

The Story Of Shyena



**Mathematics and
Astronomy Exhibition held in
connection with the
Kozhikode Athirathram**



The Story Of Shyena

I am Shyena. I stand here, holding countless secrets folded within my wings.

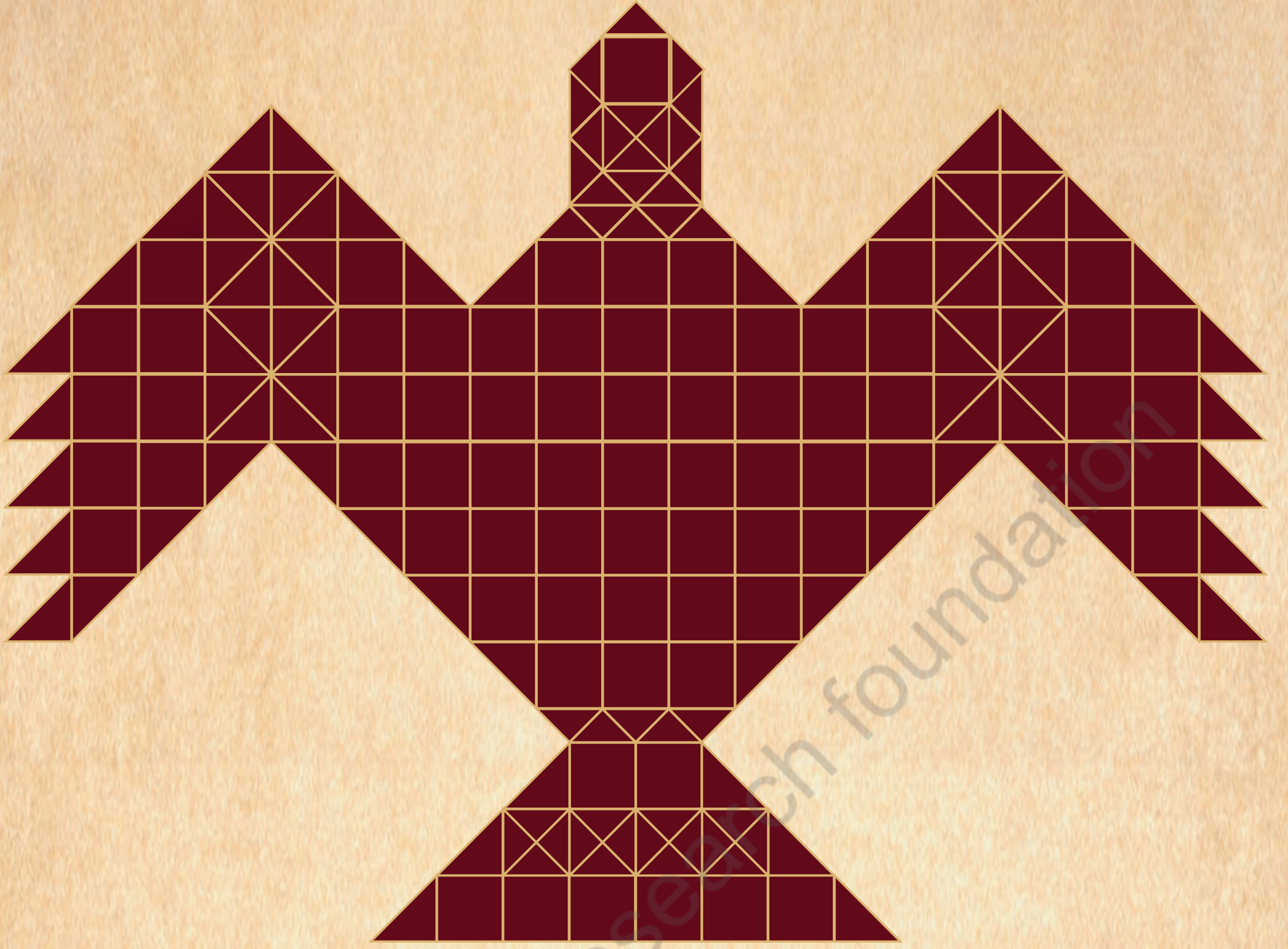
Long ago, Prajapati revealed those secrets to the devas. They reconstructed my body in bricks, and through that, they attained immortality.

Here, on this Athirathra Yaga, my body is being reconstructed once more...

Would you like to see my body?

Let me spread my wings...





My Body

My body was built with 200 bricks per layer across five layers — 1,000 bricks in all.



Would you like to know how
I evolved into this form? That
history is also the history of the
development of mathematics
and astronomy in India...



Lets Start From Units

All measurements in the Yagashala are determined based on the body of the Yajamana.

Unit	Definition
Angula	Width of the middle finger at its base
Pada	Length of a footstep
Prakrama	Double of a pada
Aratni	From the elbow to the tip of the middle finger
Purusha	From the sole of the foot to the fingertips of raised hands

$$1 \text{ Purusha} = 5 \text{ Aratni} = 10 \text{ Prakrama} = 20 \text{ Pada} = 120 \text{ Angula}$$

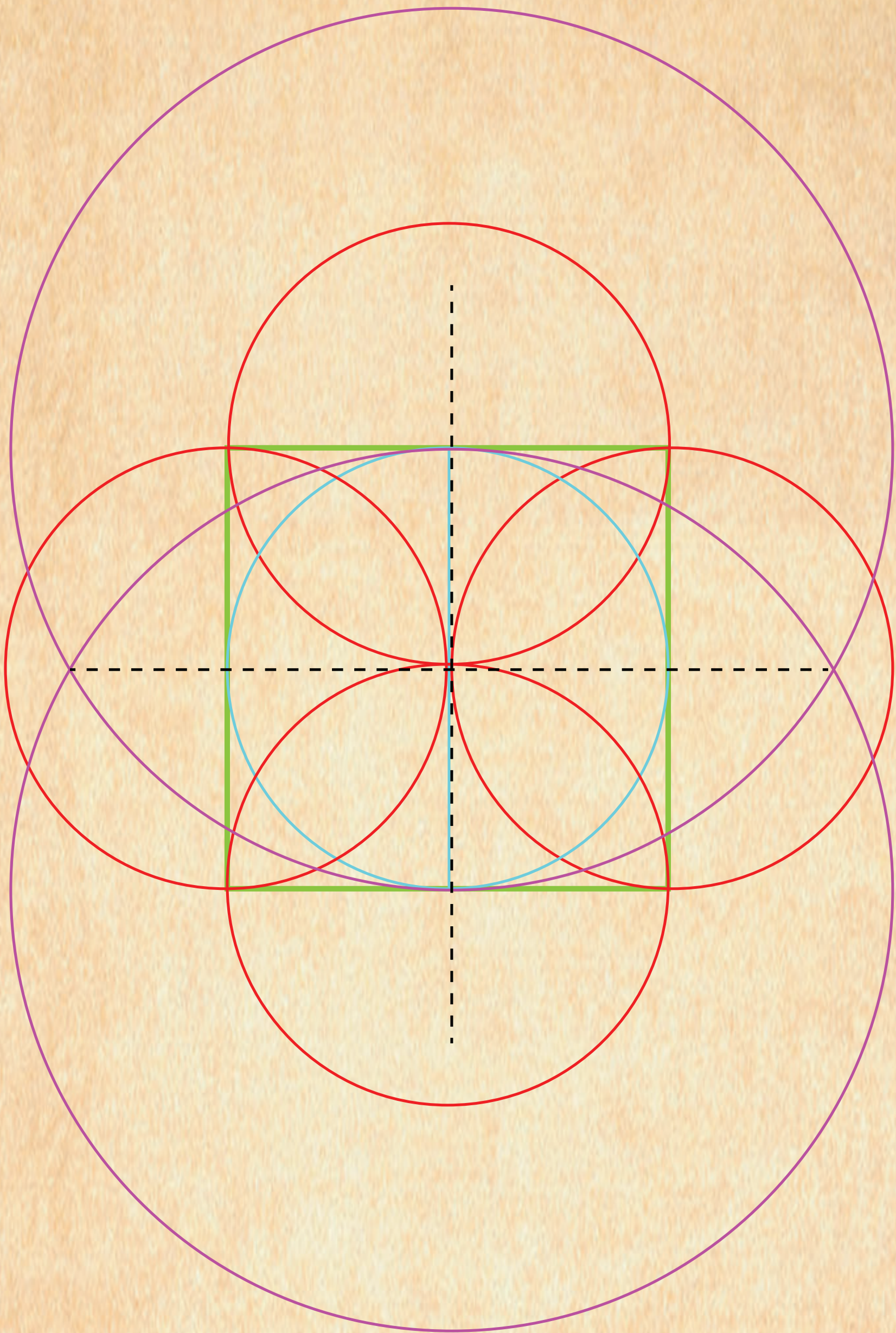


Now, all you have in hand
are the measurements described
earlier, a rope, and a peg.
With just these, how does one
construct my fundamental
form - the square?



How The Square Came To Be

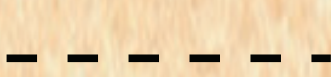
The Fish Figure (Matsya Chitrana) — one of the several methods described in the Shulbasutras for constructing a square.



