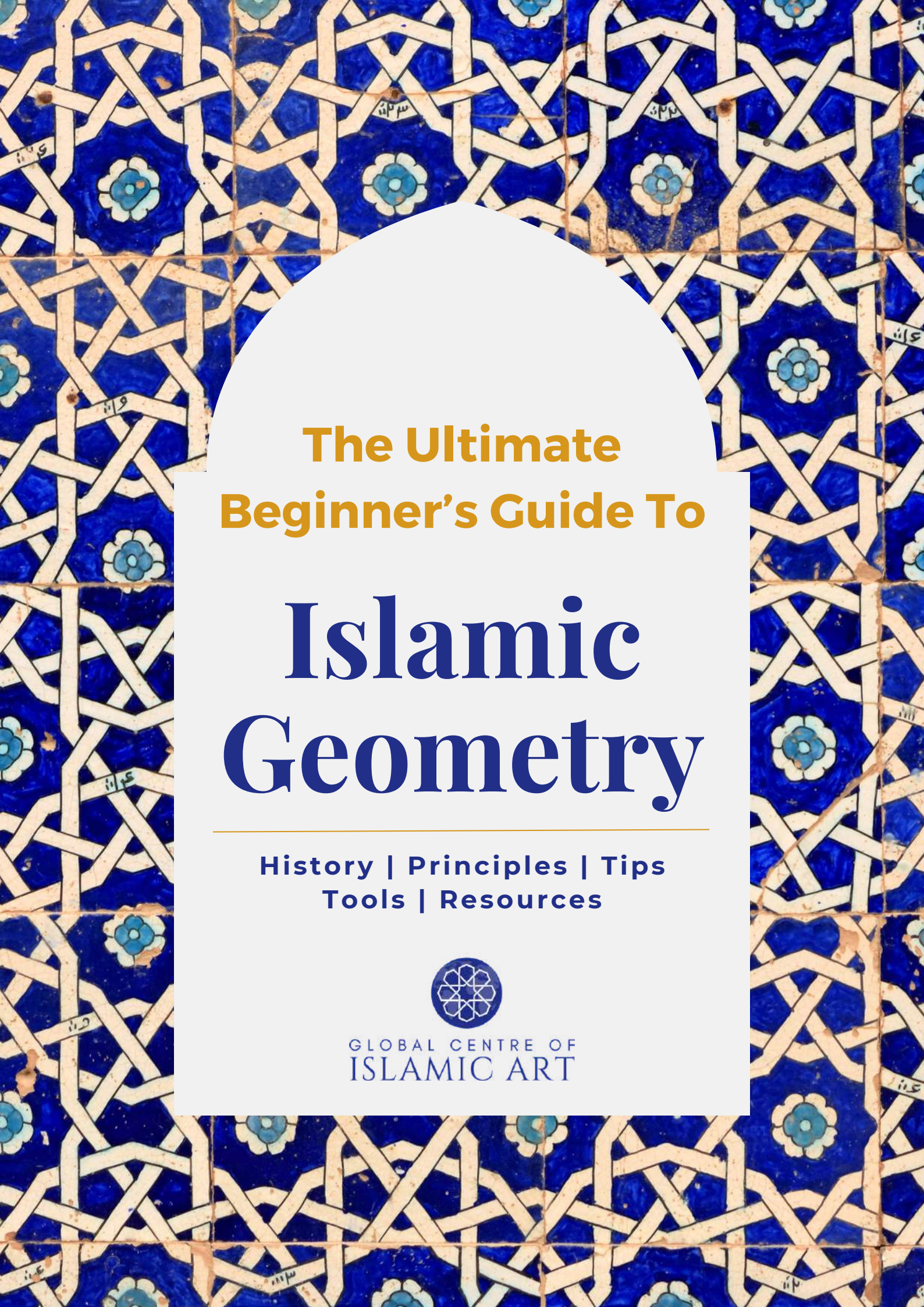

The Ultimate Beginner's Guide To

Islamic Geometry

History | Principles | Tips
Tools | Resources

GLOBAL CENTRE OF
ISLAMIC ART

Welcome

The online space offers a lot of free material to help you get started. Individual providers, artists and accounts share what they can so that others can easily fall in love with Islamic Geometry. We've compiled the most credible sources for learning to help kick-start your learning. So there's no excuse now!

We hope you enjoy and find value in this guide.

Fadhila Al Dhahouri

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Fadhila Al Dhahouri started practising Islamic Geometric Art in 2019 as a means of healing from depression and anxiety, using it as a way to connect with the Oneness of Allah.

Fadhila is currently dedicated to organising, uniting, and empowering the Islamic Art community. She co-founded The Global Centre of Islamic Art, aiming to make the transformative power she experienced through Islamic art accessible to people from all around the world.

Sandy Kurt

GCIA Co-Founder & Head of Courses

@sandy.kurt

Sandy Kurt is a self-taught artist, designer, and educator based in Italy. Her courses on complex geometry attract beginners and Islamic Art enthusiasts from all over the world!

As a co-founder of The Global Centre of Islamic Art, she aims to bring Islamic art and the enriching experience it offers to a wider audience, creating unprecedented impacts that will resonate into the future.

Table of Contents

Introduction

Islamic geometry is the term that incapsulates the geometric forms used in architecture and ornamentation. It has been influenced by a range of cultural, historical, and religious factors but all are rooted in universal principles.

For centuries, practitioners of geometry have used the very same tools that were used to build the Great Pyramids, Gothic cathedrals, temples, and the greatest mosques – ruler, straight edge, dividers or compasses.

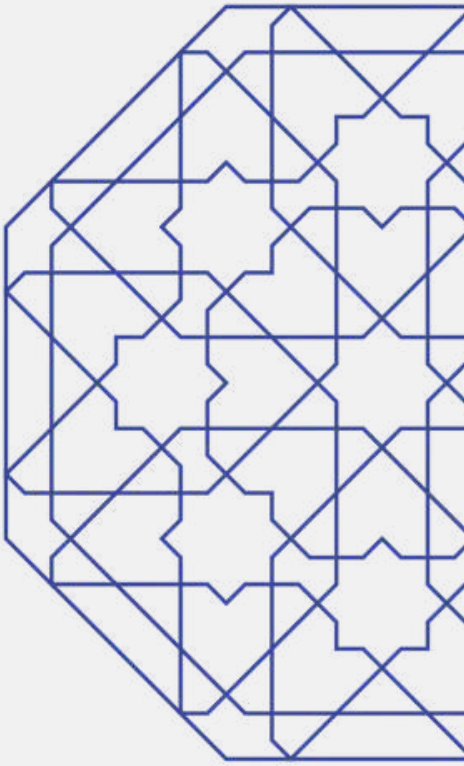
Geometry underwent significant development throughout the ages. Esteemed figures such as **Euclid**, **Plato**, **Socrates**, **Thales**, and **Pythagoras** played foundational roles in advancing geometry, recognising it as an integral branch of mathematics.

Islamic Influence

It is important to remember that geometry is not merely a practical art form, it holds significant deep and profound meaning, both philosophical and cosmological. It was the craft guilds within the Islamic tradition who were crucial to upholding this sacred knowledge. These guilds protected the quality of craftsmanship as well as the philosophical meanings behind the work; the deeper inner meaning of these forms were taught but kept confidential to these guilds.

“Geometry will draw the soul towards truth, and create the spirit of philosophy, and rise up that which is now unhappily allowed to fall down”

– Socrates in the seventh book of *Plato’s Republic*



Drawing upon Plato and Socrates, we come to an understanding that geometry aids rediscovering or remembering the soul, which in the Islamic tradition is very similar to ***zhikr*** (the active remembrance of God). From the Islamic point of view, the secret and highest function of geometry is to bring humanity into a direct relationship with Allah, The Divine (or what Socrates calls the *“ever-true”)* and facilitating the soul to remember itself.

“He is the One who made the sun a radiant source and the moon a reflected light, with precisely ordained phases, so that you may know the number of years and calculation ˹of time˺. Allah did not create all this except for a purpose. He makes the signs clear for people of knowledge.”

Surah Yunus, Verse 5

The fundamentals of Islamic geometry are deep-rooted within the religion, using concepts surrounding: *unity, perfection, shape, balance, harmony and symmetry*. At various points in the Quran, Allah creates emphasis on the measurement, calculation and precise order of natural phenomena as well as those who go out and seek that knowledge.

Beyond ornamental decorations, Islamic geometry was used significantly in architecture. Whether it was infinity pools, large rooms or corridors of seemingly endless arches or seemingly infinitesimally intricate patterns, the core motivation was to reflect infinity or re-imagine Heaven whilst being on this earth. For example, the entire Alhambra Palace in Granada, Spain is built on 4-fold geometry and the mathematical base of root 2, like many of the architectural wonders of the region.

There is an assumption that the methods in which Islamic geometric patterns have been constructed are either unknown, partly due to a scarcity of documented information, or that they have only been transmitted orally. However, when one looks into the historical accounts are available, we see a different picture:

A foundational book, **Ihasa Al Ulum by Al Farabi**, written in the 10th Century, clearly subdivided mathematical sciences into 7 major disciplines: ***arithmetic, geometry, optics, astronomy, music, weights and mechanics.***

It also included theoretical (Nazari) and practical (Amali) sides of science. Practical geometry was applied on wood by carpenters, on piece of iron by smiths, on a wall by masons, and on plots of land when used by surveyors. Al Farabi concluded that practical geometry was a key part of every craft.

Al-Farabi

Al-Buzjani, folio showing text and geometric figures

Another key figure in Islamic history is **Abu Al Wafa Al Buzajani,** a mathematician and astronomer. In the late 10th century he wrote a treatise called "**Kitab Fima Yahtaju Ilayhi Al-Sani' Min A'mal Al-Handsa**" (Book About That Which The Artisan Needs To Know Of Geometric Construction) which has a guide to generate regular polygons in a plane and sphere and it includes the Platonic solids (5 polyhedrons), Archimedean solids (12 semiregular polyhedrons) and many many more techniques. The book simply covers its instructions with the use of ruler, set square and compass utilising a single opening without the use of complete theory or calculations.

This proportioning system of geometry became relevant in application in mechanics, architecture, land surveying, architectural design and decorative design.

The biographical work of the Persian author **Abu al-Hasan al-Bayhaqi** (1100-1169/1170) mentions an entry written by a geometer **al-Hakim Abu Muhammad al-Adli al-Qajini,** who establishes a hierarchy based on the differing levels of geometric knowledge required from the designing architects and the masons executing their designs; the architect with their practical knowledge of geometry follows after the theoretical geometrician, and the bricklaying mason comes last. The same hierarchy is mentioned in the thirteenth-century ethical digest of **Nasir al-Din al-Tusi,** who himself was a mathematician.

The practical geometry of the architect was considered under the superior theoretical knowledge of the geometer, while the craftsman is ranked lowest.

This shows that not only was geometry a practice that was widespread across various levels of society and was used to spur innovation in the sciences and the arts.

Orientalism and Islamic Art

The peak of Europe's fascination with Islamic Ornament peaked in the **19th Century**, although it started in the Medieval and Renaissance periods. In the wake of Industrial Revolution, interest in abstract patterning grew and grew.

Driven purely by artistic demands, there was little interest in geometry as a science and there was a hyper-focus on 2D plane art, resulting in no classification of 3D-geometric pieces such as **muqarnas**.

Muqarnas: A unique decorative-architectural element introduced by Islamic architecture before the 10th century. Often called 'honeycomb' vaulting.

With little reason for historical rigour, the general point of view of Orientalists was filtered through their own cultural point of view.

Albert Gayet's "Vart Arabe", 1893, argued that the abstract decoration of Arab monuments reflected deeply seated racial characteristics:

"This is not the art of a religion or of a people, but that of a race."

