# A Short Account of Problem 25 in the Rhind Papyrus[1]

The Rhind Papyrus is an ancient Egyptian mathematical text comprising a series of specific mathematical problems and their solutions.[2] Problem 25 deals with the following question: "A quantity and its ½ added together become 16. What is the quantity?" Translated into the language of modern mathematics, this becomes: Find x when

A problem that we might solve $x + \frac{x}{2} = 16$ thus:

$$\begin{aligned} x + \frac{x}{2} &= 16 \\ \frac{3x}{2} &= 16 \\ \frac{x}{2} &= \frac{16}{3} \qquad \{1\} \\ x &= \frac{32}{3} \\ x &= 10\tfrac{2}{3} \end{aligned}$$

The method suggested in our extract is strikingly different. Using a technique common in Egyptian mathematics (the method of false position[3]), the mathematician begins with an initial trial, by supposing that the sought quantity is two. Since two added to its half gives three, the mathematician knows that two is to the sought quantity as three is to sixteen (compare {1} above). More exactly, the mathematician now knows that if they can find a number which when multiplied by three gives sixteen, then that same number when multiplied by two will give the required quantity. Armed with this knowledge, the mathematician first performs a division (sixteen divided by three), and then a multiplication (two multiplied by the result of the division).

To divide sixteen by three, the mathematician heads two columns with the numbers one and three (since he is dividing by three). Subsequent rows of the table are produced by doubling or halving the entries in some previous row (or in some cases by dividing them by three). The mathematician then searches for entries in the right-hand column which sum to sixteen. The rows containing these entries are marked. From there, all that remains is to sum the entries in marked rows of the left-hand column … the result being equal to sixteen divided by three, i.e. to five-and-one-third.

Since the mathematician now needs to multiply two by five-and-one-third, the first row of the next table contains the numbers one and five-and-one-third. Since he is multiplying and

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[1] Problem 25 can be found in **SB** 1.D2(a), p. 16.
[2] See **SB** 1.D7, p. 23.
[3] MA290 *Unit 1: Early Mathematics*, p. 17.

not dividing, the mathematician attempts to produce entries in the *left-hand column* that sum to two (the other number involved in the multiplication). Again, the rows containing these entries are marked. Now he finds the sum of the entries in the marked rows of the right-hand column, this sum being the result of our calculation. After making these calculations (the trial, the division and the multiplication), the mathematician concludes that the sought quantity is ten-and-two-thirds. Finally, the mathematician checks his working by adding ten-and-two-thirds to its half (i.e. to five-and-one-third); the result being sixteen, as required.

These typical Egyptian methods effectively reduce both division and multiplication to addition. After all, even the common Egyptian operations of doubling and halving (used to produce extra rows in the tables described above) can be thought of as adding a number to itself and as finding a number which when added to itself gives the number you began with.[4]

Lest the foregoing should mislead the reader, I point out here that the Egyptian use of fractions was very different from our own. Drawing on other material outside this extract, we know that Egyptian fractions were all of the form 1/N or (N – 1)/N (where N is a positive integer).[5] While Problem 25 conforms to this pattern, that pattern could scarcely be abstracted from this problem taken in isolation.

I also note here that this problem seems of little help in deciding whether the Egyptians were interested in mathematics for its own sake or only for its practical applications.[6] For while the quantities involved in Problem 25 are not quantities *of* anything, the problem may have been posed merely for the sake of illustrating and teaching the method by which more obviously practical problems may be solved.

[4] MA290 *Unit 1: Early Mathematics*, p.13.
[5] See **SB** 1.D5, p. 22.
[6] On which debate see **SB** 1.D6, pp. 22-3, and **SB** 1.D7, pp. 23-4.