# Concept of Pythagorean Theorem's New Proof and Pythagorean's Triple with Ancient Vedic Investigation

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#### 1. Abstract

"In a Right-Angle Triangle the sum of the Areas of Semi circles (Half -circles) formed on the two sides is equals to the Area of the semi circle (Half circle) formed on the hypotenuse."



Area of a circle =  $\pi r^2$  (where r is radius of the circle) Area of a semi circle (Half-Circle) =  $\frac{1}{2}\pi r^2$  OR

 $=\frac{1}{2}\pi\left(\frac{D}{2}\right)^2$  (Where 'D' is diameter of the circle)

Semi-circles Area of two legs (a and b)  $= \frac{1}{2}\pi \left(\frac{a}{2}\right)^2 + 1$ 

$$\frac{1}{2}\pi\left(\frac{b}{2}\right) = \frac{1}{2}\pi\frac{a^2}{4} + \frac{1}{2}\pi\frac{b^2}{4} = \frac{1}{8}\pi a^2 + \frac{1}{8}\pi b^2 = \frac{\pi}{8}(a^2+b^2)$$
 Sq. Units (1)

Now Area of the long leg c is Semi Circle (Half -Circle)

Area of the Long Leg (Hypotenuse) =  $\frac{1}{2}\pi \left(\frac{c}{2}\right)^2$ 

$$=\frac{1}{2}\pi\frac{c^{2}}{4}$$

$$=\frac{1}{8}\pi c^{2} \text{ Sq. Units}$$
From (1) and (2)  
They are equal i.e. (1)=(2)  

$$\frac{\pi}{8}(a^{2}+b^{2}) = \frac{1}{8}\pi c^{2}$$

$$a^{2}+b^{2} = c^{2}$$
(3)  
[Dividing both sides by  $\frac{\pi}{8}$ ]

This is Pythagoras (Pythagorean) Theorem. In the Mantra of Gunia, Vishavakarma Ji gave the Triple before the Pythagoras and other ancient Philosopher.

Mantra of Gunia is:

ਨੌਂ ਰਾਜ ਬਾਰਾਂ ਰਾਸ ਪੰਦਰਾਂ ਤਿਬ ਬਿਠਾਵੇ ਰਾਸ ਬਨੋ ਸੁਤ। ਤਬ ਅਖਵਾਵੇ ਵਿਸ਼ਵਕਰਮਾ ਕਾ ਪੂਤ {Nau Raj Barah Ras Pandrah, Tab Bithawe Ras bano Sut (Thread) Then will be say to son of Vishavkarma}

# Vishavakarma's Triple is (9, 12, 15)

Right angle Triangle (i.e. Gunia) is formed only when there are Vishavakarma's Triple i.e. (9, 12, 15)

And its prime Triple is formed dividing by 3 i.e. (3,4,5) whenever the proof of this theorem is not discovered at that time. But these triple is same as Pythagorean Triple (3n, 4n, 5n) i.e.  $(3n)^2 + (4n)^2 = (5n)^2$  where is any multiple of this triple. These are also related to the Babylonians Triple who discovered Algebraically between 2000 and 1786 BC. The middle Egyptian kingdom.

So, we can say that Triple was discovered by Vishavakarma although Right Angle triangle does not mentioned in it.

#### What is Gunia?

Gunia is an instrument which is used to check and mark right angles in constructional and wood work. It is used for marking as well as measure purposes. Nowadays, it is known as Try Square. It consists of two legs joined together exactly at a 90° angle.

#### Mantar of Gunia



At about twenty centuries ago there was an amazing discovery about right angled triangles: "In a right angled triangle the square of the hypotenuse is equal to the sum of squares of the other two sides." It is called Pythagoras Theorem and can be written in one short equation:

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#### $a^2+b^2=c^2$

where c is the longest side of triangle and a and b are the other two sides.

Pythagoras was born in the island of Samos in 570 BC in Greek in the eastern Agean. He was the son of Mnesarchus and his mother's name was Pythais as early writers say. His father was a gem-engraver or a merchant. As to the date of his birth Asistoxenus stated that Pythagoras left Samos in the reign of Polycrates at the age of forty.

