

“Sulba Sutra” of Vedic India and Pythagorean Principle of Mathematics:

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Natural Affinity with Mathematics:

While I was a Young student, I always wondered about my special love for Mathematics over Arts and Geography. During the later stage of my engineering education, I realized how useful the knowledge of mathematics was for a successful engineering career. In today's world, the knowledge of Mathematics is universal and not reserved for any nationality or a group. The use of computer technology and the degree of the precision obtained cannot be matched by the slow manual computation method that was practiced in ancient world. Some may still claim that large presence of Indians in academic world of mathematics demonstrates their DNA affinity to Mathematical science. I still remember my Engineering school teacher in India while teaching Thermodynamic remembered the logarithmic table by heart while I was constantly shifting the Pages of logarithmic table. He never shared his method as how he can translate a number or sequence of numbers within a formula in logarithmic scale through memory but it sure impressed all of us.

We know from the history that Pythagoras , an Ionian Greek of 6th century BC , who the world owes the Pythagorean theorem followed the suggestion of his Egyptian teacher and made a special trip to India to learn the principle of mathematics that were rooted in ancient Sanskrit text of “Sulba sutra.” “Sulba Sutra” by some is dated to 10th century BC or perhaps older. The Śulba Sūtras enumerates the rules for the construction of Vedic fire altars designed by Vedic priestly class of “Brahma Bhatt”. Brahma Bhatt were the followers of Brahminical religion and belonged to Brahmin class. All of the rules spelled out in this text require the construction of various shapes of the Vedic fire altars that will occupy the same space. The earlier Vedic Fire alters required five layers of bricks and each layer consisting 200 burnt bricks, and each layers will be in the perfect harmony of each other. This may look to be a simple math problem but without using Trigonometric it is hard to construct the rule based fire altars.



Vedic Fire Altars and use for ceremonies and rituals

Hayashi believes that Śulba Sūtras reveals the Pythagorean Theorem in its earliest form expressed in verbal Sanskrit form as sloka-struti. It is believed that this theorem was already known from the days of Indus –Saraswati, ancient Egypt and Sumerians. S. G. Danni, confirms this through the Babylonian cuneiform tablet 322 dated to 1850 BCE that contains fifteen Pythagorean triples with quite large entries, including other tablets that were triple in primitive form. The Indus valley Excavation shows similar understanding of the layout of the settlements and city construction. The Egyptian Pyramids demonstrate the earlier understanding of Trigonometric with three dimensional forms.

Baudhayana Sulba Sutra clearly defines the numerology associated with altar by giving examples of simple Pythagorean triples, such as: (3, 4, 5), (5, 12, 13), (8, 15, 17), (7, 24, 25), and (12, 35, 37), as well verbalization of the Pythagorean theorem for the sides of a square without expressing into a mathematical formula.

"The rope which is stretched across the diagonal of a square produces an area double the size of the original square" Like some say, Indian Rope can be use for mathematics as well as Rope trick magic. The formula is accurate up to five decimal places, the true value being 1.41421356.

Baudhayana gives a formula for the square root of two.

$$\sqrt{2} = 1 + \frac{1}{3} + \frac{1}{3 \cdot 4} - \frac{1}{3 \cdot 4 \cdot 34} \approx 1.4142156 \dots$$

The formula is accurate up to five decimal places, the true value being 1.41421356. This formula is similar in structure to the formula found on a Mesopotamian tablet from the Old Babylonian period (1900–1600 BC):

$$\sqrt{2} = 1 + \frac{24}{60} + \frac{51}{60^2} + \frac{10}{60^3} = 1.41421297.$$

Obviously, one can draw the secondary conclusion that has established by the discovery of Indus seal in Mesopotamia and reconfirms the Vedic connection to Mesopotamia and Indus Valley as theorized by Charles Waddell several decades ago that early Vedic Kings may have come from Mesopotamia.

These basic principles were also assumed to be employed in architectural designs of various kinds of monuments of the ancient world, whether it was a Ziggurats, Pyramids, Temples or Assembly Hall or residential building of Indus-saraswati valley. There are other sections of Sulba Sutra that furnishes the evidence that this basic knowledge was known much earlier than written down in textual form.

