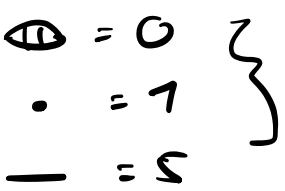
Puzzles

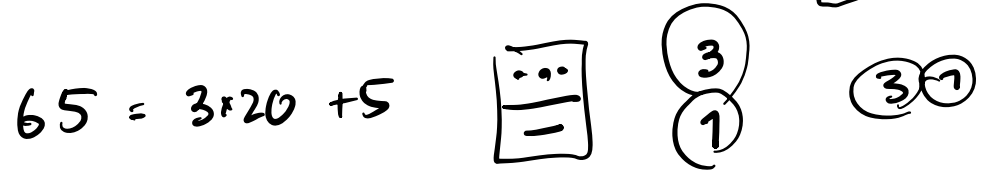
There are three doors. Behind one is a duck & a chicken, behind a second are two ducks & behind the third are two chickens. The doors are closed, and on each door there is a sign describing which animals are behind it.

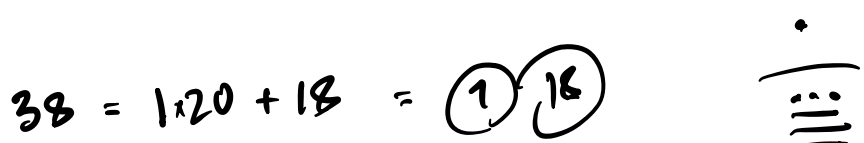
But – all the signs are wrong!

If you open a door & wait, one animal will come out. But you can't see who else is in the room. How many animals do you need to release to find out who was in which room?

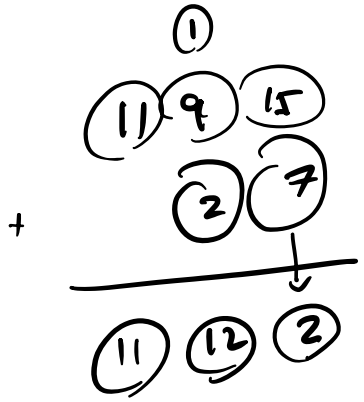
Mayan system







(11)(9)(15) + (2)(7)



Positional #systems (w/ bases)

ex: base 5:

(2)(3) = 2×5 + 3 = 13

(4)(2)(1) = 4×5² + 2×5 + 1 = 111

ex: base 2:

1 = (1)

2 = (1)(0)

3 = (1)(1)

4 = (1)(0)(0)

(1)(1)(0)(1)(1) = 1×16 + 1×8 + 1×2 + 1 = 27

Binary = base 2 Octal: base 8

Hexidecimal = base 16

Colors is HTML/CSS RGB

1 (1)	(10) A	FFF	white
2 (2)	(11) B	ϕϕϕ	black
	⋮	Fϕϕ	red
	(15) F	ϕϕF	Blue
		F51	Pumpkin.

10 (1)(0) = 16

(2)(3) = 2·16 + 3 = 35

0 1 bit

byte = 8 bits 8 digit binary #

256 = 16^2

So far: concepts & language of counting numbers

$\mathbb{Q}$ { 0, 1, 2, 3, ... } $\mathbb{N}$

{ other number system concepts } $\mathbb{Z}$ integers

- negative numbers
- fractions ⟶ Egyptian fractions $\frac{5}{8}$

$\frac{2}{3}$ $\frac{1}{8}$ $\frac{1}{3}$ $\frac{1}{7}$

$2x^2+3x-5=0$

$x=\ldots$

$ax^2+bx+c=0$

$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$ax^3+bx^2+cx+d=0$

$x=$ huge thg ... Cardano

$ax^4+bx^3+cx^2+dx+e=0$ yes!

Fifth pow? Evariste Galois
proved impossible!

Real #s (w/ decimal representations)

$\mathbb{R}$ (rat'l & irrationals)

$\mathbb{C}$ complex #s. $a+bi$ $i^2=-1$

$\mathbb{H}$ Quaternions $a+bi+cj+dk$

Conceptual need ⟹ introduce language & rules/axioms
to allow reasoning & communication
which is internally consistent.

sufficient? fit the need?
efficient?
consistent?

Euclid's Elements of geometry

Cantor's theory of sets.