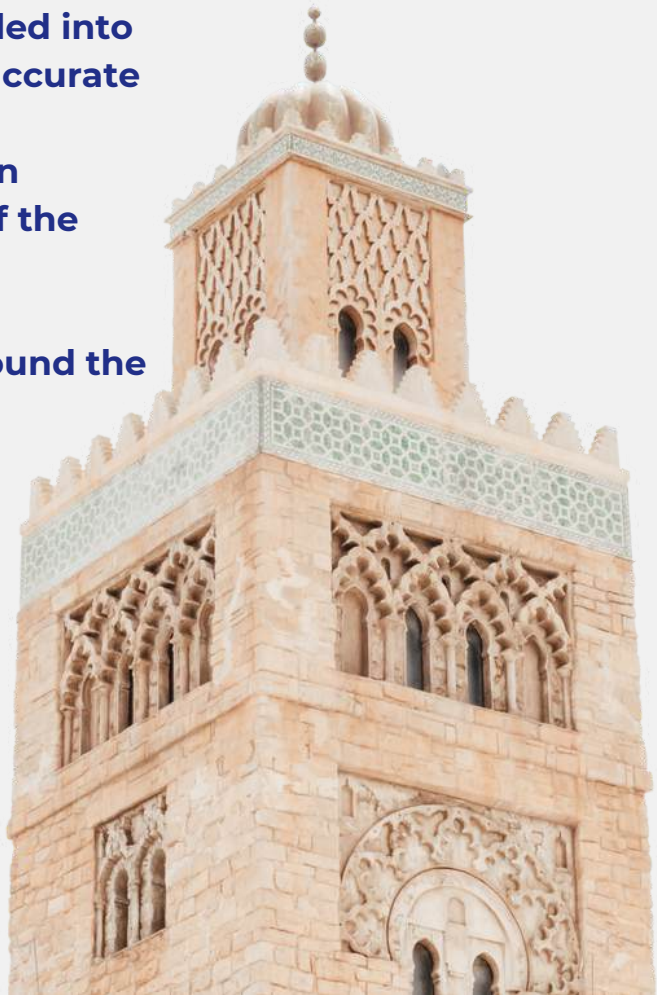
In addition, he comments that Islamic or “Arab” art originated in nomadic tents, a view that would be repeated in countless publications including Gayet's "Vart Arabe", seeing the art as distant memories of tents in polygonal geometric patterns.

By far the most important and comprehensive encyclopedia from this period and region was **Jones's The Grammar of Ornament, 1856,** which classified Islamic ornament in terms of the ethnoracial categories typical of his time: Arabian, Moresque, Turkish, Persian, and Indian.

This framing, repeated in several later publications, distorted the multi-ethnic social-cultural realities of premodern Islamic dynasties, whose rule had unified several geographic regions with diverse populations and religious minorities.

The categorisation of Islamic art was divided into races and regions, as opposed to a more accurate historical and religious lens, in addition to downplaying the level of sophistication, an attitude that reflected the colonial view of the world at the time.

This is still a discourse that still lingers around the art today.

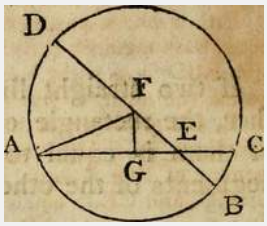


A Quick Look To The Past

The time between 790-1258 AD was monumental for Muslims as it marked the Islamic Golden Era. When Muslims controlled Alexandria, driven by the Islamic principle of honouring knowledge, they quickly took to learning, mass translation and distribution across their empires. This led to countless discoveries and contributions made in the fields of mathematics, science, philosophy, medicine, literature and the arts.

Today, we definitively know that it was this Islamic Golden age that re-connected Europe to the Greek tradition, who otherwise neglected such traditions out of paranoia of Pagan Greek sources, igniting the European Renaissance, especially via Al-Andalus.

Notable Scholars
Euclid (300 BC)

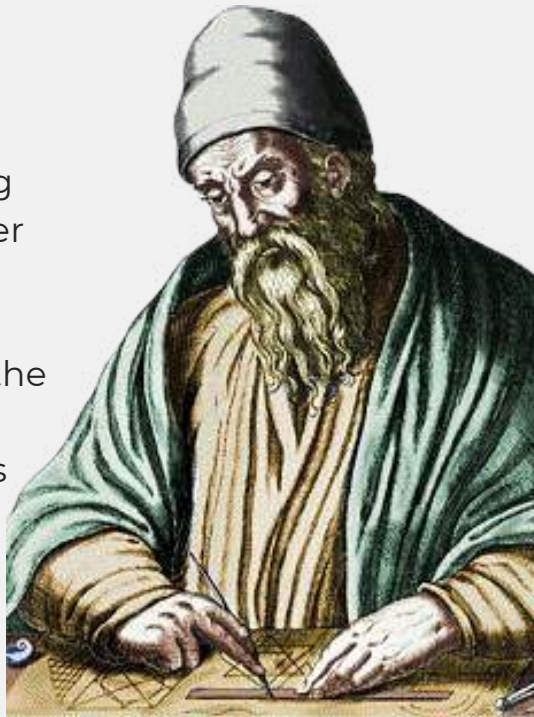


excerpt from
Euclid's treatise 'Elements

Euclid was an ancient Greek mathematician who was active as a geometer and logician. Considered to be the "father of geometry", he innovated via a combination of various theories from earlier Greek mathematicians.

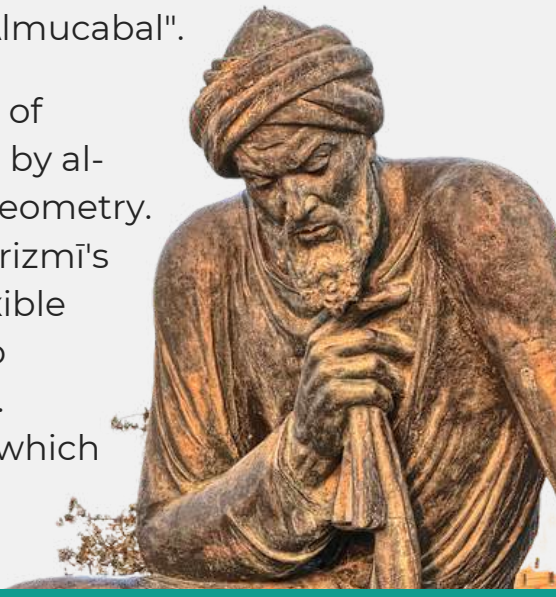
Little is known about Euclid's life; it is generally agreed that he was born and spent his career in Alexandria, Egypt and is often regarded as bridging the earlier Platonic tradition in Athens with the later tradition of Alexandria.

Euclid, Archimedes, and Apollonius, were three of the major Greek scholars who had major influences on Muslim mathematicians and helped form the basis of Islamic mathematics.



Muhammad ibn Mūsā al-Khwārizmī (780 — 850 AD)

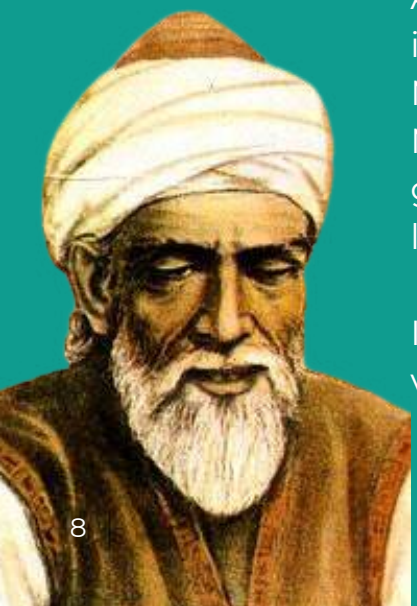
A Muslim mathematician who elevated the field of geometry with his pioneering work. His famous work includes the writing of "al-Kitāb al- Fī ḥisāb al-Jabr Wa'l-Muqābala" around 825 AD. Later on in the 12th century, the contents and teachings from this particular book were translated into Latin and it was titled "Algebra et Almucabal".



Known for his contribution as a Muslim in the field of mathematics, in the aforementioned book written by al-Khwārizmī, he proposed a flexible perspective of geometry. The developments of geometry based on Al-Khwārizmī's work in Islamic mathematics allowed for more flexible rules of geometry that enabled mathematicians to approach problems by creating multiple solutions. Therefore, unrestricting and breaking boundaries which were once created by the Greeks.

Abū al-Wafa (Buzjani) (940 — 998 AD)

Abū al-Wafa, whose full name was Muḥammad ibn Muḥammad ibn Yaḥyā ibn Ismāʿīl ibn al-ʿAbbās Abū al-Wafāʾ al-Būzjānī, (born June 10, 940, Buzjan — died 997 or July 998, Baghdad), was an astronomer and mathematician and his work contributed to the field of trigonometry. His discoveries paved the way for a simplified method of trigonometry and knowledge, expanding both complex, general rules and topics in maths. As the study of geometry progressed, Abū al-Wafāʾ and another mathematician called Abū Naṣr Manṣur together demonstrated the link between geometry and astronomy.



As this field of geometry expanded, it was implemented into various other sciences and practices. One of Abū Naṣr Manṣur's student, al-Bīrūnī (also known as Abū al-Rayḥān Muḥammad ibn Aḥmad al-Bīrūnī), discovered the use of geometry to calculate geographical distances based on latitudes and longitudes.

It is these innovations that propelled the creation of various patterns that we practice today.

Global Breadth & Diversity

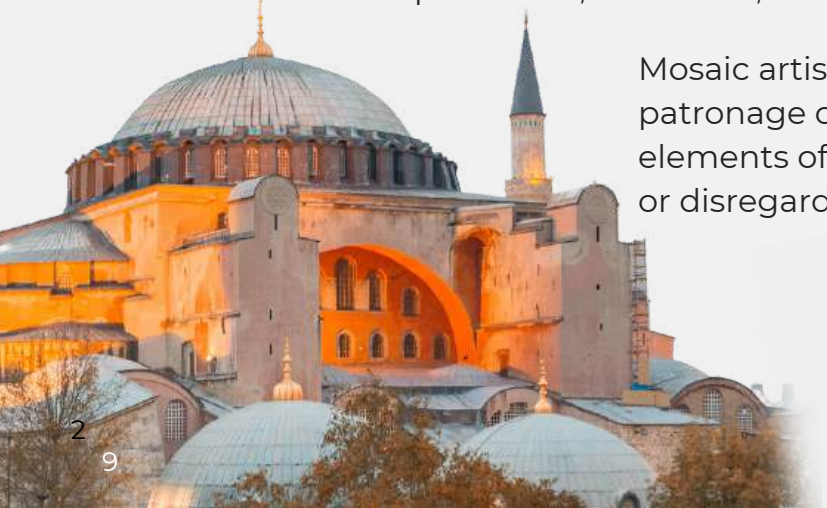
Islamic geometry has immense richness and diversity with various styles and patterns, found in different regions, and influenced by local cultures and traditions. As a result, Islamic geometry represents what is at the heart of Islam, that is, the freedom and space of wide cultural expression inside very broad but fundamental frameworks.

This development of Islamic geometry has not just occurred through wide-ranging geographical regions but also through centuries, and in the following pages you will discover how Islamic geometry became increasingly more sophisticated over time, giving you a sense of active development and cultural expression up until the advent of colonialism.

Byzantine 330 - 1453 CE

The Byzantines were understandably influenced by the early Christian and classical Roman architecture; encompassing mosaics, apse and clerestory.

Mosaics were prevalent during the reign of the Christian Byzantine Empire (as well as in the territories of its allied regions), and they also flourished in the earlier Roman Empire. However, mosaic art did not have a significant presence in Arabia. Following the Islamic conquest of the southern and eastern regions of Byzantium, Jerusalem and Damascus emerged as the key cities of the caliphate and, as a result, slowly their art was adopted.



Mosaic artists working in this area under the patronage of Muslim rulers retained certain elements of the Byzantine style while modifying or disregarding others.

Umayyads 661 - 750 CE

The Umayyad period existed in the early years following the death of the noble Messenger of God, Muhammad (peace and blessings be upon him). During this period, Damascus became the capital and the empire expanded West and East. There was an immediate need for places of worship and holy books to convey the word of God, so artists naturally focused on producing calligraphic Qur'ans and ornamented mosques.

Since Islam was a new religion, it had little to no artistic vocabulary, so much of the art was influenced by the older nations; the Dome of the Rock is a timeless masterpiece that incorporates Byzantine, Sassanian and Coptic elements.

The majority of patterns found was largely floral and vegetal patterns. Geometry was quite rare and widely unused during this time.

330-1453 CE	661–750CE	750-1258 CE	909-1171 CE	1038-1194 CE
Byzantine	Umayyad	Abassid	Fatamid	Seljuk

Abbasids 750 – 1258 CE

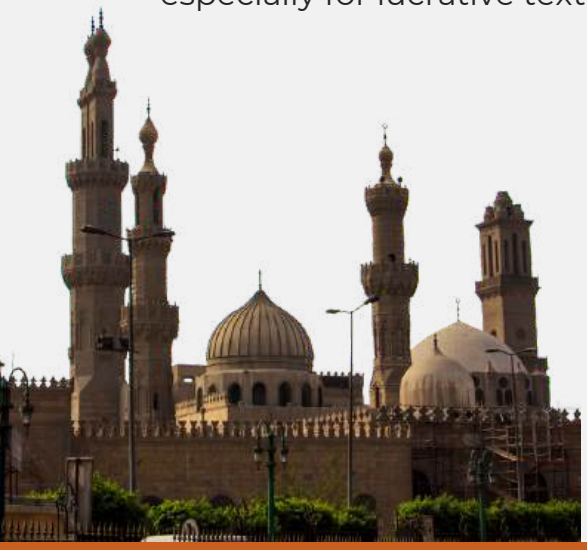
The Abbasid dynasty began with a revolution in the mid-eighth century. After the revolt, the new caliphate turned their attention eastward, by first changing the capital from Damascus to Baghdad.

