Seminar on

Ancient Egyptian Mathematics

Presented by

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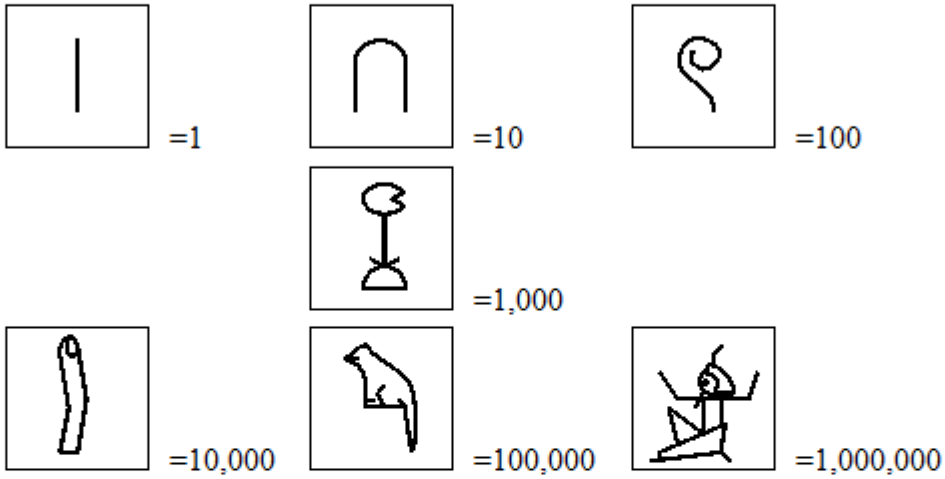
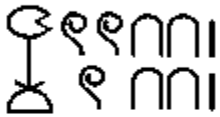
Overview

- Inspiration
- Number System
- Arithmetic Operations
  - Addition and Subtraction
  - Multiplication and Division
- Fractions
- Some Numericals
- Trivia
  - Golden Ratio at Giza
  - Egyptian Calendar

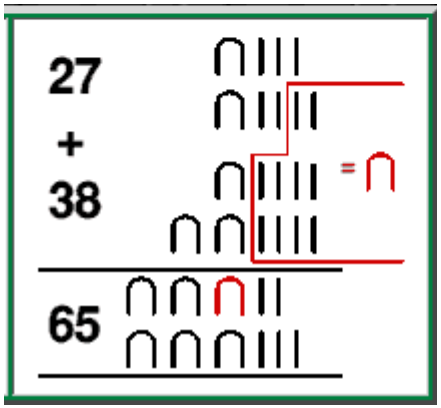
Number System[1]



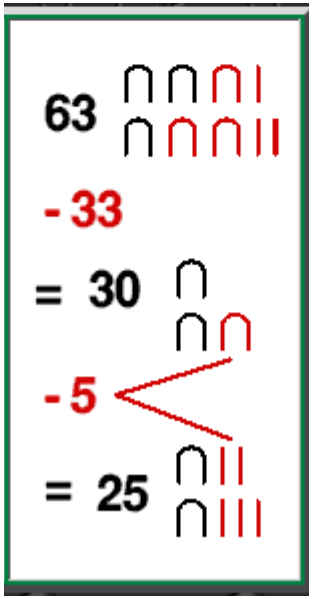


=?

Addition



Subtraction



Multiplication[2]

41	59
1	59
2	118
4	236
8	472
16	944
32	1888

64>41….so no further “doubling” required
41-32=9
9-8=1
Therefore, 41=32+8+1

41 = 1.2^0 + 0.2^1 + 0.2^2 + 1.2^3 + 0.2^4 + 1.2^5

Division[2]

1	65
2	130
4	260
8	520
16	1040

1. 1495/65
   16+4+2+1=23
   1495/65=23

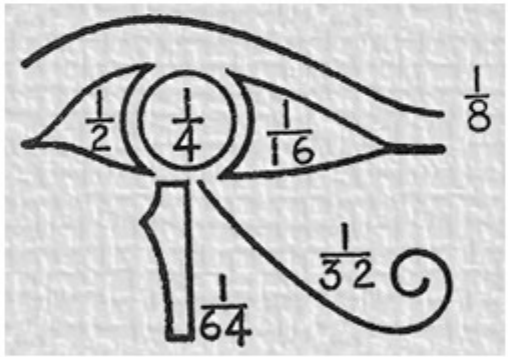
2. 1500/65

   $1500-65 < n \leq 1500$

   16+8+2+1=23
   remainder=5
   1500/65=23 1/13

Fractions[1][2]

- Only unit fractions
- 2/3 being the exception
- Use of the ‘Eye of Horace’
- All fractions denoted as sums of unit fractions



‘Method of False Position’

- Take a first guess

  $x + x/4 = 15$

- Multiply to get desired result

Some Numericals[1]

Problem 50. A round field has diameter 9 khet. What is its area?

Solution by Ahmes (Rhind Papyrus):

- Take away 1/9 of the diameter, namely 1; the remainder is 8.
- Multiply 8 times 8; it makes 64.
- Therefore it contains 64 setat of land.
- The solution equivalent to taking

$$\pi = 4(8/9)^2 = 3.1605$$

Example 14. Example of calculating a truncated pyramid.

Base square side: 4 cubits, Top square side: 2 cubits, Height: 6 cubits.

Area of the base: 4 x 4 = 16

- Area of the top 2 x 2 = 4.
- Product of the side of the base with the side of the top is computed: 4 x 2 = 8.
- The three added: 16 + 4 + 8 = 28
- 1/3 of the height: 2
- the product : 56
- $V = h\,(a^2 + ab + b^2)/3$

Trivia[3]

Great Pyramid:

- The faces at 51° 50' 35“ with base. The secant 1.61806 remarkably close to the golden ratio 1.618034.
- Cotangent of the slope angle of 51° 50' 35" is very close to π/4.
- A numerical coincidence: the square root of the golden ratio times π is close to 4, in fact this product is 3.996168.

Calendar

- The beginning of the year was chosen as the heliacal rising of Sirius, the brightest star in the sky.
- The Nile flooded shortly after this. The year computed to be 365 days long
- A more accurate value of 365 1/4 days worked out for the length of the year but the civil calendar never changed

References

1. http://www.gap-system.org/~history/HistTopics/Egyptian
2. http://math.suite101.com/article.cfm/the_mathematics_o
3. The Impressive Numerical History of an Ancient Civilization by Isaac M. McPhee