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On Geometric Pattern in Golden Hexagon

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Abstract

Golden section, golden ratio and golden section geometry is known concept since the classical Greek civilization. It is seen in ancient Egypt and is used in construction, architecture and fine Arts. Also scientists point out that some pattern of branching and of flowers and cones follow Fibonacci-series, golden ratio and the golden section. The related literature is immense [1, 2, 3], so gives us flexibility to restrict ourselves to cite literature. The objective of this work is to expand the golden ratio images in two dimensional objects. Create one two dimensional pattern and experiences the infinity and continued golden ratio which is proven mathematically and seen in created geometrical pattern. A typical illustration of construction of geometric design in golden hexagon is selected, drawn and presented. Golden sections and golden ratios are used for making the geometric pattern in golden hexagon.

Keywords: Golden ratio,golden section,Golden hexagon

INTRODUCTION

Golden ratio is an irrational number that’s equal to approximately 1.6180 and is written by Greek letter φ. When we divide a line into two segments such that the whole length is divided by the longer segment is also equal to the longer segment divided by the shorter segment.[1]

Fig. 1 Golden Line

$$\text{Then, } \frac{AB}{AC} = \frac{AC}{CB} \cong 1.6180 \qquad (1)$$

Golden hexagon is a two dimensional golden section object where the ratio of two adjacent sides gives the golden number.

The basic geometrical shape of golden hexagon is systematically constructed based on the method described in [4, 5]. In this two dimensional image, a continuous pattern is thought for creating a new geometry in two dimensional golden section hexagon. The following section describes the construction of such pattern in geometrical shape golden section hexagon.

CONSTRUCTION OF GEOMETRIC PATTERN IN GOLDEN HEXAGON

Construct golden hexagon ABCDEF as shown in Fig. 1.

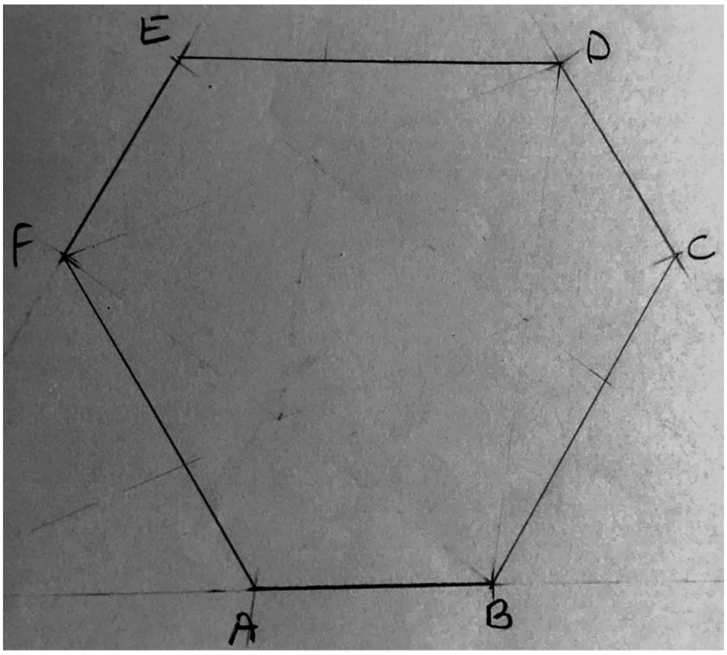

Fig. 1 Golden hexagon

Mark point G on the side ED such as $\frac{ED}{EG} = \frac{EG}{GD} = \varphi$. (Fig. 2)

Also, knowing that ED – EG = GD.

Now, obtain two points H and I on line ED such as $EH = ID = \frac{GD}{2}$. Similar points obtain on all other longer sides of the golden hexagon such as AF, BC, to obtain points J and K, L and M respectively.

Join KLMIHJ is another golden hexagon which has now longer sides are JH, MI and KL. Mark on this hexagon on lines JH to obtain point N such as, $\frac{JH}{JN} = \frac{JN}{NH} = \varphi$. Also, knowing here the fact, JH – JN = NH. Obtain two points on JH line such as JT = SH = $\frac{NH}{2}$. Obtain similar points on the other longer sides IM and KL, R, Q, P and O. Join OPQRST to construct hexagon which happen to be golden hexagon. Here the longer sides are SR, QP and TO.