It was under the Abbasid rule that the production of decorative stone, wood and ceramic crafts flourished. Artisans in Samarra developed new and innovative ways of carving that allowed for curved vegetal forms and simple geometric designs.

The Mosque of Ibn Tulun (868–884) is located in Cairo, Egypt. It is one of the oldest mosques in the whole of Africa surviving in its full original form, and is also the largest mosque in Cairo in terms of land area. The arches that surround its square courtyard are decorated with simple geometric and floral pattern.

Fatimid 909 – 1171 CE

This period is often called the Islamic renaissance, for its booming trade in decorative objects as well as the high quality of its artwork and craftsmanship. The wealth of the Fatimid court led to a rapid increase of the craft trade. Centers near Cairo were known for ceramics, glass, metal, wood, and especially for lucrative textile production.



Al-Azhar mosque: 970-972 CE:

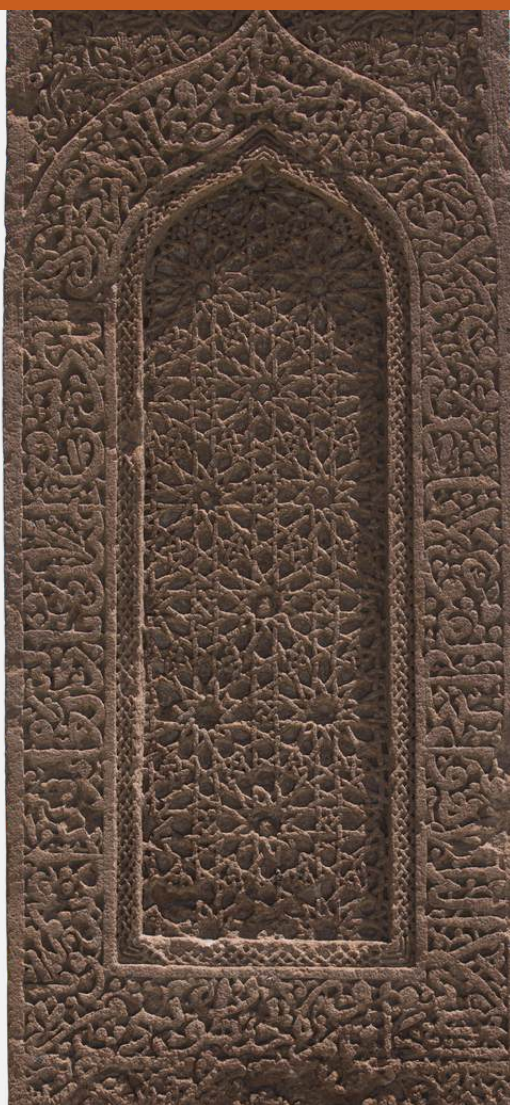
In Cairo, with the original designs consisting of stucco panels featuring vegetal motifs and window screens made with geometric designs. Stucco work above the windows and wall of a 6-point geometric design was added by Caliph al-Hafiz (1129-1149). Another mihrab with significant geometric patterns was built during the Ottoman restoration in 18th century.

330-1453 CE	661–750CE	750-1258 CE	909-1171 CE	1038-1194 CE
Byzantine	Umayyad	Abassid	Fatamid	Seljuk

Seljuk 1038–1194 CE

This era is known to be the first artistic movement that transitioned ornamental decoration from floral and figurative to geometric patterns, which gave them their distinctive recognition. People observed 6 and 8 point patterns based on tetractys motifs, which were prominently used by Muslims architects in Seljuk and late Fatimid era.

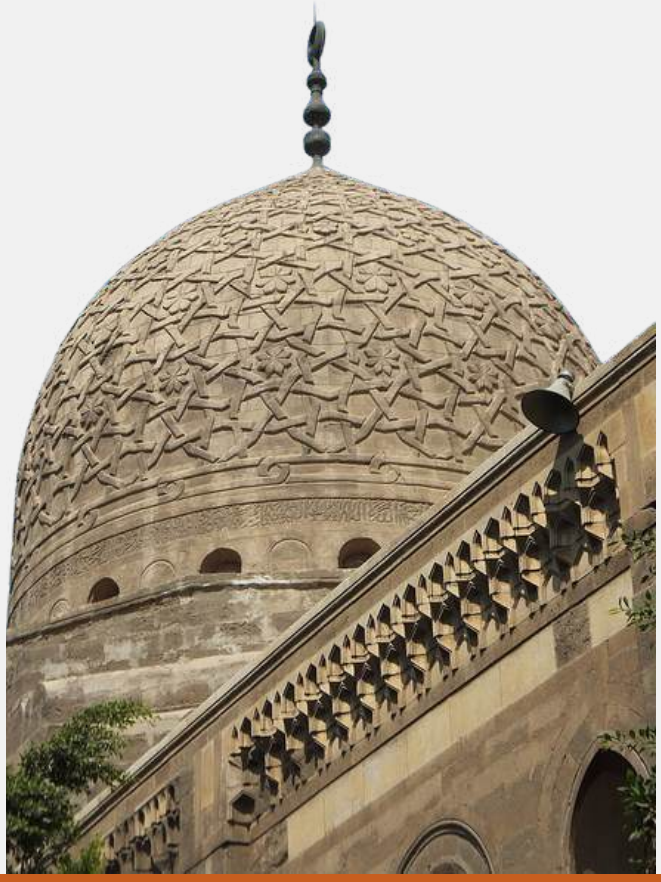
During this period, geometric patterns had significantly developed and this can be seen in the intricate and more detailed patterns found in the structure of aged mosques. The more recent Seljuk mosques were part of this artistic movement of implementing conventional geometric patterns (10-point, 6 and 8 point geometric patterns). This movement influenced the development of unique patterns, diverting from the even point to 7, 9, 11 and 13 point patterns, which were considered to be non-constructable polygons in the 13th century.



Mamluk 1250 – 1517 CE

The Mamluk period is considered to be the second artistic movement; often referred to as the Islamic renaissance because of its booming trade in decorative objects as well as the high quality of artwork and craftsmanship.

Many types of geometric patterns, particularly 16-point geometrical patterns, were an extraordinary feature of the ornamentation at this time. They were used on 2D planes as well 3D architectural pieces such as domes, in ways that were never seen before.



1250-1517 CE **Mamluk**

1300-1924 CE **Ottoman**

1369-1502 CE **Timurid**

1501-1736 CE **Safavid**

1526–1858 CE **Mughal**

Ottoman 1300 – 1924 CE

In 1453, the Ottomans captured the great Byzantine capital, Constantinople, and in 1517, they defeated the Mamluks and took control of the most significant state in the Islamic world.

The Ottomans were considered master builders, taking influence from the Seljuk and Mamluk styles. In addition to large-scale architectural projects, the decorative arts developed and flourished; mostly floral and vegetal motifs while geometrical constructions were kept to doors and minbars.

Timurid 1369 – 1502 CE

While the Timurid dynasty itself was short-lived, its legacy survives in the grand architecture and this period was also marked by the flourishing of art and science in Central Asia. Timur brought the best craftsmen and architects from conquered regions to Samarkand, making the city dazzle with the splendour of its magnificent architecture.

- Registan of Samarkand is the greatest monument of Timurid architecture.
- Complex Muqarnas were created using smaller individual cells. Visual balance could be achieved by alternating one pattern of decoration with another between the different subdivisions of the vault.

1250-1517 CE **Mamluk**

1300-1924 CE **Ottoman**

1369-1502 CE **Timurid**

1501-1736 CE **Safavid**

1526-1858 CE **Mughal**

Safavid 1501 – 1736 CE

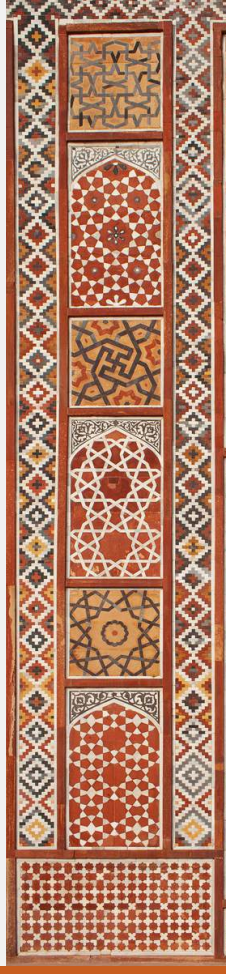
Exquisitely detailed miniatures, fine silks and complex, ornate palaces. The art of the Safavids was simply magnificent and it was during this time that there was a significant growth of art and science.

During their reign, they built hundreds of mosques, monuments, palaces, markets and shrines. The ornamentation of the architecture differed, but the structural composition remained the same, consisting of a dome and four *iwans* (rooms that open on one side to a courtyard, framed by arches).
In Isfahan there are two significant Safavid structures: the Ali Qapu Palace (1598 CE) and the Chehel Sutun Palace (1645-47 CE). These show significant ornamentation of 8 and 10-point geometrical patterns and muqarnas.

Mughal 1526 – 1858 CE

The Mughals were responsible for some of the greatest works of art produced in the canons of both Indian and Islamic art. Mughal architects used red sandstone, white marble, and polychromatic tiles. Similar to the Safavid era, Mughal architects decorated religious and secular buildings with 6 and 8-point patterns, avoiding more detailed patterns of 12 and 16 points. Almost all the tombs built in this period were based on the four-fold Mughal garden concept (*charbagh*) with a mausoleum building in the centre.

Akbar's Tomb of Sikandra is a splendid example of Mughal architectural design. Built during the life of the third Mughal Emperor, Akbar, it is a geometric treasure. The *muqarnas* is another decorative element which was used at the tomb and is often seen in Mughal architecture in India.



1250-1517 CE — Mamluk
1300-1924 CE — Ottoman
1369-1502 CE — Timurid
1501-1736 CE — Safavid
1526-1858 CE — Mughal

Muslims of Spain

Spain is an homage to many surviving buildings that are relevant today. With the Great Mosque of Cordoba (785 - 987 CE), Aljaferia Palace in Zaragoza (11th century), and the Great Mosque of Seville (1182 CE) being the most significant to Muslims.
These buildings share commonalities in their geometric patterns. With floral and geometric motifs, they consist of intricate and colourful 6, 8, 12, and 16-point geometrical patterns (e.g. Alhambra Palace in Spain). Geometrical ornaments were also used to decorate and signify the historical homage of Muslims in Spain.

Geometry enlightens the intellect and sets one's mind right. All it's proofs are very clear and orderly. It is hardly possible for errors to enter into geometric reasoning, because it is well arranged and orderly.

Thus the mind that constantly applies itself to geometry is unlikely to fault into error.

IBN KHALDUN

Benefits Of Practicing Geometry

In case you're still wondering if practising geometry is for you, we've listed a few of the commonly found benefits of Islamic geometric art:

Endless Possibilities

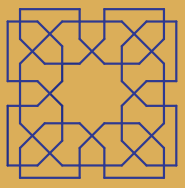
You'll never get bored with an infinite number of patterns. These geometric patterns can also be applied in other mediums such as ceramics, parquetry, weaving and much much more.

Meditative

Drawing geometric patterns requires your mind, hand and heart to be present so it can become an incredibly meditative experience. It will also improve your mental health!

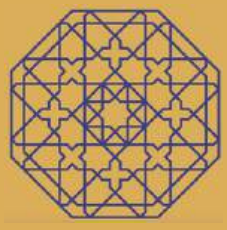
Reflective

Through observing and contemplating geometric shapes and patterns, they can reveal deep wisdom and serve as reminders of the Divine's presence.



Sharpens the mind

No one says it better than Ibn Khaldun: "– a mind that constantly applies itself to geometry is unlikely to fall into error. In this way, a person who knows geometry acquires intelligence."



Join a community

You'll have a chance to be a part of a rich and growing community of like-minded artists.

Professional Growth

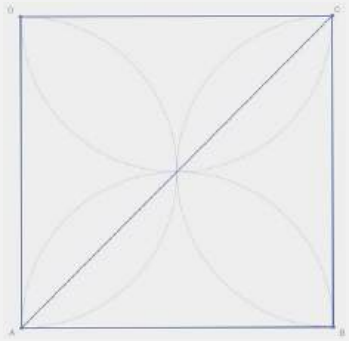
Grow your skillset and artistry with the possibility of turning a hobby into. a career! It's definitely possible...

Mathematical Principles

The most important geometric proportions are the golden mean and the primary three proportional roots √2, √3 and √5, in which most Islamic arts and architectural forms are based, especially their geometric pattern designs.

