7.A1 Leonardo Fibonacci

(a) *Double false position*

Elchataieym in Arabic is rendered into Latin as 'duarum falsarum posicionum regula' [in English, 'the rule of double false position'], by means of which the solutions of almost all questions can be found. [...] Now, the two false positions are taken at will. This means that sometimes they are both smaller than is correct, sometimes both larger, sometimes one larger and the other smaller: and the truth of the solutions is found from the proportion of the difference of one position from the other, that is what happens in the rule of fourth proportion, where three numbers are involved; from which a fourth (unknown) [number], that is the truth of the solution, is to be found; the first number of these is the difference of one number of false position from the other. The second is the approximation, which becomes truth by means of this difference. The third is the remainder, which is for approximating to the truth. We wish to show how they work in the rule of weighing, so that by the demonstration of how these differences work subtly in weighing you may be able to understand the subtle solution of other questions by elchataieym.

(b) *Tree problem*

There is a tree, $\frac{1}{4}$ and $\frac{1}{3}$ of which lie below ground; and are 21 *palmi*: we are asked for the length of the tree: because $\frac{1}{4}$ and $\frac{1}{3}$ are found in 12, suppose the tree to be divided into 12 equal parts; of which a third, and a quarter, that is 7 parts, are [i.e. make] 21 *palmi*: so that as is the proportion of 7 to 21, so will be [the proportion of] 12 parts to the length of the tree. And because, when four numbers are proportional, the first multiplied by the fourth is equal to the second multiplied by the third: so if you multiply the second of the numbers mentioned, 21, by the third 12, and divide by the first number mentioned, that is by 7, they give 36 for the fourth (unknown) number, that is, for the length of the tree: or because 21 is three times 7, take three times 12, and you will similarly have 36.

There is another method we use, namely that for the unknown thing you put any number, chosen at will, which can be divided exactly into the fractions that are proposed in the question: and according to how the question is posed, with this proposed number you try to find the proportion that occurs in the solution of the question. For example: the number we are asked to find in this question is the length of the tree: therefore suppose it to be 12, since this can be divided exactly by 3, and by 4, which are given as divisors: and because it is said $\frac{1}{4}$ and $\frac{1}{3}$ of the tree are 21, take $\frac{1}{4}$ and $\frac{1}{3}$ of the 12 you supposed, they will be [i.e. will add up to] 7; and if this [sum] had chanced to be 21 we should have arrived at the required answer, namely that the tree would be 21 *palmi*. But because 7 is not 21; it happens that as 7 is in proportion to 21, so the supposed tree will be to the one we seek, that is as 12 to 36: therefore we might say: for 12, which I suppose, we obtain 7; what should I suppose so that we obtain 21? And when it is expressed this way, [we see that] we should multiply together the numbers at the end, that is 12 by 21; and the sum [*sic*, although he means product] should be divided by the remaining number.