STEP 1 -



STEP 4 -



STEP 2 -



STEP 5 -



STEP 3 -

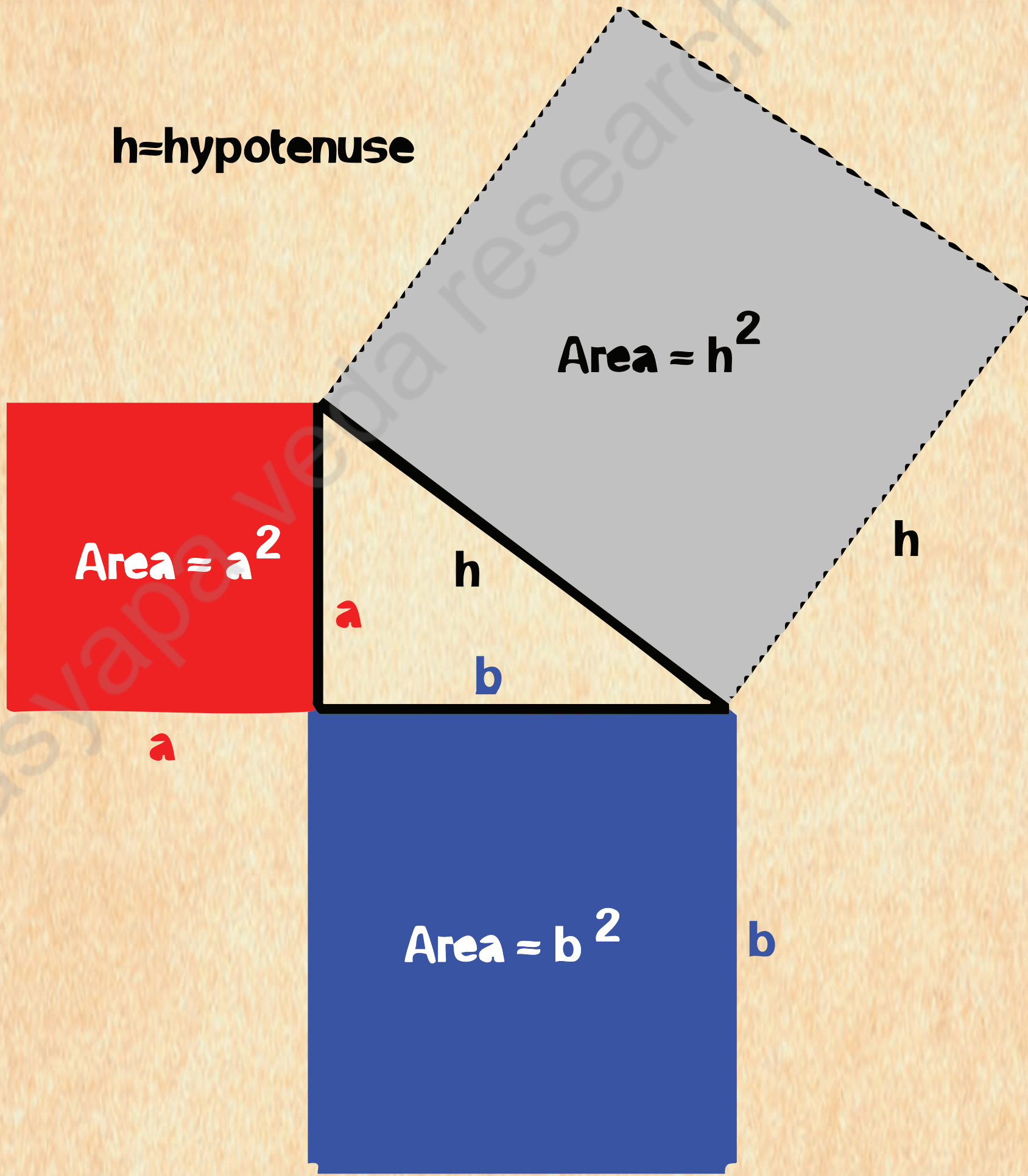


STEP 6 -



Before Pythagoras

To Perform geometric operations on squares, a theorem is essential — what you today call the Pythagorean theorem, is known in Sanskrit as Bhujakotikarna Nyaya. This theorem was first defined in the world not by Pythagoras, but in the Shulbasutra written by the sage Baudhayana — centuries before Pythagoras.

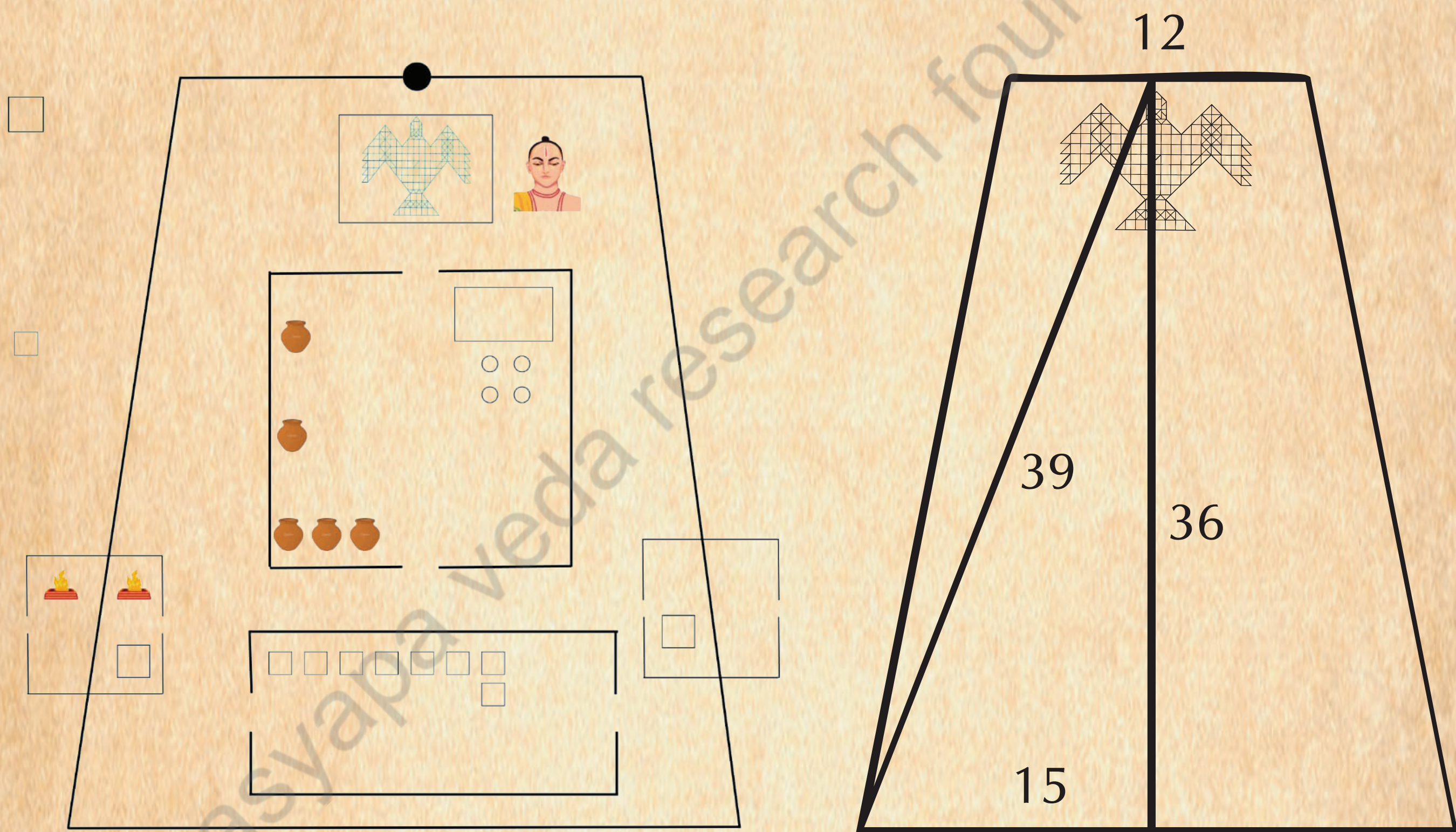


दीर्घचतुरस्रस्याक्षण्या रज्जुः पार्श्वमानी
तिर्यङ्मानी च यत् पृथग्भूते कुरुतस्तदुभयं करोति ॥
(बौधायन शुल्बसूत्र.1.48)



My Place

In the ritual space, I am seated upon the Mahavedi — an isosceles trapezium in form. The method to construct it is also found in the Shulbasutras. If you look closely at this Mahavedi, you will find within it the very Pythagorean triplet.



Finding East

I face the direction of the East. However, because the Sun's rising point shifts due to Ayana (the solstitial movement), true East cannot be determined simply by observing sunrise. For this very purpose, the Shulbasutras describe a precise method.