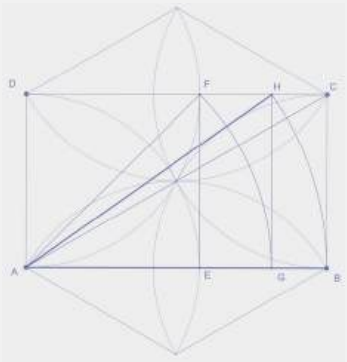
Root √2

The square includes √ 2



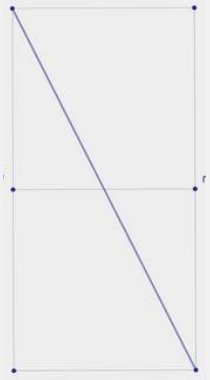
Root √3

The rectangle within a hexagon includes √ 3



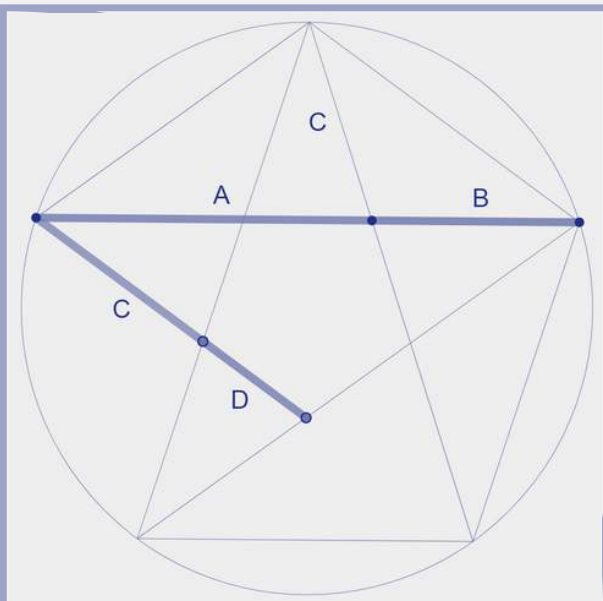
Root √5

Two squares include √ 5



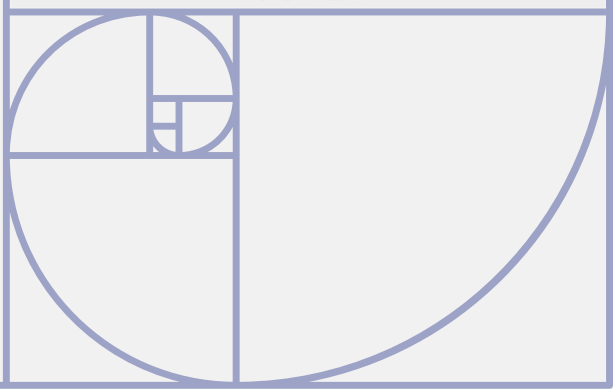
Golden Rectangle

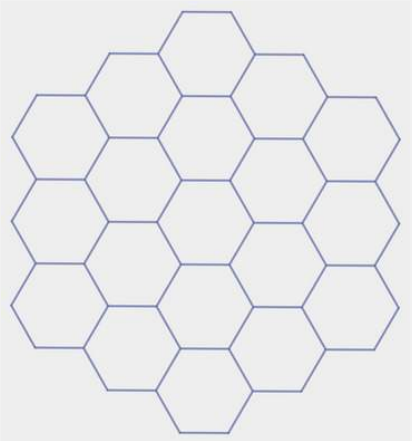
It is important to remember that geometry is not merely a practical art form, it holds significantly deep, profound, philosophical and cosmological aspects. It was the craft guilds within the Islamic tradition that were crucial to upholding this sacred knowledge.



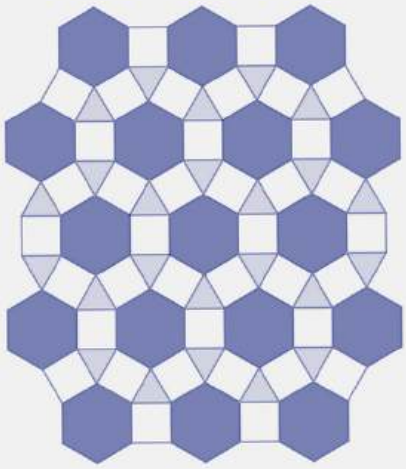
Golden Ratio

Mathematicians have studied the golden ratio's properties since antiquity. The golden ratio often appears in nature, including the spiral arrangement of leaves, other parts of vegetation, the spiraling of sunflower seeds, the wild rose and the apple.





Regular tessellation of hexagons



Semi regular tessellation

Creating a Pattern

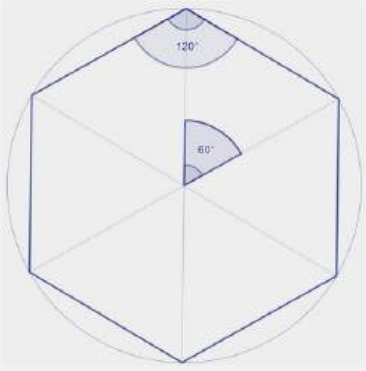
When shapes are combined, duplicated and interlaced to form patterns, these patterns are often referred to as tessellations, in which regular polygons repeat to tile a surface plane.

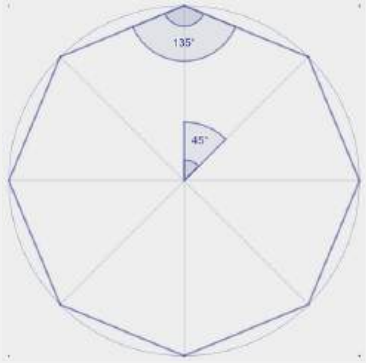
Only three types of regular polygons can tessellate (on their own): triangles, squares and hexagons, which is referred to as "regular tessellation". When several different regular polygons are combined to form a grid or pattern, this is called semi-regular tessellation.

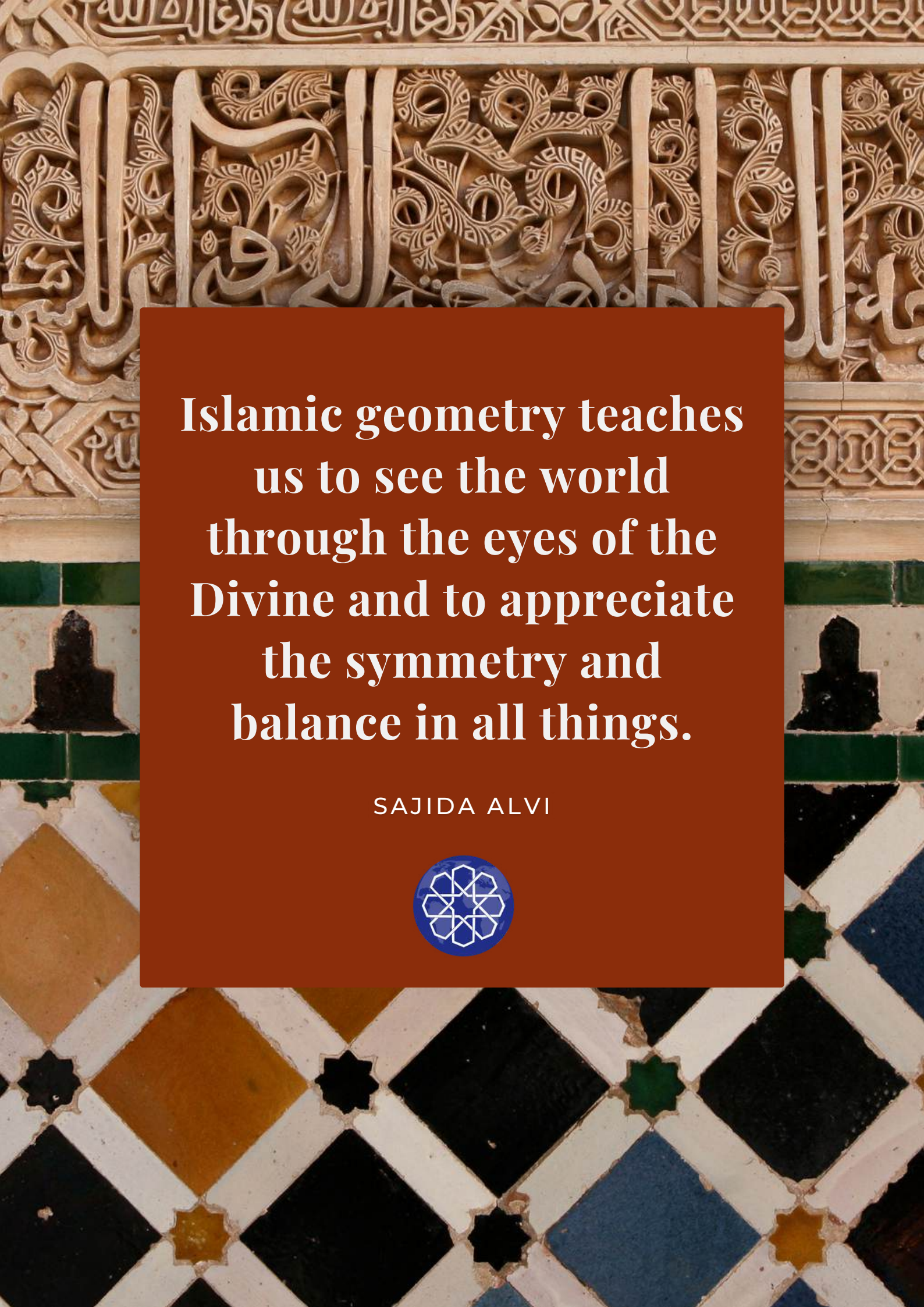
In general, mathematical patterns appear to be an integral part of Islamic Art. The repeating patterns give the illusion of infinity, reminding us of the infinite nature of God.
Numbers also seem to play a role in reflecting certain Islamic themes, such as using octagons to represent the eight angels that will bear the throne on the Day of Judgment.

Elements of Islamic Art

The most common geometric elements used in Islamic Art are circles, squares, star patterns (usually derived from squares and triangles inscribed in circles), and multi-sided polygons (for example hexagons and octagons). Through repetition and mirroring, the design can be elaborated and made complex. The symmetrical repetition and mirroring creates a sense of harmony and balance.







Islamic geometry teaches us to see the world through the eyes of the Divine and to appreciate the symmetry and balance in all things.

SAJIDA ALVI

Methodologies

Each geometric pattern that we see nowadays has been constructed using a particular method of construction.

The architectural drawings of the Topkapi scrolls, Tashkent scrolls and Mirza Akbar scrolls provide significant insight into how those within Muslim civilisations constructed geometric patterns. These scrolls highlight what is now called the “Traditional” method.

What stands out from this research is that mathematicians and geometers use proof and rigour to verify whether the information is correct, while craftsmen consider the aesthetic of the piece. Artisans frequently mask imperfections in the application of what would be otherwise accurate pattern construction, to a certain degree of approximation when applied in different mediums.

Subsequently, more methods have been created inside their own historical context.

You will also see here that some of the less complex geometric patterns can be constructed using more than one method, although we are not always certain of which one was used in the creation of a particular historical example.

Traditional Method

The Traditional method involves the use of a compass, a set square and a straight-edge ruler. It is highly dependent on the understanding of pure mathematical geometric principles of various shapes, usually constructing a ¼ of the final pattern (fig.1), either in a square or rectangle of a specific proportion, such as √2 or √3 rectangles, silver-ratio rectangle or golden-ratio rectangle.