Great Philosophers/Scholars does not agree that Pythagorean Theorem was proved by himself. In twentieth century Bartel Leendar van der Waerden conjected that Pythagorean triple were discovered algebraically by the Babylonians.

The Baudhaya Sulba Sutra the dates of which are given variously as between (800 BC & 200 BC) in India contains a list of Pythagorean triples discovered algebraically. Philosophers Proklos and Plato (400 B.C.) gave Pythagorean triple algebra and Geometry, also in China, Gnomon proved this theorem called 'Gough Theorem' having triple. (3, 4, 5) This theorem was called Bhaskara theorem in India.

During the Han Dynasty form (202 B.C. to 220 A.D.) Pythagoras triple appear in the nine chapter on the Mathematical Art together with a mention of right triangles.

The Middle kingdom Egyptian Papyrus Berlin 6519 includes a problem, written between 2000 and 1786 B.C. who solution is a Pythagorean triple. (6:8:10), but the problem does not mention a triple.

The Apastamba Sulba Sutra (circa 600 BC) contains a numerical proof of the general Pythagorean theorem; using an area computation.

Pythagoras, whose dates are commonly given as 569-175 BC, used algebraic methods to construct Pythagorean triples, according to Proklos's commentary in Euclid. Proklos, wrote between 410 and 485 AD.

The Mesopotamian tablet Plimpton 322, written between 1790 and 1750 BC during the reign of Hammurabi the Great, contains many entries closely related to Pythagorean triples.

There are much debate on whether the Pythagorean Theorem was discovered once or many times. Boyer (1991) thinks the elements found in the Sulba–Sutram may be of Mesopotamian derivation.

As for Pythagoras education concern, he was taught by various teachers and philosophers in different field of education. Pherecydes was the favorable teacher among the Greek teachers. He is said to be have been taught by Delphic priestess who was called Themistocles who introduced him to the principles of Ethics. Egyptians taught him Geometry, the Phoenicians Arithmetic, the Chaldeans Astronomy, the margins the principles of religion and Practical maxims from the conduct of life. Pythagoras journeyed among the Chaldeans and Magi for the purpose of collections all available knowledge and especially to earn information concerning the secret or mystic cults of Gods.

Some represent Pythagoras as forbidding all animal food, advocating a plant-based diet and prohibiting consumption of beans.

Pythagoras has been attached to music and gymnastics daily exercise of the disciple. The stories told the members of the sect could recognize each other, even if they had never met before.

He set up an organization a school with men and women. Pythagoras's teachings were religious and secretive. Pythagoras kept secrecy among his members. There were also gradations among the members themselves. It was an old Pythagorean maximum that everything was not to be told to everybody. This was his Pythagoreanism.

It was said that he was the first man to call himself a philosopher, or lover of wisdom and Pythagorean ideas exercised a marked influence on Plato and through him, all of Western Philosophy.

Xenophanes says that Pythagoras believed in the 'Transmigration of Souls'. Xenophanes mentions the story of his inter coding on behalf of a dog that was being beaten, professing to recognize in its cries the voice of a departed friend. Pythagoras is supposed to have claimed that he had been Ephorbus the son of Ranthus, in the Trajan war, as well as various other chactor's, a trade man, a courtsan etc.

According Aristotle that Pythagoras as a wonder worker and somewhat of a super natural figure attributing to him such aspects as a golden thigh, this was a sign of divinity.

Some ancients believed that he had the ability to travel through space and time and to talk (communicate) with the animals and plants. Pythagoras is said to have had a golden-thigh, which he showed to Avris, the Hyper borean priests and exhibited in the Olympic games.

Pythagoras was so brainy that he could write on the moon. His plan of operation on was to write on the looking glass in blood and place it opposite the moon, when the inscription would appear photographed or reflected on the moon's disc.

Pythagoras was interested in Metaphysics. He loved the nature. He also interested in music. According to legend, the way Pythagoras discovered that musical notes could be translated into mathematical equations was one day he passed blacksmiths at work, and thought that the sounds emanating from their anvils being hit were beautiful and harmonious and decided that whatever scientific law caused this to happen must be mathematical and could be applied to music. He found that different sounds were due to the different sizes of the three Hammers.

