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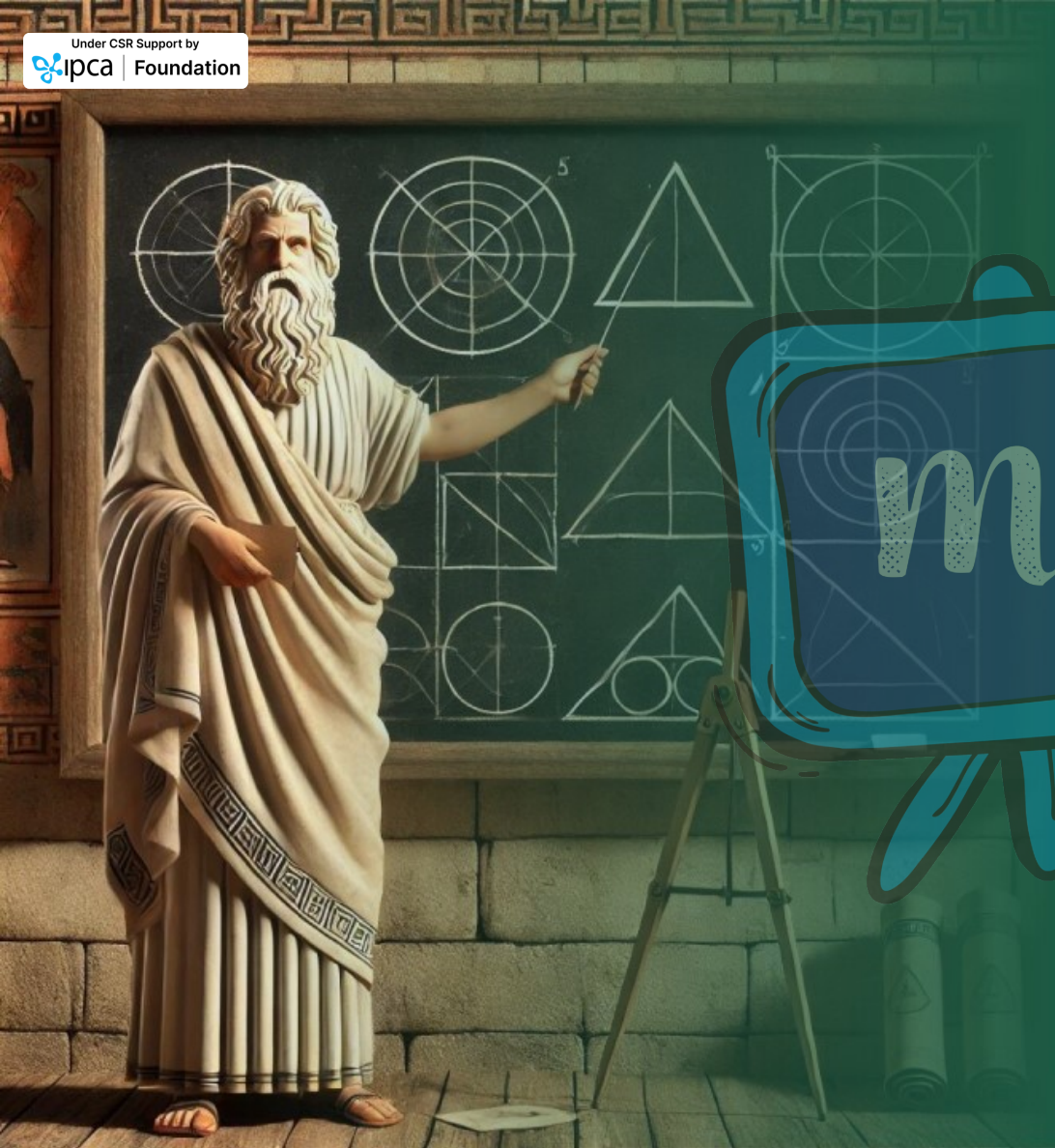