The pattern is then repeated to completion by adhering to symmetry systems, such as reflection, rotation or translation symmetry (fig.2)

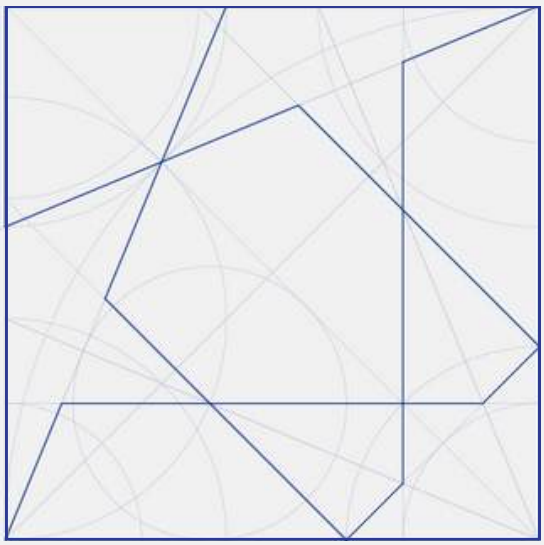


fig.1

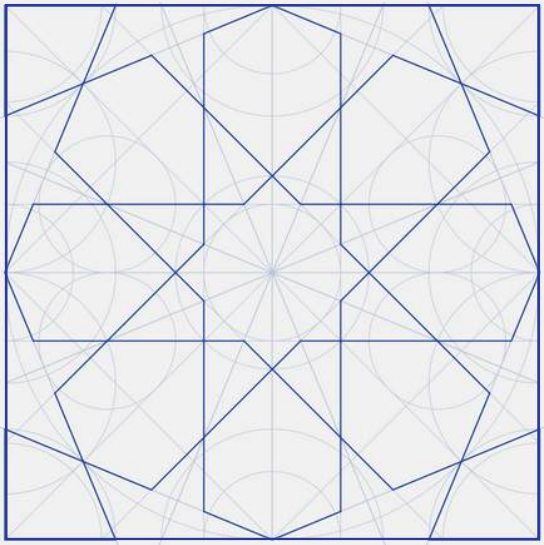


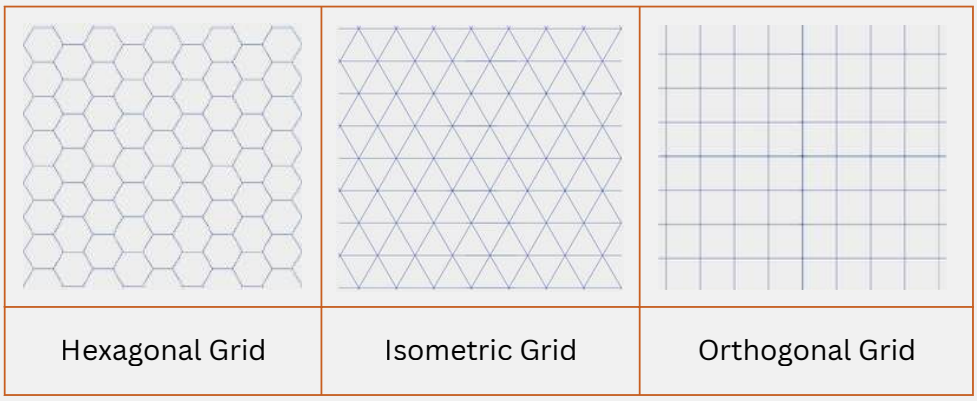
fig.2

Because this method is based on pure mathematical principles, and therefore highly purposeful, minimal and accurate, it can be used to derive a full range of patterns, from simple to complex, that can be tessellated infinitely and applied on any medium.

Grid Method

The grid method is known to have been created by Europeans purely based on their own observations of how geometric patterns were constructed. They viewed it purely from an artistic perspective.

The grid method consists of a flat surface filled with polygonal shapes placed next to each other in such a way that they do not overlap or leave spaces between them. A grid can be made of squares, equilateral triangles or regular hexagons (fig.3).



Hexagonal Grid	Isometric Grid	Orthogonal Grid

fig.3

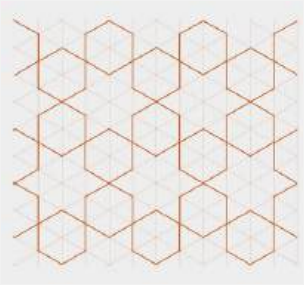
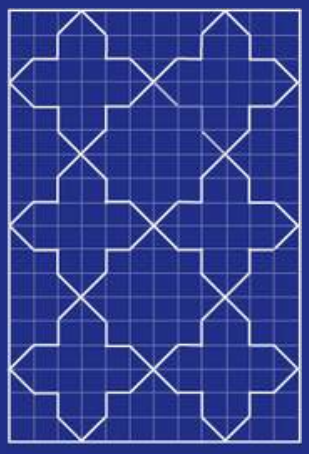
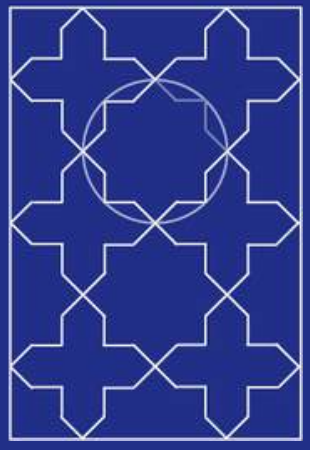


fig.4

The Isometric grid can be used to create less complex patterns (fig.4). In the orthogonal grid, diagonal lines can be added giving two more directions to the pattern line. This grid, for example, is used to construct the well-known star-and-cross design (called Breath of the Compassionate) although it's not the best method to use for accuracy since the finished star does not have an eightfold rotational symmetry (fig.5)



This method is simpler to get into drawing simple patterns, however it can be more challenging to derive more complex patterns and in both cases, accuracy can be harder to achieve.



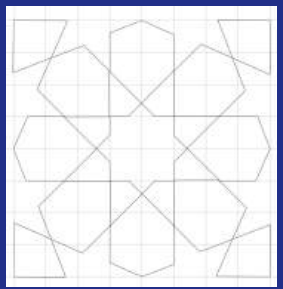
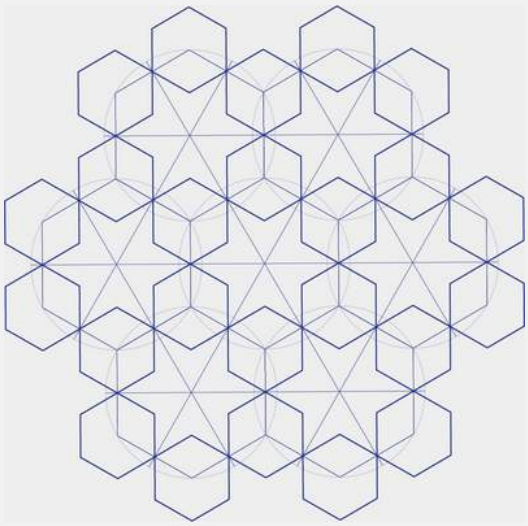


Fig.6 shows you the construction of the 8-fold rosette using the Grid Method.

Polygon in Contact Method

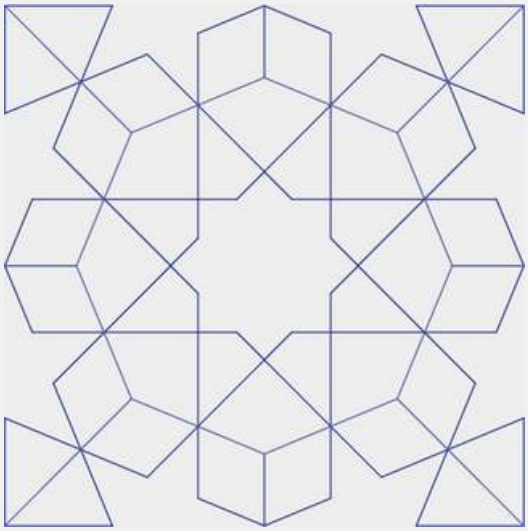
This method seems to be first articulated in the West by Ernest Hanbury Hankin in the early part of the twentieth century, based on his own observations.

The Polygon in Contact (PIC) method is realised by drawing a series of intersecting polygons, starting with a central polygon and then drawing additional polygons around it, each one touching the sides of the previous polygon.



Pattern lines are found by drawing v-shape lines from midpoints of existing polygonal edges, with a specific angle depending on the polygon. As a result, multiple designs can be created from a single underlying construction line, particularly when v-shape lines intersect. After the pattern is created, the polygons get discarded.

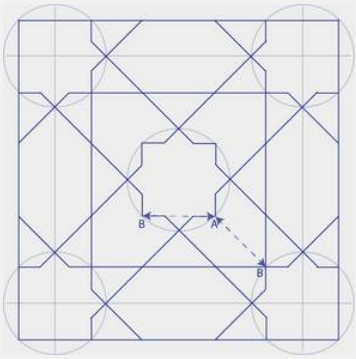
Fig.7 and Fig.8 show you examples of well-known patterns constructed using the Polygon in Contact Method.



It can be fun to use this method to explore new patterns because it can be treated like a puzzle. However, accuracy is a concern because it can create incorrect lengths or angles in a pattern.

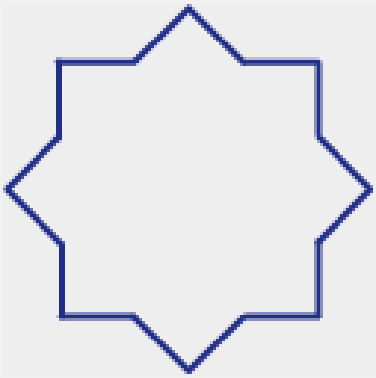
Rshim, Qasma & Hasba Method

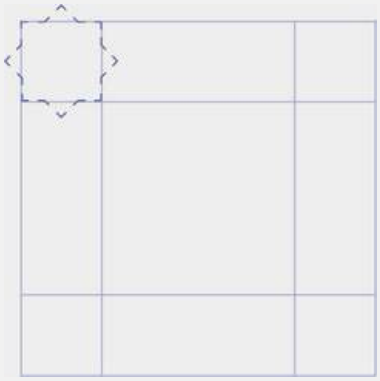
This method originated in Andalusia and it is still practiced by artisans and craftsmen in Morocco. In Morocco, it is called at-Tasṭīr (التسطير) which means “ruled with lines”. There are three different methods of at-Tastir, namely, Rshim, Qasma and Hasba methods. They vary in their degree of minimalism and way of construction.

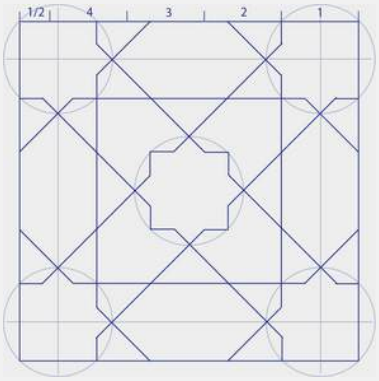


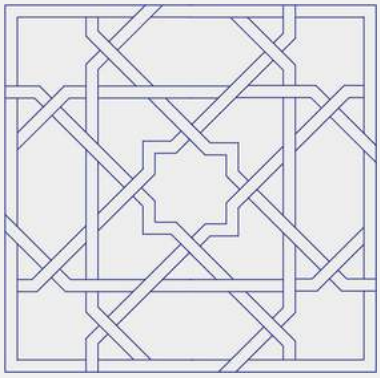
The Rshim (رشم) (“tracing”) method is based on approximation, shortcuts, and minimalism and focuses on the space and proportions between the circles. In Fig. 9 you can see that AB is both the width of the square and the diagonal gap between circles.

The Qasma (قسمة) (“division”) method aims to define the proportions between the Khatem (fig.10) of a certain pattern and the dimensions of the surface of the design the Khatem is part of (fig.11 and fig.12).



