Book

Reimer, D. W. (2014). Count like an egyptian : A hands-on introduction to ancient mathematics. Princeton University Press.

Question 1

a

$$
\begin{aligned}
&18 = 16 + 2 \\
&1 \times 25 = 25 \\
&2 \times 25 = 50/ \\
&4 \times 25 = 100 \\
&8 \times 25 = 200 \\
&16 \times 25 = 400/ \\
&16 \times 25 + 2 \times 25 = 400 + 50 = 450 \\
\Rightarrow &18 \times 25 = 450
\end{aligned}
$$

b

$$
\begin{aligned}
&105 = 64 + 32 + 8 + 1 \\
&1 \times 59 = 59/ \\
&2 \times 59 = 118 \\
&4 \times 59 = 236 \\
&8 \times 59 = 472/ \\
&16 \times 59 = 944 \\
&32 \times 59 = 1888/ \\
&64 \times 59 = 3776/ \\
&1 \times 59 + 8 \times 59 + 32 \times 59 + 64 \times 59 = 59 + 472 + 1888 + 3776 = 6195 \\
\Rightarrow &105 \times 59 = 6195
\end{aligned}
$$

Question 2

a

$$\begin{array}{ccc} 8 & 1 & / \\ 16 & 2 & / \\ 32 & 4 & / \\ 64 & 8 & \\ 128 & 16 & / \end{array}$$

$$\Rightarrow 184/8 = 1 + 2 + 4 + 16 = 23$$

b

$$\begin{array}{ccc} 9 & 1 & / \\ 18 & 2 & \\ 36 & 4 & / \end{array}$$

$$\begin{aligned} & 47 - (1 \times 9 + 4 \times 9) = 2 \\ \Rightarrow & \frac{47}{9} = 5 + \frac{2}{9} \\ & \frac{2}{9} = \frac{1}{6} + \frac{1}{18} \text{(by Rhind Papyrus)} \\ \Rightarrow & \frac{47}{9} = 5 \frac{1}{6} \frac{1}{18} \end{aligned}$$

c

$$\begin{array}{ccc} 1 & 51 & \\ \frac{2}{3} & 34 & 1\frac{1}{2} \\ 2 & 102 & \frac{1}{2} \end{array}$$

$$\Rightarrow \frac{2}{51} = \frac{1}{34} \frac{1}{102}$$

$$\begin{array}{ccc} 1 & 99 & \\ \frac{2}{3} & 66 & 1\frac{1}{2} \\ 2 & 198 & \frac{1}{2} \end{array}$$

$$\Rightarrow \frac{2}{99} = \frac{1}{66}\,\frac{1}{198}$$

Question 3

$$140 \div (2 \times 93\frac{1}{3}) = 140 \div (186\frac{2}{3})$$

$$\begin{array}{ccc} 1 & 186\frac{2}{3} & \\ \frac{3}{280} & 2 & 93\frac{1}{3} \\ \frac{3}{140} & 4 & 46\frac{1}{2}\frac{1}{6} \end{array}$$

$$\begin{aligned} &\Rightarrow \frac{140}{186\frac{2}{3}} = \frac{1}{2}\frac{1}{4} \\ &\frac{1}{2}\frac{1}{4} \times 7 \\ &7 = 1 + 2 + 4 \end{aligned}$$

$$\begin{array}{ccc} \frac{1}{2} & 1 & / \\ 1 & 2 & / \\ 2 & 4 & / \end{array}$$

$$\begin{array}{ccc} \frac{1}{4} & 1 & / \\ \frac{1}{2} & 2 & / \\ 1 & 4 & / \end{array}$$

$$\begin{aligned} &\Rightarrow \frac{1}{2} \times 7 = 3\frac{1}{2} \\ &\Rightarrow \frac{1}{4} \times 7 = 1\frac{1}{2}\frac{1}{4} \\ &\frac{1}{2}\frac{1}{4} \times 7 = 3\frac{1}{2} + 1\frac{1}{2}\frac{1}{4} = 5\frac{1}{4} \\ &4 = 4 \end{aligned}$$

$$\begin{array}{ccc} \frac{1}{4} & 1 & \\ \frac{1}{2} & 2 & \\ 1 & 4 & / \end{array}$$

$$\Rightarrow \frac{1}{4} \times 4 = 1$$

$\Rightarrow$ 5 palms 1 finger

Question 4

$a = 7$

$a_1 = 2.5$

$b_1 = \dfrac{a}{a_1} = \dfrac{14}{5}$

$a_2 = \dfrac{1}{2}(a_1 + b_1) = 2.65$

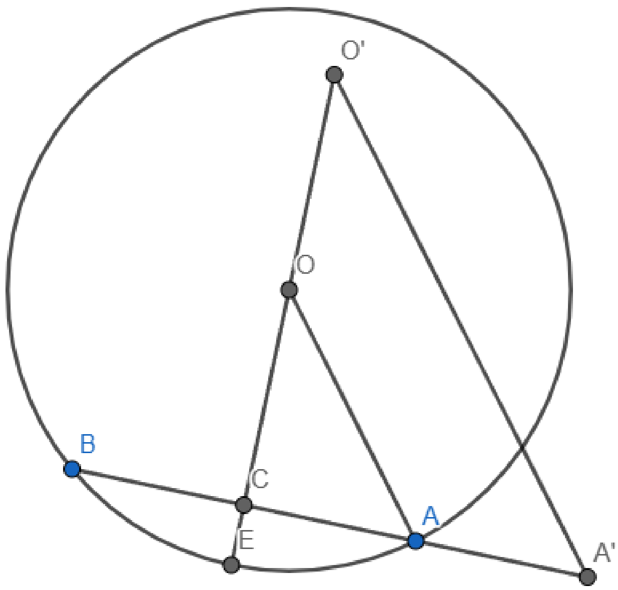
$b_2 = \dfrac{a}{a_2} = \dfrac{7}{2.65}$

$a_3 = \dfrac{1}{2}(a_2 + b_2) = \dfrac{5609}{2120} \approx 2.64575$

$\sqrt{7} \approx 2.64575$

Using two steps to get the estimation $a_3 \approx 2.64575$

Question 5



By the figure, AB is a chord of the circle O, and OE is a radius perpendicular to AB and intersects at C. By the inscription, circumference is 60, by $C = 2\pi r$ and $\pi = 3$, $r = 10$. So $OE = 10$, and CE, which is the sagitta, is 2. $OC = OC - CE = 8$. And extending O to O' so that $OC = O'O = \frac{1}{2}O'C$, extending A to A' so that $AC = A'A = \frac{1}{2}A'C$, the two triangles, $\Delta A'CO'$ and ACO are similar triangles, so AO and $A'O'$ should have the same ratio as others, which is $A'O' = 2AO$, AO is the radius, which is 10, so $A'O' = 20$. $O'C = 2OC = 16$. So by the Pythagorean theorem, $A'C = \sqrt{A'O'^2 - O'C^2} = 12$, and since AB is a chord and OC is perpendicular and goes through the center, C bisects AB, so $AC = \frac{1}{2}AB$, also $AC = \frac{1}{2}A'C$, so $AB = A'C$. As calculated by the Pythagorean theorem before, $A'C = 12$, so $AB = 12$. So the calculation in the inscription is true.