Volume 6 Issue 4, April 2017 <u>www.ijsr.net</u> Licensed Under Creative Commons Attribution CC BY Pythagoras was interested in Ethics. He was also interested in Politics. But his keen interest was in the Mathematics.

The philosophy and institutions of Pythagoras might easily have been developed by Greek mind exposed to ordinary influences of the age; the ancient authorities note the similarities between the religious ascetic peculiarities of Pythagoras with the orphic certain mistiest or the Delphic oracle

# 2. Literature Review

In the words of Scot and Martheimer, "Review of related literature may serve to avoid unnecessary work of problems and may help to make progress towards selection of new ones. Similarly, pointing out the necessity of survey for related literature. Goode and Scote (1941) says, "Survey of related literature helps us to show whether evidence already available solves problems adequately without further investigation and thus may remove duplication. It may contribute to general scholarship of the investigator by providing ideas, theories and explanations valuable in formulating the problem and may also suggest the appropriate methods of research.

Thus it provides the investigation pursuers knowledge and in side on what to start and how to start. Surveys of related literature also furnish the researcher a necessary sequence and enable him to enrich the shallow knowledge in the related field. Avoiding the work of duplication, it reveals the facts which had remained unexplored in the previous studies if any.

The main purpose of literature is a analytical review of the various resources. It is stimulus and encourages the investigation to dive deep into the intricacies regarding their possible solution

Those scholars, who have tried to study the Pythagorean's Theorem and writing, did not try to evolve a systematic philosophy as conceived by Pythagoras. There are so many proofs were discovered by some authors. The Philosophers written the articles after the two centuries passed away the Pythagoras. These articles to, are not based upon some systematic research.

Bearing this in mind the investigator made a survey of related literature and could find out some of the relevant materials which are being reproduced now. He looked for related studies from various resources. The volumes of literature having implications for the present study, as available are very briefly described below.

Pythagoras defines the relationship between the sides of a right triangle. Pythagoras Theorem says that in a right triangle the sum of the squares of the two sides will always be the same as the square of the hypotenuse (the long side).

In Symbols: a<sup>2</sup>+b<sup>2</sup>=c<sup>2</sup>

Pythagorean Theorem First Proof named as Bridge chair likely being the most popular. This proof has been illustrated by an award winning Java applet written by Jim Morey.

J.A. Garfield President of USA in 1876 (PAPPAS) also proved a Pythagoras proof. Loomis (PP 49-50) mansion that the proof "was devised by Mauric Laisnez, a high school boy, in the Junior-Senior High School of South Bend, Ind., and sent to me, May 16, 1939, by his class teacher, Wilsom Thomton"

B.F. Yanny and J.A. Calderhead (Am Math Monthly, Vol.3, No. 12 (1896), 299-300) offer a somewhat different route by the intersecting chords.

Daniel J. Hardisty, proved a proof of Pythagoras theorem.

Greg Frederickson form Purdue University, the author of truly illuminating book, Dissection: Plane & Fancy (Cambridge University Press 1997) pointed out the historical inaccuracy.

Dr. Scott Brodle from the Mount Sinai School of Medicine, NY proves the theorem and its generalization to the law of cosines.

S.K. Stein (Mathematics: The Man-made Universe Dover, 1999, P 74) gives a slightly different dissection.

Michael Hardy form University of Toledo and was published in the Mathematical Intelligencer in 1988.

Adam Rose (Sept. 23, 2004 submitted proof. (W.J. Dobbs, The Mathematical Gazette, B (1915-16), P. 268)

Dao Thanh Oai (Vietnam) by taking two altitudes in the triangle.

Marcelo Brafman (Israel) proved the algebraic proof.

There are many proofs of Pythagoras theorem which are related with the same figure.

Philosopher Quang Tuan Bui discovered many proof many proofs of the Pythagoras Theorem.

Tran Quang Hung & Nuno Zuzia found a proof that makes use of analytical geometry.