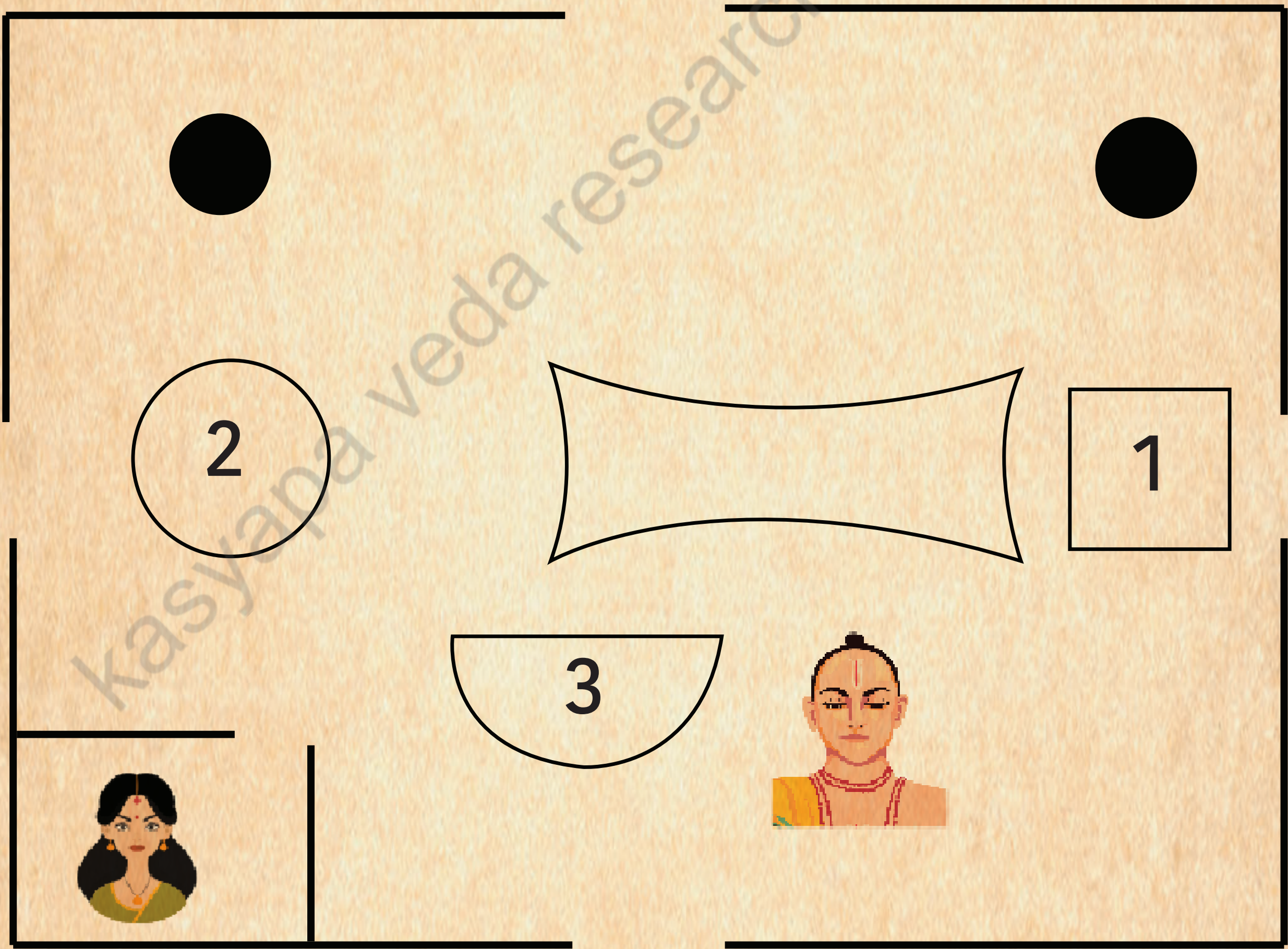
1. Fix a sharpened stake (Shanku) upright on level ground.
2. Tie a rope at least twice the length of the Shanku to it, and draw a circle with the free end.
3. Mark the points where the tip of the Shanku's shadow touches the circle, once in the morning, and once in the evening.
4. Connect these two points — this is the East–West line.



3 Sacred Fires - Same Area

Though I am seated upon the Mahavedi, my origin is in the Prachinavamsha Shala to the west. There, three sacred fires burn in three distinct forms (Square, circle, semicircle).

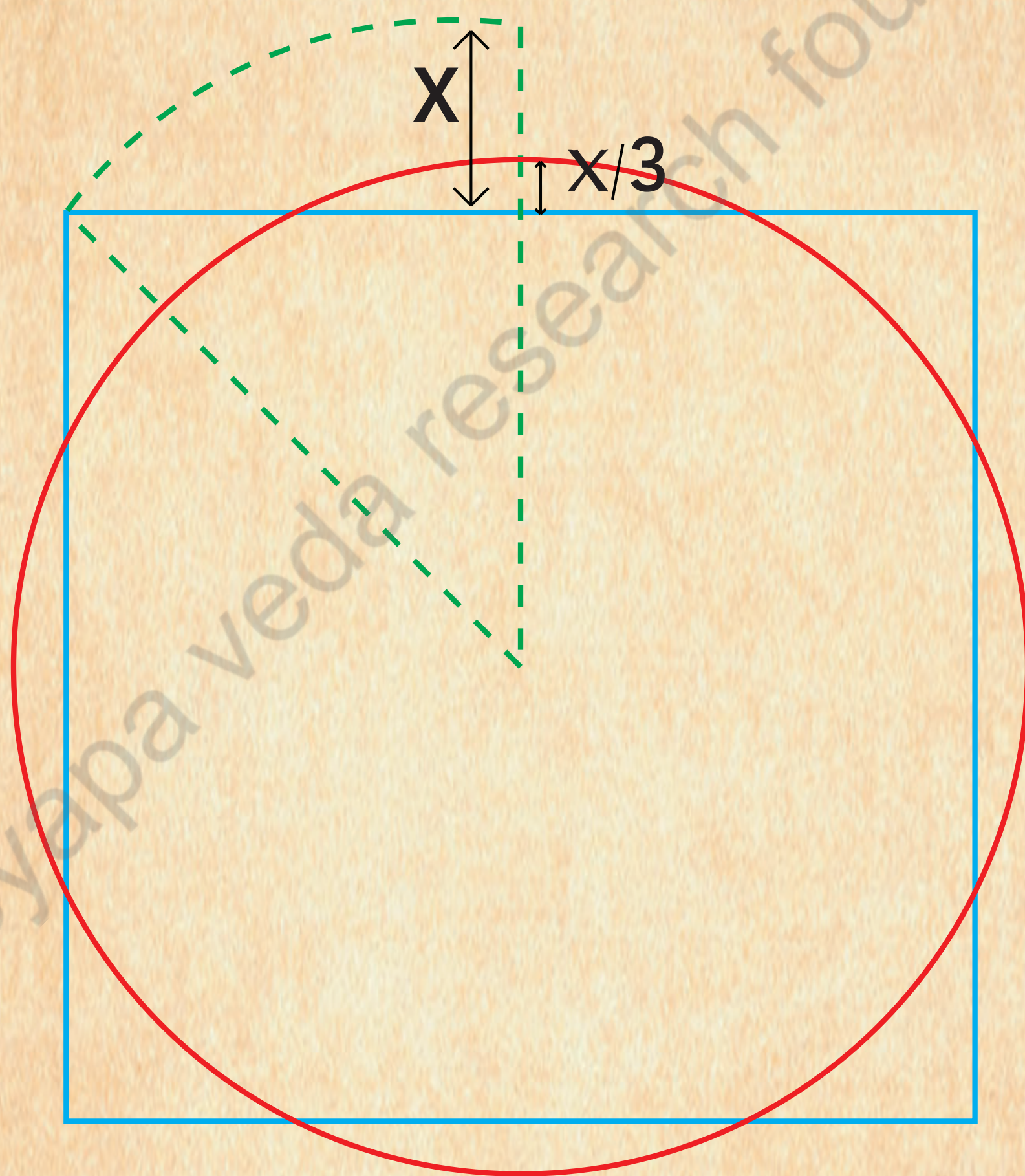
What is remarkable is that all three hold the same area, 1 square Purusha!



The Way Of Shape Transformation

We have learned to construct a square of a given area. But using only a rope and a peg, how does one construct a circle and semicircle of that same area?

The Shulbasutra's method for square-to-circle transformation is shown in the figure below.



A semicircle of equal area can also be constructed by taking the diagonal of a square — whose side is the radius of this circle — as the new radius.



Sutra Of $\sqrt{2}$

Within this discussion of geometric transformation, sage Baudhayana also recorded the value of the irrational number $\sqrt{2}$ with remarkable precision.

Baudhayana then adds the word "savisheshah" — indicating that this is an approximation for practical use.

प्रमाणं तृतीयेन वर्धयेत्तच्च
चतुर्थेनात्मचतुस्त्रिंशोनेन ॥

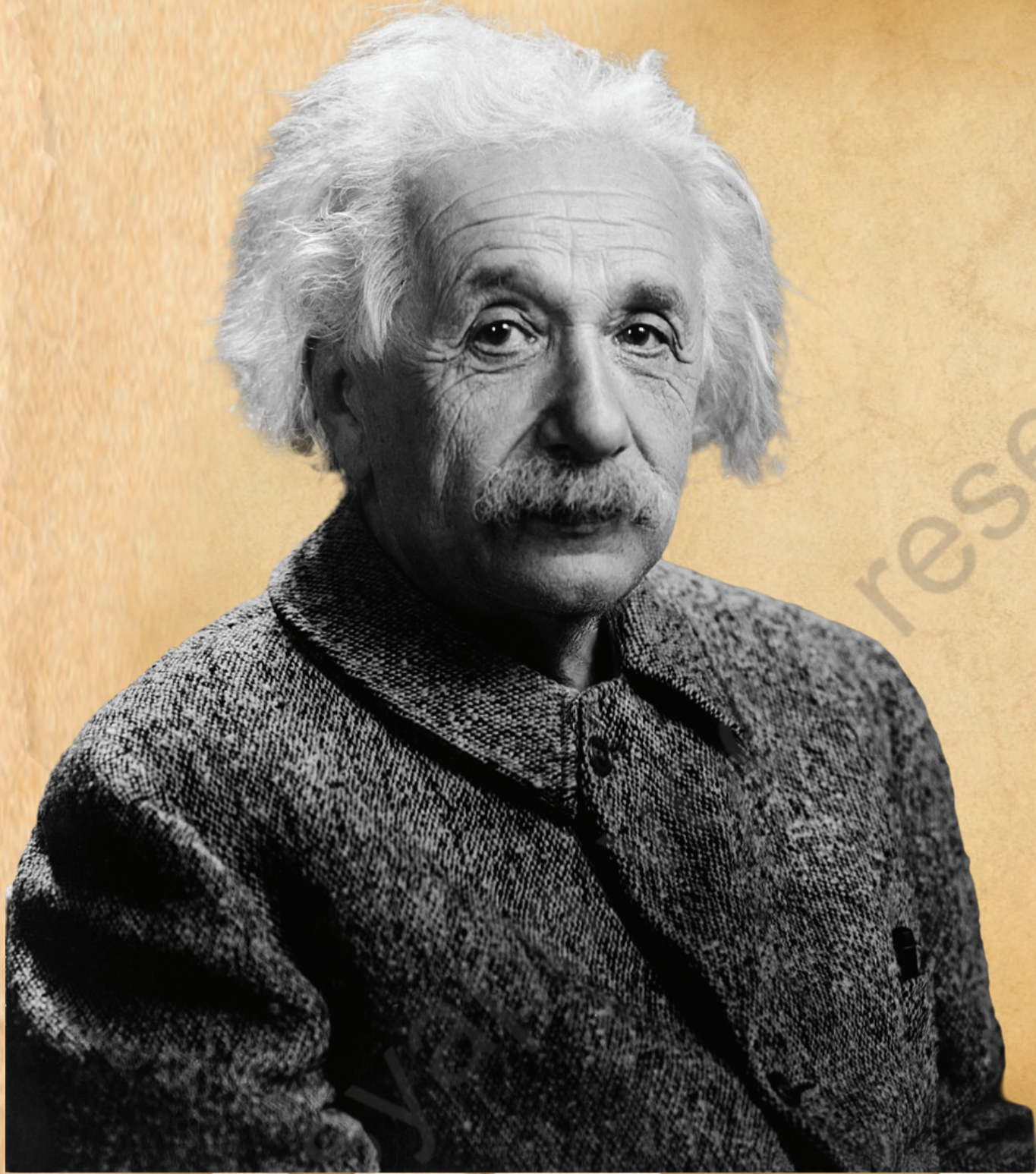
$$\sqrt{2} = 1 + (1/3) + (1/(3 \times 4)) - (1/(3 \times 4 \times 34)) = 1.414256$$

