Abu Al-Wafaa Al-Bozjani

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Who is **Abu'l-Wafa al'Buzjani?**

- Mohammed Abu-Alwafa AlBuzjani.

- He was born in Būzjān – Iran (940 –998 CE).

- Lived in Baghdad until he died there.

- An Islamic mathematician and

astronomer.
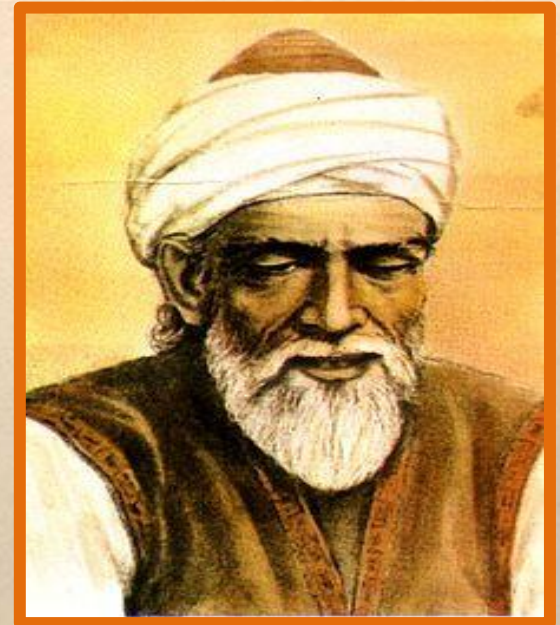
His Books

- **A book of [zij](#) called Zīj al-wāḍiḥ, no longer extant.**

- **A Book on Those Geometric Constructions Which Are Necessary for a Craftsman"**

- **A Book on What Is Necessary from the Science of Arithmetic for Scribes and Businessmen",).This is the first book where [negative numbers](#) have been used in the medieval Islamic texts.**

- **He also wrote translations and commentaries on the algebraic works of [Diophantus](#), [al-Khwarizmi](#), and [Euclid](#)'s Elements.**

Contribution and Achievement

- Translated and commented on Greek's works.

- Simplified ancient methods of spherical [trigonometry](#).

- Proved the [law of sines](#) for general spherical triangles.

- Developed the knowledge of the *tangent* function.

- Introduced a new method of constructing sine and tangent tables.

- Discovered the secant and cosecant functions, as well as relationships among all six of the trigonometric functions.

- Developed the half/double angle formulas.