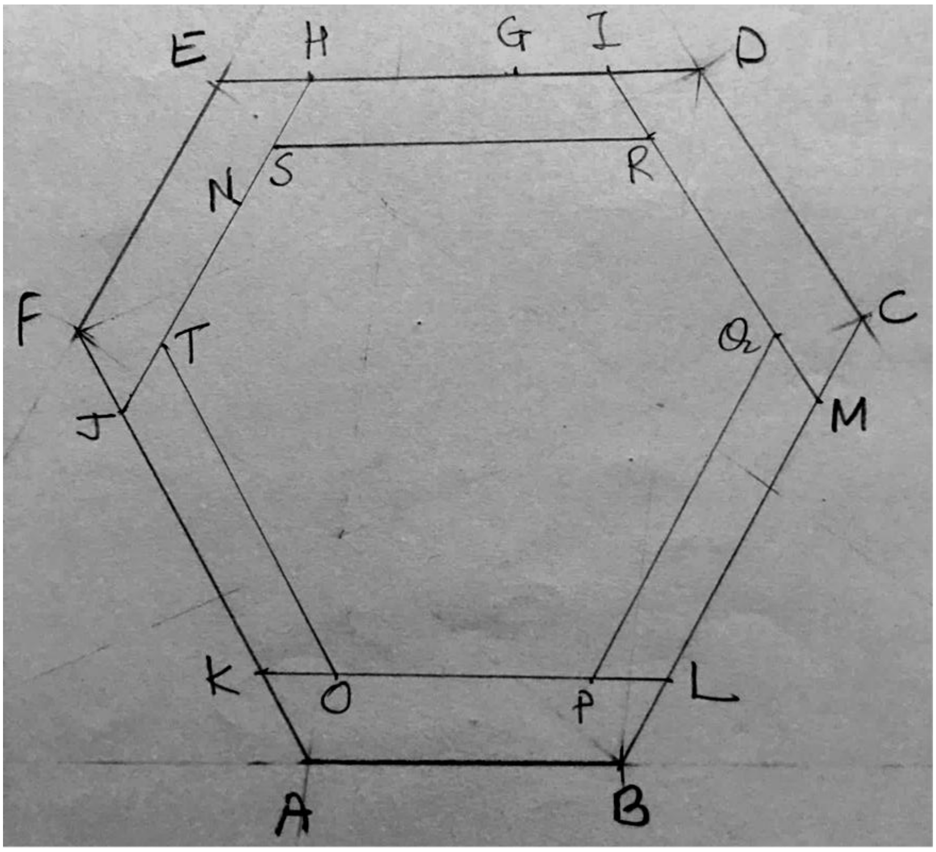

Fig. 2 Golden sections in hexagon

This continuous ratio pattern will be seen further if we repeat the procedure. Such hexagons are obtained are : 123456, 789101112, 12 14 15 16 17 18, 19 20 21 22 23 24 and 25 26 27 28 29 30 (Fig. 3).

