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ASTRONOMY AND MATHEMATICS IN ARYABHATTA

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Abstract

Aryabhata is the father of Indian Mathematics contributed to Mathematics and astronomy, Varahamihira (born 505, Ujjain, India-died 587, Ujjain) was an Indian Philosopher, astronomer, and mathematician, author of the pancha-siddhantika, a compendium of Greek, Egyptian, Roman and Indian astronomy. Aryabhata (476-550 CE) was the first of the major mathematician astronomers from the classical age of Indian mathematics and Indian astronomy. He was born in Ashmaka around but offer ward moved to Kusumapura. The father of Mathematics Archimedes is considered of his notable inventions in mathematics and science. Aryabhata calculated the value of PI (π) to be approximately 3.14, which is close to the modern value. He also stated that Pi is a constant and the ratio of a circle's circumference to its diameter.

Key note = [https:// Unacademy.com](https://Unacademy.com)

Introduction

Aryabhata (476-550 CE) was an Indian Mathematician and astronomer who made significant contributions to the fields of Mathematics and astronomy.

Mathematics

Aryabhata is a known as the "father of Indian Mathematics". He made contributions to trigonometry, including the definitions of sine, cosine, versine and inverse sine. He also developed methods for calculating the areas of triangles and circles.

Astronomy

Heliocentric Model- According to his Heliocentric theory, planets revolve around the sun. He calculated the speed of the various planets concerning the sun with the help of his theory.

Earth rotation-

Earth's Rotation and the motion of the solar system Aryabhata proposed that the Earth rotates on its axis daily, explaining the apparent motion of the stars.

Sidereal Year-

According to his calculated that a sidereal year is 365 days, 6 hours, 12 minutes and 30 seconds.

Solar and lunar eclipses :- He explaining that Solar and lunar eclipses occur when the Earth and the moon cast shadows.

Solar system model:- He Introduced a geometrical model of the Solar System that theorized that the moon and the sun move in epicycles, and that the planets so how two epicycles.

Key note- Principles of Astronomy and mathematical Astronomy)- by Dr. Monoj Kumar/P-63) SAMM India/2018th/ Sagar publication/ Delhi 2018.

THE CELESTIAL SPHERE

Astronomy is the science which deals with the celestial bodies. These comprise all the various bodies distributed through no at the universe, such as the Earth, the Sun, the planets,

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the moon, the comets, the fixed stars and the nebulae. It is convenient to divide Astronomy in to three different branches.

That first may be called Descriptive Astronomy. It is concerned with observing and recording the motions of the various celestial bodies.

The second Gravitational Astronomy is an application of the Principles of dynamics to account for the motions of the celestial bodies.

The third, called physical Astronomy is concerned with determining the nature, physical condition, temperature and chemical constitution of the celestial bodies.

The Celestial Sphere:- On observing the stars it is not difficult to imagine that they are bright points dotted about on the inside of a hollow spherical dome, whose centre is at the eye of the observer.

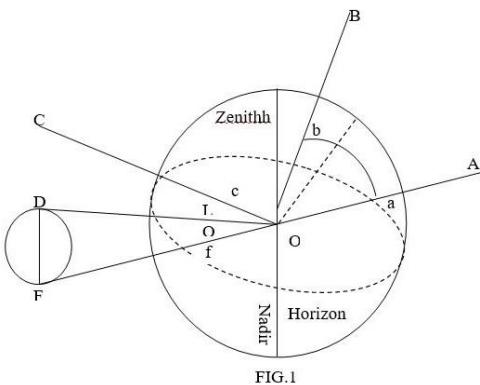


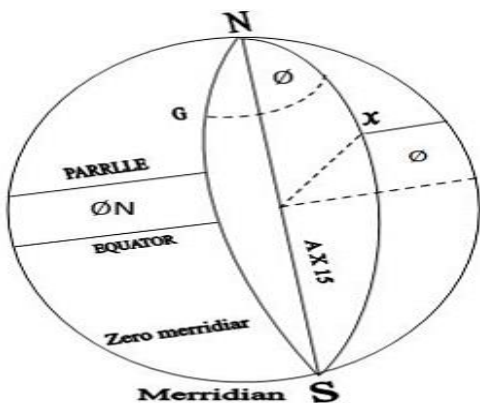
FIG.1

The way in which is done is shown in shown in figure to let 0 be the position of any observer, A,B,C & e, any stars other celestial bodies.

(Mathematical Astronomy for Amateurs E, A, Beet) David & Charles.

The Earth

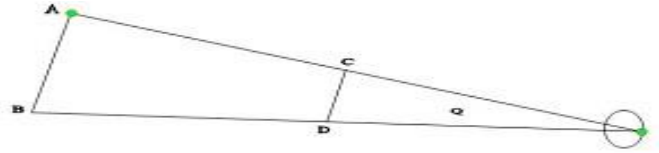
The Earth as is well known is a sphere rotating about a diameter known as the polar axis. A plane through the centre and at right angles to the axis cuts the surface in a line called the equator. The Earth is not, however, a perfect sphere.