Boolean Algebra:

An important landmark of the Vedic period was the work of Sanskrit grammarian, Panini (. 520–460 BC). His grammar includes early use of Boolean logic, of the null operator, and of context free grammars, and includes a precursor of the “Backus–Naur” form (used in the description programming languages). This is not to suggest that he had the knowledge of computer programming. But, the Boolean Algebra served the basis of early transistors and capacitors used in early primitive form of the computer.

Pythagoras of the Greek Island of Samos off Turkey (560-480BC)

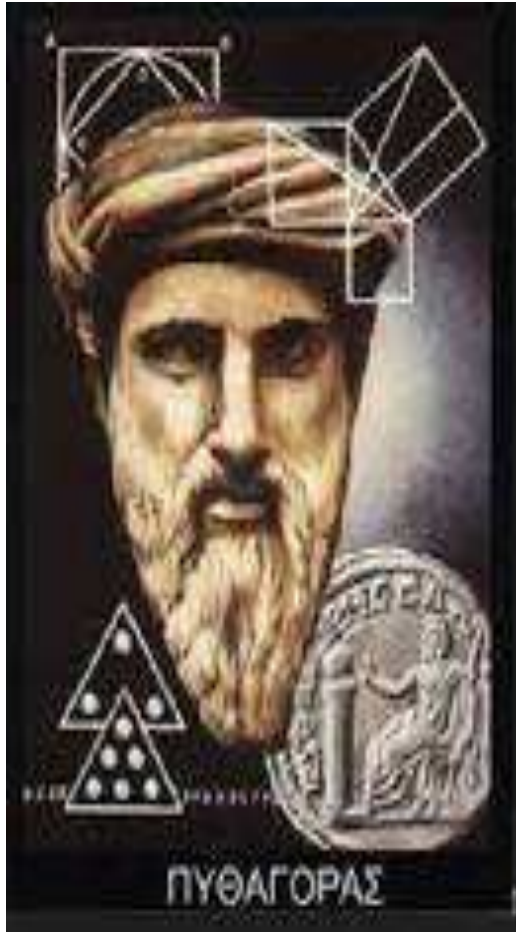
Pythagoras was an Ionian Greek. He became a Mathematician, philosopher, astronomer, logician and musician responsible for important developments in the history of mathematics, astronomy, and the theory of music in Western World. He founded the “Pythagorean Order” similar to the Templar Order and formulated principles that influenced the thoughts of Plato, Aristotle and Other philosophers and sophist of the ancient world.

The influence of Pythagoras was so widespread; that he had developed many followers like Aristotle, Plato, Pliny, Tacitus, *Porphyry*, Diogenes Laertius, *Cicero*, Apollonius of Tyana, Josephus and many others. Since no personal writings of Pythagoras exist today, what we know of him is through secondary accounts of Porphyry and Diogenes Laertius.

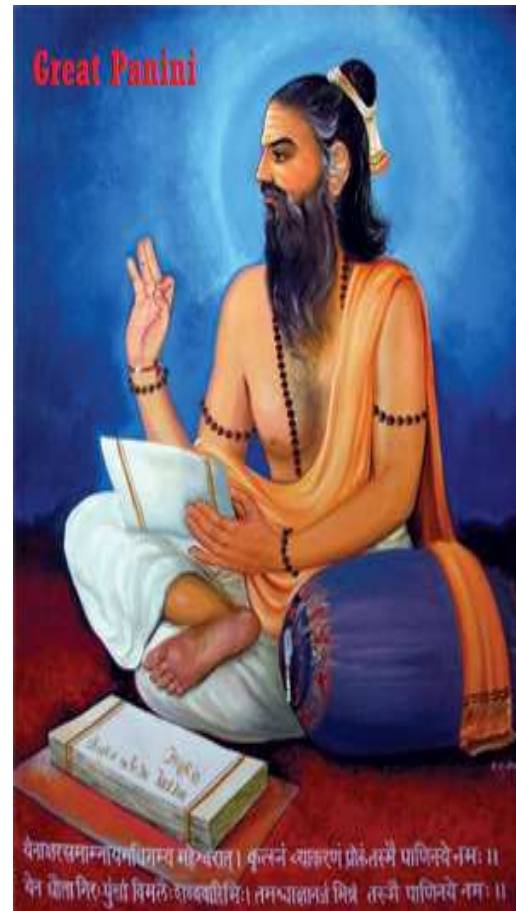
His father was a Gems merchant of either Syrian or Phoenician origin as he was from Tyre of Lebanon. He may be mixed origin part Greek and part others. They lived with his mother at a village Pythais on the island of Samos, near southern Turkey. He had a chance to travel with

