The History of Mathematics - BBC doc (part2)

http://www.youtube.com/watch?v=eq1dat0jvxs&feature=related

Listen to and watch the video, then decide whether the statements are true or false. Correct the false ones.

1) The Rhind Mathematical Papyrus originated in 1615 B.C.
2) Egyptian workers got money for their work.
3) After the division of bread, each person gets 1 half, 1 third, and one fifth.
4) Egyptians used fractions for practical purposes, e.g. trade.
5) Horus lost both his eyes in a fight.
6) The geometric series appeared first in the Rhind Papyrus.
7) The concept of infinity was also discovered in the ancient Egypt.
8) We do not know how the Egyptians calculated the area of a circle.
9) The Egyptians calculated the value of π to 3.14.
10) The Egyptians used larger shapes to capture smaller shapes.
11) Pyramids are impressive for a mathematician for their symmetry.
12) Pyramids use the concept of the Golden Ratio.
13) The relationship between the longest and the shortest side is the same as the sum of the two to the shortest.
14) Egyptians proved before Pythagoras the right angled triangle.
15) Egyptians used only concrete numbers, they were not looking for general proofs.
16) The surface area of a pyramid was the first attempt at calculus.

Pre-reading

1. What is the abacus? What does it look like?
2. What is mental arithmetic?

Reading.

Read the text and fill in the missing words.

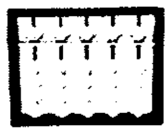
longer	**horizontal**	**Arabic**
trigonometry	**good**	**distinct**
digit	**decimal**	**random**

The SOROBAN

The *soroban* is the Japanese version of the ancient computing device known as the abacus. Historians suggest that it was invented by the Romans. This makes sense to anyone who has attempted arithmetic using Roman numerals. It is far easier to convert to Arabic numbers, compute the result, and convert back.

This is basically what the Romans did. Except that since Arabic numbers didn't exist, the numbers were converted to an abacus-like representation, the calculations were performed, and the result was converted back.

The abacus migrated to China, where it was modified, and on to Japan, where it was modified further. It should be noted that there are Indian, Russian, Korean, and other variants of the abacus. I concentrate on the Japanese variant, the soroban, since it is quite elegant in it's handling of 1. .... arithmetic. The soroban design reached it's modern form around 1920.



I have two instruments - one with five rods and large beads, and one with 27 rods. The smaller one is pictured. Note that it has a 2. .... dividing bar, with a four beads below, and one above. The beads below are worth one each - counting zero through four, and the one bead above is worth five - counting zero or five. Beads gain value when they are placed toward the bar. The soroban is showing all fives.

It works just like 3. .... numbers. The rod on the right is the ones column. The next to the left is tens. This soroban allows one to count from zero to 99,999. Addition, subtraction, multiplication and division are possible. With 27 rods, one can work with 4. .... numbers and multiple numbers at a time, storing temporary numbers, etc.

Once addition, subtraction, multiplication and division are mastered, essentially any computation can be performed. When I first studied this I noticed two very significant features. First is that addition and subtraction are about the same speed as on an electronic calculator (I had a scientific calculator back then). Basically, it only takes the time required to enter numbers. Secondly, after performing numerous calculations, it became apparent that I had not made any mistakes. I couldn't say this for pencil and paper methods. I couldn't even say this for calculator use. The error rate for calculators is increasing, as cheaper buttons are used.

As one practices, it may become apparent that an abacus can be visualized mentally. This is similar to playing chess without a board. Mental arithmetic seems to be about twice as fast as it is with the physical soroban, extending the high reliability by eliminating errors due to change of focus. After practicing mental arithmetic for awhile, I could extend my mental soroban to as many rods as I wished. For example, I multiplied two 9 5. .... numbers to arrive at an 18 digit result. This was remarkable, in that without the visualized soroban, I couldn't remember an 18 digit number. I found that I could use many soroban images to hold 6. .... numbers. There didn't seem to be any practical limit.

In calculus, Taylor series expansions for 7. .... functions give formulas for computation. Since the calculator could verify a result, I decided to compute a nine digit sin(x) function, in my head. I started with a slightly 8. .... number. It was something like 23.7 degrees. I converted it to radians, then plugged it into the formula. I carried ten significant digits for all computations so that I would have nine 9. .... ones when finished.

I just sat there for about 35 minutes. I wrote down the answer. and checked it on the calculator. I was correct.

Oddly, I did find a limit to mental calculation, sort of. This was approximately the largest problem that I had patience to solve. I must have held at least six ten digit numbers in my head while wrestling with this monster.

Answer these Qs.

1. What is the soroban?
2. Which math operations are possible on the soroban?
3. What does the soroban look like?
4. What are the advantages of the soroban compared to a calculator?

Decide whether these statements are true or false.

1. All mathematical operations can be done as quickly on the soroban as on an electronic calculator.
2. Cheap buttons on the calculator cause more mistakes.
3. Playing chess without a board heightens one´ s ability to visualize mentally.
4. The Romans invented the abacus since arithmetic using Roman numerals is extremely difficult.
5. The soroban gained its modern design in the first quarter of the 19th century.

Sort out these jumbled key words.

n e t c v r o ______________________
t l a r l c o c u a ____________________
p a t o m c u t n i o _________________
s l u c u c a l ______________________