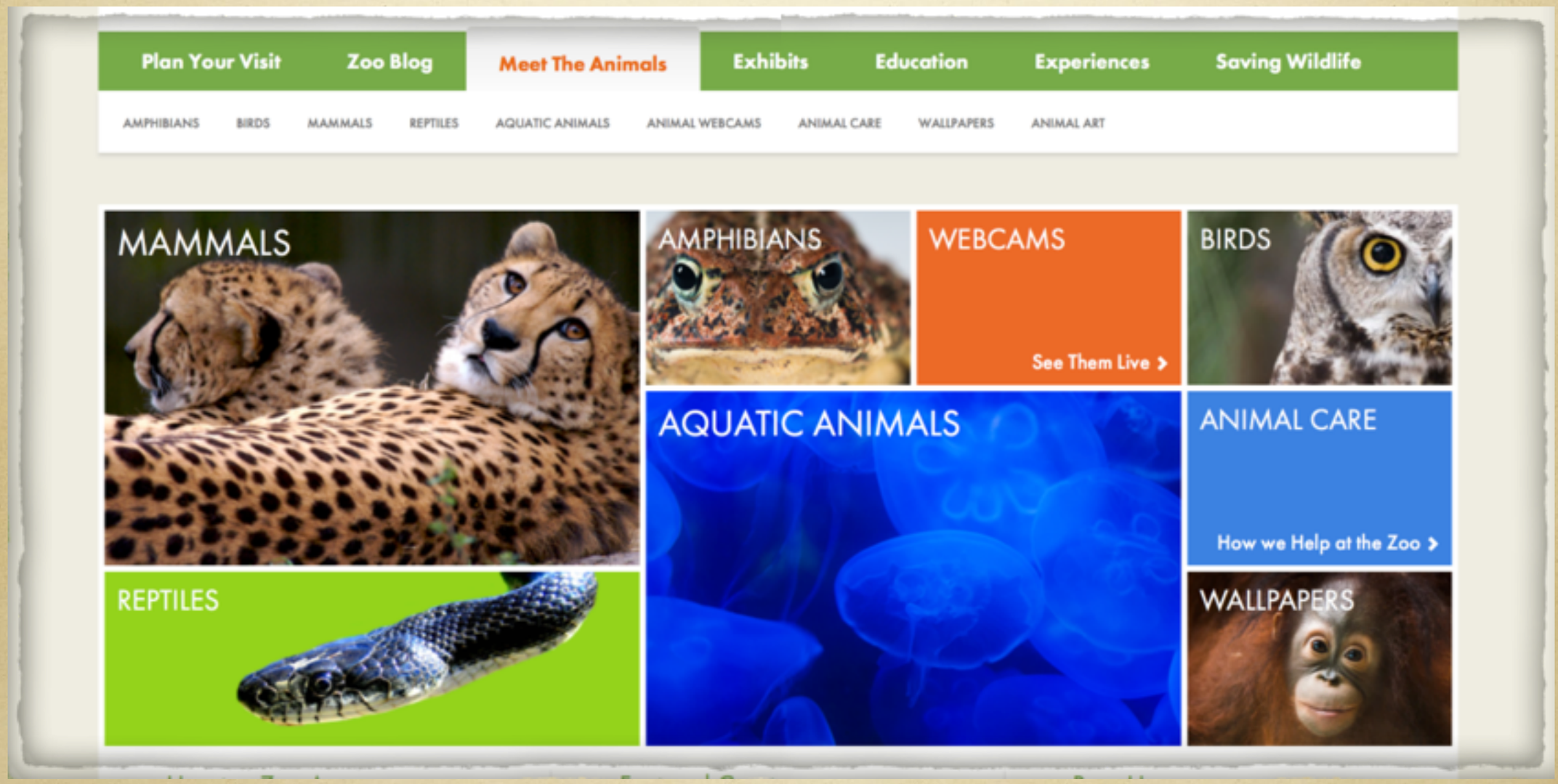
says the Riemann zeta function has its zeros only at the negative even integers and the complex numbers with real part 1/2.

Multiple Math Connections

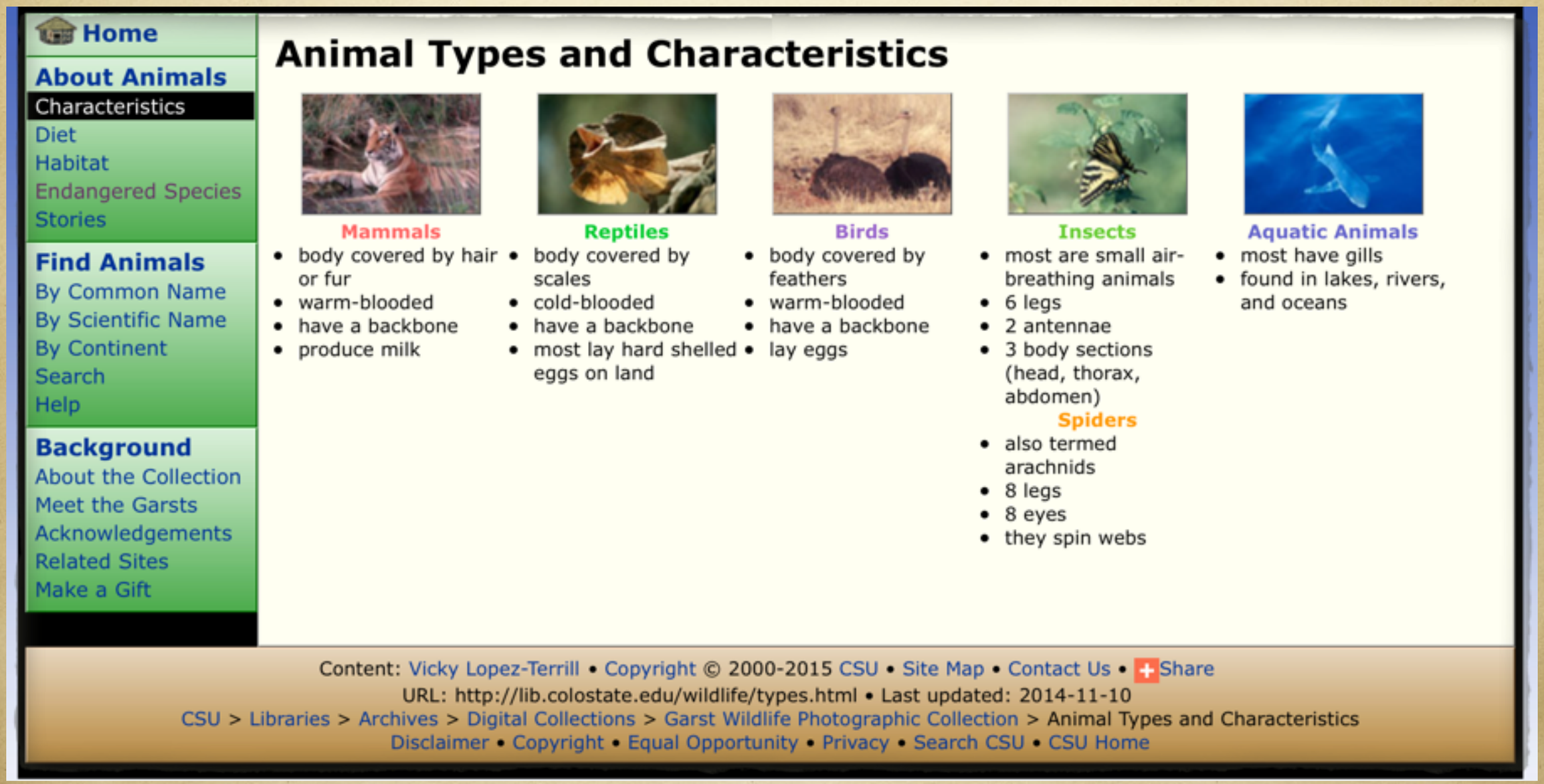
- How do we draw and name an array.
- Is One a Prime Number?
- Are there an infinite number of Primes?
- What are some differences and similarities between the numbers 6 and 9?