# CLASS – 9

# MATHEMATICS

## Chapter – 5

## Introduction to Euclid's Geometry

### Part – 1

### Introduction to Euclid's Geometry

Vikas Saini

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# OVERVIEW

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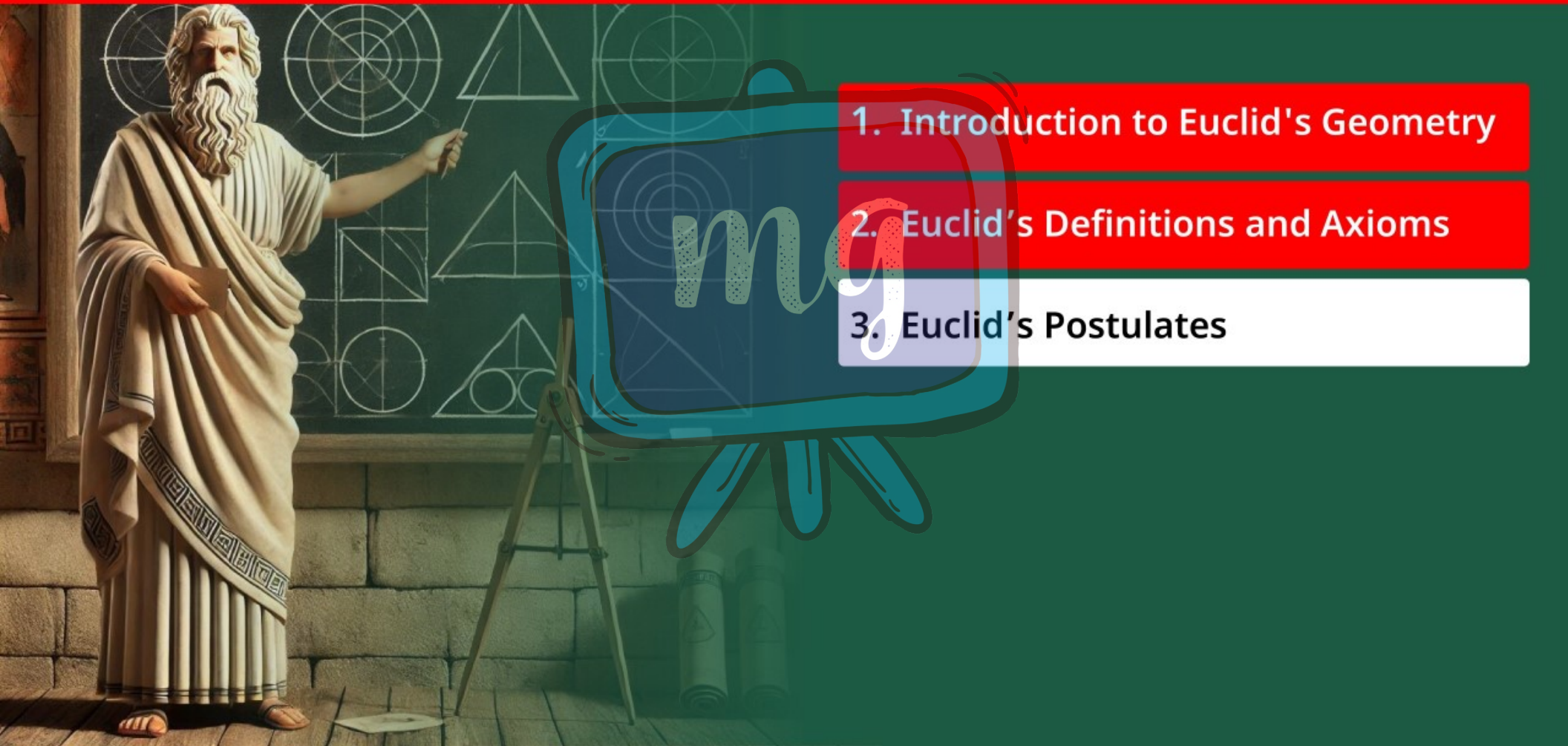

1. Introduction to Euclid's Geometry
2. Euclid's Definitions and Axioms
3. Euclid's Postulates

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# GEOMETRY

- The branch of mathematics under which we study different types of shapes is called geometry.
- The origin of the word 'geometry' is believed to be from two Greek words 'geo' and 'metry'.
- 'geo' means - 'land or earth'.

