

# Tiles with a doll-like shape

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The blue text are links to the main site.

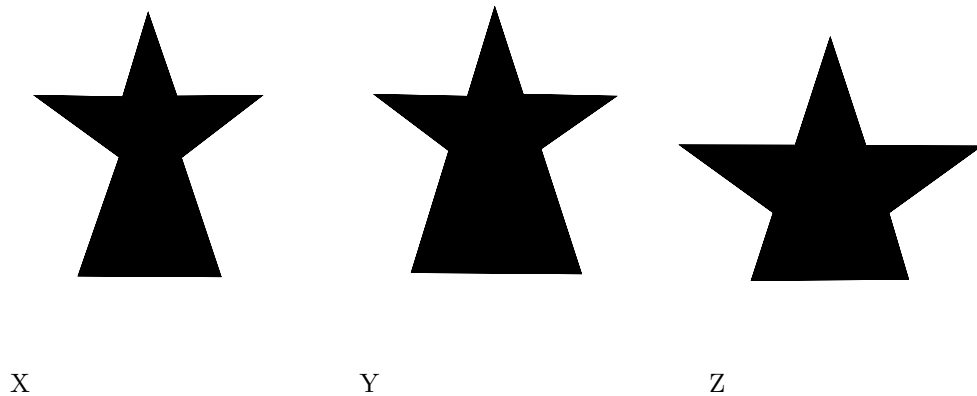


Figure 1: Three doll-shapes

## 1 Introduction

For a few years, an index to all the individual tiles for most of the patterns has been produced. The patterns considered are those for which a mathematical representation has been produced, and whose angles are not multiples of  $90^\circ$ , but are a multiple of some angle  $P/Q \cdot 180^\circ$ . The index is for over 3,400 tiles from nearly 2,000 patterns.

This information is difficult to use and so no effective use has been made to date. The basic data is included in the SQL database [1].

## 2 Finding the doll-shaped tiles

The shapes have 9 sides with a vertical line of symmetry (as shown above). Moreover, these tiles are from decagonal patterns which implies that the internal angles are multiples of  $36^\circ$

(or perhaps a submultiple of that). This locates the three shapes shown above all having angles which are a multiple of  $36^\circ$ .

### 3 The three tiles

The analysis of each tile has A as the top edge length, followed by the alphabet for the other edge lengths. The internal angles are given as multiple of  $36^\circ$ .

The other information consists of the patterns containing that tile, given by a link.

**X.** See the first graphic above.

Edges: AABCDCBAA  
(Lengths: A = 1.0 B = 1.17082039324991 C = 1.44721359549994 D =  
1.61803398874985 )  
Angles: [7,1,7,2,2,7,1,7,1]

This tile appears in the following patterns:

1. [Rustem Pasha mosque](#);
2. [Sultan Ahmed Mosque](#);
3. [Konya door](#).

Note that this doll the nearly vertical edges are not colinear.

**Y.** See middle graphic above.

Edges: AAABCBA  
(Lengths: A = 1.0 B = 1.38196601125015 C = 1.85410196624956 )  
Angles: [7,1,7,2,2,7,1,7,1]

This tile appears in the following patterns:

1. [Friday mosque, Isfahan](#);
2. [Aleppo, mihrab of the al-Khosrowiyya Mosque](#);
3. [Sokullu Mehmet Pasha mosque](#);
4. [Bourgoin, Plate 174](#).

Note that this doll has the longest edge length.

**Z.** See the third graphic above.

Edges: AAABCBA  
 (Lengths:  $A = 1.61803398875000$   $B = 1.0$   $C = 2.23606797750000$  )  
 Angles:  $[7,1,7,2,2,7,1,7,1]$

This tile appears in the following patterns:

1. Panel from Suleymaniye Mosque;
2. Selimye Mosque, Edirne;
3. Fatima's Haram, Qom.

Note that this doll used 4 different edge lengths.

It can be seen that the doll shape (Angles:  $[7,1,7,2,2,7,1,7,1]$ ) is characterised by these angles.

#### 4 The generic doll tile

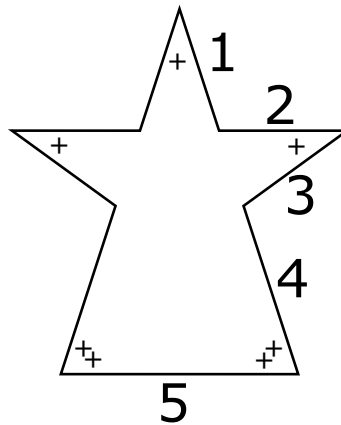


Figure 2: The generic doll: 1-5 possibly distinct edge lengths,  $+ 36^\circ$ ,  $+ + 72^\circ$

Several possible examples have not been found, such as all 5 edges being distinct. Edge 1 is A.

#### References

[1] SQL and Islamic Geometric Design Brian Wichmann: Nexus Netw J (2019). <https://doi.org/10.1007/s00004-019-00439-2>

- [2] Brian Wichmann and David Wade. *Islamic Design: a Mathematical Approach*. Springer. 2018. ISBN 978-3-319-699

v49