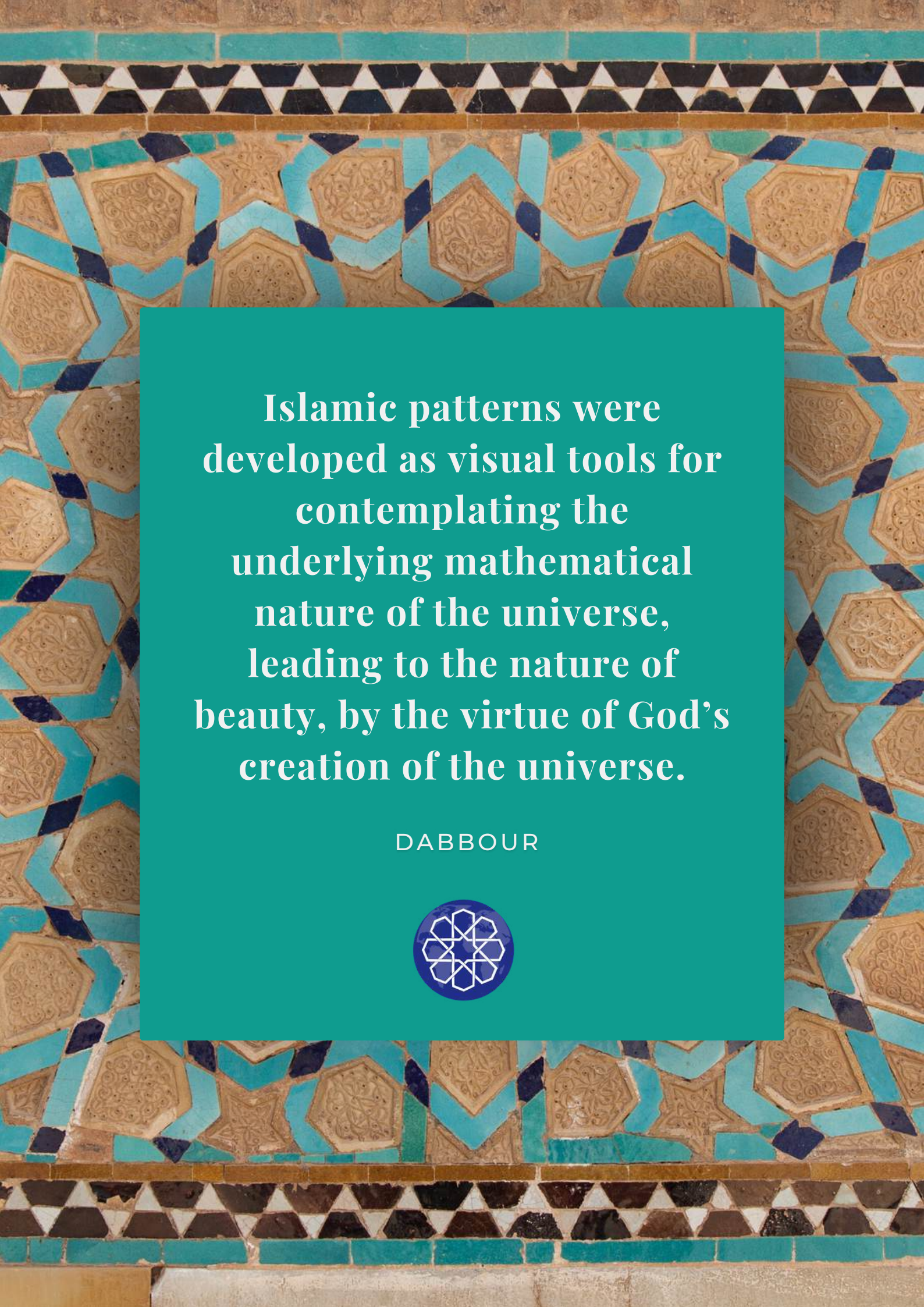






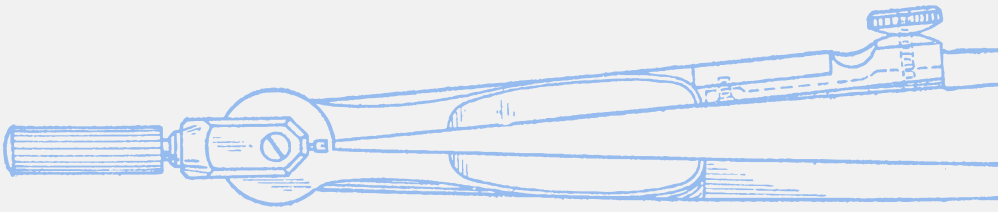
The Hasba (حسبة) (“calculation”) method creates an interwoven design straight from the beginning instead of adding the interlacing afterward, decreasing the time needed to construct a specific pattern (fig.13).
Perfect for artisans.

With these methods, it is easy to construct a large range of patterns. Even 5-fold and 6-fold designs can be constructed having the Khatem at the base of the analysis, whilst being economical and accurate.



Islamic patterns were developed as visual tools for contemplating the underlying mathematical nature of the universe, leading to the nature of beauty, by the virtue of God's creation of the universe.

DABBOUR



Tools

Many beginners of geometry ask how it is that they can maintain accuracy throughout their drawings.
Well here's the secret:
It all comes down to your tools and techniques.

Having quality, accurate tools is vital to the quality of your geometric construction, but what good are tools if you don't know how to use them?
Here's where we show you how!

The best tools have become rarer and rarer due to many manufacturers having stopped making them.

Essentials to Get Started

Compass

Plastic loosens over time, which will affect accuracy BIG TIME so find a compass that is 100% metal.
Also look for a compass with single arms or legs. Compasses with elbows will loosen over time.

Pencil

Mechanical pencils will not only allow for consistent lead width but will also eliminate the need to have to constantly sharpen. Trust us, once you have experienced mechanical pencils you will never go back!

Ruler

Transparent rulers are the best to see the points when drawing your lines. You can also use an architect scale ruler that has little thickness or a set square for better accuracy.

Eraser

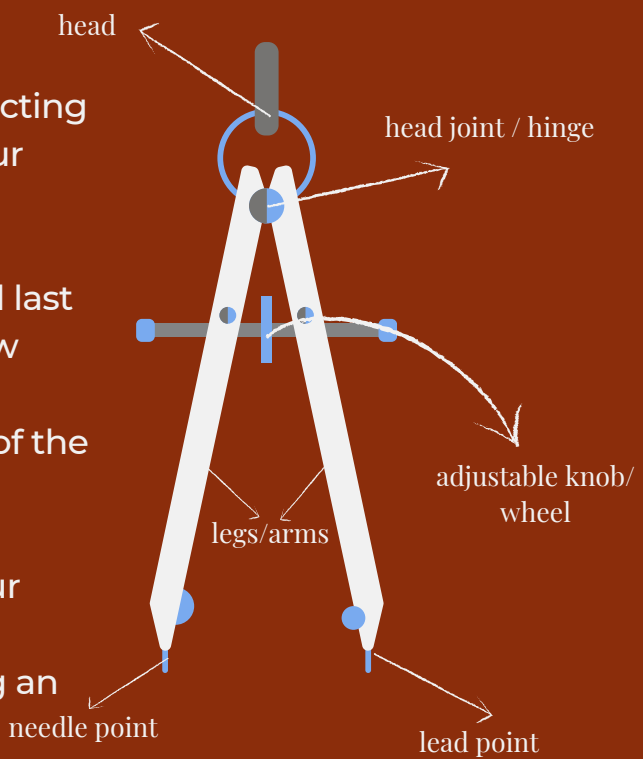
Why bother with bulky erasers when click erasers allow for better control or a kneaded eraser for a cleaner process?

Compass Care & Anatomy

Your tools (especially your compass) are the foundation of your creativity, therefore neglecting them will be detrimental to the quality of your work.

If you treat a high-quality compass well it will last a lifetime. If you have had a compass for a few years it will need lubrication. Simply apply beeswax or hard paraffin wax on the thread of the adjustment wheel.

You may also find that over a long period your compass loosens up, if this happens you can easily adjust and tighten the head joint using an appropriate screwdriver.



Tips On Accuracy

Carefully following these simple steps will help you work with precision and accuracy when constructing geometric patterns.

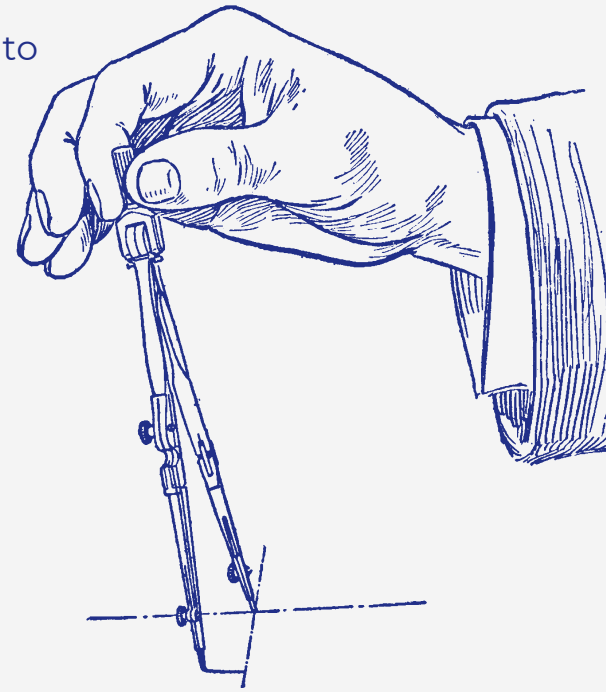
1. Make sure your mechanical pencil (pencil nib side) of the compass is slightly shorter than the needle nib side. By doing this, you have more control over the pencil lead by not touching the surface immediately when placing the compass on paper.

2. Place the compass needle to the point of interest gently and don't pierce the paper, as constantly piercing it will make the hole bigger, which will impact the accuracy of the intersection points.

3. Once you have placed the compass needle on the point of interest, tilt the compass either towards you or away from you by a 45-degree angle. Then place the pencil lead side of the compass on the paper.

4. Hold the compass from the top (head) as it allows you to draw a full circle in one movement.
If held from the side, you will only be able to draw a quarter of the circle.

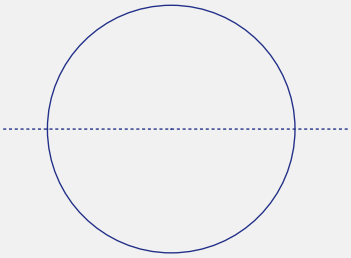
5. Then rotate it gently and allow the weight of the pencil to lead the compass to create the circle. Make sure not to apply pressure when at any point of drawing with the pencil as this helps you to erase the lines easily without leaving a mark on the paper.



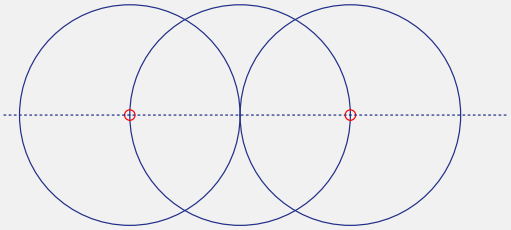
Train yourself to hold the compass correctly, as shown in this illustration:

Exercise For Accuracy

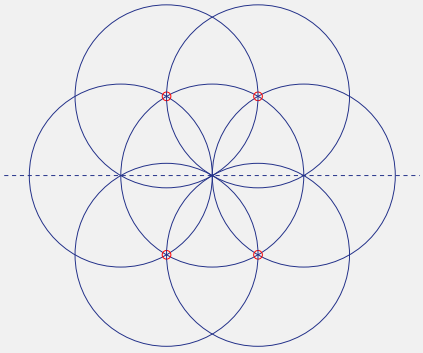
Unlock the secrets of the mesmerising Flower of Life with these step-by-step instructions! This effective exercise not only enhances your accuracy but also provides a fun and effective way to practice regularly.



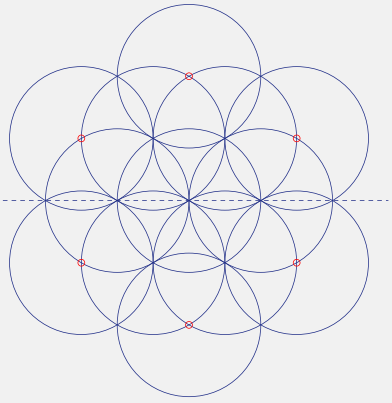
Drawing a horizontal line, carefully draw a circle at the centre. Ensure the compass centre is accurately placed on the line or everything else will be off.



Carefully draw two more circles at the intersections where the line crosses the circle.

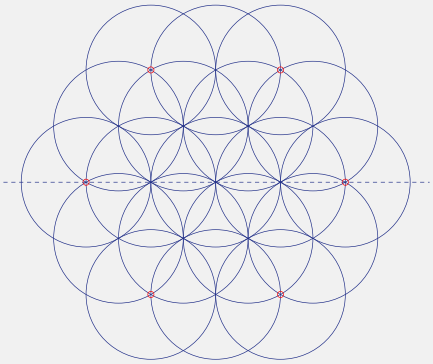


Continue to draw circles at the new intersections (indicated). It's important to apply consistent pressure with your compass when drawing.



Continue to draw cirles at the indicated intersections.

Practicing this many times over with both hands is highly recommended. Just keep on creating circles!



Continue to draw circles at the indicated intersections. See how far you can get before visible inaccuracies appear.

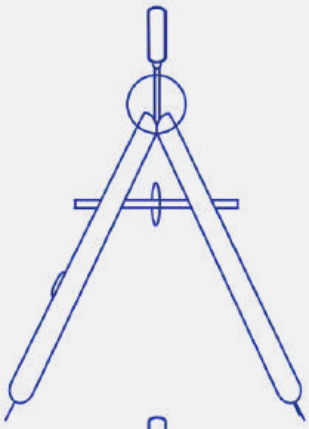
Pro Tip:

- *We recommend having two or three mechanical pencils with one 0.3 mm/ 0.5 2H/H and another 0.7 mm B to draw your final patterns.*
- *When we are writing, we hold the pencil from the end close to the lead. However, in drawing, make sure to hold the pencil from the middle with three fingers.*

GET TO KNOW YOUR

Compasses

Bow Compass



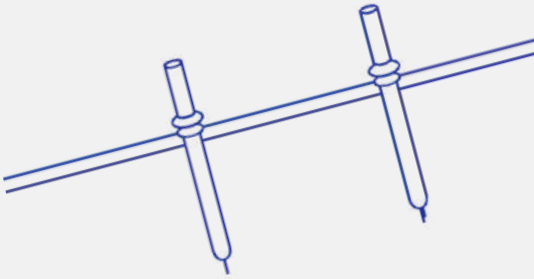
The bow compass is the foundational tool for geometric drawings. They come in varying sizes and it is always a good idea to have a number of these in varying sizes in your toolkit.

