**MEANING**

Trigonometry(from Greek τρίγωνον*(trígōnon)* “triangle”, and μέτρον*(métron)* “to measure”) is a branch of mathematics concerned with the relationships between angles and ratios of lengths and sides in right-angle triangles. Therefore, it helps to find missing or unknown values of lengths or sides in a right-triangle via using trigonometric formulas, functions, or trigonometric identities, with angles either in radians or degrees. The most common trigonometric angles for mathematical procedures include 0°, 30°, 45°, 60°, and 90°.

Trigonometric ratios of a right-angle triangle are usually referred to as “trigonometric functions”. The most common functions are sin, cosine, and tangent. Below is a table of all available trigonometric functions. Use a memory guide known as S**OH** C**AH** T**OA** to remember the three most crucial trigonometric functions.

|  |  |  |
| --- | --- | --- |
| **Functions** | **Abbreviation** | **Relationship to sides of a right triangle** |
| Sine Function | *sin* | Opposite side/ Hypotenuse |
| Tangent Function | *tan* | Opposite side / Adjacent side |
| Cosine Function | *cos* | Adjacent side / Hypotenuse |
| Cosecant Function | *cosec* | Hypotenuse / Opposite side |
| Secant Function | *sec* | Hypotenuse / Adjacent side |
| Cotangent Function | *cot* | Adjacent side / Opposite side |

**HISTORY**

Sumerian astronomers studied the art of angle measuring, using circles divided into 360°. They, along with the Babylonians, studied the ratios of triangles and discovered some properties of these ratios, but did not document them properly.

During the third century before the Common Era, Hellenistic mathematicians like Euclid and Archimedes studied the properties of chords and angles, proving them equal to modern trigonometric formulae, although geometrically. During the 2nd century before the Common Era, Hipparchus produced the first tables of half-chords, know regard as sine values. During the second century, the Greco-Egyptian astronomer Ptolemy constructed detailed trigonometric tables. Ptolemy used chord lengths to define his trigonometric functions, different from our modern methods. Centuries after, and these great books stood against the tests of time.

The modern sine equivalent was written in the Surya Siddhanta, with its properties being documented by the 5th century Indian mathematician and astronomer Aryabhata, soon being translated into Arabic scholars. During the 10th century, Islamic mathematicians using trigonometric functions were applying them in complex problems. The Persian polymath Nasir al-Din al-Tusi, the father of trigonometry, was the first to treat trigonometry as a mathematical subject diverse from astronomy, soon developing modern spherical trigonometry. He listed the six crucial trigonometric functions and found laws regarding their behaviors. Trigonometric functions would soon enter the Western world though Latin translations of Ptolemy’s works and from renowned Arab mathematicians. Knowledge regarding Trigonometry in the Western world was still very little in 16th-century northern Europe that Nicolaus Copernicus devoted only two chapters of *De revolutionibus orbium coelestium* to explain basic and already well-known concepts.

Driven by the demands of navigation and the growing need for accurate maps of large geographic areas, trigonometry grew into a major branch of mathematics. Bartholomaeus Pitiscus was the first to use the word, publishing his *Trigonometria* in 1595. Gemma Frisius described for the first time the method of triangulation still used today in surveying. It was Leonhard Euler who fully incorporated complex numbers into trigonometry. The works of the Scottish mathematicians James Gregory in the 17th century and Colin Maclaurin in the 18th century were influential in the development of trigonometric series. Also in the 18th century, Brook Taylor defined the general Taylor series.

Trigonometry first reached fame due to the past world's needs for navigation and accurate geographical maps. Bartholomaeus Pitiscus was the first to use the current term we use today, publishing his Trigonometria in 1595. Gemma Frisius described, for the first time, the method of triangulation still used today in surveying. It was Leonhard Euler who fully incorporated complex numbers into trigonometry. The works of the Scottish mathematicians James Gregory in the 17th century and Colin Maclaurin in the 18th century were influential in the development of trigonometric series. Also in the 18th century, Brook Taylor defined the general Taylor series. From there, trigonometry would only soon gain attention from the Western world, soon becoming the thing we know today.

**APPLICABLE USES**

1. **Astronomy**

For times old as history tells, spherical trigonometry had been used for discovering solar, lunar, and stellar positions for celestial objects, also helping for predictions regarding galactic or earthly mattes. Now, in modern times, triangulations are used in astronomy to measure the distance of nearby stars, while also being used in satellite navigation systems.

1. **Navigation**

In the old times, trigonometry had been used to calculate the latitude and longitude of moving vessels, and now is also used in geography.

1. **Surveying**

During land surveying, trigonometry, on a large scale, is used to calculate lengths, areas, and relative angles between landmarks.

1. **Optics and acoustics**

Trigonometry is used in numerous physical sciences, as they help to describe sound and light waves, and help to solve boundary—and transmission—related problems.

1. **Other applications**

Other applications include but not limited to music theory, geodesy, audio synthesis, architecture, electronics, biology, medical imaging chemistry, number theory, and seismology.

**FURTHER INFORMATION**

For further calculation of trigonometric functions, use the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Angles** | **0°** | **30°** | **45°** | **60°** | **90°** |
| *Sin θ* | 0 | ½ | 1/√2 | √3/2 | 1 |
| *Cos θ* | 1 | √3/2 | 1/√2 | ½ | 0 |
| *Tan θ* | 0 | 1/√3 | 1 | √3 | ∞ |
| *Cosec θ* | ∞ | 2 | √2 | 2/√3 | 1 |
| *Sec θ* | 1 | 2/√3 | √2 | 2 | ∞ |
| *Cot θ* | ∞ | √3 | 1 | 1/√3 | 0 |

**REFERENCES**

<https://www.britannica.com/science/trigonometry>

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