Recently Burkard Polster & Marty Ross gave another proof of Pythagoras Theorem which is based on the following diagram:



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#### **Statement of Pythagoras Theorem in Pictures**

#### **Statement of Pythagoras Theorem:**

Pythagoras defines the relationship between the sides of a right triangle. Pythagoras Theorem says that in a right triangle the sum of the squares of the two sides will always be the same as the square of the hypotenuse (the long side).

In Symbols: a<sup>2</sup>+b<sup>2</sup>=c<sup>2</sup>

#### Pythagoras's Theorem Proof

This theorem that may have more known proofs than any other theorem, the Book "Pythagorean Proposition" by Elisha Scott Loomis contain 367 proofs.

Only a few of them will be discussed in review.



**Proof using similar triangles:** 

In this proof of the Pythagoras Theorem is based on the proportionality of the sides of two similar triangles.

Let a right triangle  $\triangle ABC$ , right angle at C. Draw a perpendicular CH from C

Point H divides the length of the hypotenuse c into d and e. The new triangle ACH is similar to triangle ABC, because they both have a right angle and they share the angle at A, meaning that the third angle will be the same in both triangles as well, marked as in the figure. Similarly  $\Delta CBH$  is also similar to  $\Delta ABC$ 

The triangles lead to the equality of ratios of corresponding sides.

$$\frac{BC}{AB} = \frac{BH}{BC} \Rightarrow BC^2 = AB \times BH$$
(1)

$$\frac{AC}{AB} = \frac{AH}{AC} \Rightarrow AC^{2} = AB \times AH$$
(2)  
Adding (1) & (2), we have  

$$BC^{2} + AC^{2} = (AB \times BH) + (AB \times AH)$$

$$= AB(BH + AH)$$

$$= ABxAB = AB^{2}$$

$$\Rightarrow BC^{2} + AC^{2} = AB^{2}$$

which proved the Pythagoras Theorem.

#### Similar figures on the three sides:

#### Hippocrates of Chios in the fifth century BC

He said that, if one erects similar figures with corresponding sides on the sides of a triangle, then the sum of the areas of the ones on the two smaller sides equals the area of the one on the larger side.

This extension assumes that the sides of the original triangle are the corresponding sides of the three congruent figures. The basic idea behind this generalization is that the area of a plane figure is proportional to the square of any linear dimension, and in particular is proportional to the square of the length of any side. Thus, if similar figures with area A, B and C, are erected on the sides with corresponding lengths a, b and c then,

$$\frac{A}{a^2} = \frac{B}{b^2} = \frac{C}{c^2} \tag{1}$$

$$A+B = \frac{a^2}{c^2}C + \frac{b^2}{c^2}C$$
(2)

From (2) we have

$$\mathbf{A} + \mathbf{B} = \frac{(a^2 + b^2)}{c^2} \mathcal{C} \tag{3}$$

But by the Pythagoras Theorem

$$a^2 + b^2 = c^2$$
 (4)

From equation (3) and (4)

$$A+B=\frac{c^2}{c^2}C$$

So, A+B=C

Generalization for similar triangles

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## Pythagoras Theorem Using Similar Right Triangles

The converse of theorem is also true.

It can be proved that A+B=C for three similar figures without using the Pythagoras theorem. The starting center triangle can be replicated and used as a triangle C on its hypotenuse and two similar right triangle (A and B) constructed on the other two sides, formed by dividing the central triangle by its altitude. The sum of the areas of the two smaller triangles is equal to the third triangle which is formed on the hypotenuse. Therefore A+B=C and reversing the above logic leads to the Pythagoras theorem

 $a^2+b^2=c^2$ 

From the above review, that there are so many proofs of Pythagoras theorem. Some proofs are related with the same figure. Philosopher Quang Tuan Bui discovered many proofs of the Pythagoras Theorem. Recently Tran Quang Hung & Nuno Zuzia found a proof that makes use of analytical geometry.

