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OER Ancient Egyptian Numerals and Arithmetic Activity

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Egyptian Scribal School:
An Egyptian Arithmetic Activity

by

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Supplies:

- 2 sheets of letter size (8.5 by 11 inches) paper per student, if available choose a color or texture to mimic papyrus
- Clipboard for each student (optional)
- Fine point black marker to mimic brush and ink

Introduction

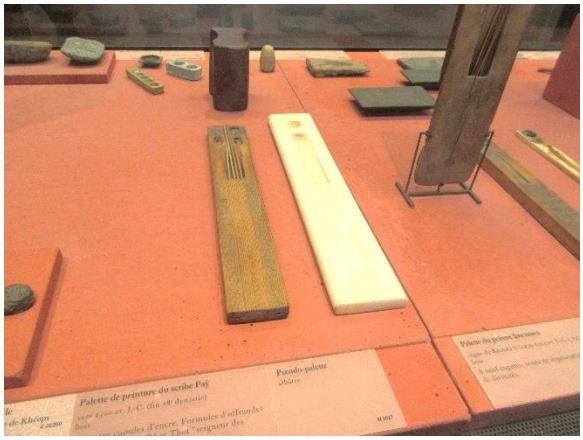
Many people are fascinated with ancient Egypt. The amazing, unique culture influenced many other civilizations and cultures. If you study the history of math, you will see how this influence included mathematics. Ancient Egypt also lasted an incredibly long time – over 3000 years. According to Egyptologist Bob Brier, "No civilization lasted so long, contributed so much, or repeatedly amazed as did ancient Egypt."

In this activity, students will have the opportunity to learn about ancient Egyptian numerals and basic arithmetic. For motivation, the setting is a scribal school with each student using a clipboard, paper, and fine point black marker to simulate a board, papyrus, and brush with ink. The activity can also be completed on its own without the scribal school setting.

Egyptian Scribes

Egyptian scribes, some of the few literate people in ancient Egypt, were responsible for keeping records and accounts, writing letters, and recording events. According to *The Teaching of Khety* [T. Wilkinson, p. 289-299], an ancient Egyptian text of a father's advice to his son, the vocation of scribe is a desirable one and "there is no job without a boss except for the scribe." Khety explained that being a scribe had advantages over other professions, such as not smelling like the smith ("who stinks more than fish roe") and the stoker ("his fingers are putrid and smell of

corpses"), not having to watch out for crocodiles like the fisherman and washerman, not having to be out in the weather like the reed cutter, arrow maker, and messenger, or not having to do back-breaking work like the gardener, mason, and farmer. Photos of several examples of scribes at work and scribal tools are given below. Boys might enter a scribal school as young as four years old and stay in school about 12 years.



Various photos of scribes and their tools in the Louvre.

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Introduction to Egyptian Numeric Hieroglyphs

Counting numbers were a crucial part of the centralized government of ancient Egypt, since the bureaucracy needed to keep records of many things including inventories, workers, time, and taxes. The Egyptians used an additive decimal system with symbols for the powers of ten from 0 to 6, in which like symbols were grouped together in descending order, and often stacked for aesthetics. If the writing was in columns, the hieroglyphs were to be read from top to bottom. If written horizontally, the hieroglyphs were meant to be read toward faces. Thus, they might be read left to right or right to left.

In the picture below, which is from the Edfu temple, we can see six of the seven hieroglyphs that are used in creating natural numbers.

1,333,330 in Egyptian hieroglyphs from the Edfu temple in Egypt.

The hieroglyph on the left is the Egyptian god Heh (chaos or infinity) representing a million. Next a tadpole hieroglyph represents 100,000. The bent finger hieroglyph is 10,000, the lotus flower is 1000, the coil of rope is 100, and the hobble (used for cattle and missing the crossbar) is 10. Reading from left to right, the hieroglyph number is 1,333,330. The one missing numeric hieroglyph symbol in the photo is the stroke or tally mark for 1.

A roughly 45 minute video by the author with more information on Egyptian numeric hieroglyphs can be found at https://youtu.be/WlKMSspU8DM, while a short (less than 3 minutes) video on Egyptian numeric hieroglyphs by the author is at https://youtu.be/TDmeLJugtsY.