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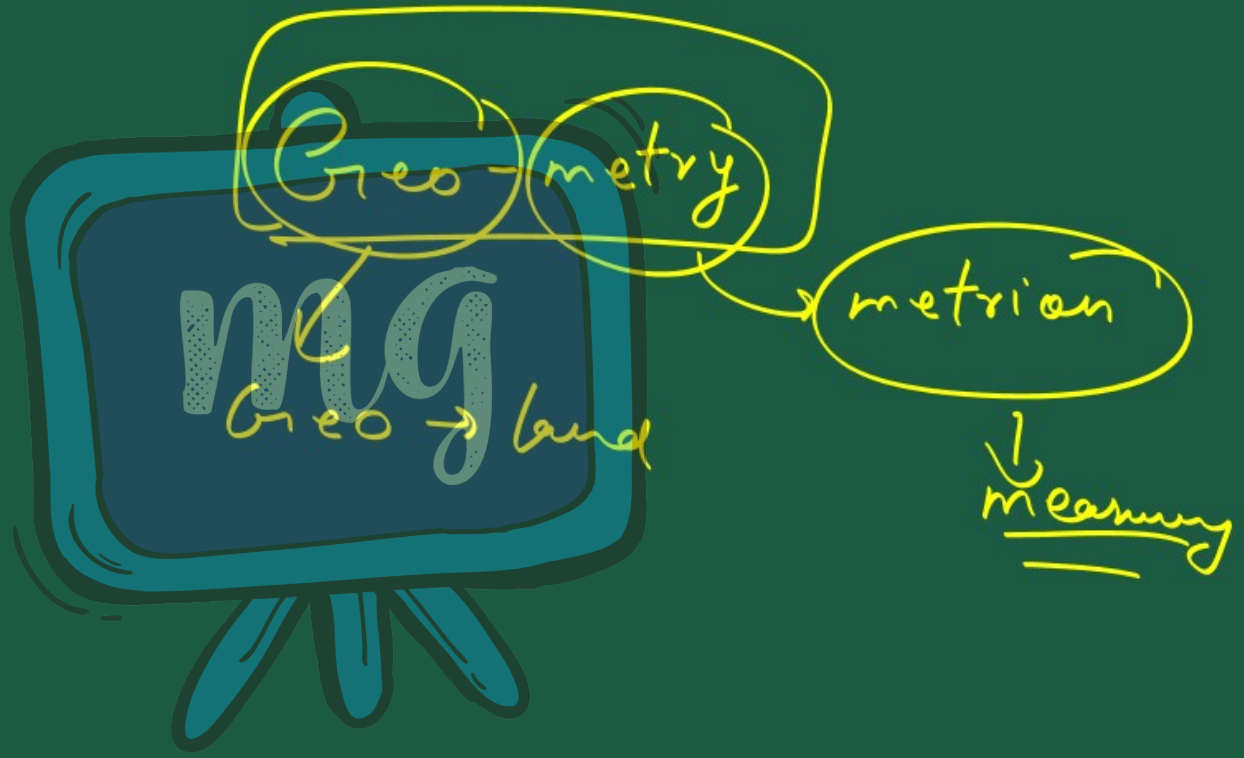