How can a field trip to the regular zoo help students understand such a variety and depth of mathematical ideas?

On a visit to the Houston Zoo you will see some organized animals!



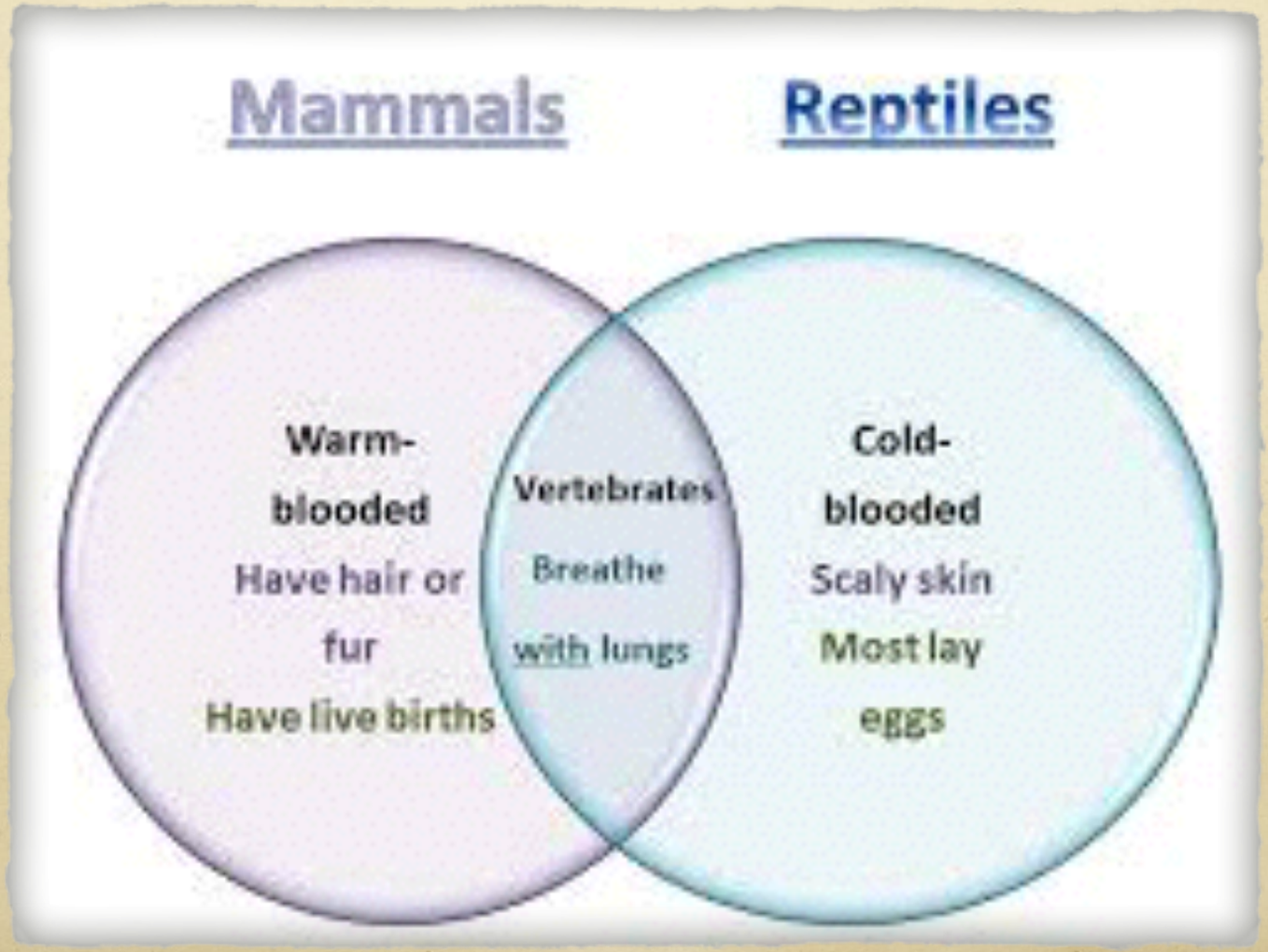
You might study animal species, and learn about their unique and common characteristics




AN YOU SPOT IT?
Can you distinguish which species this is based on its spots?
Three species of large cats have spots and to the casual observer, they may all look the same. But if you look a bit closer you'll see they are actually quite distinct.
Large Distribution Species
Hard To Tell Apart?