(बौधायन शुल्बसूत्र 1.61)



The Veda That Taught How To Count

After all, who can rival Indians in the knowledge of numbers? Have you not heard what the great scientist Albert Einstein said?



“Indians taught us how to count, without which no worthwhile scientific discovery could have been made”

The first exposition of the decimal number system, used everywhere in the world today, is found in the Vedas!



The World Of Large Numbers

In the Agnicayana, there is a Yajurveda mantra chanted while visualising the bricks as cows (dhenu). The numbers spoken in sequence are:

1 (Eka)

10 (Dasha)

100(Shatam)

1000(Sahasram)

10,000 (Ayutam)

100,000 (Niyutam)

10,00,000 (Prayutam)

100,00,000 (Arbudam)

10,00,00,000 (Nyarbudam)

100,00,00,000 (Samudram)

10,00,00,00,000 (Madhyam)

100,00,00,00,000 (Antam)

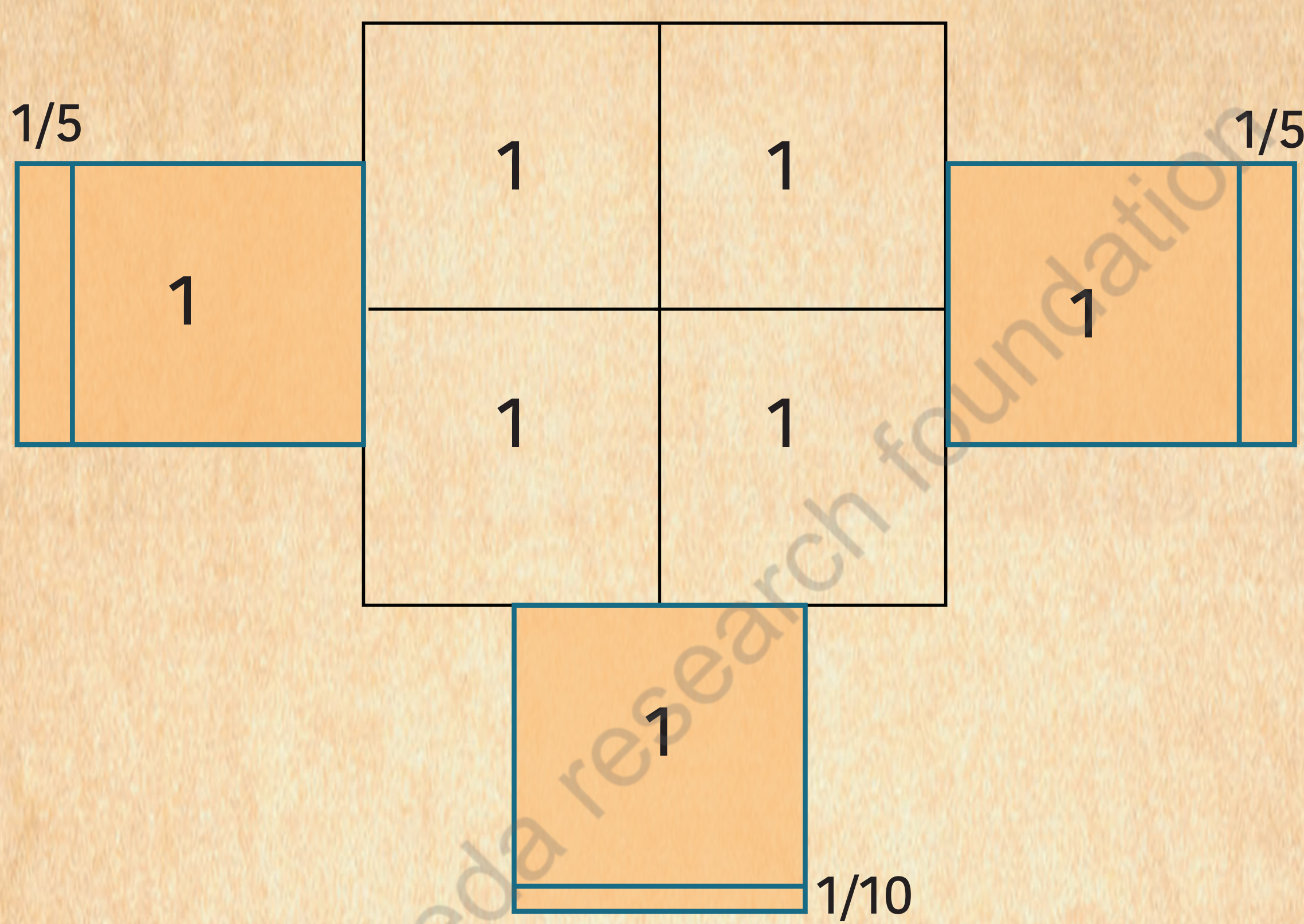
10,00,00,00,00,000 (Parardham)

The Greeks had no distinct names for numbers beyond ten thousand. But those who built me lived in a vast world — a world that thought in numbers this large.



Chaturasra Shyena

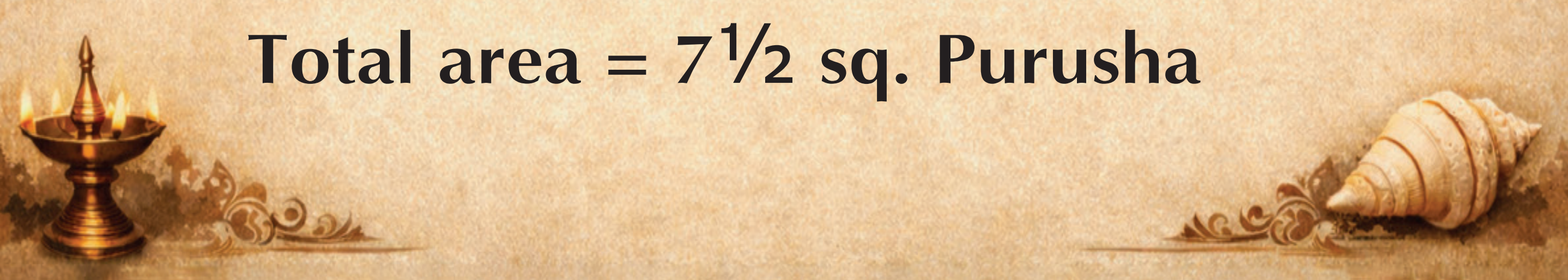
But before that, would you not like to know how I was built? For that, one must first know my prototype, the Chaturasra Shyena (the square falcon).



body part	Area
Body	4x 1 sq. Purusha
Wings	2x 1 sq. Purusha
Tail	1 sq. Purusha

Additionally, for completeness — each wing carries an extra 1/5 and the tail an extra 1/10 sq. Purusha.

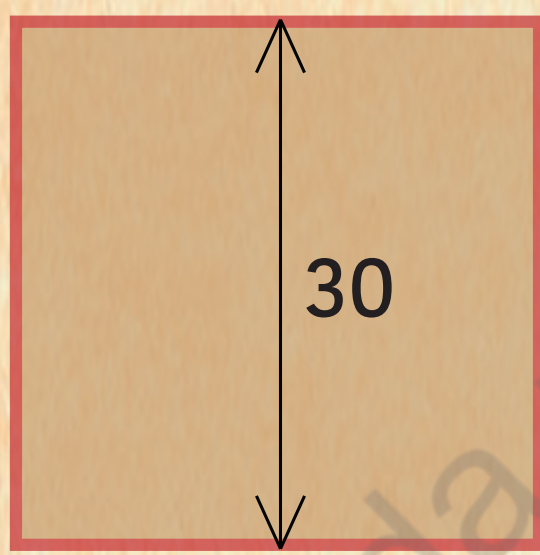
Total area = 7½ sq. Purusha



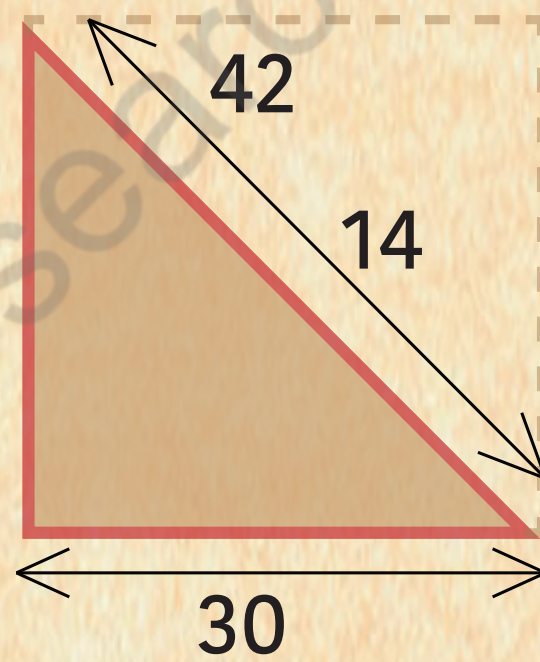
Now, I...

