

THE FIBONACCI DRAWING BOARD DESIGN OF THE GREAT PYRAMID OF GIZEH

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The comments on the Great Pyramid of Gizeh by Herodotus (484 to 424 B. C.) contained the statement that "The base was a square. The base side was 800 feet. The height was equal."

Apparently some student of the dimensions of this pyramid has interpreted this 'obscure' statement to mean that the square of the vertical height of the pyramid is equal to the area of each of its triangular faces.

Such an imaginative interpretation is not acceptable evidence. It also credits the Egyptians of 3000 B. C. with familiarity with the golden section. However, the facts fit the theory remarkably well.

The elevation of the face triangles of the pyramid is made the unit of measure in the accompanying cross section of the pyramid. Let k symbolize the golden section ratio of $\frac{1}{2}\sqrt{5} - \frac{1}{2}$.

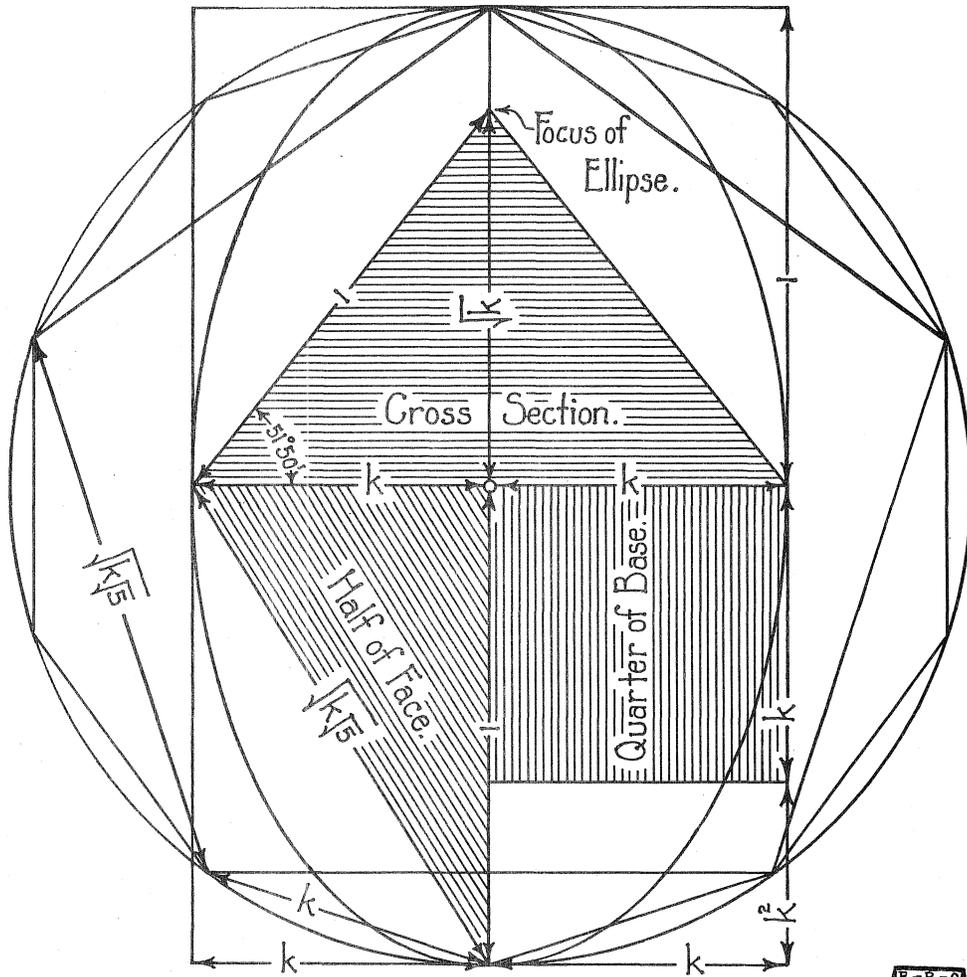
If the square of the vertical height of the pyramid equals the area of one triangular face, each such face is a golden rectangle that has been halved on one diagonal and rejoined on its long sides. The base of the pyramid is then a $2k \times 2k$ square and it has an altitude of \sqrt{k} . Each quarter section of the $2 \times 2k$ golden rectangle in the sketch has the area of one triangular face. The inscribed ellipse has one focus at the apex of the pyramid. A circle of radius 1 is centered on the base. The inscribed regular decagon has sides of k length. The sides of the inscribed regular pentagon has sides of the same length as the sloping edges of the pyramid.

Such relationships would certainly have appealed to these Egyptian masters of practical geometry.

The Great Pyramid is now about 750 ft. square at the base. It is 451 ft. high and has a small flat deck on top. Sir William Mathew Flanders Petrie made an exceptionally accurate survey of the pyramid in the early 1880's. On the basis of his painstaking studies, he concluded that the original base of the pyramid was 755.73 ft. square and that its original height was 481.33 ft.

Under the Herodotus design, a base of 755.73 ft. would correspond to the $2k$ dimension in the drawing. This would make the height of the pyramid

THE GREAT PYRAMID.



| Item | In fact. - Feet. | Slant Height Ratio. | |
|-------------------|------------------|-------------------------------|---|
| Height. - | 481.33 | $\sqrt{k} = 0.786151$ | $k = \frac{1}{2}\sqrt{5} - \frac{1}{2} = 0.618034^*$ |
| * Base. - | $(755.73)^2$ | $(2k)^2 = (1.236068)^2$ | Square of Height = $(481.33)^2 = 231679.$ |
| * Slant Height. - | 611.93 | $\sqrt{k\sqrt{5}} = 1.175570$ | Face Triangle = $\frac{1}{2} \times 611.93 \times 755.73 = 231229.$ |
| | | | * $\frac{377.87}{611.93} = 0.6175$ $\frac{377.87}{481.33} = 0.7851$ |

$$\frac{755.73}{2\sqrt{k}}$$

or 480.65 ft.

Surprisingly the dimensions of the pyramid conform equally well to a second and a third theory as to its design.

A widely held second theory makes the height of the pyramid equal to the radius of the circle that has a circumference equal to the perimeter of the base of the pyramid.

$$\frac{4 \times 755.73}{2\pi} = 481.11$$

Sir William Petrie himself was thoroughly convinced that the Egyptians constructed the pyramid with a height-to-width-of-base ratio of seven to eleven.

$$\frac{7}{11} \times 755.73 = 480.92 .$$

Herodotus reports that 100,000 men labored for 30 years to construct this gigantic exhibit of personal egotism. This massive structure has probably settled more than the variations in these computed heights. Nobody will ever know its true original height and early Egyptian knowledge of the golden section remains unconfirmed. So roll the dice and choose your own theory.

REFERENCES

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3. "The Geometry of the Pentagon and the Golden Section," The Mathematics Teacher, Jan. 1948.
4. Sir William M. F. Petrie, Seventy Years in Archeology.
