

Learn Math like an Ancient Egyptian

Respective blueprint	Egyptian Numbers
Description	Learn the history of how Ancient Egyptians represented different values and fractions and used different strategies to solve addition, subtraction, multiplication, and division problems involving whole numbers.
Learning Objectives	For students to become familiar with: <ul style="list-style-type: none"> • Egyptian Hieroglyphs for different values • The meaning of an Egyptian Fraction • Compare two fractions without finding common denominators
Related curricular subject(s)	Mathematics, Art
Prerequisites / preparatory actions for teachers	Teachers should make sure that pupils are familiar with addition, subtraction, multiplication, division, and fractions. In addition, students should be familiar with the concept of common denominators.
Prerequisites / preparatory actions for students	Students should know: <ul style="list-style-type: none"> • To make basic calculations

	<ul style="list-style-type: none"> ● Explain the use of fractions ● Basic calculations between fractions
Age of students	10-12 years old
Duration	45 minutes
Level of difficulty	Low

Step by step description of the tasks

Step 1:

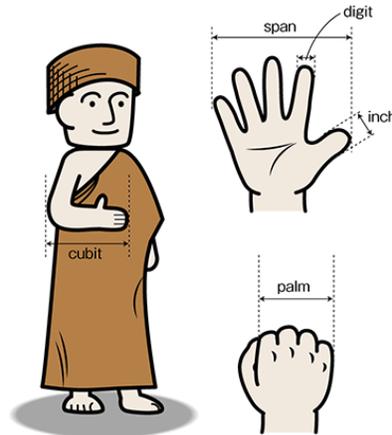
How did Egyptians come up with this numerical system?

The early Egyptians settled along the fertile Nile valley as early as about 6000 BCE. They began to record the patterns of lunar phases and the seasons, both for agricultural and religious reasons.

The Pharaoh's surveyors used measurements based on body parts (a palm was the hand's width, a cubit the measurement from elbow to fingertips) to measure land and buildings very early in Egyptian history.

A decimal numeric system was developed based on our ten fingers. The oldest mathematical text from ancient Egypt discovered so far is the Moscow Papyrus, which dates from the Egyptian Middle Kingdom around 2000 – 1800 BCE.

Units of length derived from the hand



Source: hitachi-hightech.com

How did Egyptians represent different values?

The Egyptians had a writing system based on hieroglyphs from around 3000 BC.

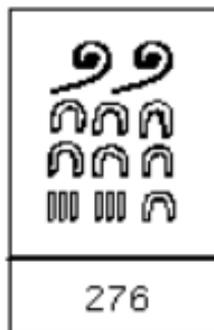
Hieroglyphs are small pictures representing words.

The Egyptians had a base-ten (10) system of hieroglyphs for numerals. By this, we mean that they had separate symbols for one unit, one ten, one hundred, one thousand, one ten thousand, one hundred thousand, and one million.

1	10	100	1000	10000	100000	10 ⁶
Egyptian numeral hieroglyphs						

Picture Source: https://mathshistory.st-andrews.ac.uk/HistTopics/Egyptian_numerals/

To make up the number 276, for example, fifteen symbols were required: two "one hundred" symbols, seven "ten" symbols, and six "single unit" symbols. The numbers appeared thus:



Picture Source: https://mathshistory.st-andrews.ac.uk/HistTopics/Egyptian_numerals/

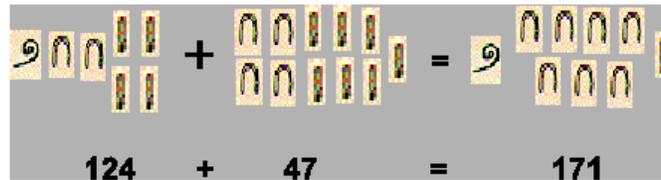
Step 2: Basic Calculations

Addition / Subtraction

The techniques used by the Egyptians for these are essentially the same as those used by modern mathematicians today. The Egyptians added by combining symbols. They would combine all the ones units (|) together, then all of the tens () together, then all of the hundreds (), etc. If the scribe had more than ten units (|), he would replace those ten units by  . He would continue to do this until the number of units left was less than ten. This process was continued for the tens, replacing ten tens with  , etc.

Multiplication

The Egyptians' multiplication method is very intuitive but can take longer than the modern-day method. This is how they would have multiplied **5** by **29**.



Picture Source: <https://www.math.tamu.edu/~don.allen/history/egypt/node2.html>

*1	29
	258
*4	116
1 + 4 = 5	29 + 116 = 145

They would begin with the number they were multiplying by 29 and double it for each line when multiplying. Then they went back and picked out the numbers in the first column that added up to the first number (5). They used the distributive property of multiplication over addition.

$$29*(5) = 29*(1 + 4) = 29 + 116 = 145$$

Division

The way they did division was similar to their multiplication. For the problem $98/7$, they thought of this problem as 7 times some number equals 98. Again, the problem was worked in columns.

1	7
2	*14
4	*28
8	*56
$2 + 4 + 8 = 14$	$14 + 28 + 56 = 98$

This time the numbers in the right-hand column are marked, which sum to 98, then the corresponding numbers in the left-hand column are added to get the quotient.

So the answer is 14. $98 = 14 + 28 + 56 = 7(2 + 4 + 8) = 7*14$

Step 3:

Fractions

Fractions have a long history of use in mathematics, but they have not always been written as we see them today. About 5,000 years ago, the Egyptians represented fractions using symbols like these:



The  shape means part, and the marks indicate the parts

of the whole, so  represents $\frac{1}{3}$

For the most part, the Egyptians used only **unit fractions** (a fraction with the number 1 as the numerator). One of the few fractions that existed in a form rather than a unit fraction was $\frac{2}{3}$. It was represented like this: 

Furthermore, fractions were represented without repeating the same fractions by using sums of progressively smaller fractions. For example, $\frac{5}{9}$ would not be represented as $\frac{1}{9} + \frac{1}{9} + \frac{1}{9} + \frac{1}{9} + \frac{1}{9}$ but as $\frac{1}{2} + \frac{1}{18}$.

Assessment activities

The teacher could make the following questions to evaluate the activity:

Question 1:

Convert these Egyptian hieroglyphs into modern day numbers

1		<input type="text"/>
2		<input type="text"/>
3		<input type="text"/>
4		<input type="text"/>
5		<input type="text"/>
6		<input type="text"/>
7		<input type="text"/>
8		<input type="text"/>

Picture Source:

http://www.primaryresources.co.uk/history/pdfs/egyptian_maths_problems.pdf

Question 2:

Determine an Egyptian fraction for $5/9$.

Question 3:

Make the following calculations with the Egyptian method.

- $18 * 85 =$
- $12 * 25 =$
- $35 * 24 =$

Solution:

18*	85
1	85
2	170
4	340
8	680
16	1360

$16 + 2 = 18$ so we add $170 + 1360 = 1530$

Question 4:

If  pyramids have  bricks

How many bricks are needed to build  pyramids?

Decode:

$$\begin{aligned} \text{If 3 pyramids have } & 1000 + (5 * 100) + (7*10) + 2 = \\ & = 1000 + 500 + 70 + 2 = 1572 \text{ bricks} \end{aligned}$$

How many bricks are needed to build 5 pyramids?

Solution:

3 pyramids -> 1572 bricks



5 pyramids -> ? bricks

$$3 * x = 5 * 1572 \Rightarrow 3x = 7860 \Rightarrow x = \frac{7860}{3} = 2620 \text{ bricks}$$

are needed