

# Magic Square Cube Design

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## Introduction

A **Magic Square Cube** is a 3x3x3 **Rubik's Cube** used to display numbers found on a 3x3 Magic Square. In recreational mathematics, a **magic square** of order 3 is an arrangement of 9 numbers, usually distinct integers, in a square, such that the 3 numbers in all rows, all columns, and both diagonals sum to the same constant: 15. A **normal** magic square contains the integers from 1 to 9.

Magic Square – Useful Links	
<a href="http://en.wikipedia.org/wiki/Lo_Shu_Square">http://en.wikipedia.org/wiki/Lo_Shu_Square</a>	<a href="http://en.wikipedia.org/wiki/Magic_square">http://en.wikipedia.org/wiki/Magic_square</a>

There are **Virtual Cubes** that can be *virtually* rotated and twisted on a computer screen and **Real Cubes** that can only be *physically* rotated and twisted by hand. A **Texture** is laid down on a Virtual Cube whereas real **Stickers** are stuck down on a Real Cube. A Magic Square Cube is designed by placing numbers on a texture which is then laid down on a Virtual Cube (see <http://www.randelshofer.ch/> for more details).

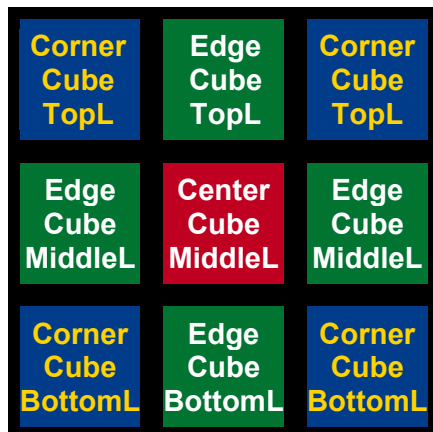
The following example shows the initial (solved) state of a Magic Cube. Arabic, eastern arabic, chinese, chinese (*dâxiě*), devanāgarī and roman numerals are shown on each of the 6 faces. Numbers in all rows, all columns, and both diagonals sum to the same constant: 15, on each face.

Magic Square Cube									
			肆	玖	貳				
			叁	伍	柒				
			捌	壹	陆				
୪	୯	୨	4	9	2	四	九	二	
୩	୬	୭	3	5	7	三	五	七	
୮	୧	୫	8	1	6	八	一	六	
			୧	୯	୨	IV	IX	II	
			୩	୦	୭	III	V	VII	
			୮	୧	୬	VIII	I	VI	
Magic Square Cube Texture					Magic Square Cube				
Download <b>CubeTwister</b> from: <a href="http://www.randelshofer.ch/">http://www.randelshofer.ch/</a>									



## Terminology

In a 3x3x3 **Rubik's Cube**, there are 8 *Corner Cubes*, 12 *Edge Cubes*, 6 *Center Cubes* and 6 *Cube Faces*. There are also 4 Corner Cube faces, 4 Edge Cube faces and 1 Center Cube face *per Cube Face*, as shown below.



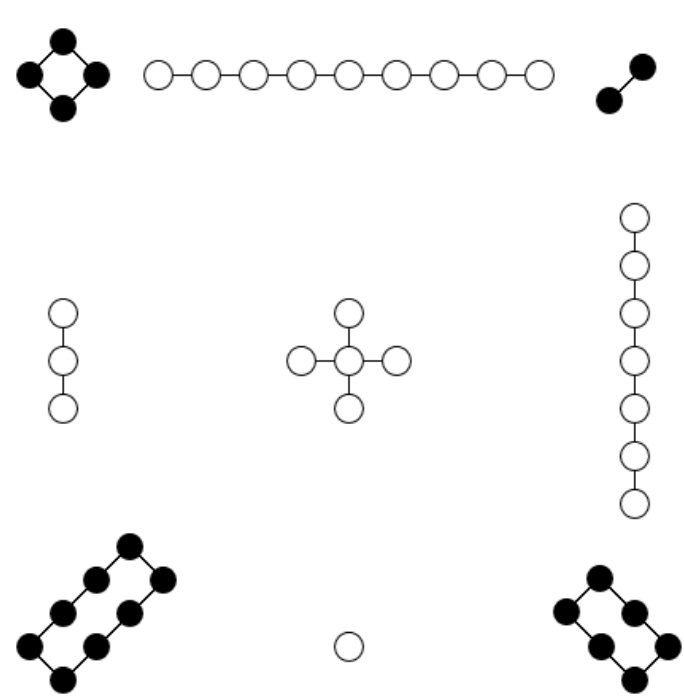
There are 1 face per Center Cube, 2 faces per Edge Cube and 3 faces per Corner Cube.