$$\cos(a + b) = \cos a \cos b - \sin a \sin b$$

$$\cos(a - b) = \cos a \cos b + \sin a \sin b$$

$$\sin(a + b) = \sin a \cos b + \cos a \sin b \quad \longleftarrow$$

$$\sin(a - b) = \sin a \cos b - \cos a \sin b$$

$$\tan(a + b) = \frac{\tan a + \tan b}{1 - \tan a \tan b}$$

$$\tan(a - b) = \frac{\tan a - \tan b}{1 + \tan a \tan b}$$

Half & Double Angles

$$2 \, sin^2 \left(\frac{x}{2}\right) = 1 - \cos x$$

$$sin2x = 2 \, sinx \, cosx$$

$$\sin 2x = \sin(x + x)$$
$$= \sin x \cos x + \cos x \sin x$$
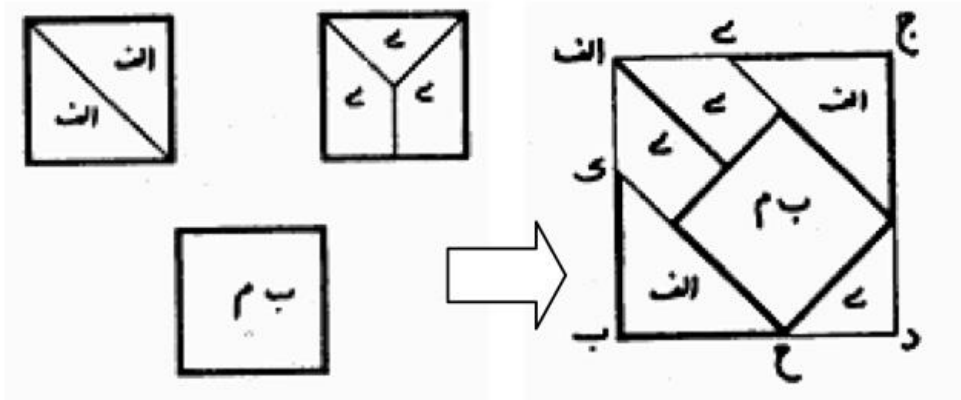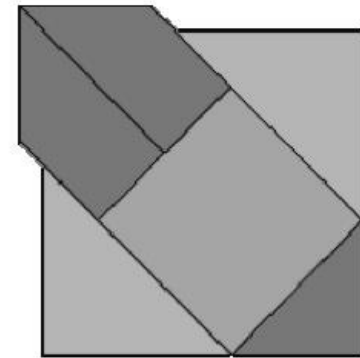$$= 2 \sin x \cos x$$

Bad Geometry

Figure 4-1 - *Incorrect construction of a square from three unit squares. From original Persian. (Arrow added.) (6, p. 10.)*

4-2 - *Purposefully exaggerated depiction of underlying error.*

Correct Constructions of Greater Squares

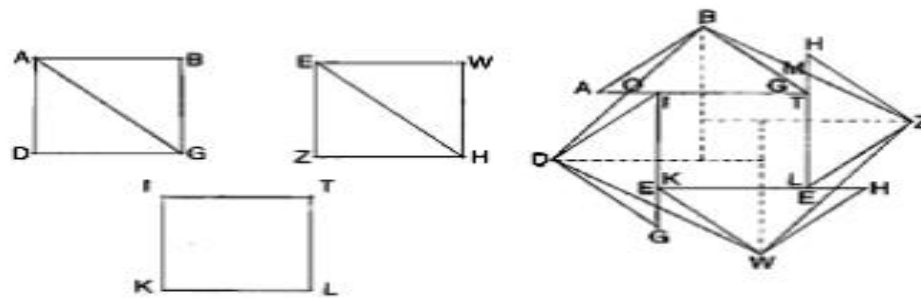- Al-Buzjani highlighted a mathematically correct method of dividing and reassembling the squares.

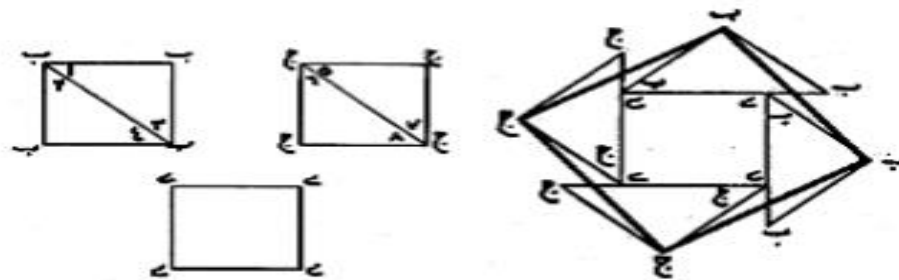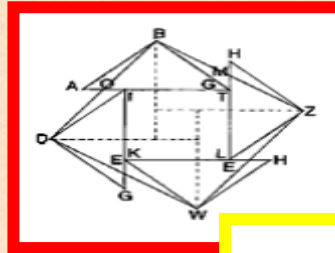**Figure 5-1:** *The correct construction of a square from three unit squares.*