## 3. Research Methodology

Research is defined as systematic gathering of data and information and its analysis for advancement of knowledge in any subject research attempts to find answer intellectual and practical questions through application of systematic methods. This research is applied versus fundamental research because in this research is carried out to find answers to practical problems to be solved. As the present problem for research in primarily Philosophical in nature. So, the investigator will base his study in the Philosophical and Historical method. The relevant information will be treated various primary and secondary sources. The primary source consists of Vedas. The secondary source of information will be based on the material available in the form of research papers, magazines, Journals, periodical newspapers and books on the topic.

## 4. Data Collection

#### **Primary Data**

The data collected by the researcher himself / herself is called Primary Data. This is data that has never been gathered before, whether in particular way or a certain period of time. Researchers tend together this type of data when what they want cannot find be find from outside sources. The primary source consists of Vedas.

### Secondary Sources

Secondary Data Sources of information will be based on the material available from the research papers, magazine, Journals, periodical newspapers, books and internet etc. on the topic

## 5. Statement of the Problem

Concept of Pythagoren Theorem's New Proof and Pythagorean's Triple with Ancient Vedic Investigation

Ancient and Present Philosophers/Scholars and Educationists proved the Pythagorean Theorem by similar triangles on the three sides of right triangle. But they does not explained the Pythagorean theorem by half circles (Semi circles) on the three sides of the right angle triangle. Hence the present problem has been undertaken.

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Ancient and Present Philosophers does not touch the 'DHARMA GRANTHA VEDA' i.e. **RIGVEDA** and **PURAN** which are full of knowledge about Science and Mathematics.

Volume 6 Issue 4, April 2017 <u>www.ijsr.net</u> <u>Licensed Under Creative Commons Attribution CC BY</u> That is only, investigator is prompted to take it up as a topic for his study. Hence the present problem has been again undertaken.

# Noteworthy Contributions in the Field of Proposed Work

#### Theorem: Pythagorean

Given: Right Angle Triangle ABC

**To Prove**: The sum of Areas of the two squares on the legs (a and b) equals to the area of square on hypotenuse(c)

**Construction**: Draw semicircles (Half Circles) on the each sides of the Right angle triangle having radii  $\frac{a}{2}$ ,  $\frac{b}{2}$  and  $\frac{c}{2}$  respectively.



**Proof:** As from the above diagram

"In a Right-Angle Triangle the sum of the Areas of Semi circles (Half -circles) formed on the two sides is equals to the Area of the semi circle (Half circle) formed on the hypotenuse."

Area of a circle =  $\pi r^2$  (where r is radius of the circle) Area of a semi circle (Half-Circle) =  $\frac{1}{2}\pi r^2$  OR = $\frac{1}{2}\pi \left(\frac{b}{2}\right)^2$  (Where 'D' is diameter of the circle) Semi-circles Area of two legs (a and b) =  $\frac{1}{2}\pi \left(\frac{a}{2}\right)^2$  +  $\frac{1}{2}\pi \left(\frac{b}{2}\right)^2$ = $\frac{1}{2}\pi \frac{a^2}{4} + \frac{1}{2}\pi \frac{b^2}{4}$ = $\frac{1}{8}\pi a^2 + \frac{1}{8}\pi b^2$ = $\frac{\pi}{8}(a^2+b^2)$  Sq. Units (1) Now Area of the long leg c is Semi Circle (Half -Circle) Area of the Long Leg (Hypotenuse) =  $\frac{1}{2}\pi \left(\frac{c}{2}\right)^2$ = $\frac{1}{2}\pi \frac{c^2}{4}$ = $\frac{1}{8}\pi c^2$  Sq. Units (2) From (1) and (2) [Dividing both sides by  $\frac{\pi}{2}$ ]

This is Pythagoras (Pythagorean) Theorem. The sum of the area of two squares on the legs (a and b) equal to the area of square on the hypotenuse (c)

## 5.1 Theorem



**Construction :** Let a  $\triangle ABC$  a Right Angle at C. Draw semi-circles (Half-Circles) on the each sides of the Right Angle having radii $\frac{a}{2}$ ,  $\frac{b}{2}$  and  $\frac{c}{2}$  respectively.

