

Jen Cipriano

Wake Forest University

TOPIC: Egyptian Math**NCTM STANDARDS:** Algebra, Geometry, Problem Solving, Reasoning, Connections**GOALS:**

- Students will use the Internet to complete a guided WebQuest on Egyptian numerals.
- Students will use geometry and algebra to solve problems about the Great Pyramid.
- Students will review geometry concepts including area, surface area, and volume.
- Students will compare and contrast Egyptian numerals with our current number system.

INTRODUCTION:

The Ancient Egyptians were one of the first civilizations to practice scientific arts, and were especially interested in applied mathematics. This meant that unlike other civilizations who delved in abstract mathematical thinking, the Egyptians were much more concerned with practical arithmetic, or what we might think of today as real world applications. Their earliest numerals were hieroglyphics, and all numbers could be expressed by seven symbols. This activity explores Egyptian numerals through word problems about pyramids, perhaps one of the greatest legacies of Ancient Egypt.

ACTIVITIES:

- Part 1. Egyptian Numerals - Students use the Internet to learn about Egyptian numerals.
- Part 2. Pyramid Problems – Students work in groups to solve word problems about the Great Pyramid. They must decipher Egyptian numerals in the process.
- Part 3. Extension - Students discover a method for adding and subtracting Egyptian numerals and compare and contrast this method to our number system.

ASSESSMENT:

Students should be assessed on their work and answers to Part 2, as well the clarity of their reasoning in Part 3.



RESOURCES:

Discovering Ancient Egypt - <http://www.eyelid.co.uk/index.htm>


Egyptian Math

Part 1: Egyptian Numerals

Go to <http://www.eyelid.co.uk/numbers.htm> and complete the following table of Egyptian numerals:

Number	Symbol	Description
1		
		
		Coil of rope
		Lotus plant
10,000		
100,000		
		

Convert the following Egyptian numerals to numbers:

(1)  = _____

(2)  = _____


Convert the following numbers to Egyptian numerals:


(3) 32,402 = _____



(4) 1,000,430 = _____



Part 2: Pyramid Problems



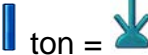

Answer the following questions about the Great Pyramid at Giza. Write your final answer as an Egyptian numeral.

(1) The Great Pyramid at Giza is a square pyramid. The sides of its base measure  feet. How much desert sand does this pyramid cover?

(2) The height of the peak of the Great Pyramid is  feet. If you wanted to climb the side of the pyramid, how many feet would you travel up it?

(3) If it were possible, how many gallons of water could you store inside the Great Pyramid? (Hint:  cubic feet =  gallons). (You do not need to write this answer in Egyptian numerals!)

(4) Suppose the pharaoh decides to paint the Great Pyramid gold. If one gallon of paint covers  square feet, and the pyramid needs  coats, how many gallons would he need to buy?

(5) The pyramid was constructed using approximately  limestone blocks. If each block weighs about  pounds, how many tons does the entire pyramid weigh? (HINT:  ton =  pounds)

Part 3: Extension

Add the following Egyptian numerals without converting them to real numbers. Your final answer should be in the most concise form of Egyptian numerals.

(1)  + 

= _____

(2)  + 

= _____

(3)  + 

= _____

- (4) Explain the method you used to add the numerals. How is this similar to addition of real numbers?








Challenge: Can you subtract the following Egyptian numerals without converting them to real numbers? Show your work and explain your method and how it is similar to real numbers.

 -  = _____

Egyptian Math – Teacher Notes

Part 1: Egyptian Numerals

Go to <http://www.eyelid.co.uk/numbers.htm> and complete the following table of Egyptian numerals:


Number	Symbol	Description
1		Single stroke
10		Hobble for cattle
100		Coil of rope
1,000		Lotus plant
10,000		Finger
100,000		Tadpole or frog
1,000,000		Figure of a god

Convert the following Egyptian numerals to numbers:

(1)  = 202,010

(2)  = 2,352

Convert the following numbers to Egyptian numerals:

(3) 32,402 = 

(4) 1,000,430 = 

Part 2: Pyramid Problems

(1) The Great Pyramid at Giza is a square pyramid. The sides of its base measure **755** feet. How much desert sand does this pyramid cover?

Use Area formula:

$$A = s^2 = 755^2 = 570,025 \text{ ft}^2$$



(2) The height of the peak of the Great Pyramid is **481** feet. If you wanted to climb the side of the pyramid, how many feet would you travel up it?

Use Pythagorean Theorem: (Right triangle is created by height, slant height, and half of the base length)

$$a^2 + b^2 = c^2$$

$$377.5^2 + 481^2 = l^2$$

$$l = 611 \text{ ft}$$



(3) If it were possible, how many gallons of water could you store inside the Great Pyramid? (Hint: **13** cubic feet = **100** gallons) (You do not need to write this answer as an Egyptian numeral!)

Use volume formula:

$$V = \frac{1}{3} s^2 h$$

$$V = \frac{1}{3} (755)^2 (481) = 91,394,000 \text{ ft}^3$$

Convert to gallons:

$$\frac{91,304,000 \text{ ft}^3}{x} = \frac{13 \text{ ft}^3}{100 \text{ gal}}$$

$$x = 703,031,000 \text{ gal}$$

(4) Suppose the pharaoh decides to paint the Great Pyramid gold. If one gallon of paint covers **400** square feet, and the pyramid needs two coats, how many gallons would he need to buy?

Use lateral surface area formula:

$$SA = 2sl$$

$$SA = 2(755)(611) = 922,610 \text{ ft}^2$$

Divide by 400 to get needed gallons and multiply by 2 since you need two coats.

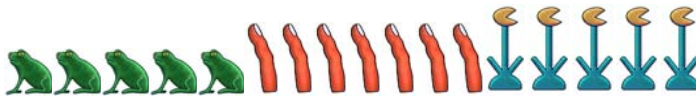
$$x = 4,613 \text{ gal}$$



(5) The pyramid was constructed using approximately **2,300,000** limestone blocks. If each block weighs about **2,500** pounds, how many tons does the entire weigh? (HINT: **1 ton = 1,000** pounds)

$$x = \frac{2,300,000(2,500)}{1,000}$$

$$x = 575,000 \text{ tons}$$



Part 3: Extension

NOTE TO TEACHERS: Believe it or not, the Egyptian numeral system is very similar to the decimal system that we use today! While the Egyptians used pictures instead of actual numbers, both systems are base 10. Challenge students to add two Egyptian numerals without converting them to our number system first. They should group together like symbols. If they have 10 of one symbol, trade them for one of the next highest number...just like adding real numbers! For example, 12 coils become 1 lotus plant and 2 coils. If they get good at this, really challenge them with subtraction and borrowing!

Add the following Egyptian numerals without converting them to real numbers. Your final answer should be in the most concise form of Egyptian numerals.

(1) +

=

(2) +

=

(3) +

=

(4) Explain the method you used to add the numerals. How is this similar to addition of real numbers?

**Group together like symbols, if there are 10 of one symbol, trade them for one of the next highest symbol.