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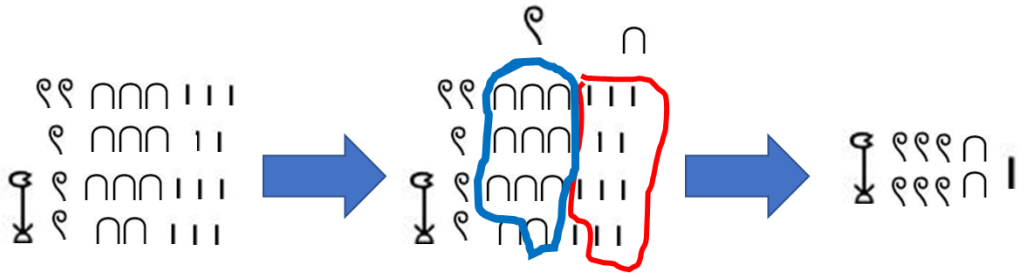
Introduction to Egyptian Arithmetic

Addition

Addition is carried out by writing down each number, combining like symbols, and trading any ten of a particular hieroglyph for the next up power of 10. For example, if there are ten or more hobbles, replace ten hobbles ∩ with a coil of rope 𓆼 .

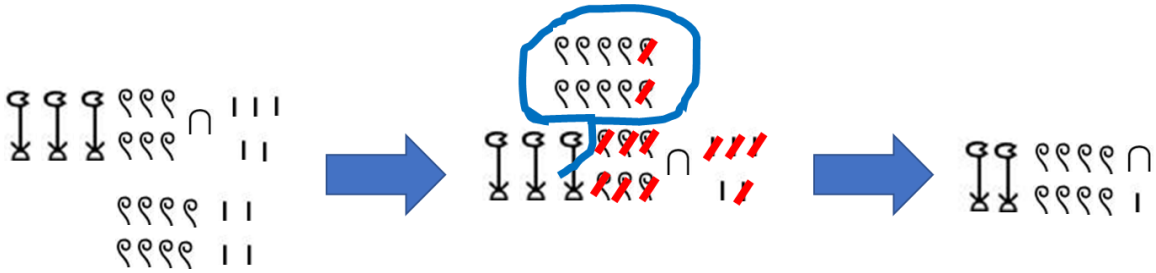
Example: Adding 365 + 1256 like an Egyptian.



Subtraction

To subtract, write down the numbers and take away the hieroglyphs in the subtrahend from the minuend, "borrowing" as in the modern-day algorithm, as needed. For example, if subtracting 8 coils of rope from 6, trade a lotus flower in the minuend for 10 coils of rope.

Example: Subtracting 3615 – 804 like an Egyptian.



Multiplication

Egyptians multiplied by doubling and adding, and occasionally multiplying by 10. To multiply two numbers, start with two columns: the first column with 1 and the second column with the larger of the two factors that are being multiplied. Next form another row by doubling each of these. To double with Egyptian numerals, the number is just written down twice and whenever needed 10 of a particular hieroglyph is traded in for the next symbol up. Continue the process until the number in the first column is as large as it can be without surpassing the second factor.