But constructing my true form is no simple task. The constraints are

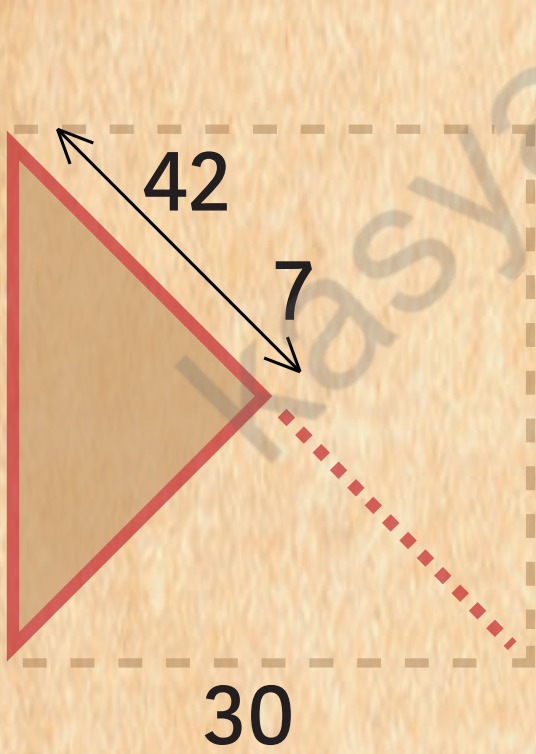
1. Each layer must have exactly 200 bricks
2. The total area must be precisely $7\frac{1}{2}$ sq. Purusha
3. The joints between bricks must not align in the same row across adjacent layers.
4. Only prescribed brick types may be used.



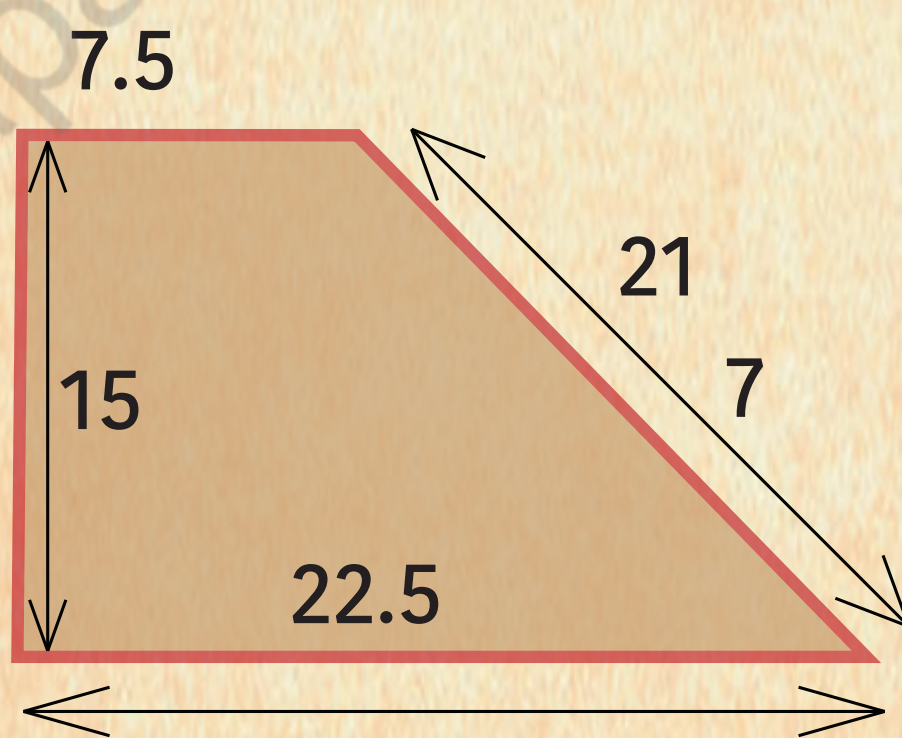
Chaturthi



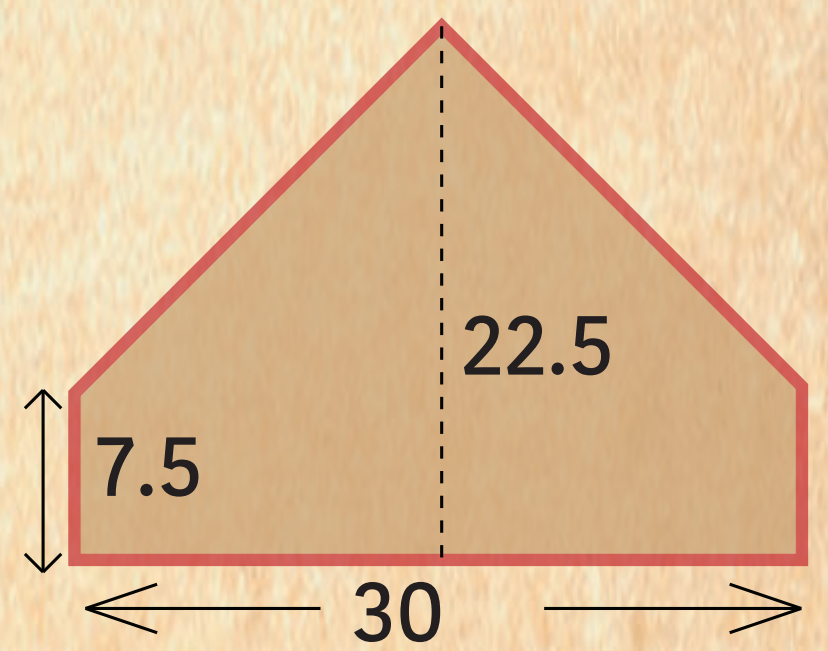
Ardha



Padya



Chaturasra Padya



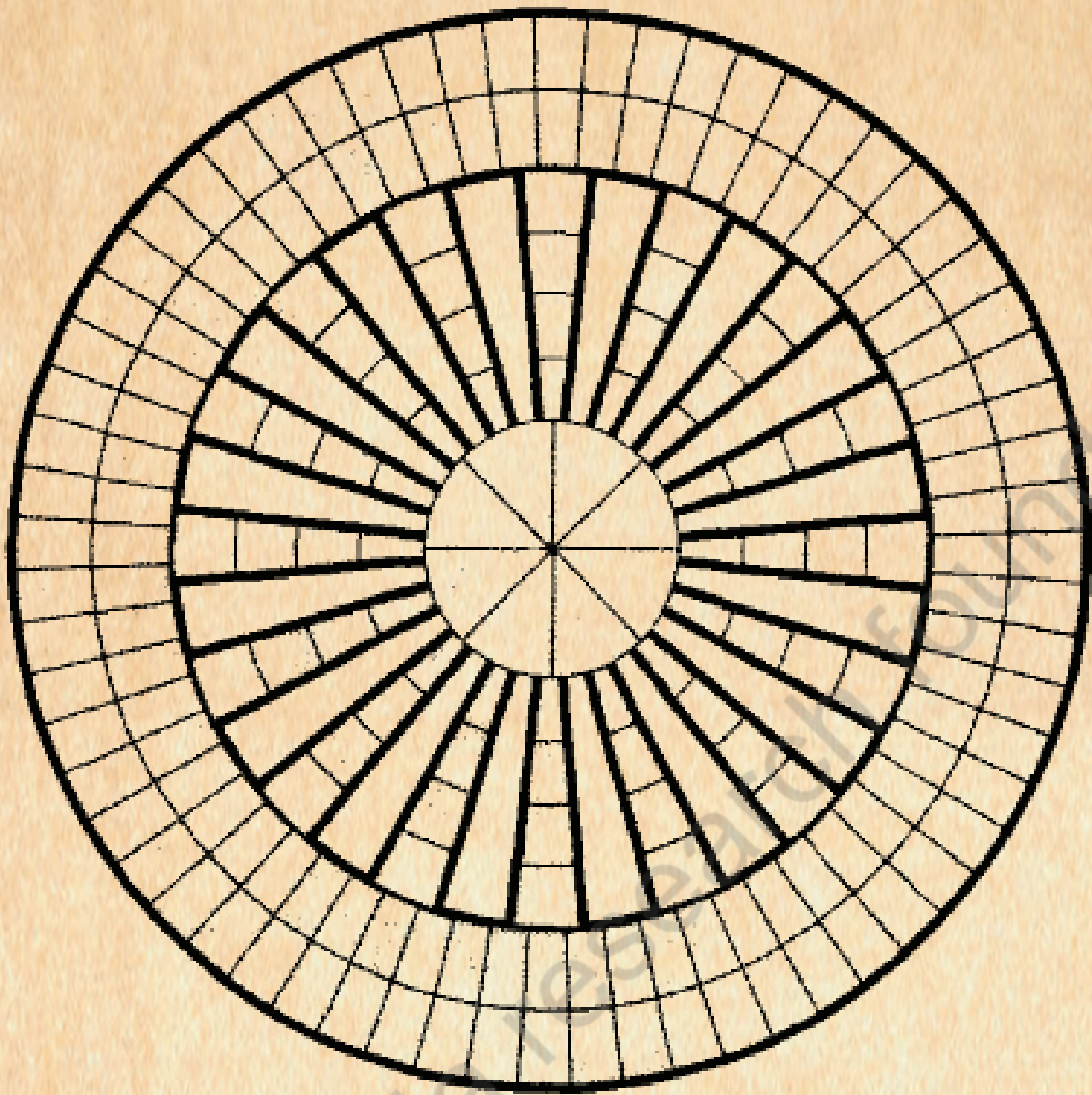
Hamsamukhi

And yet, they accepted these challenges and built me to exact measure.