his father Mnesarchus to various places in Mediterranean cities. This allowed him to be in contact with different culture and traditions.

(“Yuvanacharya Prythra”)



Pythagoras in Indian-Persian Hat



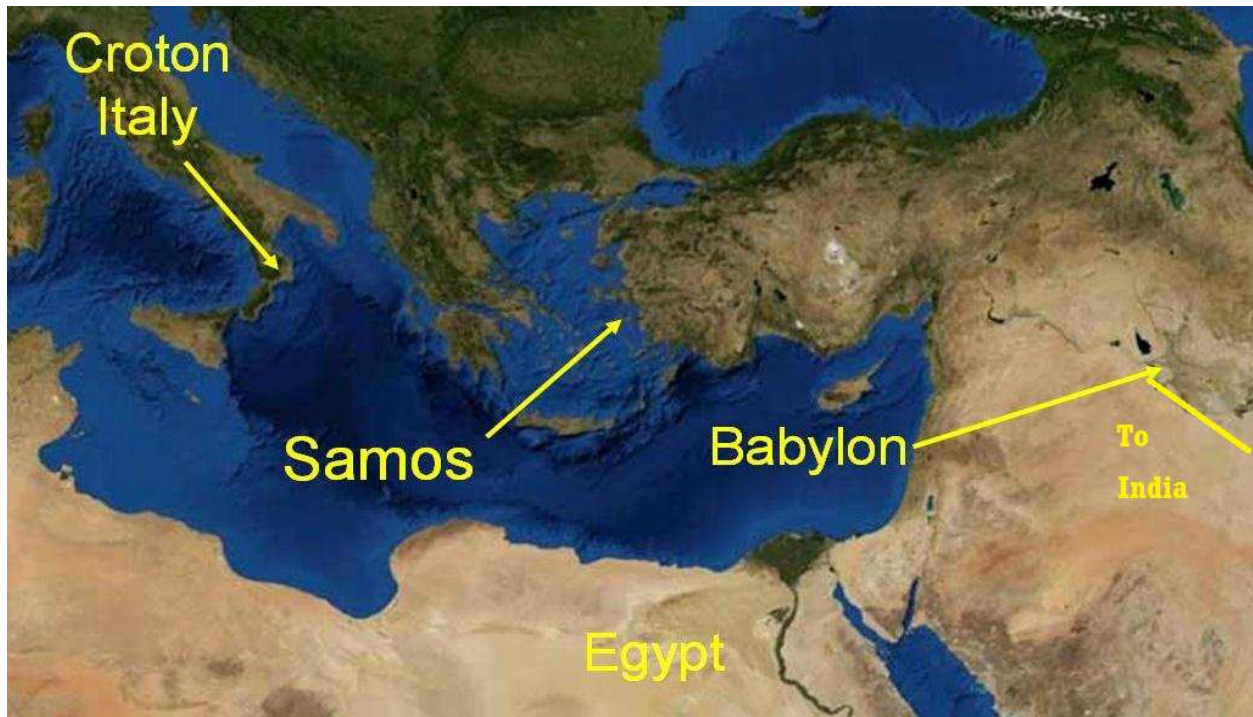
Panini of India

The early Greek philosophers like Pherekydes and Thales gave him some basic knowledge of Philosophy and astronomy. To learn more, He was advised by Thales at home town to travel first to the school of mystery at Tyres and Byblos, two Phoenician trading cities and finally Egypt. He first received the letter of recommendation from Polycrates of Tyre for advanced learning of Indian asterism and Yogic breathing exercise. Polycrates thought that through Egyptian contact, he would gain the knowledge of Far East from the Egyptian school of mysticism. The Egyptians told him that he has to go through 40 days of fasting and certain way of breathing exercise before they can admit him. **This is typically a Jaina and Ajivikas**