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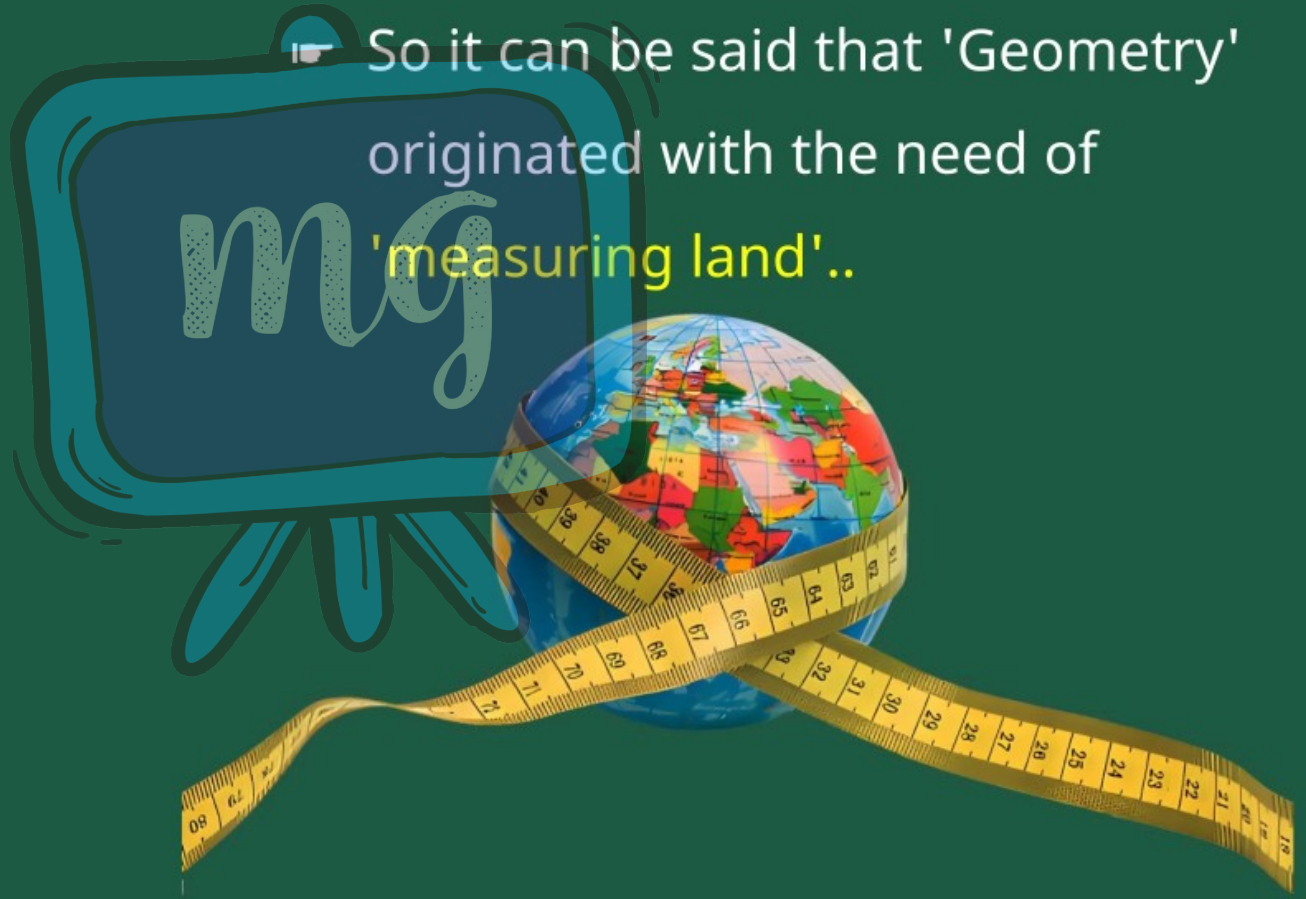
- 'Metrion' means – 'to measure'
- So it can be said that 'Geometry' originated with the need of 'measuring land'..



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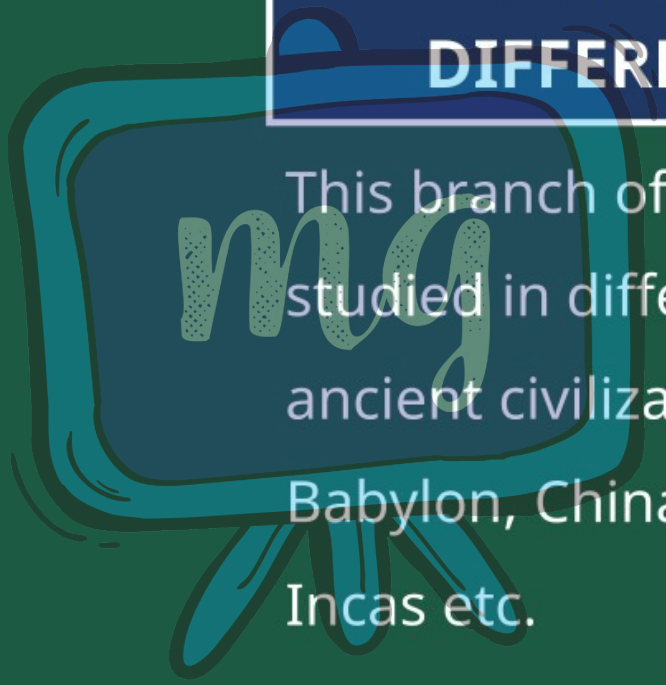
# EVALUATION OF GEOMETRY IN DIFFERENT COUNTRIES



This branch of mathematics was studied in different forms by every ancient civilization, be it Egypt, Babylon, China, India, Greece or the Incas etc.