Study Spots

Organizers like this Venn diagram can help the visitor and students compare and contrast



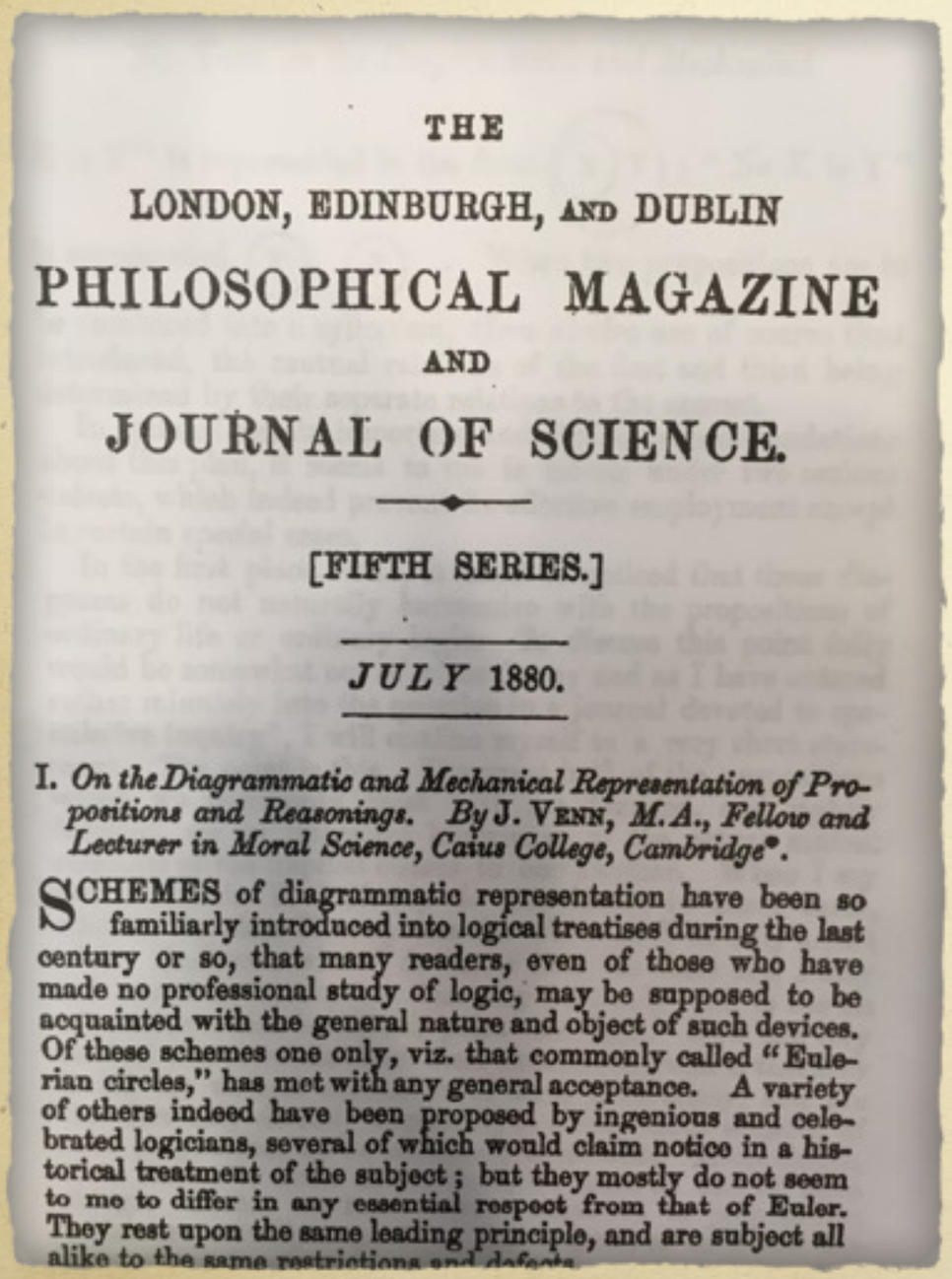
The study of numbers and the history of organizational schemes for numbers has much in common with this thought process.

Cabinets of Curiosity late 1700s

Mystery hooves and bones.
Houston Zoo Feb 20, 2016

Euler/Venn (1800s)

Venn was a logician and Mathematician who built on an organizational system developed by Euler, a mathematician.



THE

LONDON, EDINBURGH, AND DUBLIN

PHILOSOPHICAL MAGAZINE

AND

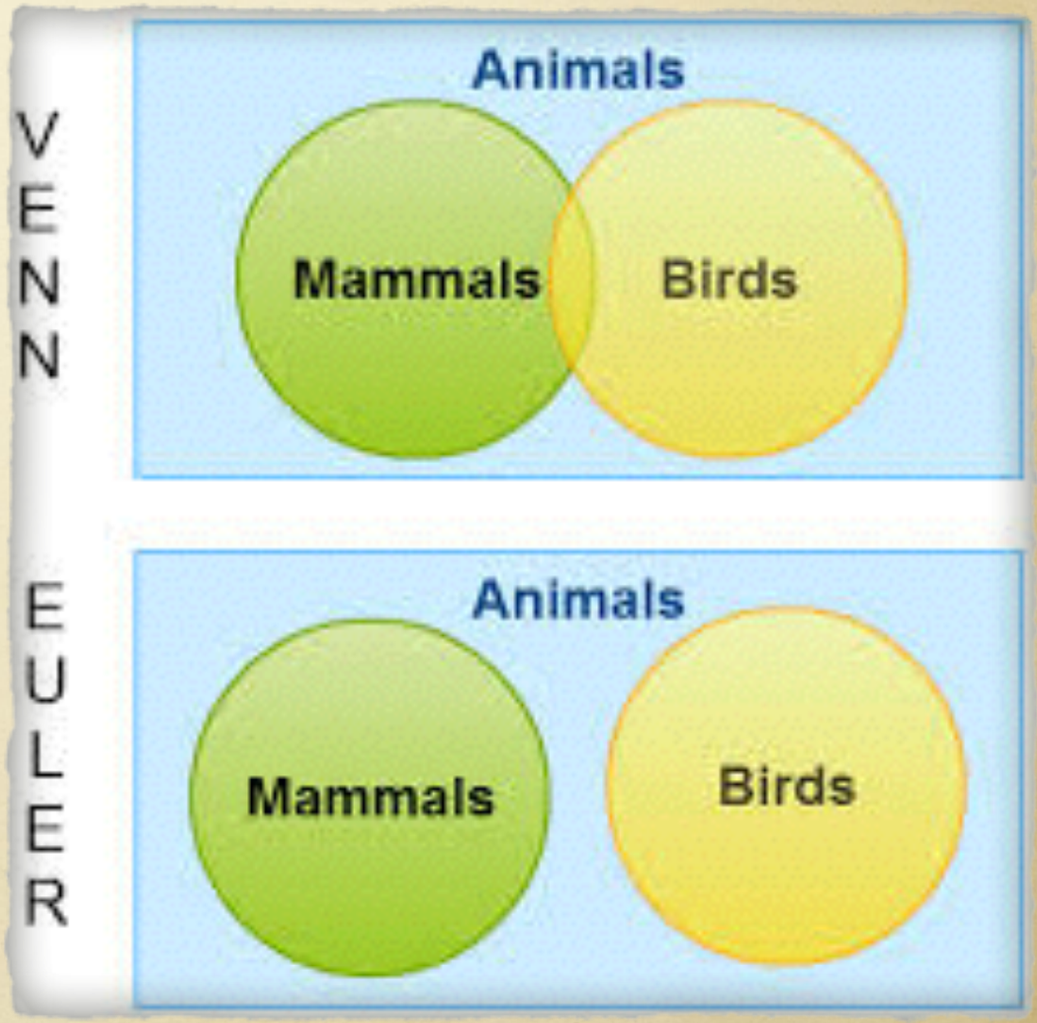
JOURNAL OF SCIENCE.