Dividers

The divider has two steel points and was the predecessor to the beloved compasses we use today. Before the demand for inks and lead, they were used to impress arcs and lines into the paper creating 'invisible construction marks'.

They can still be used today to make invisible markings and measurements in geometric drawings.

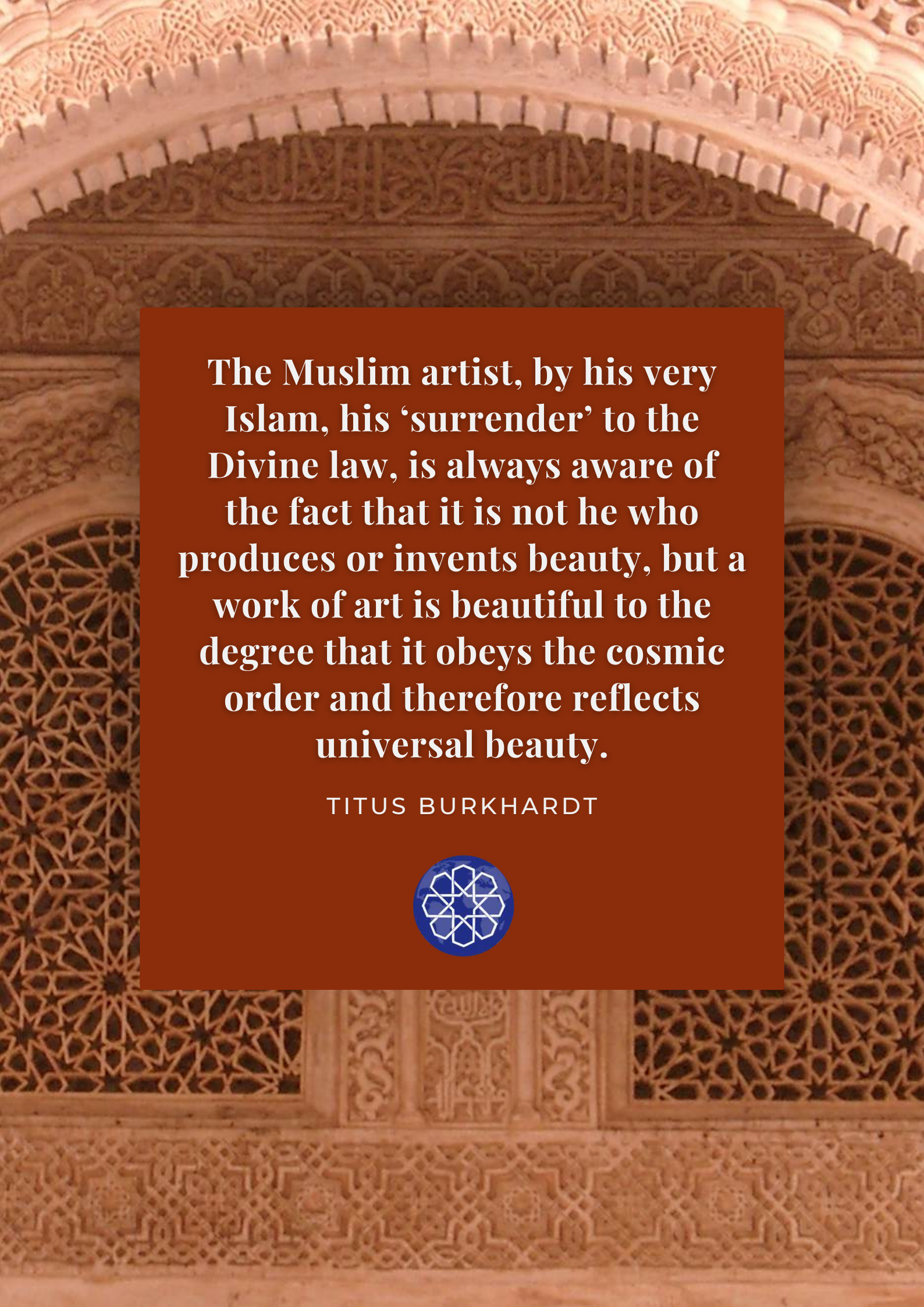
Beam Compass



This compass has a reputation for being used to solely draw large circles. Due to its ability to stay completely vertical, it is in fact the epitome of accuracy among all compass designs. So, when you require impeccable precision in your drawings, this is the compass you can rely on.

Drop Bow Compass

This nifty little tool is a necessary tool to add to your toolkit when drawing tiny little circles. A must if you like to challenge yourself to draw on a miniature scale!



The Muslim artist, by his very Islam, his ‘surrender’ to the Divine law, is always aware of the fact that it is not he who produces or invents beauty, but a work of art is beautiful to the degree that it obeys the cosmic order and therefore reflects universal beauty.

TITUS BURKHARDT

This page contains clickable links

Books

PERFECT FOR BEGINNERS

Within this assortment of books, you'll discover a wealth of knowledge but it's important to note that no book can claim absolute flawlessness. However, we have collected a list of books that we think would be exceptionally useful and valuable for hobbyists and beginners to provide a solid foundation.

As your skills develop and you delve deeper into the art, you'll begin to notice these imperfections, but consider it an opportunity to refine and master your craft even further.

- Islamic Design: A Mathematical Approach
Brian Wichmann, David Wade

- Islamic Design: A Genius for Geometry
Daud Sutton

- Islamic Patterns: An Analytical and Cosmological Approach
Keith Critchlow

- Ruler & Compass: Practical Geometric Constructions
Daud Sutton

- Zillij: Art of Moroccan Ceramics
S Samar Damluji, John Hedgecoe

- Symmetries of Islamic Geometrical Patterns
Syed Jan Abas, Amer Shaker Salman

- Islamic Art and Architecture: System of Geometric Design
Issam El-Said

- Arts and Crafts of the Islamic Lands: Principles, Materials, Practice
Khaled Azzam, Prince's School of Traditional Art

- The Royal Alcazar of Seville with a Ruler and Compass
Manuel Martinez Vela

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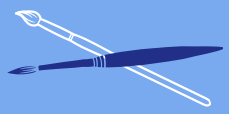
Where To Find High Quality Tools

Our team of experts have compiled a list of affordable and reliable tools that can help enhance your creative process. Check out our recommended tools to make your journey smoother and more enjoyable.



Paint brushes*

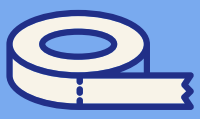
Eraser

B Pencils or Mechanical Pencils

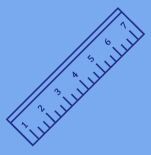
Compass

Watercolour Paints

Paper & Tracing paper



Masking tape



Straight Edge Rulers

We ALWAYS advocate for organic and eco-friendly paints as they are sustainable, non-toxic and aligned to Islamic ethical values. We are opposed to plastic-based acrylics and other toxic synthetic paints.

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Ruby Mountain offers handmade watercolors, pastels and other art supplies to artists worldwide. Colors and collections change seasonally but are always non-toxic and professional quality.

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Find out more: www.naturalearthpaint.com

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Free Resources

There is a plethora of free resources available to assist you in embarking on your journey. Many arts practitioners willingly spread their knowledge, aiming to ignite a passion for Islamic geometry within others. However, it's easy to become overwhelmed by the endless loop of Google searches for reliable resources.

That is why we have curated a collection of the most trustworthy sources for learning geometry right here at your fingertips!

Global Centre of Islamic Art	• Introductory Masterclass to Islamic Geometry
Mohamed Al Janabi	• YouTube Video Tutorials
Ambigraph	• Blog: In depth explorations of geometric patterns and concepts.
Patterns in Islamic Art	• Collections, Essays, PDF's and more!
Alan Adams	• In depth blog posts, articles and more if you're serious about Islamic geometric patterns.
Samira Mian	• Youtube Video Tutorials • Website: Free Tutorials and valuable resources
Sandy Kurt	• Getting started • Blog: Everything you want to know about Islamic geometric patterns

This page contains clickable links

Paid Resources

We have also gathered the most reliable course providers, educators, and organisations for you to browse freely.

Global Centre of Islamic Art	• Beginner pre-recorded courses on Geometry with life-time access
Mohamed Al Janabi	• Foundation Level Course In Five Fold Patterns
Art of Islamic Pattern	• In-person and online courses, workshops and international study trips
Samira Mian	• Online and in-person Islamic geometry educator
Princes Foundation School of Traditional Art	• UK based course provider of the traditional arts and further education masters and PHD programme
Istanbul Design Centre	• Istanbul based, providing online and in-person courses, workshops, seminars and exhibitions in the field of Islamic Art
Sandy Kurt	• Online pre- recorded courses for learning Islamic Geometry
Hamza El Fasiki	• Moroccan based educator and craft studio providing services both online and in-person

30 PATTERNS IN 30 DAYS CHALLENGE

Guest Artists

DAY 19: JANUARY 20TH*

ARCHITECT

Alberto Aguilar

@the_geometrician

Alberto Aguilar is Spanish architect who uses AutoCad to create Islamic geometric patterns and will be demonstrating his techniques during his session in the challenge.

* Subject to change of date

DAY 26: JANUARY 27TH

ARTIST, EDUCATOR & CONSULTANT

Mohammed Aziz

@maziz_aia

Mohammad Abdul Aziz, who is a Master in Visual Islamic and Traditional Arts and also a scholar in Islamic sciences, theology, and jurisprudence, will enlighten us on the deeper philosophical and cosmological meanings behind Islamic geometry as he teaches us a pattern.

Join our like-hearted Islamic geometric art enthusiasts from all across the world and connect, learn and grow together as one global community and kick-start your new year powerfully!

Artists To Follow

When you connect with an educator, don't wait for them to post. If you are interested in a course or some resources, reaching out to them directly is usually the best way.

Dr. Serap Ekizler Sönmez

Academician, Artist & Educator

Based in Istanbul, she completed her master's degree in the same university Islamic Arts History field and her doctorate (PhD) in Yeditepe Üniversity History field. She has publications on Islamic architecture and geometric patterns.

Mostafa Sedky

Artist & Educator

An accomplished artist and educator who regularly delivers courses, has been part of heritage preservation projects and has established Mamluk Art House, Mamluk Store and Mamluk Design House.

Mohammad Aziz

Artist, Educator & Consultant

A London-based scholar in Islamic sciences, theology, and jurisprudence. Muhammad is a Hafiz, a Master in Visual Islamic and Traditional Arts. He teaches traditional arts in London's Islamic faith schools.

Hasret Brown

Artist & Geometer

Hasret Brown specialises in Islamic geometric patterns. Fusing time-honored techniques with the modern and the influences of her multicultural upbringing, she expresses and reinvigorates this tradition in a contemporary and contemplative manner.

Artists To Follow

Many artists have a wealth of information and inspiring content available on their websites and social media pages. So, have the courage to connect with them and embark on your artistic journey!

Rajen Astho

Artist & Educator

Around the same time as completing his MA in music composition in Russia, he discovered his second biggest passion; the art of Islamic geometric patterns. It blossomed over time and now he shares his passion through his artworks, research and teaching.

Antara Biswas

Artist, Educator & Graphic Designer

Antara is based in India who took the plunge, switched careers, and dedicated herself to Fine Arts. After exploring multiple art forms, she found her calling in Islamic Arts, evolving her practice from hyperrealism to contemporary art.

Alberto Aguilar (The Geometrician)

Architect

The Geometrician is a graphic research project created by Spanish architect Alberto Aguilar. Its main objective is the study of traditional Islamic architecture and geometry using contemporary tools.

Sarah Gelsinger Brewer

Artist & Mathematician

Sarah holds advanced degrees in art and pure mathematics, and taught maths for 13 years. She is currently working on her M.F.A. and teaches GeoGebra classes via Zoom.

Artists To Follow

As you increase in your skills and post more online, you will undoutably grow online too. Don't forget to bring others up with you as we all grow through the generosity of others.

Aziza Iqbal

Artist, Surface Designer & Pattern Specialist

A quintessential maths nerd and pattern junkie, Aziza thrives on symmetry, grids and details. Her work is fundamentally inspired by the harmony and symbolism in Islamic arts and crafts, particularly geometry and architecture of the Indian Subcontinent.

Margi Lake

Artist, Geometer, Poet

By drawing and painting Islamic geometric designs, Margi believes it enables us to become co-creators in an alchemical process whereby the timeless principles of harmony, balance, proportion and symmetry are revealed through circles and lines, colour and light.