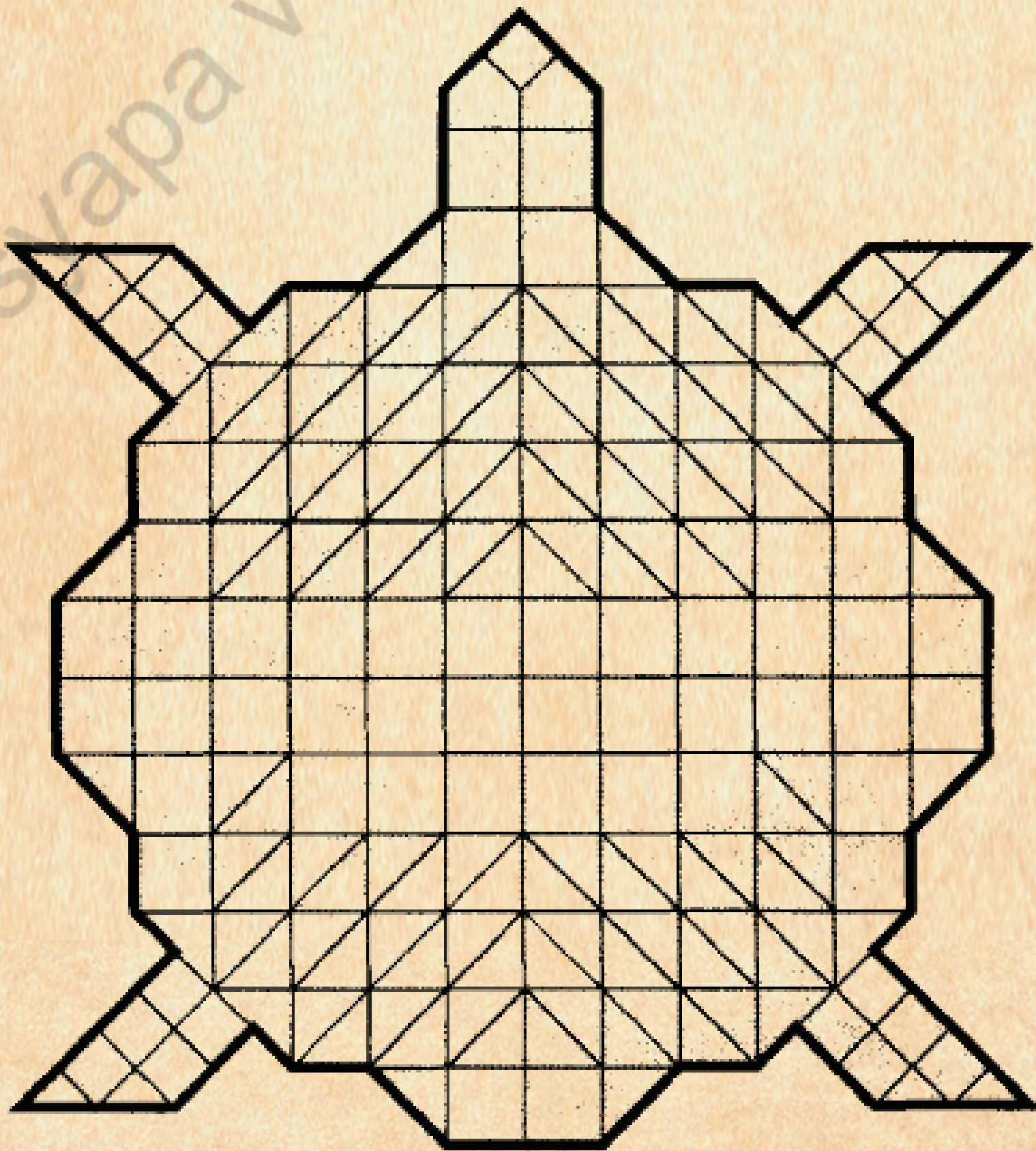


Other Chitis

And it was not just me, following similar principles, they constructed many kinds of Chitis (fire altars).



RathaChakra Chiti



Kurma Chiti



I am Growing

The construction of my body was not yet complete — they made me grow. From $7\frac{1}{2}$ sq. Purusha, I became $8\frac{1}{2}$ the next year, then $9\frac{1}{2}$ the year after — and so, over 95 years, they grew me to $101\frac{1}{2}$ sq. Purusha.

Each year, they calculated how much area must be added to each brick of varying shapes, took the square root of that value, and continuously determined new brick dimensions. And knowing how much area a brick loses when dried and fired, they built each brick larger by exactly that margin.



Why did they grow me,
facing all these complexities?
To know that secret, we must
journey from mathematics
into astronomy...



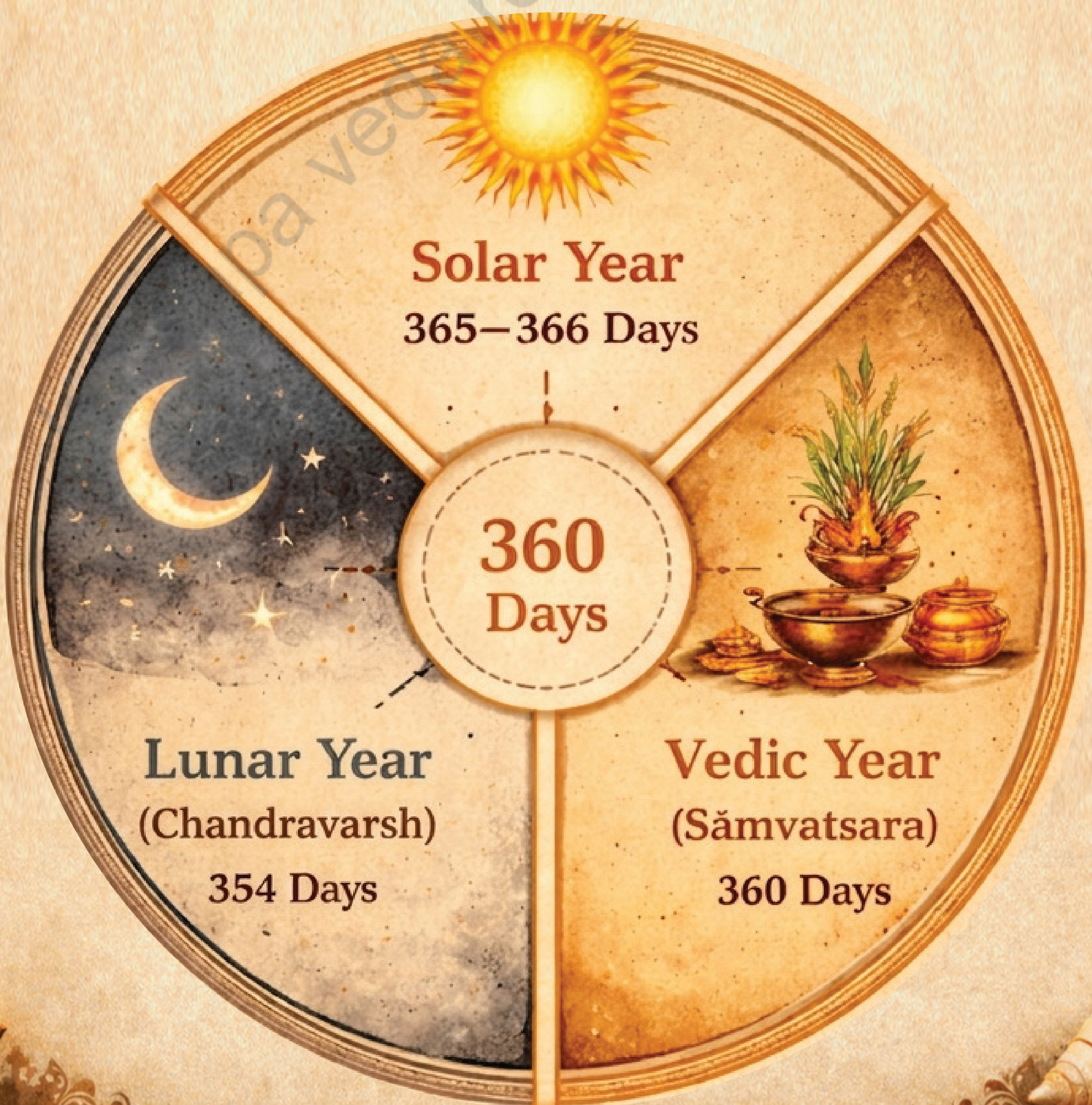
Know the Savana Samvatsara

You are familiar with these two principal years:

1. Solar year — 365–366 days

2. Lunar year — 354 days

But the distinctive year put forward by the Vedas has 360 days — approximately the mean of the two. Because of its connection with the Soma Yaga, it is called the Savana Samvatsara.



Intercalation

To resolve the difference in length between the various years, the Rigveda proposes Antarniveshana — the method of intercalation, inserting an additional month.