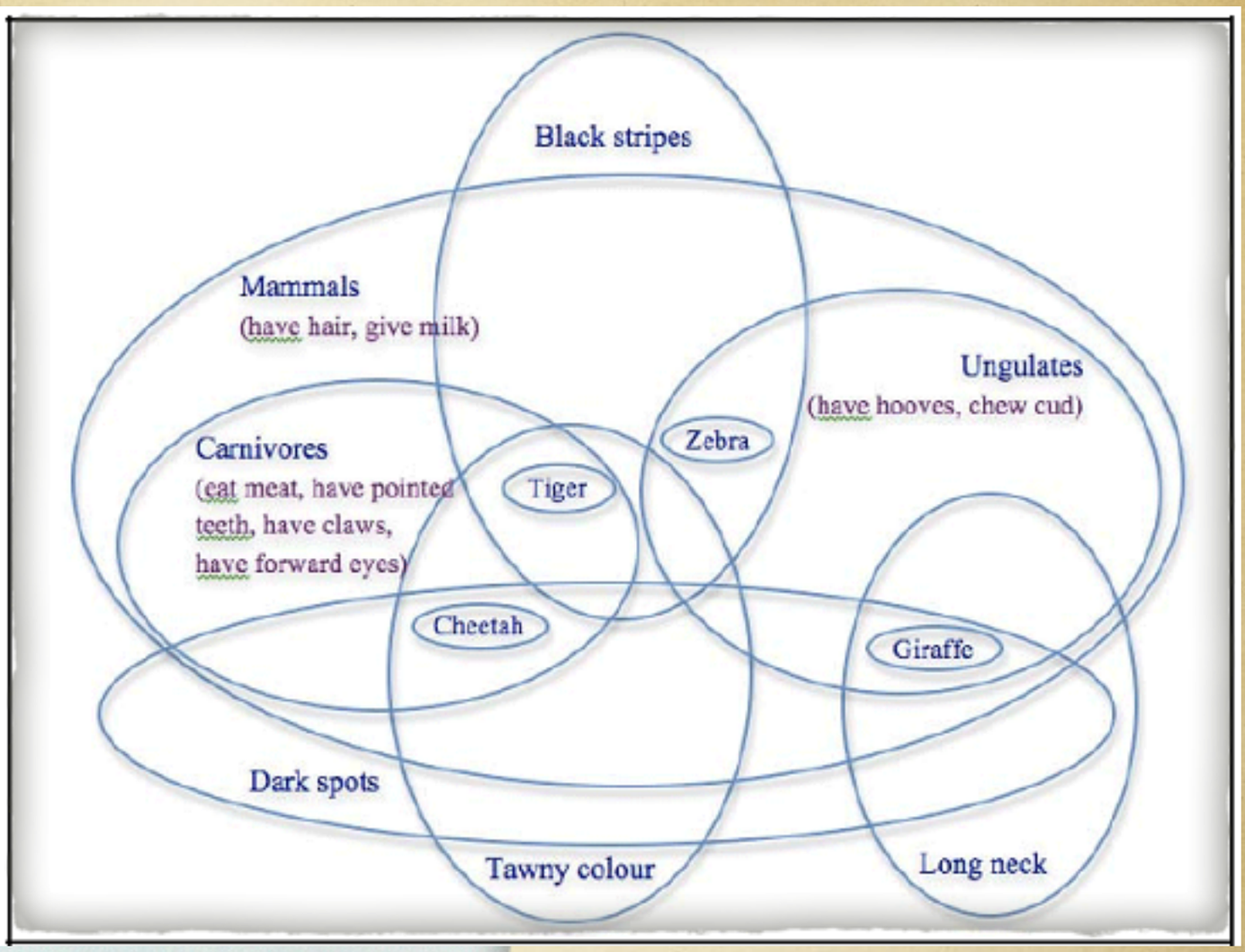
[FIFTH SERIES.]

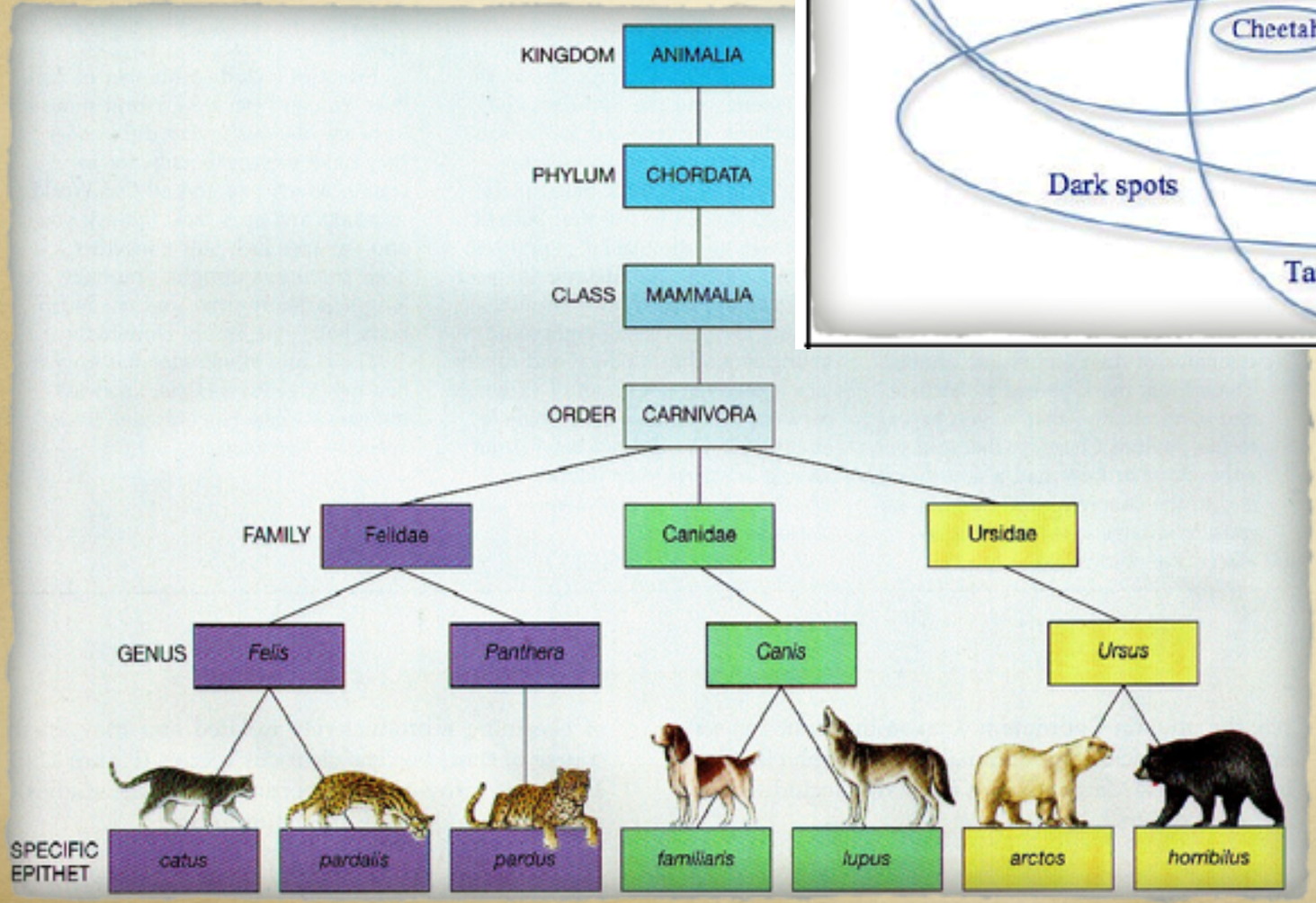
JULY 1880.