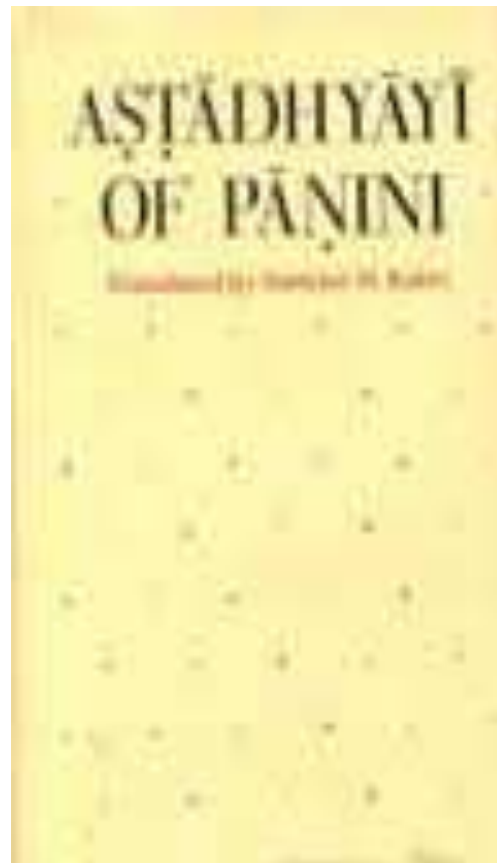
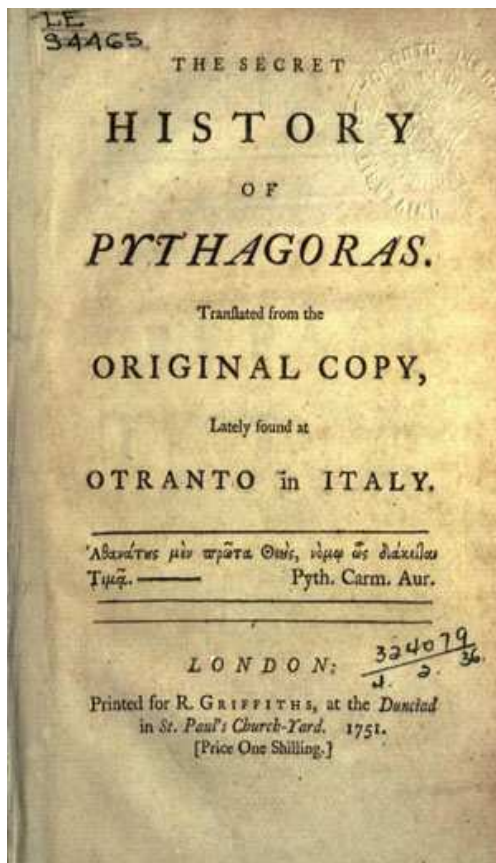
tradition of that time. The Egyptian finally admitted that they cannot give him the knowledge unless he has the “hands on “experience and suggested a trip to India. When Cambyses II, (“Cyrus”-Persian and “Kambujiva or Kurus” -Indian) the king of Persia invaded Egypt in 525BC, he made Pythagoras his prisoner along with many and sent him to Babylon. This is not the way he thought he would plan his trips but he saw the opportunity. He utilized this misfortune as an opportunity for growth, and for the next 12 years he studied with the Magi Priest of Media and was initiated into the Chaldean Mysteries. Leaving Babylon, he made his way through Persia to India, where he continued his education under the Ajivikas, Jaina and Brahmin priests of Taxila School.



Samos-Home Of Pythagorus



Long March of learning, wisdom and Knowledge of Pythagoras



At that time India was still feeling the effects of the spiritual revival brought about by Mahavira of Jainism and Buddha of Buddhism. Most of the foreigners in generic term referred to all priests and monks in generic term as “Brahmana” and it is true that Jainism and Buddhism were not formalized as distinct religions in 6th century and both of these reformist schools were heretics and included Brahmins as their major disciples.