When a line is drawn from the centre of the hypotenuse; which divide the half circle on the hypotenuse in the angle ratio.

$$\frac{b^2}{c^2} \times 180^\circ : \frac{a^2}{c^2} \times 180^\circ \Rightarrow \frac{b^2}{c^2} : \frac{a^2}{c^2}$$

The circle segments on the hypotenuse are equal the half circles (Semi-Circles) on the other two legs of the right angle triangle respectively in area. The equal circle segments are in front of the semi circles respectively. While  $A_1$ ,  $A_2$ ,  $A_3$ ,  $A_4$  and  $A_5$  are areas of the required figures. As early discussed in the above theorem:

$$A_{1} = \text{Area of the half circle (Semi Circle) on b}$$
  
=  $\frac{1}{2}\pi \left(\frac{b}{2}\right)^{2}$  sq. units (1)  
 $A_{2} = \text{Area of the half circle (Semi Circle) on a}$ 

$$=\frac{1}{2}\pi \left(\frac{a}{2}\right)^2 \text{ sq. units}$$
(2)  
And

 $A_3$  = Area of the half circle -segment in front of  $A_1$  on the hypotenuse

$$=\frac{1}{2}\pi \left(\frac{c}{2}\right)^2 \left(\frac{b}{c}\right)^2 \text{ sq. units}$$
(3)

 $A_4$  = Area of the half circle -segment in front of  $A_2$  on the hypotenuse

$$= \frac{1}{2}\pi \left(\frac{c}{2}\right)^2 \left(\frac{a}{c}\right)^2 \text{ sq. units}$$
(4)
$$A_5 = \text{Area of the half circle (Semi Circle) on c}$$

$$=\frac{1}{2}\pi \left(\frac{c}{2}\right)^2 \text{ sq. units}$$
Adding (1) & (2).

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(3)

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They are equal i.e. (1)=(2)

 $\frac{\pi}{8}(a^2+b^2) = \frac{1}{8}\pi c^2$  $a^2+b^2 = c^2$ 

$$A_{1} + A_{2} = \frac{1}{2}\pi \left(\frac{b}{2}\right)^{2} + \frac{1}{2}\pi \left(\frac{a}{2}\right)^{2}$$

$$= \frac{1}{2}\pi \frac{b^{2}}{4} + \frac{1}{2}\pi \frac{a^{2}}{4}$$

$$= \frac{\pi}{8}(a^{2}+b^{2})$$
Adding (3) & (4),
(6)

$$A_{3} + A_{4} = \frac{1}{2}\pi \left(\frac{c}{2}\right) \left(\frac{b}{c}\right) + \frac{1}{2}\pi \left(\frac{c}{2}\right) \left(\frac{a}{c}\right) \implies \frac{1}{2}\pi \frac{c}{4}\frac{b}{c^{2}} + \frac{1}{2}\pi \frac{c^{2}a^{2}}{4c^{2}} = \frac{1}{8}\pi b^{2} + \frac{1}{8}\pi a^{2} = \frac{\pi}{8}(b^{2} + a^{2}) = \frac{\pi}{8}(a^{2} + b^{2})$$
(7)

From (6) & (7) equations

They are equal Areas.

And these are also equals to total Area of the semi -Circle on the hypotenuse.

This theorem shows that when a line is drawn from the center of the hypotenuse divides the half-circle (Semicircle) on the hypotenuse in the angle ratio.

$$\frac{b^2}{c^2} \times 180^\circ : \frac{a^2}{c^2} \times 180^\circ$$

[Because the Angle formed in the Half-circle (Semi-Circle) in circle segment which are formed on the hypotenuse are respectively.

$$\frac{b^2}{c^2} \times 180^\circ : \frac{a^2}{c^2} \times 180^\circ$$

and Area of the hypotenuse semi circle segment  $=\frac{1}{2}\pi r^2 \left(\frac{\theta}{180^\circ}\right)$ 

where,  $\theta$  is an angle formed in the circle segment.]

#### Example: Triple 3, 4, 5



In a right angle triangle three sides a, b, c are 3, 4, 5. Draw half circle (Semi Circle) on each side of right angle triangle having radius  $\frac{3}{2}, \frac{4}{2}, \frac{5}{2}$  units.

