

4.1-4.2

Enlightening summary #1: Section 4.1 describes the founding of the city of Alexandria by Alexander the Great and later carried out by Ptolemy. The followers of Ptolemy dedicated themselves to making Alexandria the center of intellectual life, by founding the Museum and the Alexandrian Library. The text also goes on to describe the heavy-handed methods by which the Alexandrian library attained their manuscripts. The Museum produced an incredible amount of distinguished scholars, with Euclid being perhaps the most influential. The rest of the section recounts Euclid's life and writings. Personally I love the story about King Ptolemy asking for a shorter way to learn geometry, to which Euclid responded with "There is no royal road to geometry".

Enlightening summary #2: Continuing the thread, Section 4.2 goes more in depth on the work from "The Geometer". The text explains the necessity for Euclid's Postulates and even emphasizes the controversy behind Euclid's parallel postulate which would later come to a head with the formulation of non-Euclidean geometry. We also see criticisms of Euclid's Elements with the main objection being the lack of rigor, and tacit assumptions that are omitted from the postulates. The prime examples being Euclid's use of "superposition" and his failure to ensure the continuity of lines and circles. The rest of the section gives a rundown of some of the propositions from Book I. The text also discusses Book II, which focuses on geometric algebra, with the biggest takeaway being that it allowed the Greeks to solve quadratic equations without irrational numbers.

Interesting: I really really like Micheal Stifel's description of irrational numbers as being hidden in a "cloud of infinity". I also interested in the section that explains why certain definitions in a logical system must remain undefined. Thinking back to geometry class last semester, it seems like trying to prove Euclid's parallel postulate is a right of passage for anyone interested in geometry.

Confusing: While I am aware that Greek geometric algebra was handicapped by only being able to express linear and quadratic equations, how is it any different from our symbolic representation? Although it may be "cumbersome" and "overwhelming" in the end a line segment that represents $\sqrt{2}$ is just as meaningful as our notation. Furthermore I'm fairly certain I've seen the Babylonian complete the square algorithm applied to cubic functions, did they not experiment in 3-dimensions?

$$\begin{aligned}
 (a+b)^1 &= a + b \\
 (a+b)^2 &= a^2 + 2ab + b^2 \\
 (a+b)^3 &= a^3 + 3a^2b + 3ab^2 + b^3 \\
 (a+b)^4 &= a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4
 \end{aligned}$$

The diagram illustrates the binomial expansion of $(a+b)^4$ using 3D blocks. The expansion is shown as a sum of terms: a^4 (one red cube), $4a^3b$ (four orange rectangular prisms), $6a^2b^2$ (six green rectangular prisms), $4ab^3$ (four blue rectangular prisms), and b^4 (one blue cube). The blocks are arranged to form a larger cube of side length $(a+b)$, with dashed lines indicating the boundaries of the individual terms.