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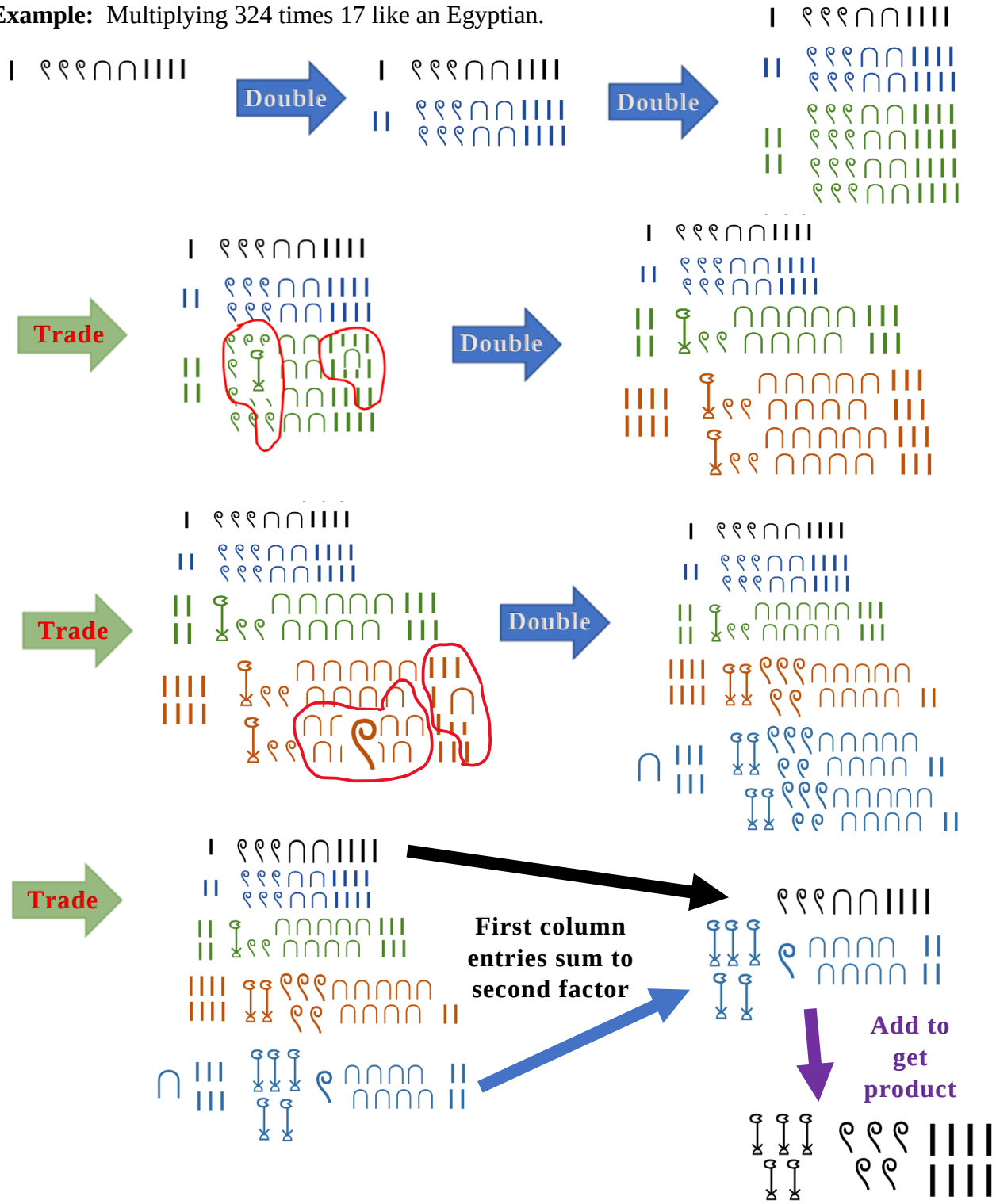
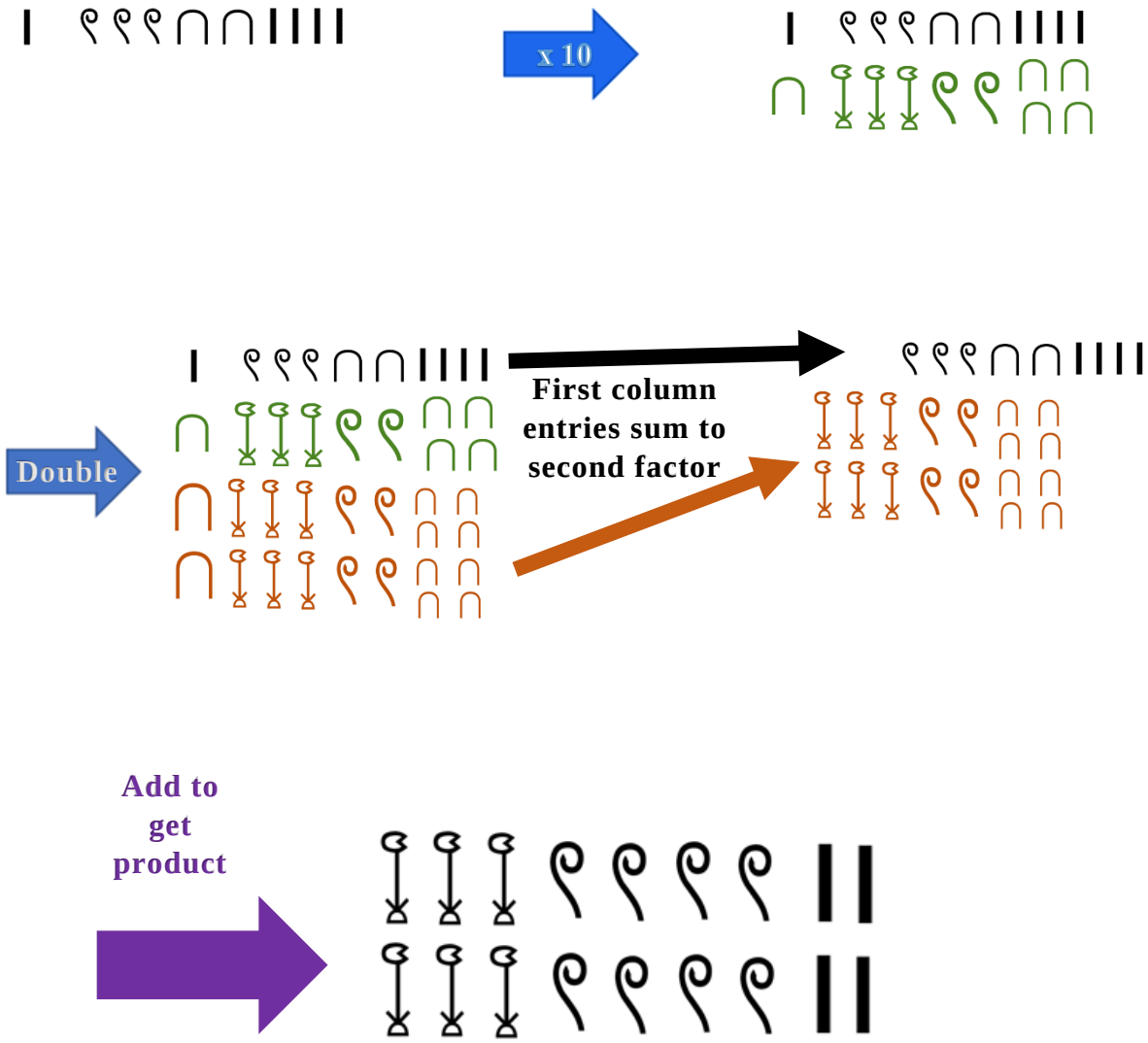
Then select the numbers in the first column that sum to the second factor. (Such a unique sum will always exist since it is essentially writing the second factor in binary notation.) The product will be the sum of the corresponding numbers in the second column.