I. *On the Diagrammatic and Mechanical Representation of Propositions and Reasonings. By* J. VENN, *M.A., Fellow and Lecturer in Moral Science, Caius College, Cambridge**.

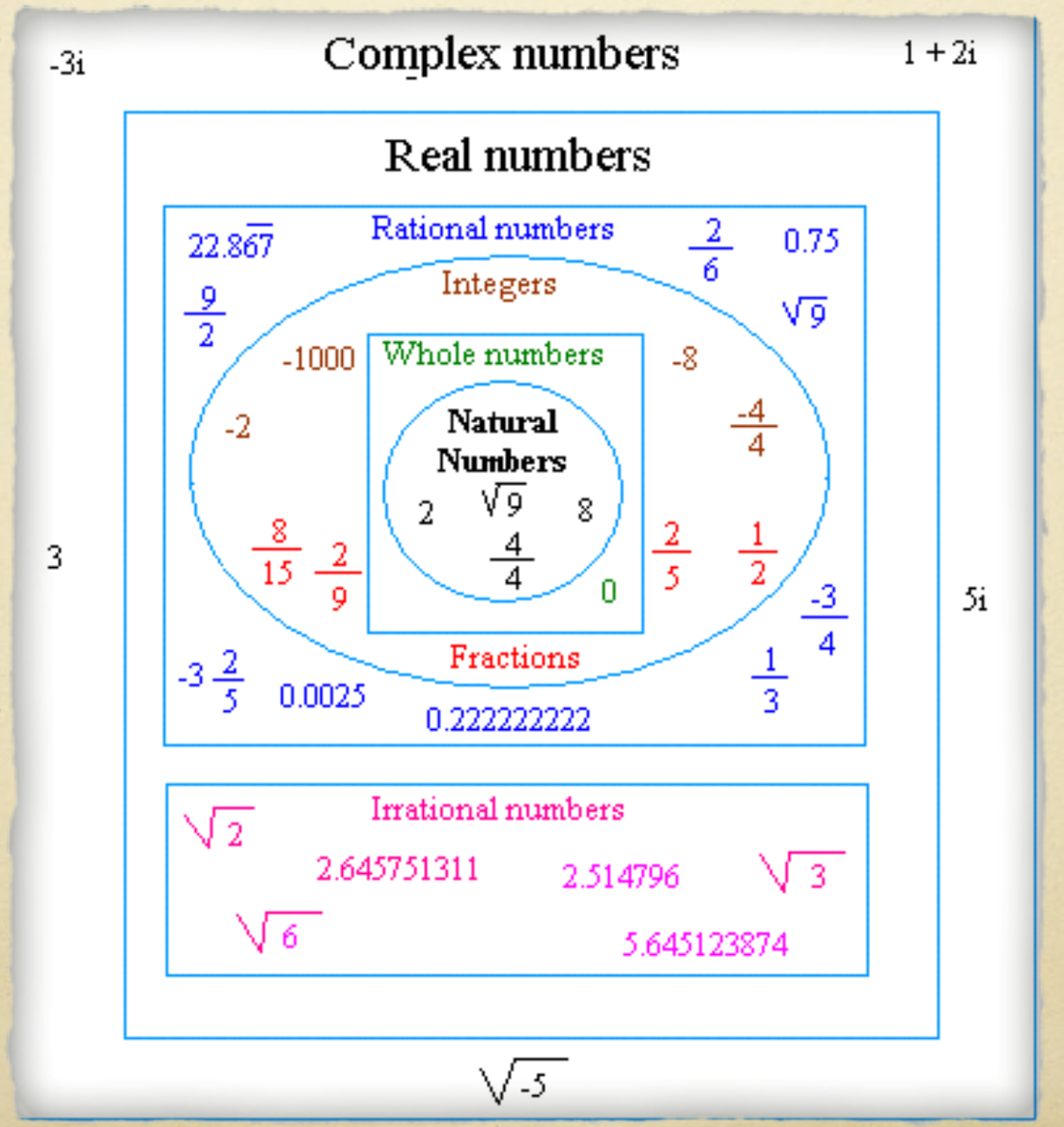
SCHEMES of diagrammatic representation have been so familiarly introduced into logical treatises during the last century or so, that many readers, even of those who have made no professional study of logic, may be supposed to be acquainted with the general nature and object of such devices. Of these schemes one only, viz. that commonly called "Eulerian circles," has met with any general acceptance. A variety of others indeed have been proposed by ingenious and celebrated logicians, several of which would claim notice in a historical treatment of the subject; but they mostly do not seem to me to differ in any essential respect from that of Euler. They rest upon the same leading principle, and are subject all alike to the same restrictions and defects




Black stripes
Mammals
(have hair, give milk)
Ungulates
(have hooves, chew cud)
Carnivores
(eat meat, have pointed teeth, have claws, have forward eyes)
Zebra
Tiger
Cheetah
Giraffe
Dark spots
Tawny colour
Long neck