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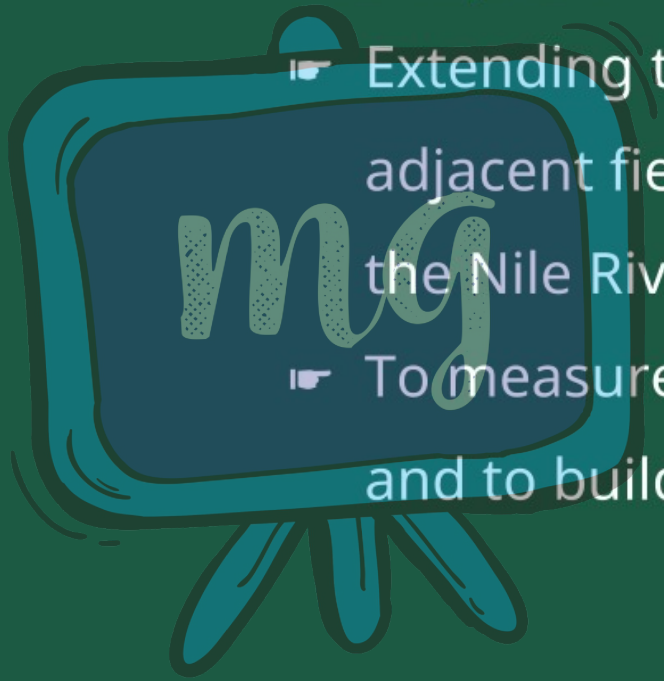
## Example :



- Extending the boundaries between adjacent fields by Egyptians when the Nile River flooded.
- To measure the volume of granaries and to build canals and pyramids.

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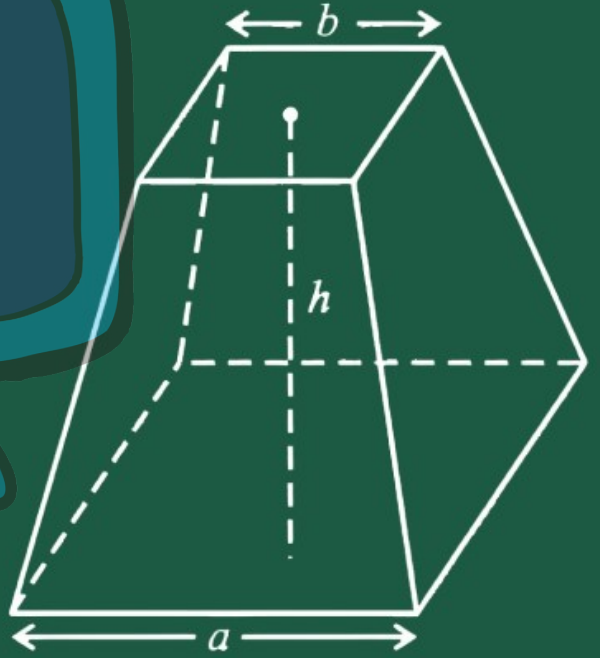
- Finding the volume of a truncated pyramid.



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# USE OF GEOMETRY IN THE INDUS VALLEY CIVILIZATION

- Excavations at Harappa & Mohenjo Daro.
- In cities, in roads, in drainage system, in many different types of rooms in houses, in bricks (4:2:1)

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# USE OF GEOMETRY IN THE VEDIC PERIOD

The 'Sri Yantra' (given in the Atharva Veda) consists of nine isosceles triangles joined together. These triangles are arranged in such a way that they form 43 smaller (or secondary) triangles.

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# THALES

It was Thales, a Greek mathematician, who provided the first known derivation. This hypothesis was the statement that the diameter isosceles (i.e., divides into two equal parts) the circle.



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# EUCLID

Euclid collected all the mathematical knowledge known up to that time and organized it into his famous treatise called Elements.

He divided the Elements into 13 chapters, each of which is considered a handbook.

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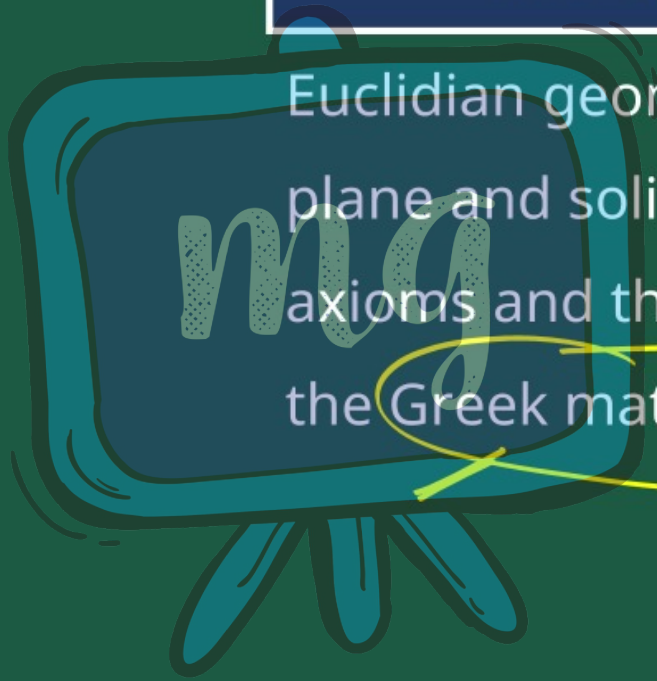
# EUCLID GEOMETRY



Euclidian geometry is the study of plane and solid figures based on the axioms and theorems employed by the Greek mathematician Euclid.