ANGLES

Everyone is familiar with degrees, 360 to a circle. A degree is divided into 60 minutes of arc, and the minute into 60 seconds.

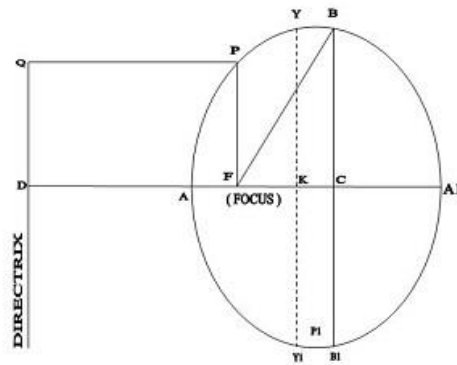
$\frac{\text{arc AB}}{\text{radius OB}}$, and in this particular diagram $\frac{\theta=20\text{mm}}{100\text{mm}} = 0.2 \text{ radian.}$



The ratio CD/OD must be the same of course. $360^\circ = 2\pi$ radius; $1^\circ = \frac{2\pi}{360}$ and $x^\circ = \frac{x \cdot 2\pi}{360} = \frac{\pi x}{180}$ radian.

THE ELLIPSE

The ellipse is a symmetrical oval, as shown in case of the Earth's orbit.



Keynote:- www.Survivorlibrary.com

Comparison of Astronomy & Mathematics

Astronomy and Mathematics are closely related with Mathematics being a crucial part of astronomy.

Uses of Math in astronomy.

The distance between planets and stars.

The speed thrust, and trajectory of space objects.

The movement, distances, and chemical characteristics of distant galaxies and stars.

The position of a galaxy and its 3D distance from another galaxy.

The trajectory of a satellite or rocket in orbit.

Math Skills used in astronomy.

Astronomy use a variety of Math Skills.

1. Algebra
2. Calculators
3. Statistics
4. Probability
5. Trigonometry
6. Logarithms

Math and Astronomy are different on the base of there basic concepts. "Astronomy is the study of everything on the universe beyond Earth's atmosphere". But Mathematic is the science and study of quality, structure, space and change. Mathematics is and always has been of central importance to astronomy. (Keynote:- [upvete quora.com](http://upvete.quora.com))

Idea of Aryabhatta Mathematic & Astronomy.

Mathematics and astronomy have a long and close relationship. Mathematics is a crucial part of astronomy. Astronomy relies on algebra trigonometry (Coefficients, cosines, distance algorithms) to solve for the relationship between things in this case., the relative age effect Astrologers were the data scientists of their day.

The earliest treatise on Jyotisha, the Bhriga Samhita, was compiled by the say , Bhrigu during the medic era. The sage Bhrigu is also called the father of Hindu Astrology and is one of the venerated saptarishi of seven vedic sages. The verse of chapter 36 Upacharah.:-

"**upacharatahavishnaouiidwertrimshatam parikiitirtah/
janeerava patukaevarpi gamanam bhagamvadangruhe ///**"
(bhrigusamhita/36/01)

Mathematics rules of Aryabhata:-

Summation of an arithmetic progression Aryabhata's rule for finding the sum of the terms in an arithmetic progression is :-

1. Subtract one from the given number of terms.

$$s = n \left[a + \left(\frac{n-1}{2} + p \right) d \right]$$

The 2nd part of the rule gives the formula $s = \frac{a1 \tan}{2} n$

$$n = \frac{1}{2} \left[\frac{\sqrt{8ds+(d-2a)^2} - 2a+1}{d} \right]$$

Aryabhata gives :- $ax + b = cy$, if $p > q$ ($b = p - q$) $ay - b = cy$,
if $p < q$

3. Add the number of preceding terms $\pi r^2 \sqrt{\pi r^2}$

4. Multiply by the common difference

5. Add the first term of the series

6. The common difference is 2. So the 20th term is $Q_{20} = 3 + (20-1) \times 2 = 41$

7. The formula for finding the nth term of an Aryabhata $a_n = a_1 + d(n-1)$.

(Keynote:- Mathematics and Astronomy)

Conclusion:-

Aryabhata changed his world as well as ours through his discoveries in the field of Mathematics as well as astronomy. Without Aryabhata many of the things we take for granted may not have been here. His estimate of Pi, Sidereal year, and use of Zero great by changed the world. Each one of his achievements had a great impact. Aryabhata deserves to win the Nobel prize for all the tremendous work he did that changed his world as well as ours.

Bibliography

1. The great Indian Mathematics and Astronomy. PDF (Google.com)
2. <https://unacademy.com>

3. Principles of Astronomy and Mathematical Astronomy/ Dr. Kumar Monoj /P.65/ SAMM India/ 2018th/ Sagar Publication/ Delhi/ 2018.
4. Mathematical Astronomy for Amateus/E.A But/ David G Charles/ P. 105.
5. Bhriga Samhita/ 30/01/ Bhriganadi Jyotisha Samhita/ Chakhomba/ 2009th/ 2009.
6. Mathematics and Astronomy (Goggle.com).