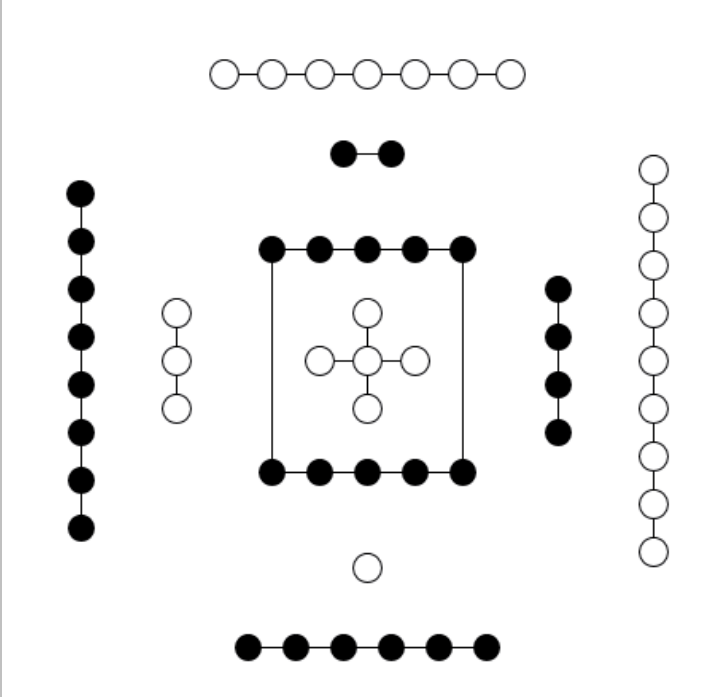
There are also 3 horizontal *Layers* called *Top*, *Middle* and *Bottom Layers*.

Cube Lexicon		
English	Français	Deutsch
Cube	Cube	Würfel
cube, cube	cube, petit cube	Würfeteil, Teil des Würfels
face	face	Seite, Seitenfläche
front face	face avant	vordere Seite, vorne
back face	face arrière	hintere Seite, hinten
left face	face gauche	linke Seite, links
right face	face droite	rechte Seite, rechts
top face	face supérieure	obere Seite, oben
bottom face	face inférieure	untere Seite, unten
sticker	étiquette (autocollante), plaquette	Kleber, Farbkleber
tile	tuile, plaquette	Plättchen, Farbplättchen
center cube, center	cube central, centre	Mittelwürfel, Mittelstein, Mitte
edge cube, edge	cube-arête, arête	Kantenwürfel, Kantenstein, Kante
corner cube, corner	cube de coin, coin	Eckwürfel, Eckstein, Ecke
layer	couronne	Schicht, Scheibe
top layer	couronne supérieure	obere Schicht, obere Scheibe
middle layer	couronne intermédiaire	mittlere Schicht, mittlere Scheibe, Mittelschicht, Mittelscheibe
bottom layer	couronne inférieure	untere Schicht, untere Scheibe
orientation, direction	orientation	Orientierung
to solve	résoudre	lösen, zusammen drehen
to twist	pivoter	drehen
to rotate	tourner, effectuer une rotation	drehen
clockwise	dans le sens horaire	im Uhrzeigersinn
anticlockwise, counter-clockwise	dans le sens anti-horaire	im Gegenuhrzeigersinn

# Chinese Luò shū Square Examples

**Chinese Luò shū Square Examples**





4	9	2		2-7	
3	5	7	3-8	5-10	4-9
8	1	6		1-6	

4	9	2
3	5	7
8	1	6

	7	2	5 10	4	9
8	3	1	6	4	9

south      fire  
 east      west  
 wood      metal  
 north      water

**Lo Shu Square** (simplified Chinese: 洛书; traditional Chinese: 洛書; pinyin: *luòshū*; also written 雒書; literally: Luo (River) Book/Scroll) or the **Nine Halls Diagram** (simplified Chinese: 九宮圖; traditional Chinese: 九宮圖; pinyin: *jiǔ gōng tú*), is the unique normal magic square of order three. Lo Shu is part of the legacy of the most ancient Chinese mathematical and divinatory (易經 *yì jīng*) traditions, and is an important emblem in Feng Shui (風水 *fēngshuǐ*), the art of geomancy concerned with the placement of objects in relation to the flow of (氣 *qì*) 'natural energy'.

Chinese literature dating from as early as 650 BC tells the legend of Lo Shu or "scroll of the river Lo". In ancient China, there was a huge flood. The people tried to offer some sacrifice to the river God of one of the flooding rivers, the Lo river, to calm his anger. Then, emerged from the water a turtle with a curious figure/pattern on its shell; there were circular dots of numbers that were arranged in a three by three nine-grid pattern such that the sum of the numbers in each row, column and diagonal was the same: 15. This number is also equal to the number of days in each of the 24 cycles of the Chinese solar year. This pattern, in a certain way, was used by the people in controlling the river.

The Lo Shu Square, as the magic square on the turtle shell is called, is the unique normal magic square of order three in which 1 is at the bottom and 2 is in the upper right corner. Every normal magic square of order three is obtained from the Lo Shu by rotation or reflection.

# Magic Square Numbers Table

Numerals					
Roman	Devanāgarī	Eastern Arabic	Chinese ( <i>dàxiě</i> )	Chinese	Arabic
I	१	١	壹	一	1
			yī one	yī one	
II	२	٢	貳	二	2
			èr two	èr two	
III	३	٣	叁	三	3
			sān three	sān three	
IV	४	٤	肆	四	4
			sì four	sì four	
V	५	٥	伍	五	5
			wǔ five	wǔ five	
VI	६	٦	陆	六	6
			liù six	liù six	
VII	७	٧	柒	七	7
			qī seven	qī seven	
VIII	८	٨	捌	八	8
			bā eight	bā eight	
IX	९	٩	玖	九	9
			jiǔ nine	jiǔ nine	

## Chinese Numerals

There are two sets of characters for Chinese numerals: one for everyday writing and one for use in commercial or financial contexts known as *dàxiě* (大寫 in traditional Chinese, 大写 in simplified Chinese). The latter arose because the characters used for writing numerals are geometrically simple, so simply using those numerals cannot prevent forgeries. A forger could easily change everyday characters 三十 (30) to 五千 (5000) by adding just a few strokes. That would not be possible when using the financial characters 叁拾 (30) and 伍仟 (5000).