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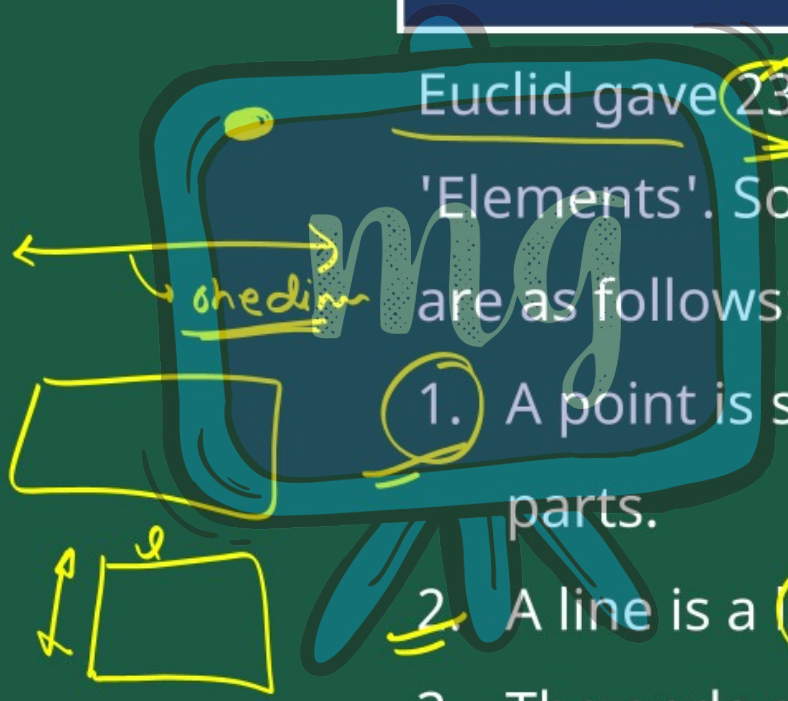
# EUCLID'S DEFINITIONS




Euclid gave 23 definitions in Book 1 of 'Elements'. Some of these definitions are as follows:-

1. A point is something that has no parts.
2. A line is a length without width.
3. The ends of a line are points.

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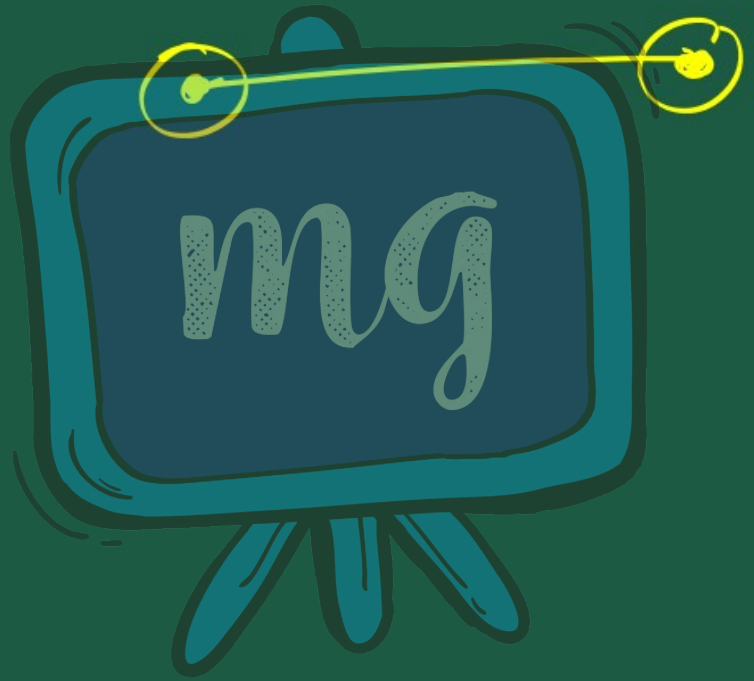