Pythagoras became a sworn vegetarian and practiced fasting and Yoga (Standing on one leg) This practice is more suggestive of him following of the early form of Jainism or Ajivikas traditions. Ajivikas was the early form of Jainism or Shramanic tradition of ancient India. Mahavira and Buddha both started out with Ajivikas leader Gosala. Ajatsharu’s father Bimbisara was known Ajivikas practitioner while Ajatshatru patronized more in favor of Buddhism than Jainism. The Buddhism permits the eating of the meat.

The foreign observers and historians used to get confused and because of the popularity of Buddhism that was gained through Asoka. They easily dubbed Jainism and other sects as part of Buddhism or made no distinction among them through the textual reference.

Pythagoras went to India and Persia as a student; but when he left he left as a great teacher. He spent 22 years away from home mastering mathematics, astronomy, music, mysticism, Yoga, various religious doctrines and philosophy of Yoga. After his return back, Pythagoras confided to a friend **“I am a different man, I am reborn. Through this purification, my center of being has changed. Now truth is not a concept to me, but a life.”** He was 56 years old when he returned home, his home, schools and temples were in ruins due to past Persian invasions. He did not feel welcomed by his friends and neighbors, so he went to southern Italy settling down in city called Crotona and impressed the people over there with his wisdom, so they decided to build an institute which would serve as a school of science, philosophy and astronomy. There was nothing about the place suggesting any secrecy , since he make sure that the statue of Hermes Trismegistus stood at the inside of the entrance to the school with the words on the pedestal: **"Let no profane enter here."**



Statue of **Hermes Trismegistus**



Map and location of **Pythagorean School** in Southern Italy

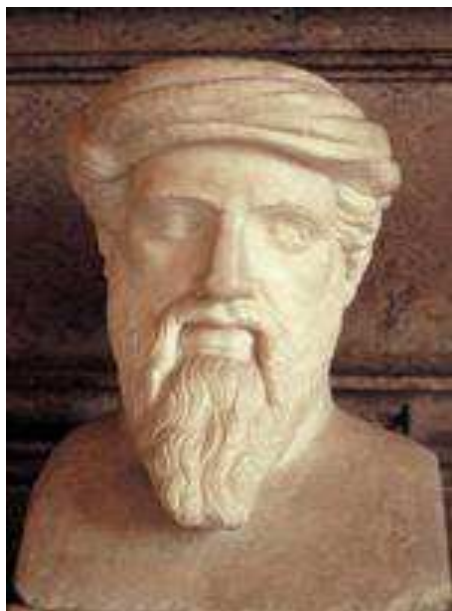
He also taught the philosophy, yoga, asceticism, breathing exercise and knowledge of healing through roots and herbs that he had learned from Indians, Babylonians, Egyptians and Persians. He discussed his trips and time in Egypt, Babylonia, Persia and India. He associated with the Egyptian priests, Brahmin Vedantists, Ajivikas ascetics, Jainas and Buddhists monks to absorb the knowledge as much as he can. It is very doubtful that he ever met either Mahvira or Buddha personally but many Ajivikas and Zaruashtra's contemporary followers at Taxila. At Croton, he opened his own order in a similar way the Persian Magi Zaruashtra and the Indian's reformist sects were organized. His own version is called "Pythagorean Order".

The Pythagorean institute was organized in three different orders:

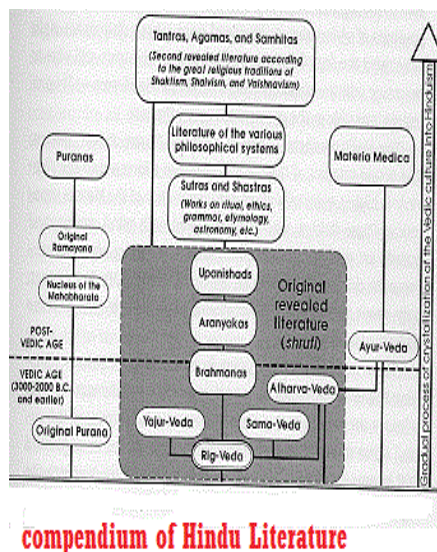
1. Akoustici: The outer order or early first order of students lived in their own houses only coming to the institute during the day. They were allowed their own possessions and were not required to be vegetarians. Acceptance into this outer society was granted after a 3 year probationary period. Both men and women were permitted to become members of the order; in fact 28 women were admitted to the institute as per the textual reference. This is very similar to early Jaina order when women were permitted in early initiation, but in this order only the music was taught to the women as the term suggests.

