Épreuve de Section Européenne

The YBC 7289 clay tablet

The word 'geometry', the study of things such as points, lines, shapes and areas, comes from the Ancient Greek "geo", meaning earth, and "metrein", meaning to measure. This etymology demonstrates that this area of mathematics was originally developed to handle everyday concepts such as measure of […].

Although the word is Greek in origin, the concepts of geometry were known much earlier. The Babylonians and the Sumerians knew about Pythagoras' theorem thousand of years before the Greek philosopher of that name made it popular, and from calculations that appear in the Rhind papyrus, we know that the Egyptians were using geometry three and a half millennia ago.

Babylonian clay tablet YBC 7289 (fig 1) from the Yale Babylonian collection shows evidence of knowledge of Pythagoras' theorem.
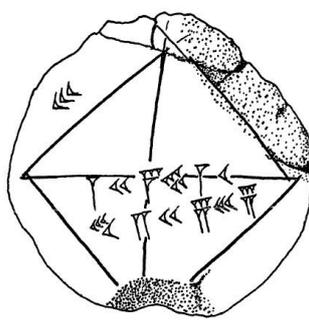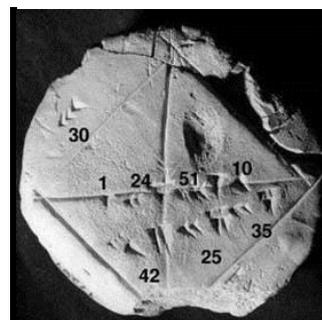

| fig 1 | fig 2 | fig 3 |

The tablet is inscribed with a set of numbers using the Babylonian sexagesimal (base 60) system. The writing is called cuneiform. Figure 3 shows the translation of each Babylonian number.

The number along the central horizontal line on YBC7289 has 4 'digits': 1   24   51   10. Without context, this system is fairly ambiguous. The previous number written in base 60 could be translated into the

value: $1 \times 60^3 + 24 \times 60^2 + 51 \times 60 + 10$ or $1 \times 60 + 24 + 51 \times \dfrac{1}{60} + 10 \times \dfrac{1}{60^2}$ or

$1 + 24 \times \dfrac{1}{60} + 51 \times \dfrac{1}{60^2} + 10 \times \dfrac{1}{60^3}$.

Historians have determined that there is an unwritten 'decimal point' after the first digit 1, and that this number along the central horizontal line would be a very accurate approximation of $\sqrt{2}$.

From then on, the meaning of the bottom number is obvious.

adapted from '*Numbers in your pocket*', by Mark Frary and various sources

Questions
1) State Pythagoras' theorem. According to the text, was it first discovered by Pythagoras himself?
2) Give examples to complete the missing part […] after '*measure of […]*' (line 3).
3) a) Why is the Babylonian system ambiguous?
   b) Among the three translations of the number along the central horizontal line (written 1 24 51 10 in base 60) suggested in the text, choose the correct one.
   c) Check that it is '*a very accurate approximation of $\sqrt{2}$* '.
4) a) Calculate the exact value of the length of the diagonal *d* of a square of side 30, then round it off to 6 d.p.
   b) The 'bottom number' written 42 25 35 in base 60 represents *d*. Find the missing coefficients for the following equality to be true $d = 42 \times ... + 25 \times .... + 35 \times ....$to....dp