

## **Triangle: the fundamental block of geometry.**

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"If you had to describe everything in the classroom- from the whiteboard to windows, and even your desks- using only shapes, lines and corners, how would you do it?" The simple thought leads us to the fascinating world of geometry, a branch of mathematics that helps us to understand and describe the shape and structure around us. Geometry is one of the oldest branches of mathematics, originating in ancient civilizations such as Egypt and Greece, where it was used to measure land, construct buildings and understand the physical world. Geometry simply means Geo "Earth" and metron "measure" generally measurement of Earth is known as geometry. Among the many shapes studied in geometry, the triangle stands out as one of the most fundamental and important.

A triangle is one of the simplest shapes in geometry. A triangle is formed by joining three straight lines. These lines meet at three points, creating three angles. One important property of a triangle is that the sum of its angles is always 180 degrees. Despite its simple structure, the triangle is a fundamental shape that helps us to understand many concepts in mathematics and the real world. Triangle is classified in two main ways. They are divided on the basis of sides and angles. An equilateral triangle has all sides equal, an isosceles triangle has two sides are equal and the scalene triangle has all sides of different lengths. Based on angle, an acute angle triangle has all angles less than 90 degree. The right angled triangle has one angle equal to 90 degree, and the obtuse triangle is one angle greater than 90 degrees. These classifications help us to understand the different shapes and properties of triangles in a simple way. Triangles follow several important properties that help us understand their structure and solve problems easily.

### Trigonometry

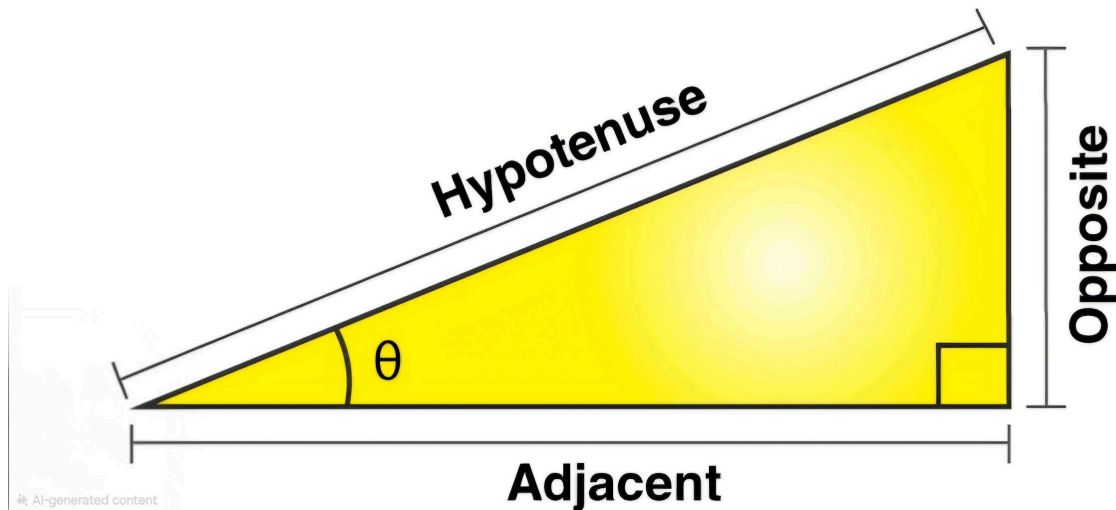
Trigonometry studies the relationship between the angle and the sides of a triangle. In a right-angled triangle, the ratios of the sides are fixed for a given angle. The sine, cosine, and tangent function help us to find the unknown side easily. One of the angles in the triangle is usually represented by the symbol  $\theta$  (theta), which simply means the particular angle we are focusing on.

Formulas

$$\sin\theta = \text{Opposite} / \text{Hypotenuse}$$

$$\cos\theta = \text{Adjacent} / \text{Hypotenuse}$$

$$\tan\theta = \text{Opposite} / \text{Adjacent}$$



Sine, cosine, and tangent are simple ratios that help us to understand the shape of a triangle by comparing its side with respect to an angle.