2. Mathematikoi: They were the next higher school of learning. They consisted of men who lived permanently with the order on the premises. They were allowed no personal possessions and were vegetarians like Jains. They were taught by Pythagoras himself and obeyed strict rules of his order. They lived totally detached, just like Jainism and Ajivikas tradition. They were taught mathematics, astronomy and Yoga.

3. Electi: This was the highest level of initiation and those seeking the knowledge of mysteries, divinity and transmigration of souls as well as philosophies and other world religions. According to Greek texts they were instructed in the secret processes of psychic knowledge, how to heal with sound and breathing exercises and fasting, and lived a strict discipline in accordance with the code of the Great Mystery Schools of the Greeks. The daily life of an "Electi" student at Crotona followed a very strict schedule. At sunrise they engaged in meditation, pronouncing a "Mantrum" (Indian-Mantra) on a certain tone. They reviewed all their actions of the previous day and planned the coming day in full detail. After breakfast, they took a solitary walk and went to the gymnasium for exercise. The rest of the morning was spent in study. At noon the Order ate together in small groups dining on bread and honey. After lunch students could receive their relatives and friends in the gardens of the institute. This was followed by another walk in the company of other students. At the close of the day, they ate together and read aloud. Before retiring for the night, each student again meditated and chanted his evening "Mantram". Those who were unable to stand the discipline left the school and went out again into the world. Even in the higher degrees of the institute, some occasionally failed by breaking their pledge of secrecy or some other rule which bound them. These students were expelled from the institute, and a tomb bearing their name was erected in the garden. Pythagoras taught that such a student was dead. "His body appears among men," he said, "but his soul is dead. Let us weep for it! ".



Pythagoras at Rome Museum



Sanskrit Text of Vedic Knowledge



Panini's Astadhyayi

Pythagorean Teaching:

Pythagoras taught that the Earth was a “round sphere” but was at the center of the universe. He recognized that the orbit of the moon was inclined to the equator of the earth, and he was first to proclaim that the Venus that was considered as an evening star, was really the planet and also appearing as the morning star. He taught that when you attain that knowledge through the meditation you can hear the movements of the planets traveling through the universe. This sound of the universe could be replicated using a single stringed instrument called the monochord.

Pythagoras used the monochord to explain musical intervals and harmonics to his students. He taught how harmony may be produced when tuning the high and low notes in the octave, thereby laying the foundation for many of the theories and teachings that have come down through the musical traditions of the west. He also taught that the music has the healing properties and soothing of anguished minds.

In Mathematics, he advanced his theorem that was widely used in construction and other application and that forms the basis of today's trigonometric. He got the news that his old teacher Pherekydes was dying in 513 BC. He stayed with him until 508 BC. During his absence, his society at croton was attacked by another noble of Croton. He went as far as Metapontum (see Map above) and there he caught his last breadth by most account of Greek historians. There is no evidence as to where he died.

The beliefs of Pythagoras:

Undoubtedly, he was also a man of science besides other expertise and tried to absorb various religious philosophies and knowledge of the ancient world and try to organize it in a way that would fit the model of Greek society. However, some of his theosophical underpinning was so much rooted to India's reformist school of thoughts of the period that his teachings resembled the Jainism, Ajivakis and Buddhism as appeared in his declarations, given below:

1. The universal reality is mathematical in nature. For examples: **Jaina Metaphysics or laws of universe such as gravity in modern science.**
- 2) The intent of philosophical thought should be for spiritual purification. **. Here he agrees with Jainism and Buddhism**
- 3) The Soul can rise to union with the Divine. **Here he agrees with Jainism and Buddhism, rather any paganism.**
- 4) The certain symbols have a mystical significance. **Similarly agrees with Mithraism, Hinduism.**
- 5) All brothers of the Order should observe strict loyalty and secrecy. The moral discipline of the Pythagorean student steadily increased in intensity, and the line of discrimination between right and wrong became finer with every passing year. Disciples were warned not to be surprised by anything that might happen and trained to meet the greatest shocks with an equal mind. Anger was considered as one of the deadly sins and every student was cautioned not to make a decision or rebuke a servant while under the influence of this passion. The students were taught:

We should never do anything with a view to pleasure as an end.