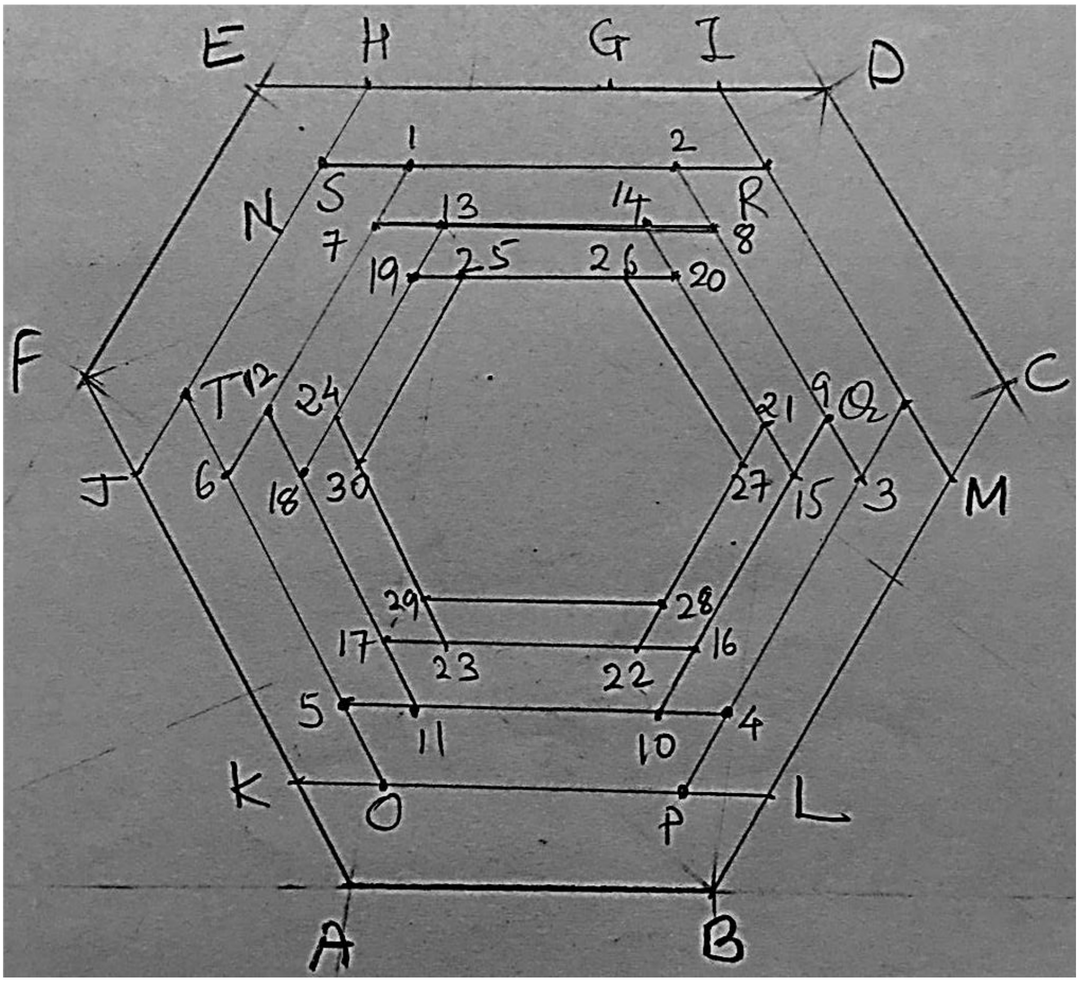

Fig. 3 Continued marked section in hexagon

To obtain points for the curve inside this golden hexagon, following Table 1 is used. The compass point and points for the arc length are given in the table. The final imagine is seen as shown in Fig. 4. The curve goes in clockwise direction and curve line remains within the trapezoids. One such trapezoid is FJHE.

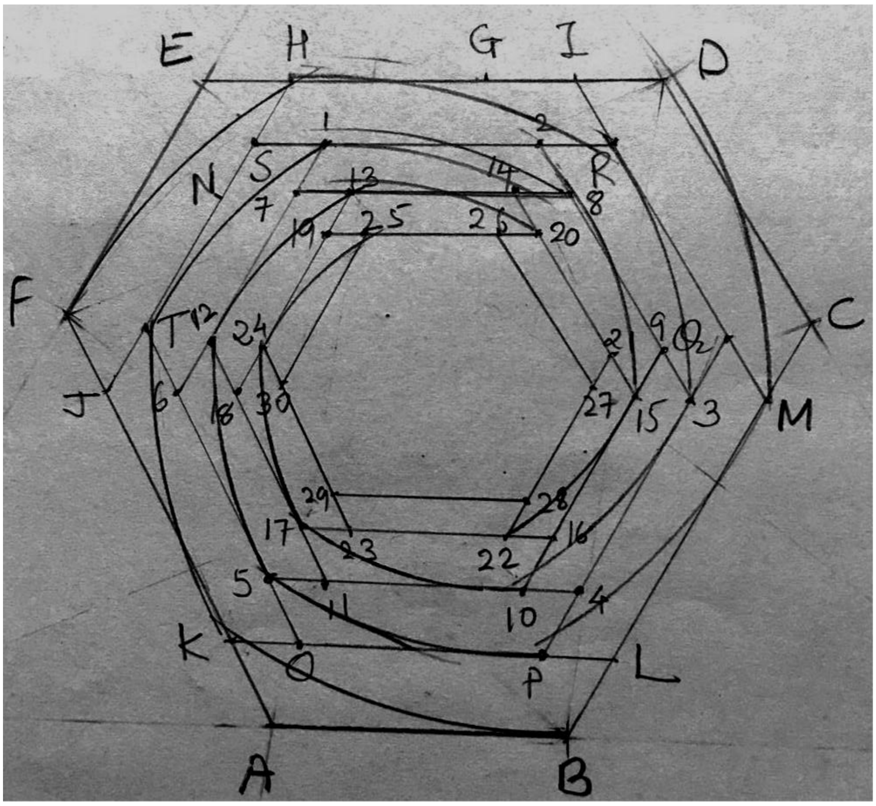

Fig. 4 Geometrical pattern in hexagon

Table 1 Various Points for the curve

Point	Arc length	Point	Arc Length	Points	Arc length
Q	K	4	F	2	B
9	5	16	T	14	P
21	17	28	12	26	10
Point	Arc Length	Point	Arc Length	Point	Arc Length
O	H	S	M	6	M
11	1	7	3	8	3
23	13	19	15	30	15

CONCLUSION

A simple pattern is thought to construct in a two dimensional geometrical object golden hexagons with golden sections. Golden sections and its divisions are used to create patterns which follow the continued and infinite ratio, proven mathematically is seen geometrically with beautiful geometrical pattern. The motivation behind the work is to understand the two dimensional geometrical objects with golden sections and its connection with mathematics.

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