"Veda maso dhritavrato dvadasha prajavatah. veda ya upajayate"
(Rigveda 1.25.8)

Meaning : He knows the twelve months that follow their fixed order and are full of life. He also knows the intercalary month that is born alongside them.



Three Types Of Bricks

The secrets of all this timekeeping
are encoded in my body too.
How, you ask?

In the Agnichayana, bricks are of
three kinds:

1.360 Parishrits — placed around
the altar.

2.360 + 36 Yajushmatis — placed
with mantras during construction

3.10,800 Lokamprinas — used to
fill the remaining space



I am Samvatsara...

The concept is that I am the Samvatsara

In my body	In the Savana Samvatsara
360 Parishrits	360 nights
360 Yajushmatis	360 days

And the 36 additional Yajushmatis?
They symbolise the intercalary month of 36 days that must be added every 6 years — to compensate for the shortfall of 6 days between the solar year and the Savana Samvatsara
The 10,800 Lokamprinas represent the total number of muhurtas in a year. (1 muhurta = 48 minutes)



Veda and Tithi

Now let us come to the lunar year. A tithi is the time taken for the Moon to travel 12 degrees of angular distance relative to the Sun, as seen from Earth.

The Vedas contain profound knowledge of the tithi. For instance, the number 3339 — the total count of Krishnapaksa tithis within the Saros cycle (18 years), the period after which the positions of the Sun, Moon, and Earth repeat and a similar eclipse occurs again. This number is recorded in the Rigveda.



Short Fall In Lunar Year

In the lunar year, there are 360 tithis in total (30×12).

In the solar year, there are 372 tithis (precisely 371.06).

To resolve this difference of 12 tithis between the solar and lunar years, two intercalary months of 30 days ($12 \times 5 = 60$), each are added to the lunar year every five years (one yuga)

However, since the solar year actually contains 371.06 tithis and not 372, this creates a shortfall of 0.94 tithis per year — accumulating to 4.7 tithis over five years. How is this resolved?



The Secret Of My Growth

To resolve this using intercalary months, the shortfall must become equal to 30 or a multiple of 30.

It is only after exactly 19 yugas (95 years) that this shortfall becomes equal to three intercalary months (90 tithis). ($4.7 \times 19 = 89.3$)

That is — from the 38 intercalary months that would normally be added over 19 yugas, subtracting these three months at precise intervals and adding only 35 intercalary months resolves the problem entirely.

And it is to enshrine the significance of these 95 years that my body's area was prescribed to grow — one sq. Purusha each year for 95 years, from $7\frac{1}{2}$ to $101\frac{1}{2}$!



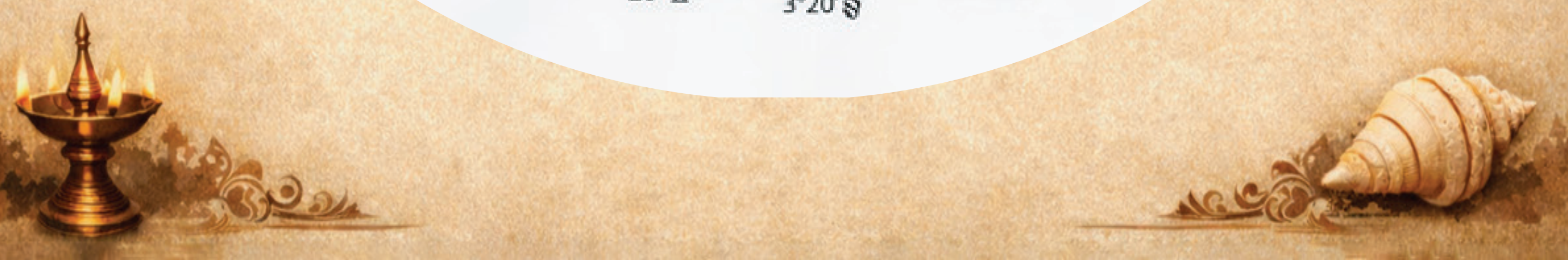
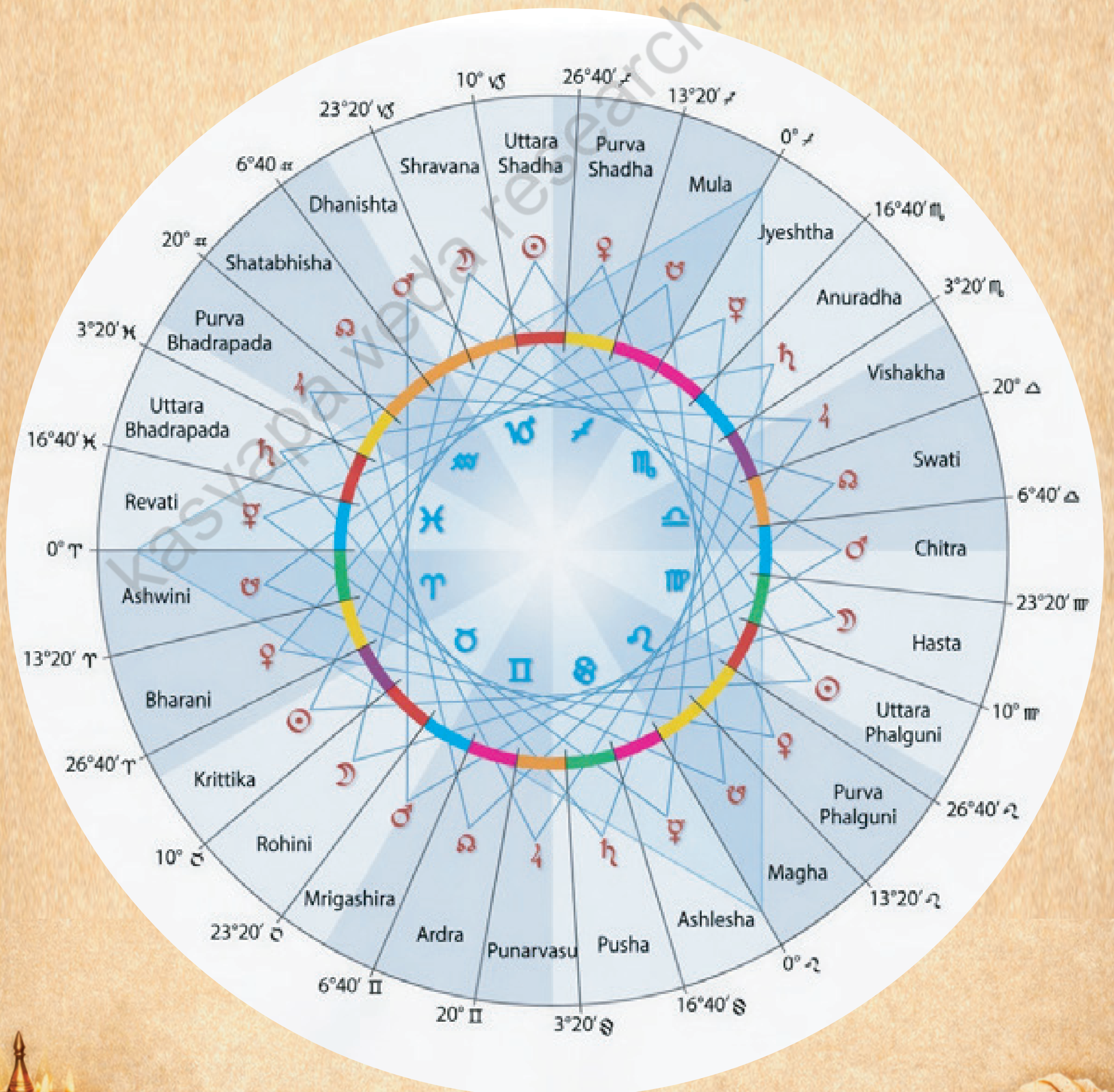
Behind my beginning at 7½
too lies an astronomical secret.
But first, one must know
about the stars.



27 NakshatraS

You will have heard of the 27 Nakshatras from Ashwathi to Revathi. In the Atharvaveda, all 27 are named — along with the special Nakshatra, Abhijit

But these are not merely star clusters. They are also units of time — dividing the Moon's celestial path into 27 parts to help measure time.



Nakshatra Secrets in Me

All these Nakshatras are present in me too!