Example: Multiplying 324 times 17 like an Egyptian.



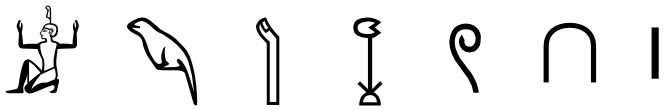
Example: Multiplying 324 times 21 like an Egyptian.



A video working through the examples from this section can be found at https://www.youtube.com/watch?v=jKEPAhuf5Pw .

Activity A video demonstrating the activity can be found at https://youtu.be/HaIKMuZQRPY

Task 1: To start the activity, ask the students to write the seven numeric hieroglyphs across the top of a page of paper. You can either have the numerals displayed on the board or have a handout with the symbols on it for each student. If desired, you can have the students practice writing the numeric hieroglyphs multiple times.



Task 2: Write the following numbers in Egyptian hieroglyphs.

426

2018

12113

Task 3: Add the following numbers in Egyptian hieroglyphs.

$426 + 2018$ $12113 + 3099$

Task 4: Subtract the following numbers in Egyptian hieroglyphs.

$12113 - 8099$

Task 5: Multiply the following numbers in Egyptian hieroglyphs.

12345×13

Task 6: Multiply the following numbers in Egyptian hieroglyphs.

127×23

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References

Brier, Bob. 2016. *Decoding the Secrets of Egyptian Hieroglyphs.* The Teaching Company.

Huffman, Cynthia J. (Pittsburg State University), "An Ancient Egyptian Mathematical Photo Album," *Convergence* (April 2022), https://www.maa.org/press/periodicals/convergence/an-ancient-egyptian-mathematical-photo-album-hieroglyph-numerals-and-more.

Huffman, Cynthia J. (Pittsburg State University), "Egyptian Numerals: Up Close and Personal," *YouTube*, video (<45 minutes) of a colloquium presented on August 24, 2021, https://youtu.be/WlKMSspU8DM.

Huffman, Cynthia J. (Pittsburg State University), "Egyptian Numeric Hieroglyphs," *YouTube*, short (<3 minutes) video created for an Online Learning Consortium workshop, https://youtu.be/TDmeLJugtsY

Huffman, Cynthia J. (Pittsburg State University), "Math Like an Egyptian," *YouTube*, a video (<16 minutes) investigation of Egyptian numerals, arithmetic, and fractions through the role of a student in an Egyptian scribal school, https://youtu.be/HaIKMuZQRPY.

Huffman, Cynthia J. (Pittsburg State University), "Some Ancient Egyptian Arithmetic," *YouTube*, short (<12 minutes) video on addition, subtraction, and multiplication using hieroglyphs and methods of ancient Egypt, https://youtu.be/jKEPAhuf5Pw

Imhausen, Annette. 2016. *Mathematics in Ancient Egypt: A Contextual History*. Princeton: Princeton University Press.

Reimer, David. 2014. *Count Like an Egyptian*. Princeton: Princeton University Press.

Rosmorduc, Serge. 2014. *JSesh Documentation*. Last modified 13 January 2022. Accessed 23 July 2022. http://jseshdoc.qenherkhopeshef.org.

Wilkinson, Toby, trans. and intro. 2017. *Writings from Ancient Egypt*. London: Penguin Group USA.

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