When line is drawn from the centre of the hypotenuse; which divides the half circle (Semi-circle) on the hypotenuse the angles formed as following.

If the figure denotes the areas of half-circles (Semi-circles) on the small legs of the right angle triangle ABC and the

circle segments on the hypotenuse and semi circle on the hypotenuse are 
$$A_1$$
,  $A_2$ ,  $A_3$ ,  $A_4$  and  $A_5$ 

The angles are:  

$$\theta_1 = \text{Angle of Circle segment of Area A}_3$$
  
 $=180^\circ \times \left(\frac{3}{5}\right)^2$   
 $=180^\circ \times \frac{9}{25} = 64.8^\circ$  (1)  
 $\theta_2 = \text{Angle of Circle segment of Area A}_4$   
 $=180^\circ \times \left(\frac{4}{5}\right)^2$   
 $=180^\circ \times \frac{16}{25} = 115.2^\circ$  (2)  
 $A_1 = \text{Area of the Half Circle (Semi-Circle) 3 units}$   
 $1 \quad (3)^2$ 

$$= \frac{1}{2}\pi\left(\frac{3}{2}\right)$$
$$= \frac{1}{2}\times\frac{22}{7}\times\frac{9}{4}$$
$$= 3.535 \text{ Sq. units}$$
(3)  
f the half circle (Semi-Circle) on 4 units

A<sub>2</sub>=Area of . 2

$$= \frac{1}{2}\pi \left(\frac{4}{2}\right)^{2}$$
  
=  $\frac{1}{2} \times \frac{22}{7} \times \frac{16}{4}$   
= 6.285 Sq. units (4)

 $A_3$ =Area of the circle segment in front of  $A_1$  on the hypotenuse

$$= \frac{1}{2}\pi r^{2} \times \frac{\theta_{1}}{180^{\circ}}$$
  
=  $\frac{1}{2} \times \frac{22}{7} \times \left(\frac{5}{2}\right)^{2} \times \frac{64.8^{\circ}}{180^{\circ}}$   
= 3.535 Sq. units (5)

A<sub>4</sub>=Area of the circle segment in front of A<sub>2</sub> on the hypotenuse

$$= \frac{1}{2}\pi r^{2} \times \frac{\theta_{2}}{180}$$
  
=  $\frac{1}{2} \times \frac{22}{7} \times \left(\frac{5}{2}\right)^{2} \times \frac{115.2^{\circ}}{180^{\circ}}$   
= 6.285 Sq. units. (6)

A<sub>5</sub>= Area of Half Circle (Semi –Circle) on 5 units

$$= \frac{1}{2}\pi \left(\frac{5}{2}\right)^{2}$$
  
=  $\frac{1}{2} \times \frac{22}{7} \times \frac{25}{4}$   
= 9.82 Sq. units (7)

Adding (1) and (2)

The area of the semi Circle which are formed on the small legs of right angled triangle.

$$A_{1}+A_{2} = 3.535+6.285$$
  
= 9.820 sq units  
= 9.82 sq. units (8)  
:- From (7) + (8)  
$$A_{1}+A_{2}=A_{5}$$
  
From (3) and (5)  
$$A_{1}=A_{3}$$
  
And From (4) & (6)

 $A_2 = A_4$ 

This shows that the line form the centre of the hypotenuse divides the half circle (Semi-Circle) of hypotenuse the angle ratio.

$$\frac{3^2}{5^2} \times 180^\circ: \frac{4^2}{5^2} \times 180^\circ$$

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$$\frac{9}{25} \times 180^{\circ} : \frac{16}{25} \times 180^{\circ}$$
$$64.8^{\circ} : 115.2^{\circ}$$

Hence proved.

### Lord Vishavakarma

### 5.2 Vishavakarma's Triple

There is very vast knowledge about the Science (Truth) and Mathematics in the DHARAM GRANTHS, "VEDA" and "PURAN". In the Tenth Mandal of DHARAM GRANTH "SHRI RIGVEDA", Shri Vishavakarma is considered as the Rachanhar (Creature) of 'Sansar' (Nature).