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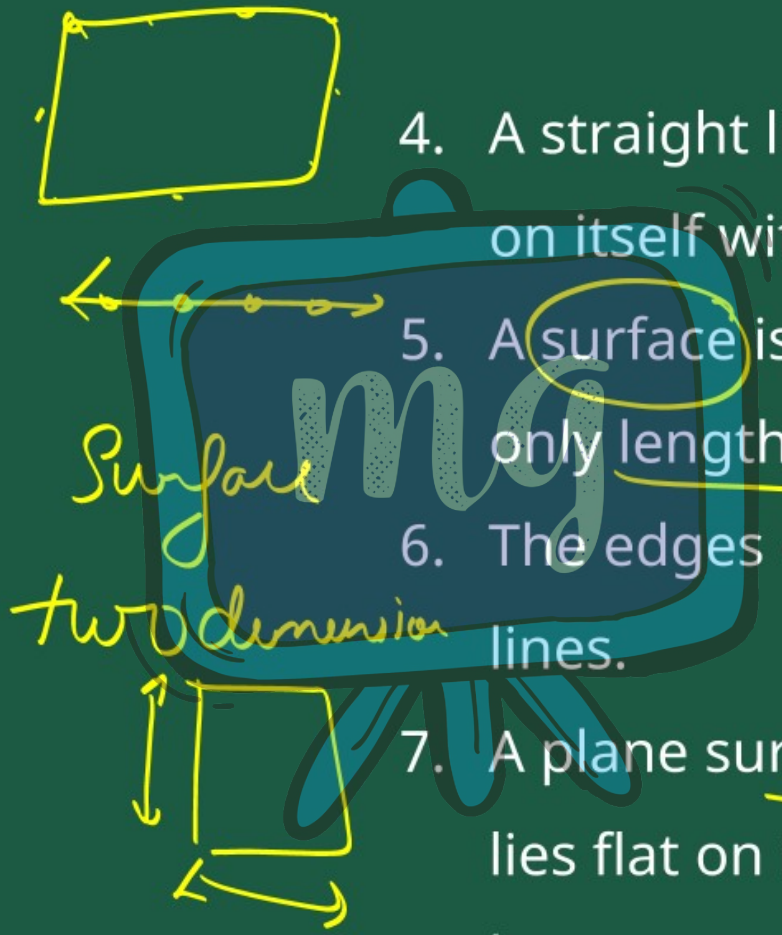


4. A straight line is a line that lies flat on itself with the points on it.
5. A surface is something that has only length and width.
6. The edges of a surface are the lines.
7. A plane surface is a surface that lies flat on itself with the straight lines on it.

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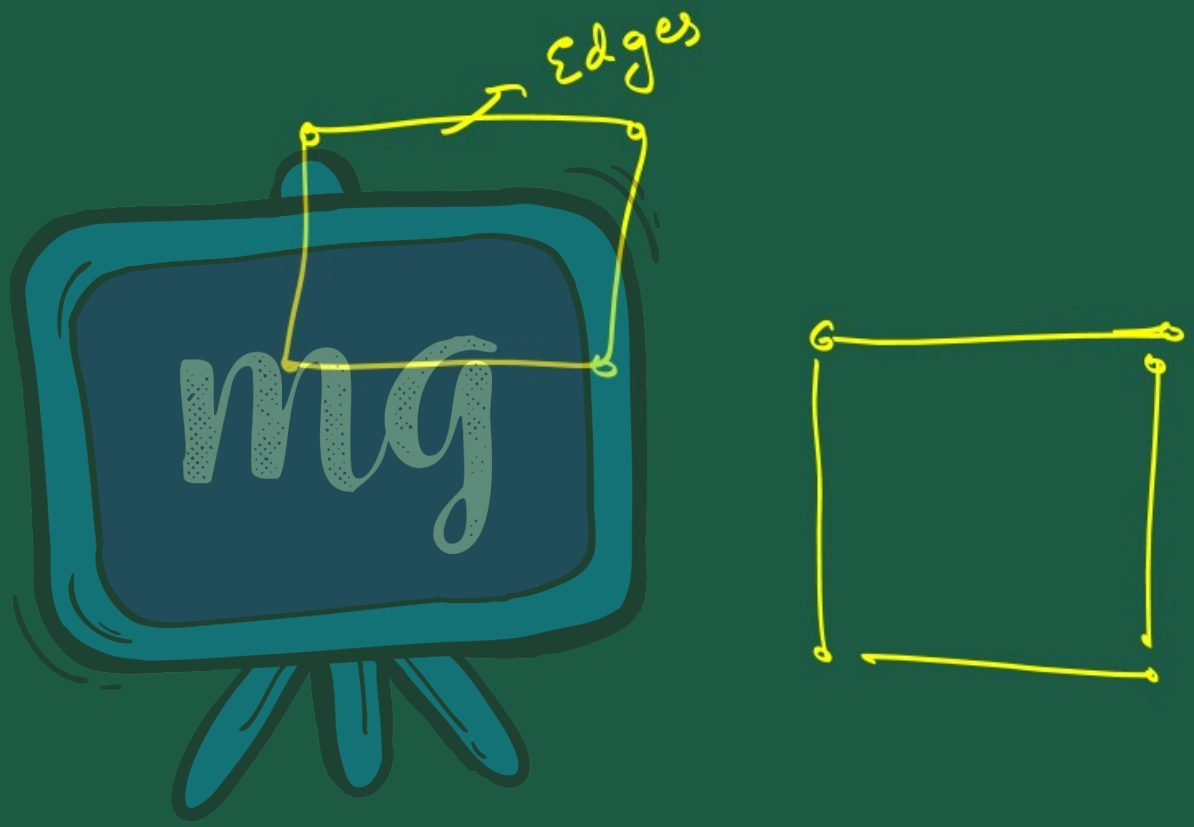