Noor Malik

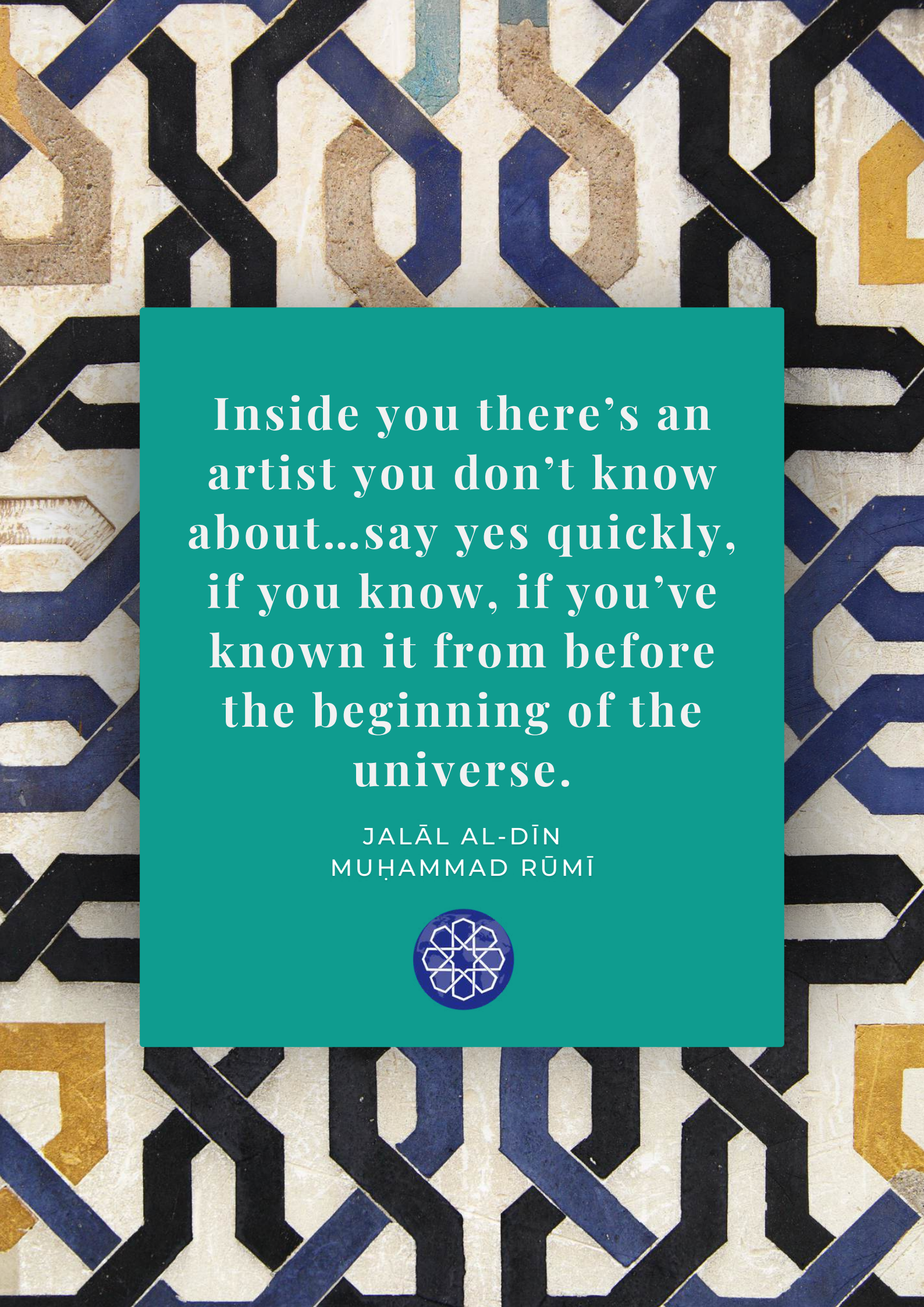
Artist

A Pakistani-Canadian watercolour artist exploring the bounds of Islamic Geometry. The purpose of her art is to inspire awe and curiosity in the Divine. She specialises in using unexpected colours in traditional constructions and wants to expand the reach of this art form in North America.

Paul Barchilon

Artist

Working from within a 1300-year-old tradition of geometric design, Paul pays homage to these sources but seeks to imbue them with a modern sensibility. This is a living breathing tradition and he has been practicing Islamic Geometry for 30 years, and ceramics for 40 years. He has researched patterns and line designs across the world.



Inside you there's an artist you don't know about...say yes quickly, if you know, if you've known it from before the beginning of the universe.

JALĀL AL-DĪN
MUḤAMMAD RŪMĪ

START YOUR JOURNEY IN ISLAMIC ART

What's Your Why?

We navigate the world and life itself by creating meanings and experiencing them. When starting Islamic art (as with everything in life), clarifying your 'why' is the most empowering way to immerse yourself, derive joy from the art, and grow in it.

Try this exercise to help discover your 'why' and become present with your experience of Islamic Art.

1) How it makes you feel:

2) What state of mind does it invoke:

3) If you are in that state more often, what is possible for your life:

4) Following on from 3), why are those things important to you?

Understanding the value of practising this art enables you to derive even greater benefits from it and recognise how it can genuinely shape and transform your life. We recommend reminding yourself of your "why" and renewing your intentions just before you commence your art practice.

Don't worry if your "why" evolves and develops as you overcome challenges and your skills expand. It is merely a testament to your growth!

Your Goals & Milestones

At the beginning of any journey, planning helps in measuring what is possible. Planning leads to action. Action leads to learning. Learning leads to better planning. Therefore, when you evaluate, do not approach it with regret. Instead, concentrate on the knowledge you gained that was previously unknown and consider how you can incorporate it into future planning.

milestones

3-month goal:

Milestone 1:

Milestone 2:

Milestone 3:

- ◯ What worked & why?
- ◯ What didn't work?
- ◯ What was missing that, if it was there, would make a difference?
- ◯ Specifically, what can you implement in the future?

milestones

6-month goal:

Milestone 1:

Milestone 2:

Milestone 3:

- ◯ What worked & why?
- ◯ What didn't work?
- ◯ What was missing that, if it was there, would make a difference?
- ◯ Specifically, what can you implement in the future?

Commitment requires both imagination and courage. Two essential qualities for any artist to thrive. Therefore, muster the courage to invest in your own growth and commit to becoming at least 1% better. It is through such incremental progress that true growth occurs.

Pro Tip

About Global Centre of Islamic Art

We are a passionate group of artists, marketers, technologists, and researchers who have united with the aim of elevating the status of Islamic Art and bringing about a transformation in the space.

Our Vision

Our vision is to make the transformation of Islamic Art accessible to every individual, fostering prosperity, community, and growth for authentic masters, students, institutions, and nations. We aim to celebrate our rich past while reimagining our future on a global scale.

Our Mission

- Raising the standard by building high-quality courses designed by the best masters
- Making high-quality tools accessible to the widest number of people
- Develop applications that innovate for today's and tomorrow's problems
- Work to expand the Islamic art space and create structures and ecosystems that enable prosperity
- Tours to various places to enrich tourists and the local economy
- Create connectedness, artistic and business mentoring through online and offline events & hubs

Our Values

As an Islamic organisation, we champion and uphold the following values:

Community-Centric

Islamic art can only flourish when it is done together. We aim to create a space that forms a thriving global community.

Pragmatic

Grounded in practicality and delivering results through a data-driven, results-oriented approach.

Independent

Encouraging everyone to bring unique perspectives to the table, driving innovation and success.

Trailblazing

Constantly pushing boundaries of what's possible, pioneering new ways to create the future.

Empowering

Supporting the next generation of talented artists, innovators and leaders to shape Islamic art and beyond.

Celebrating Diversity

For centuries, Islamic art has been global, full of the rich diversity that compels us to celebrate it.

Inclusive

Individuals from all backgrounds and perspectives are welcome to create a dynamic team and community.

Become one of our legends!

By joining our global team of volunteers to help spread Islamic Art worldwide!

Join Us

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Mathematical Principles:

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Global Breadth & Diversity of Islamic Geometry:

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- https://www.architecturaldigest.in/content/istanbul-turkey-hagia-sophia-museum-structure-mosque-church-architecture/#
- https://www.khanacademy.org/humanities/art-islam

Methodologies:

- Islamic geometric patterns - Jay Bonner
- Methods of Design - Ernest Hanbury Hankin
- Islamic geometric patterns constructed by craftsmen working on wood - A. Thalal, M. J. Benatia, A. Jali, Y. Aboufadil and M. A. Elidrissi R.
- Constructing four-fold Geometric Patterns correctly – using the traditional method - YouTube
- THE TOPKAPI SCROLL-GEOMETRY AND ORNAMENT IN ISLAMIC ARCHITECTURE by Gulru Necipoglu
- PERSPECTIVE, SELECTED ESSAYS ON SPACE, IN ART AND DESIGN, SACRED SPACE: GEOMETRIC PATTERNS IN MOROCCAN ART - Hamza El Fasiki, CRAFT DRAFT, Morocco & U.K

Tools & Tips:

- https://www.drawingislamicgeometricdesigns.com

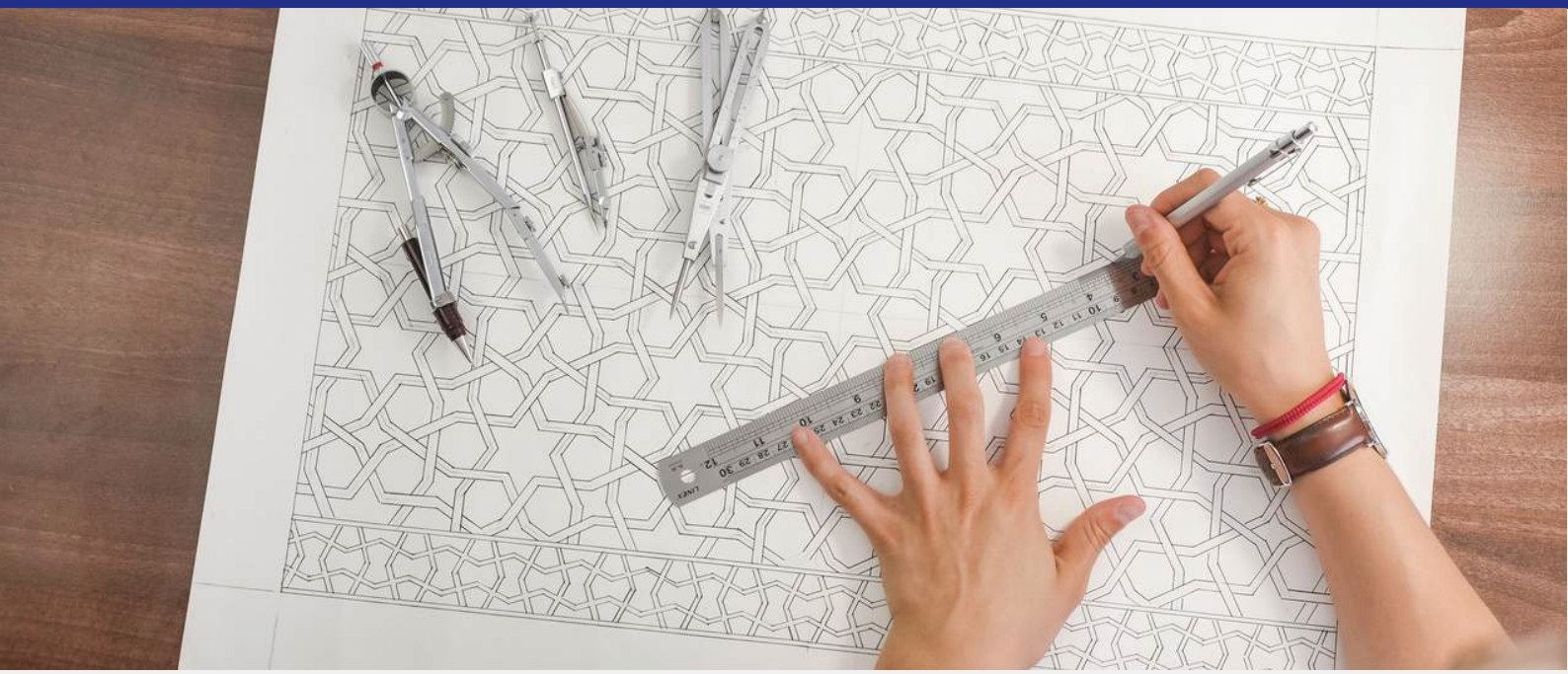
Images

- Excerpt from Euclid‘s treatise ‘elements‘ (middle right, page 10)
- Euclid (bottom right, page 10)
- Muhammad ibn Musa al-Khwarizmi (top right, page 11)
- Abu al-Wafa Buzjani (bottom left, page 11)

Thank You

If you found this guide valuable please consider donating to help support our mission to make Islamic Art accessible to all!

DONATE NOW



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