We should perform what is right, because it is right to do so.

These principles similarly agree with Ajivikas, Jaina and Buddhist traditions. We do not know how strictly their members observed the vows to chastity.

Indian Science of Mathematics-The famous Quotes:

- 1. Frances M. Voltaire (1694-1774 AD)**

"I am convinced that everything has come down to us from the banks of Ganga-Astronomy, Astrology, and Spiritualism. Pythagoras went from Samos to Ganga 2600 years ago to learn Geometry. He would not have undertaken this journey had the reputation of the Indian science had not been established before."

2. Roger Pot Droit-1949 French writer and Philosopher:

The Greeks Loved So Much Indian Philosophy that Demetrio Galliano had even translated the Bhagavad-Gita. There is not a shadow of the doubt that the Greeks knew all about Indian Philosophy."

3. Welsh Physicists, Brian David Josephson, the Nobel Prize winner (1940):

"The Vedanta and sankhya hold the key to the laws of the mind and thought process which are correlated to Quantum Field, that is the operation and distribution of particles at atomic and molecular levels."

4. John Archibald Wheeler (1911-2000), American Physicist and early participant of atomic bomb.

"It is curious that Schrodinger, Bohr and Oppenheimers were early followers of Upanishad scholars."

5. Albert Einstein (1779-1955), Nobel laureate, scientist and scholar.

"We owe lot to Indians who taught us how to count, without which no worthwhile discovery could have been made."

6. Werner Heisenberg (1901-1976), Co founder of Quantum physics

"After the conversation about Indian Philosophy, some of the idea about quantum physics looks so crazy suddenly made more sense."

Since Pythagoras himself did not write down his own work in some form, some people would question if he would make such a journey? When Achemenians conquers the Asia and Greece, they brought with them many Greeks of all types. Some of them wrote and we have the benefit and glimpse of the history by Herodotus. Porphyry of Tyre, another philosopher write Pythagoras biographical sketch. Hecataeus of Miletus was another one who was captured by the Persian and much of what was known then was written by Herodotus. Herodotus still got bum rap from other historians due to its differences with Aristogoras. Xenophon was also another historian and philosopher who were close to Persian court and historical events. The details provided by Porphyry on Pythagoras tallies so much Indian texts as to the reformist tradition of Jainism and Buddhism. You can also derive a reverse conclusion that how the great ancient universities of learning at Nalanda, Taxila and Vallabhipur was organized probably on the same model as institution of Pythagoras.

Achemenians invasion displaced many Ionian Greeks who were spread out as far as Baltic States, Black sea region and to the kingdom of Bactria where we find significant presence of Greek art and archeology. The fact that Gandhara Numismatic and Art was so much influenced by Greek Arts, proves the cross cultural connection began soon after Achemenians conquest and continued through Indo-Greek ruler's presence in Central Asia , Northwest India and Afghanistan. The premise of Greeks visiting India before Alexander cannot be questioned as Alexander knew about India but he did not know what lies after India. Most of the western Greek Travelers came as far as Taxila of the North and went back. Mahabharata always attested and recognized Ionian Greeks as "Yavanas".

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7. From this links below:
http://www.tertullian.org/fathers/porphyry_life_of_pythagoras_02_text.htm
- 7a. *Porphyry on Vita Pythagorae* on the life of Pythagoras translated by Thomas Taylor
- 7b. Porphyry, *On Abstinence from Animal Food*, Book 1through IV, translated by Thomas Taylor

8. From This link:

<http://classicpersuasion.org/pw/diogenes/dlpythagoras.htm>

Diogenes Laertius “Lives of the philosophers”-Pythagoras. This part does not cover his time in India.

9. various WIKI on Pythagoras on Google links.