According to Gurbani in The "Sri Guru Granth Sahib Ji Maharaj' write

"ਅਰਬਦ ਨਰਬਦ ਧੰਦੂ ਕਾਰਾ"

(Arbad Narbad Dhandu Kara) At that time Baba Vishavkarma Ji was born. According to Baba Vishavkarma "Work is workship." Vishavkarma Ji gave "Mantra of Kirt" In which they are:

- a) Mantra of Thihean (ਠੀਹੇਂ ਦਾ ਮੰਤਰ)
- b) Mantra of Gaz(ਗਜ਼ ਦਾ ਮੰਤਰ)
- c) Mantra of Gunia (ਗੁਣੀਆ ਦਾ ਮੰਤਰ)
- d) Mantra of Gayatri Vishavakarma Ji (ਵਿਸ਼ਵਕਰਮਾ ਗਾਯਤੀ ਮੰਤਰ)
- e) Mool Mantra of Vishavakarma Ji (ਵਿਸ਼ਵਕਰਮਾ ਦਾ ਮੁਲਮੰਤਰ)

In the Mantra of Gunia Vishavakarma Ji gave the Triple before the Pythagoras and other ancient Philosopher. Mantra of Gunia is:

> ਨੌਂ ਰਾਜ ਬਾਰਾਂ ਰਾਸ ਪੰਦਰਾਂ ਤਿਬ ਬਿਠਾਵੇ ਰਾਸ ਬਨੋ ਸੂਤ। ਤਬ ਅਖਵਾਵੇ ਵਿਸ਼ਵਕਰਮਾ ਕਾ ਪੂਤ {Nau Raj Barah Ras Pandrah, Tab Bithawe Ras bano Sut (Thread) Then will be said to son of Vishavkarma} *Vishavakarma's Triple is* (9, 12, 15)

Right angle Triangle (i.e. Gunia) is formed only when there is Vishavakarma's Triple i.e. (9, 12, 15)

And its prime Triple is formed dividing by 3 i.e. (3, 4, 5) when ever the proof of this theorem is not discovered at that time. But these triple is same as Pythagorean Triple (3n, 4n, 5n) i.e.  $(3n)^2 + (4n)^2 = (5n)^2$  where is any multiple of this triple. These are also related to the Babylonians Triple who discovered algebraically between 2000 and 1786 BC. The middle Egyptian kingdom.

So, we can say that Triple was discovered by Vishavakarma although Right Angle triangle does not mentioned in it.

## What is Gunia?

Gunia is an instrument which is used to check and mark right angles in constructional and wood work. It is used for marking as well as measure purposes. Nowadays, it is known as Try Square. It consists of two legs joined together exactly at a  $90^{\circ}$  angle.

## Mantar of Gunia



# 6. Objectives

To study the Philosophical and educational views of Pythagoras and other ancient scholars.

To cultivate Pythagorean Philosophy for right angle triangle in day to day life.

By Half –Circles (Semi-Circles) Theorem can be used in Mathematical problems.

The Half circle (Semi Circles) Theorem could be placed in the curriculum of metric standard.

Present study is philosophical in nature. The investigator will trace the concept of Pythagorean triple and ANCIENT VEDIC GRANTHA. Content analysis will be done in order to Analyses general and philosophy of Pythagorean Theorem.

The present research is applied versus fundamental research.

The use of Gunia is very useful for wood work and engineering technical work.

## 7. Expected Outcome of Research

The theorem "In a right angle triangle the sum of the area of semi-circles (Half-circles) formed on the two sides is equal to the semi-circle (half-circle) formed on the hypotenuse can be used for wood work, i.e. almirah etc and engineering work instruments. Rigveda and Puran are concepts according to the mathematics. Concept of Pythagorean Theorem's new proof would be helpful to solve problems such that when a right angle triangle; half circles (Semi-Circles) formed the two legs then the length of the hypotenuse can be found. Importance of the research would be helpful to solve so many algebraically problems in mathematics and in daily life.

Ancient Vedic Investigation shows that the Pythagorean triple was known in the Gunia instrument so many centuries before the Pythagoras in Veda. Vedas are treasure of science and mathematics.

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