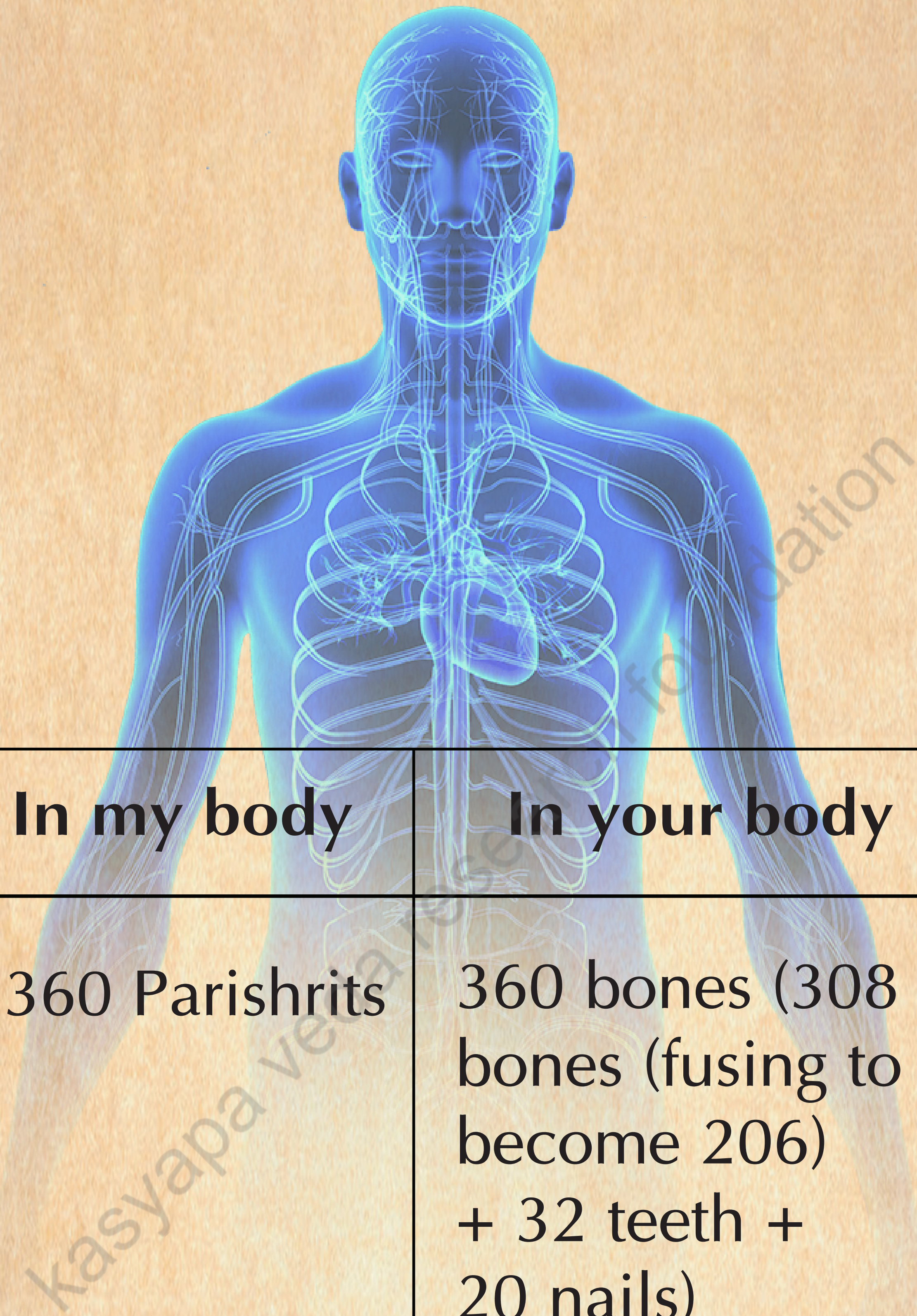
Parishrits and Yajushmatis together:
 $360 + 396 = 756$ bricks.

Also “27 Nakshatras and their sub-Nakshatras” — $27 + (27 \times 27) = 756$.

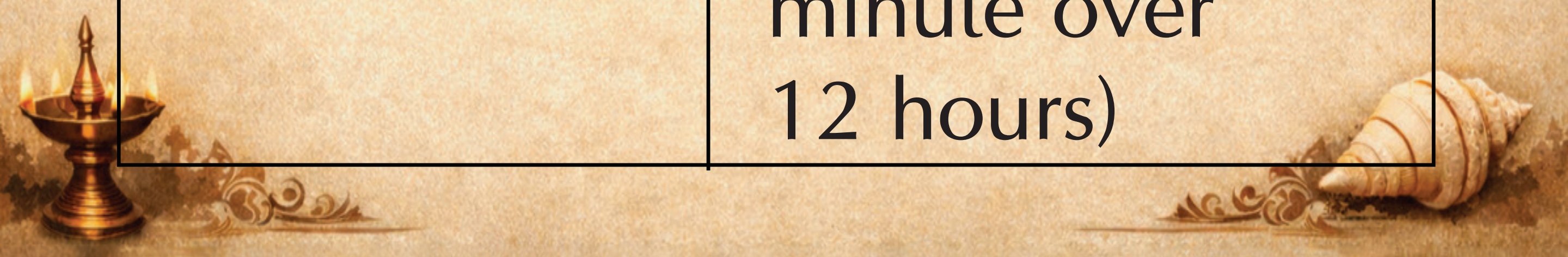
The 10,800 Lokamprinas are also said to be one-thousandth of the total stars visible in the sky.



You Are In Me Too!



In my body	In your body
360 Parishrits	360 bones (308 bones (fusing to become 206) + 32 teeth + 20 nails)
360 Yajushmatis	360 marrows
10,800 Lokamprinas	Average daytime breaths (15 per minute over 12 hours)



Saptarshi And Me

The concept holds that the Saptarshi star cluster travels through each of the 27 Naksathra-mandalas for 100 years each, completing one full revolution in 2,700 years. This is the Saptarshi Chakra.

2,700 human years is precisely $7\frac{1}{2}$ divine years. (1 divine year = 360 human years)

Thus, my beginning at an area of $7\frac{1}{2}$ sq. Purusha also symbolises the beginning of the Saptarshi Chakra.

Indian Names Of The Stars Of Sapta Rishi



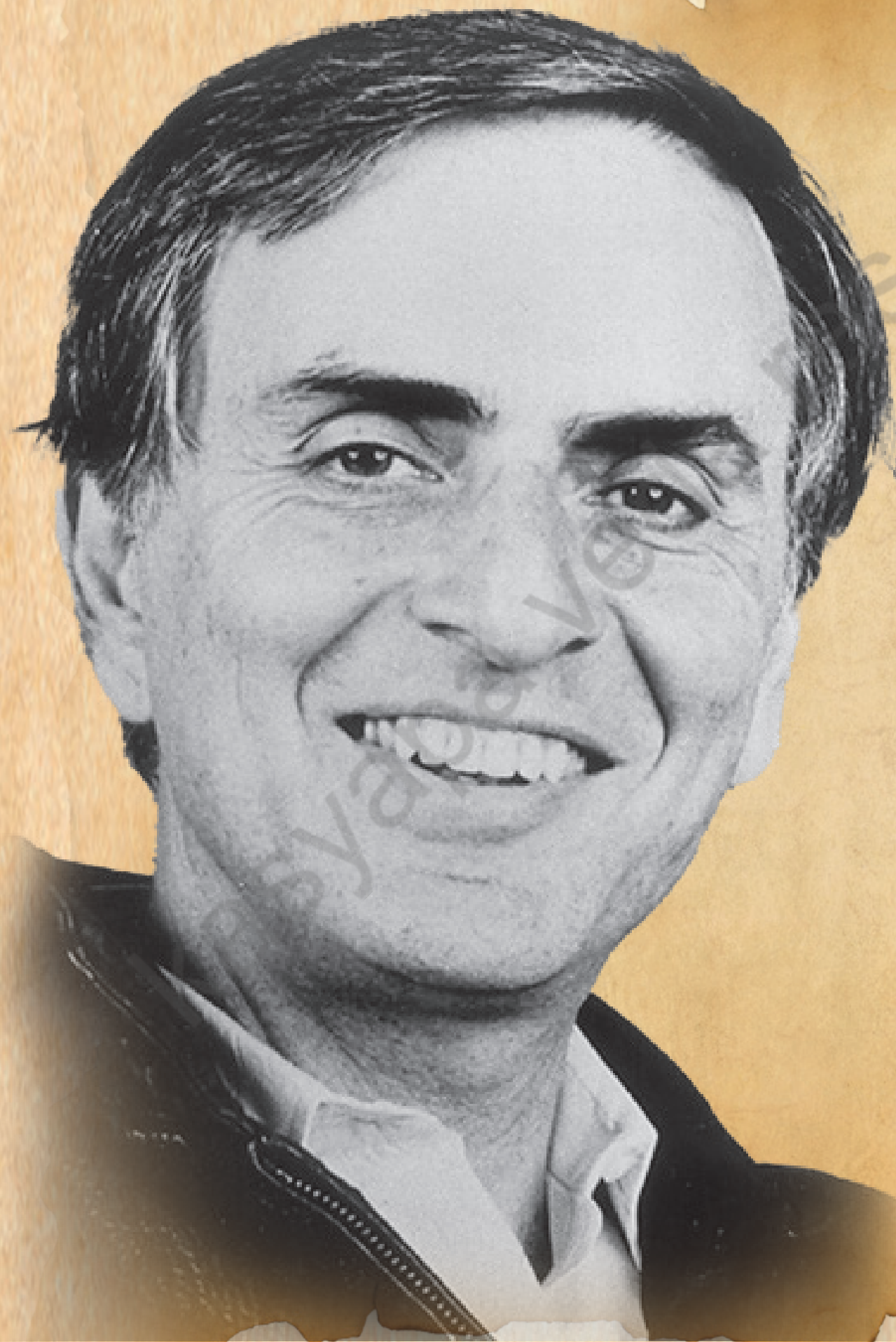
From astronomy, let us now
journey into cosmology.



Age of The Nakshatras

Modern physics tells us that the average lifespan of stars like the Sun is around 10 billion years.

The Vedas propose a close and specific number — 8.64 billion years.



“The Hindu religion is the only religion in which the time scales correspond to those of modern scientific cosmology.”

**- Carl Sagan
Renowned Astronomer**



Ahoratras of Prajapati

The 8.64 billion years spoken of earlier are also called Ahoratras in the Vedas.

These are not your nights and days, these are the nights and days of my lord, Prajapati.

Prajapati is the individualised form of the Creator's cosmic power.

The Aghamarshana Sukta of the Rigveda tells us that within each such Ahoratras, the Sun, the Earth, and the Moon all come into being and perish.



I'm the Universe

One Yajushmati and one Parishrits together in me represent one Ahoratra of 8.64 billion years.

And I, who am the Samvatsara, made of 360 such Parishrits and 360 Yajushmatis together.

That is, 360×8.64 billion = 3,110.40 billion (3.11 trillion) years. That is the lifespan of this universe!