KINGDOM
ANIMALIA
PHYLUM
CHORDATA
CLASS
MAMMALIA
ORDER
CARNIVORA
FAMILY
Felidae
Canidae
Ursidae
GENUS
Felis
Panthera
Canis
Ursus
SPECIFIC EPITHET
catus
pardalis
pardus
familiaris
lupus
arctos
horribilus

Venn Diagram extreme edition:
How numbers get Organized
We are only looking at the ones in the center circle



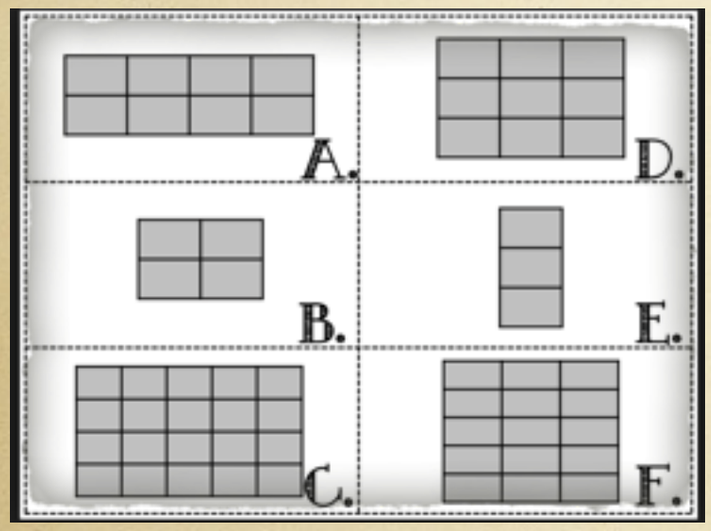
So how do we Build a Number Zoo?

Numbers are labeled: 1, 2, 3, 4….

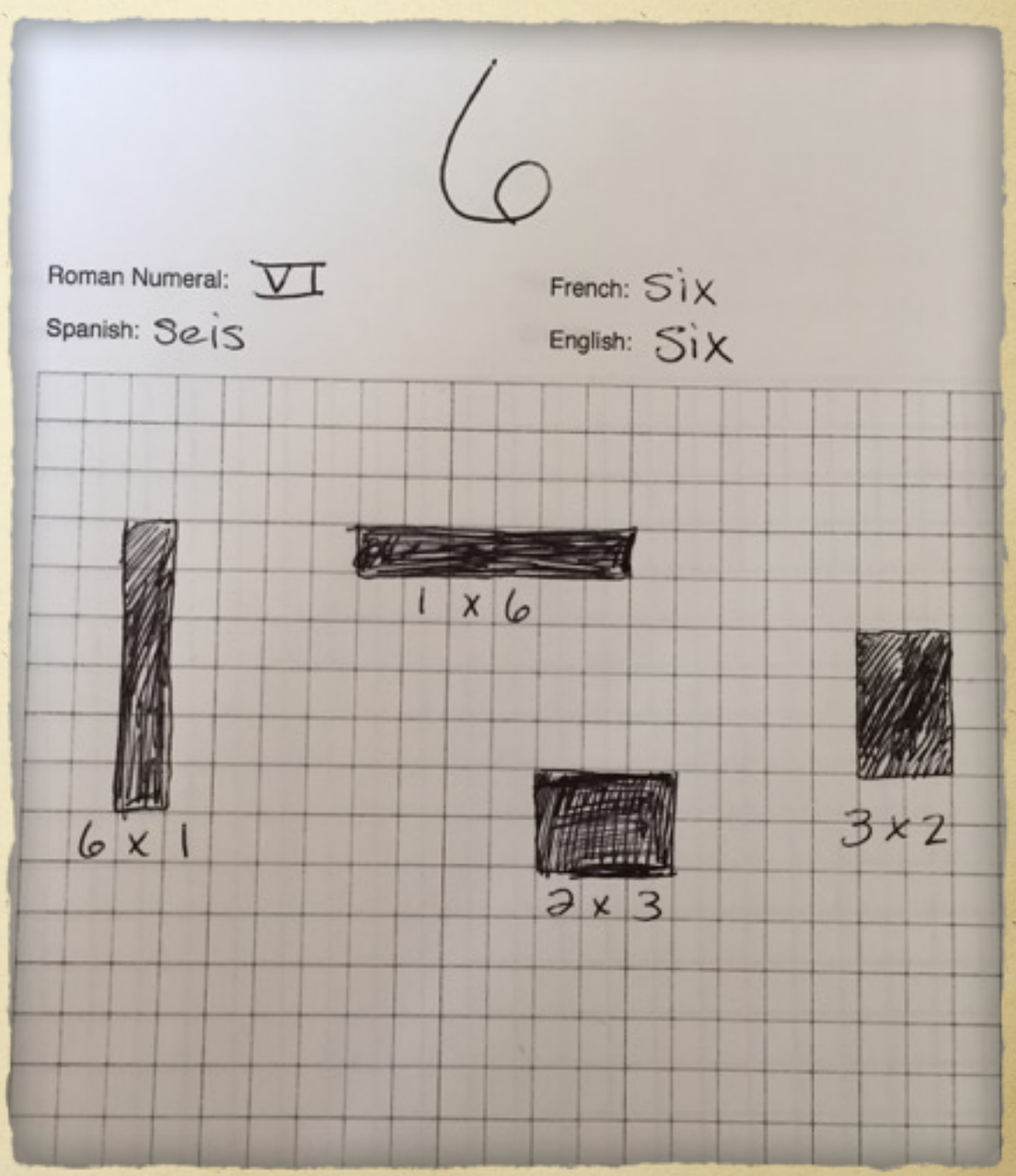
But we need something physical
features to consider.