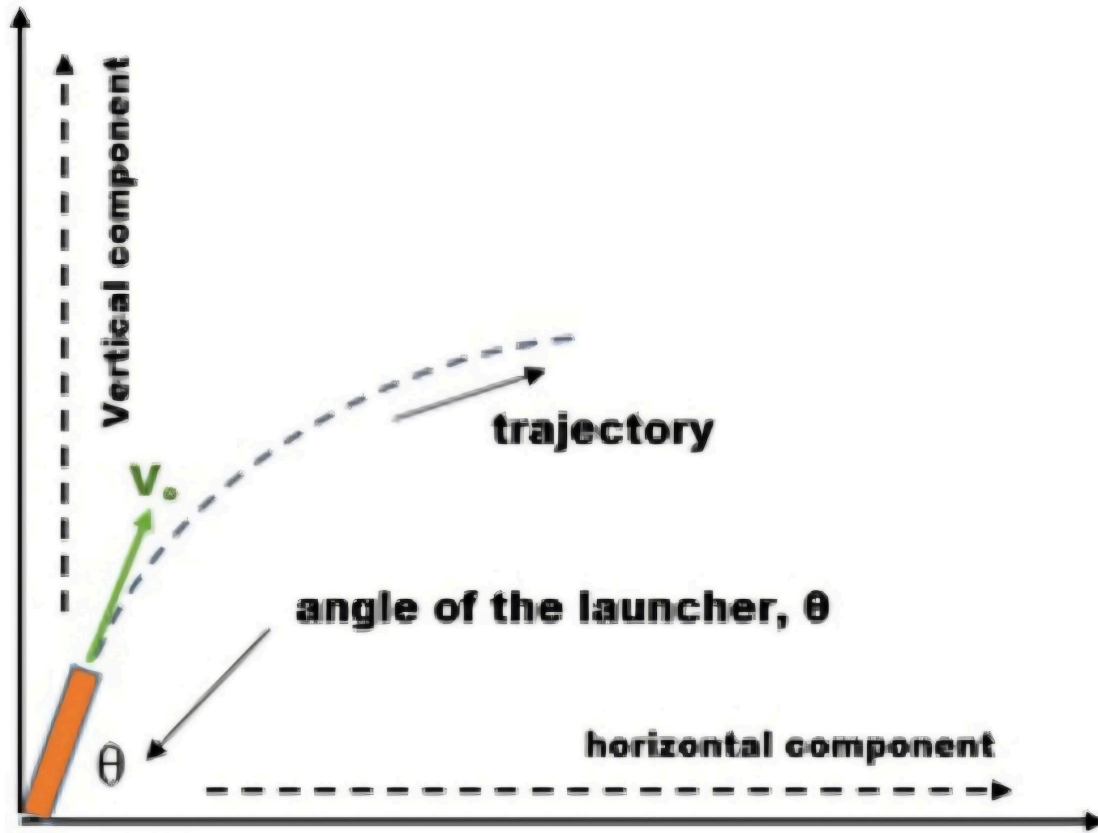
Trigonometry is widely used to measure distance and angle that are difficult to measure directly. The common uses include construction, navigation, surveying, astronomy and engineering. The importance of trigonometry lies in its ability to connect angle with distance, making it possible to solve real-world problems. If you ever adjusted your Laptop, TV, or iPad screen during daytime to avoid glare from the reflection of sunlight. At that time you are dealing with the angle of reflection. We know that if the sun strikes the screen at a certain angle, the screen will bounce toward our eye at the same angle (Laws of Reflection), so you tilt the screen at a fixed angle (theta) for properly seeing without reflection. Whether it's shooting a basketball, throwing a ball, or playing pool, we are calculating trajectories for our targets.

Volleyball- we are calculating trajectories based on our distance from the hoop to ensure the ball goes correctly into the basket.

Same with throwing a ball. We are balancing the trajectory with distance, so we can send the ball to our target.