Figure 5-2: *The correct construction, as shown in the original Persian (6, p.10)*
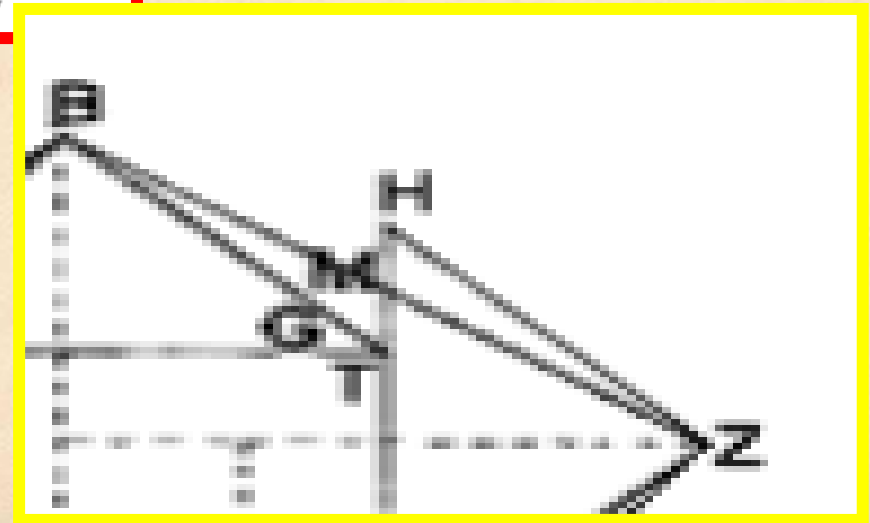
Correct Constructions of Greater Squares

RESULTS:-

That [empty triangle shape] is equal to the triangle which has been cut off from the big triangle.

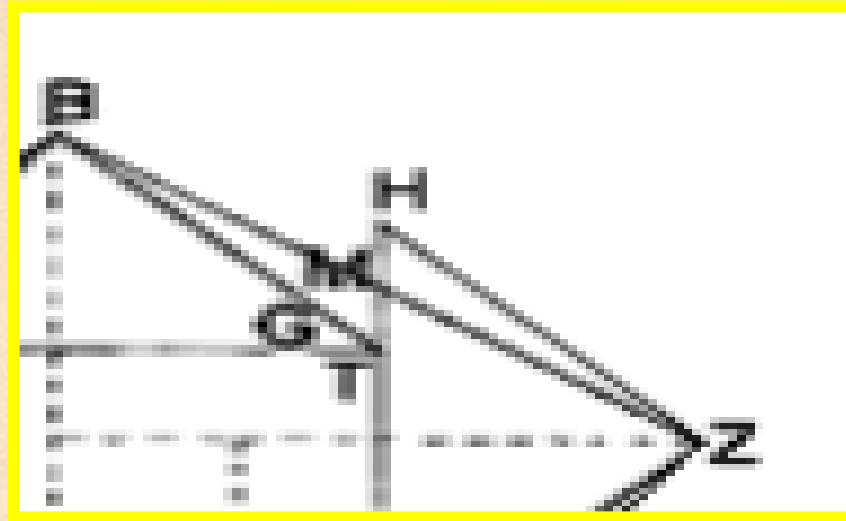**Triangle BGM is equal to triangle MZH   - Why?**

Triangles are equal [by the angle-side-angle theorem]

Correct Constructions of Greater Squares

angle-side-angle theorem

- **Angle G is half a right angle, angle H is half a right angle**
- **Two opposite angles of the triangles at M**
- **Side BG is equal to side ZH**

Do You Have Any Question?

References

Pictures References :

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http://historyofmathematics.org/wp-content/uploads/2013/09/2010-Nielsen.pdf-
http://www.alittihad.ae/details.php?id=29939&y=2009
http://fr.wikiversity.org/wiki/Trigonom%C3%A9trie/Relations_trigonom%C3%A9triques

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Mohammad Abu'l-Wafa al'Buzjani PDF http://www.robertnowlan.com/pdfs/al-Buzjani,%20Mohammad%20Abul-Wafa.pdf

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