Recall and Apply some 2nd Grade Skills

from: Step into 2nd Grade with Mrs. Lemon
http://www.stepinto2ndgrade.com/2012/04/i-spy-arrays.html



A. 2x4 D. 3x3
B. 2x2 E. 3x1
C. 4x5 F. 5x3



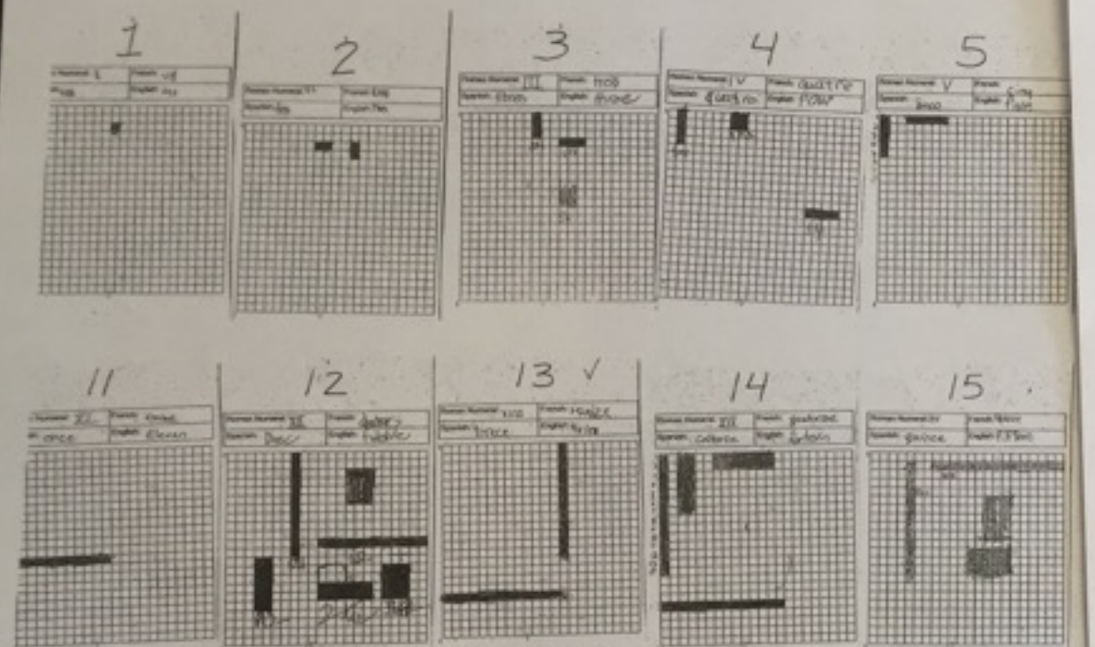
Using our 2nd Grade Array Skills, we first construct the animals in the Number Zoo.

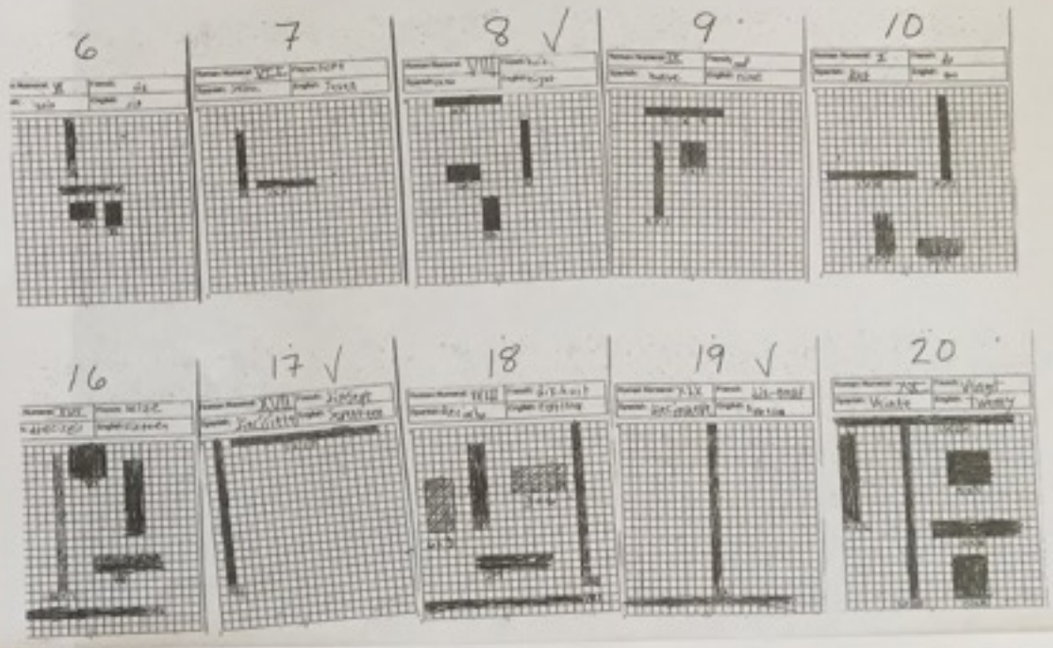
Now lets organize the “animals”.

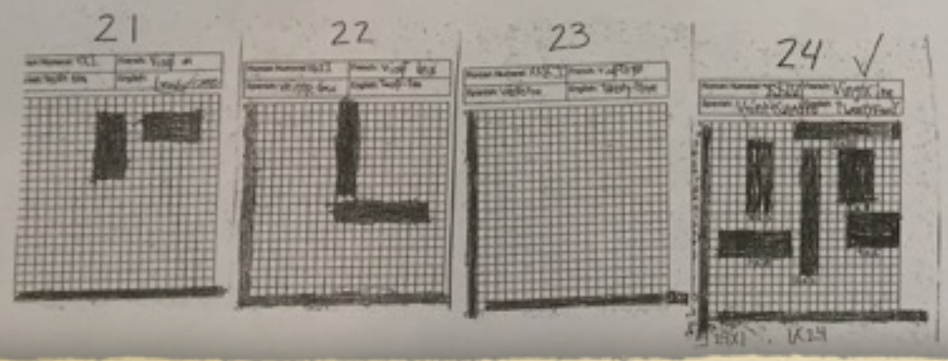
Assemble the Zoo by ordering the numbers 1-10 and starting the next row 11-20 and so on.

Next take some time to Analyze it.

* *Count factors
* *Note physical attributes and similarities
* *Look for patterns







Number Zoo
by 3rd Graders

Discuss

- The number of arrays is the same as the number of factors. Which numbers have the most factors?
- What do you notice about prime numbers?
- Choose two numbers - are they similar, different?
- What's interesting about the square numbers?

Definition of these terms is directly related to the physical features of the arrays for the numbers in the zoo..

Square
Abundant
Deficient
Perfect
Odd
Even

Prime
Twin Prime
Multiples of __
Factors of __

Creative Writing starts.

Make a team of 3-5 individuals from the Numbers in the Zoo. Who did you pick and why would they be a good team?

Choose two numbers you think could be good friends. Write a note to them telling them why.

1 is not now considered a prime number. Do you think it should be, or not? Write down your reasoning.

Back to the Big Ideas

- Goldbach's conjecture: Is every even number the sum of two prime numbers? Is this True or False or unknowable; offer your reasoning.

- Find some twin Primes in the zoo….do you think there are there an infinite number of twins? Why/why not.

Abundant, Perfect or Deficient are terms taught in middle school.