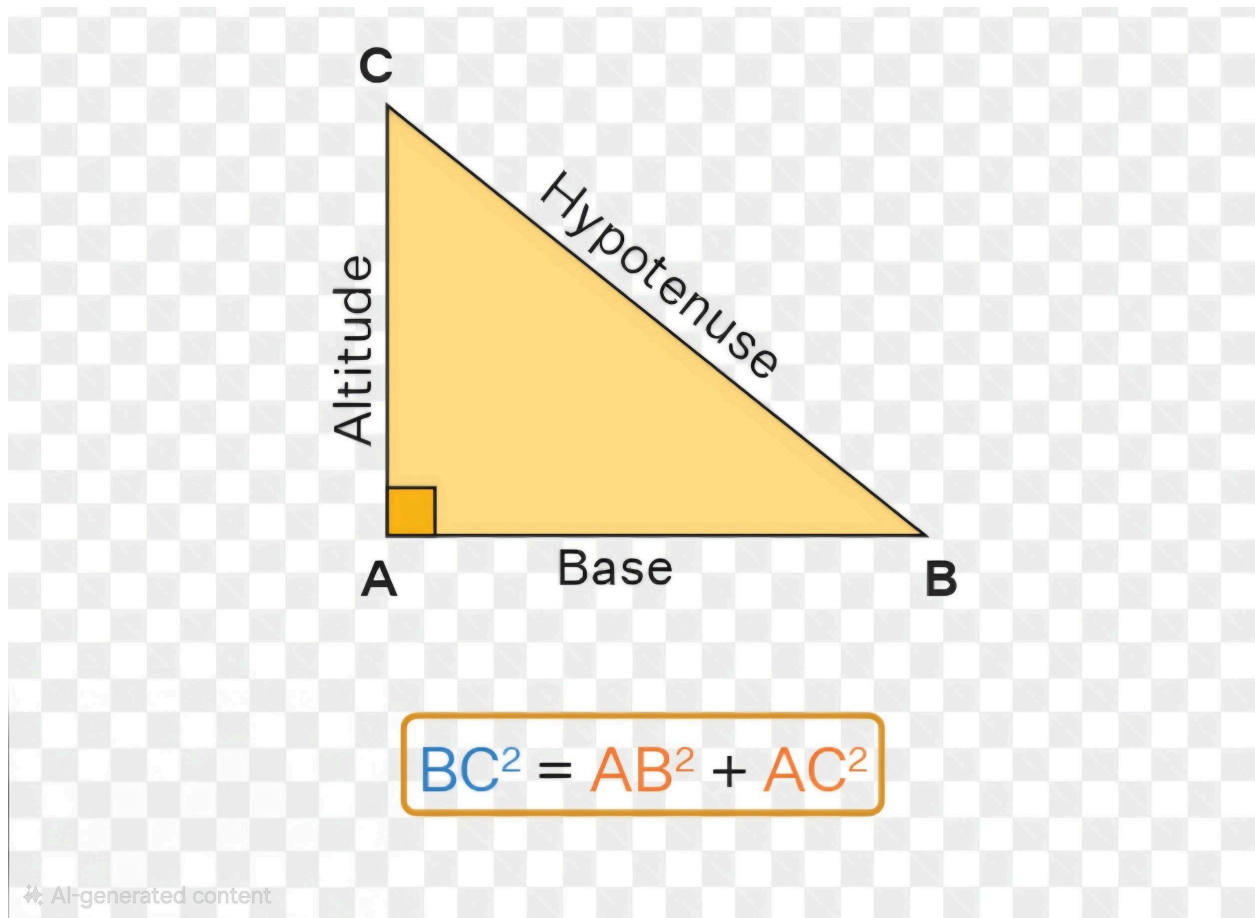
Playing a pool- we are using angles (theta) to hit the ball to perfectly go into the pocket.

They use principles of trigonometry like Angle (Theta), the horizontal distance (Cosine), and the vertical height (Sine).



### Pythagorean

The Pythagorean theorem, or Pythagoras theorem, uses a fundamental principle in geometry that reveals the relationship between the three sides of a right-angled triangle. It states that the area of the square whose side is the hypotenuse (the side opposite to the right angle) is equal to the sum of areas of squares on the other two sides.



The pythagorean theorem is widely used in real life whenever we need to find the shortest distance or measure length indirectly. It helps in situations where direct measurement is difficult or time consuming. It is used in construction work, road and map planning, and phone GPS and navigation apps. Overall, the pythagorean theorem is important because it helps us find the shortest path and solve practical measurement problems. It is also used in computer graphics to render images and animate scenes by calculating pixel distance. If you've ever tried to fit a tall lamp into your car and realized it won't fit straight, you naturally tilt it at angle from the first passenger seat to the back corner. You're using diagonal (hypotenuse) which is the longest side in a triangle. Every time we step on an escalator, we are travelling along the hypotenuse. Engineers use the theorem to figure out how much floor space (the base) they need to clear to reach the next floor (the height)

The connection between these two concepts lies in the right-angled triangle itself. Trigonometric ratios depend on the side of a right triangle, and the pythagorean theorem ensures that these sides length follows a fixed relationship. Together, they help solve real life problems. Thus, both concepts complement each other and highlight the importance of triangles in mathematics and daily life.

In conclusion, the triangle is one of the most fundamental and powerful concepts in mathematics. Its simple structure makes it highly stable, which is why it is highly stable and used in construction, engineering and design. Concepts like congruence and the exterior angle theorem make triangles more interesting because they help us understand hidden relationships between sides and angles. While trigonometry and pythagorean theorem helps us to understand the relationship between side, angle and distance in a clear and practical way. Thus, it is not just a basic geometric figure, but a key foundation that connects mathematics with the real world.