Find abundant, perfect and deficient #s in the zoo

- Abundant applies to a number if its proper divisors (factors including 1, but not including the number itself) are such that the sum of those divisors is greater than the number.
- Perfect numbers have have proper divisors that add up to the number. $6=1+2+3$
- Deficient numbers have proper divisors that add up to less than the number: $1+3 = 4$; $4<9$

Studies are written on subsets of these. Read some of this one— what is the author trying to do?

Odd Abundant Numbers

JAY L. SCHIFFMAN
http://www.rowan.edu/colleges/csm/departments/math/facultystaff/schiffman/More%20Odd%20Abundant%20Seq.pdf

The natural numbers can be divided into three types, the *abundant*, *deficient*, and *perfect* numbers. If $\sigma(n)$ denotes the sum of all the positive divisors of n (including 1 and n), then n is classified as *deficient* if $\sigma(n) < 2n$, *perfect* if $\sigma(n) = 2n$, and *abundant* if $\sigma(n) > 2n$. For example, 5 is deficient ($\sigma(5) = 1 + 5 = 6 < 10 = 2 \times 5$), 28 is perfect ($\sigma(28) = 1+2+4+7+14+28 = 56 = 2 \times 28$), and 12 is abundant ($\sigma(12) = 1+2+3+4+6+12 = 28 > 24 = 2 \times 12$). Empirical evidence might erroneously lead us to believe that all the positive odd integers are deficient, particularly if the search did not exceed 500. Indeed, odd abundant numbers exist with 945 as the first member. The purpose of this article is to explore the sequence $u_n = 945 + 630n$ for the initial 52 values of n $(0 \le n \le 51)$. What transpires is rather curious and remarkable; our formula always generates an odd abundant number. In a manner similar to E. B. Escott's prime generating formula, $f(n) = n^2 - 79n + 1601$, which produces prime outputs for the initial 80 whole numbers (Escott's formula fails when $n = 80$ which yields the composite output $1681 = 41^2$), our formula fails when $n = 52$.

http://www.rowan.edu/colleges/csm/departments/math/facultystaff/schiffman/More%20Odd%20Abundant%20Seq.pdf

Additional Activities

In Handouts

Pascal's Triangle, a different arrangement of numbers. See what kind of patterns emerge.

Find Prime Numbers-the Sieve of Eratosthenes. Do you think there are an infinite number of primes?

MATHHAPPENS.ORG

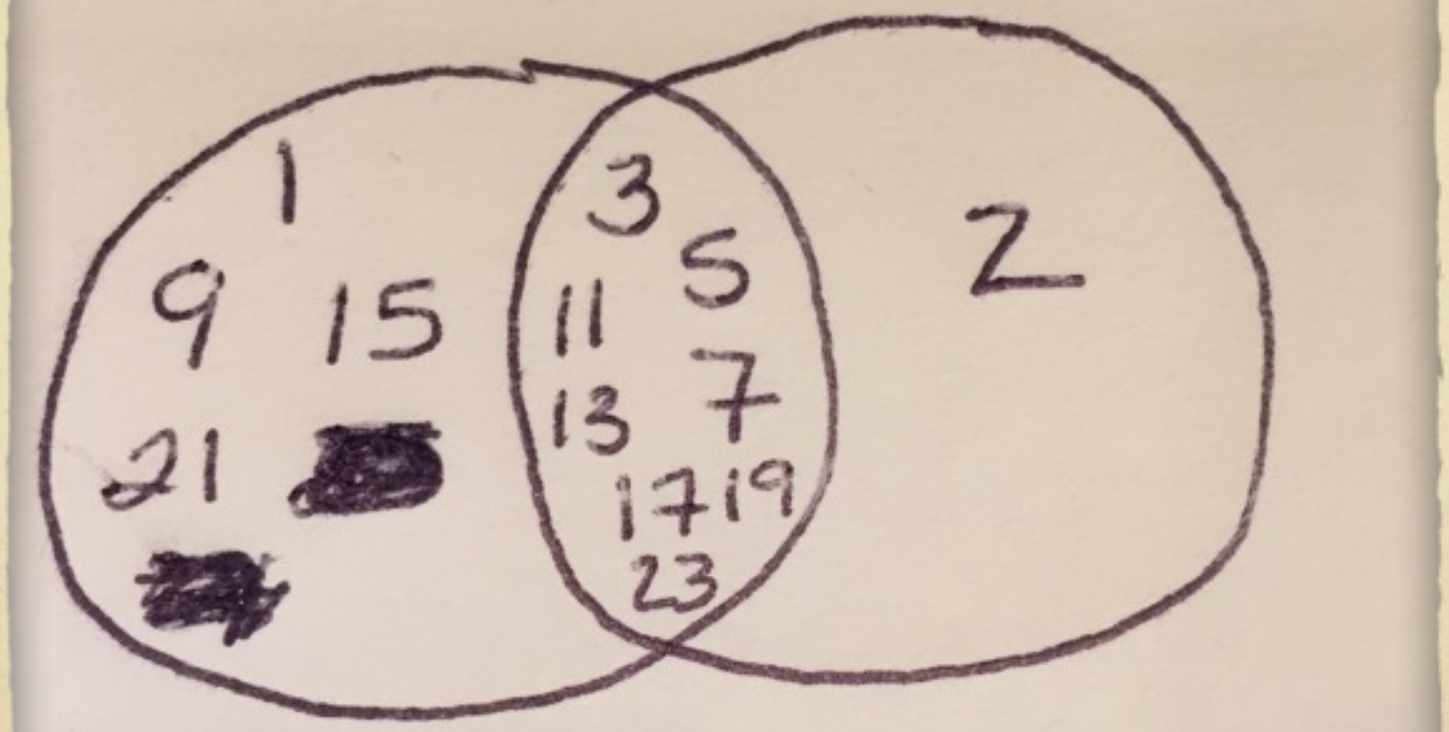
We'd like to help you enhance the M in your STEM

Capture Recapture

A classic math problem originating in nature studies.

Catch some fish - say 100
Tag them and release
Wait some time
Catch another 100 fish
If 10 of those fish are tagged you can estimate
that the lake has 1000 fish in it.

VENN



odd
#s

prime
#s

FOSS Build a Car

Table 1

Car Production			
Item	Cost per Unit	Number of Units	Sub -Total
Wheels - big or small?			
Platform			
Clips			
axels green or clear?			
Whole Car		Total Cost	

Sample Questions

How much does your car cost?

If you made 25 cars how much?

If the cost of the wheels you like doubled, by how much would your car change cost?

If you make 1000 cars, your materials go down in cost by 30% except for the binder clips. How much is each unit?

The End