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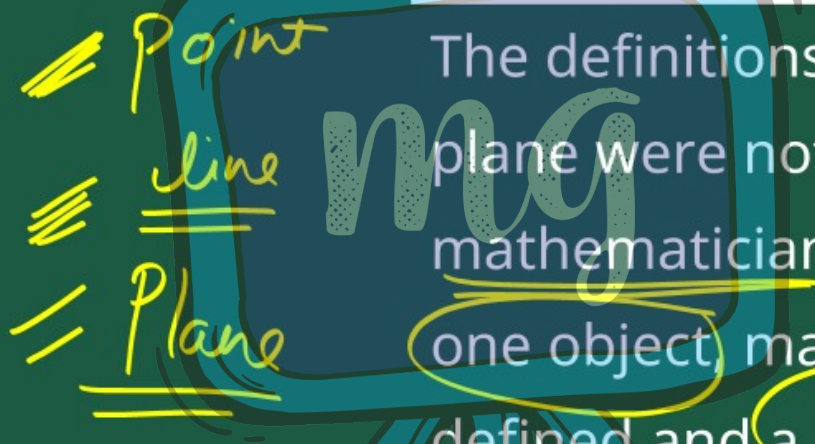
# THE PROBLEM OF EUCLID'S DEFINITIONS




The definitions of a point, a line and a plane were not accepted by mathematicians because to define one object, many objects need to be defined and a long chain of definitions can be obtained without any end. Therefore, these geometry terms were considered 'undefined'.

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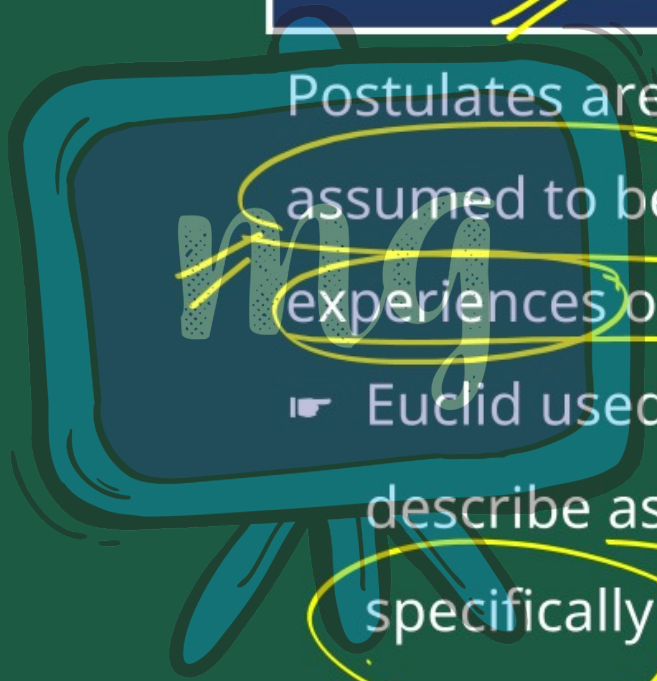
# POSTULATES



Postulates are statements which are assumed to be true according to our experiences observed in nature.

☛ Euclid used the term postulate to describe assumptions that were specifically related to geometry.

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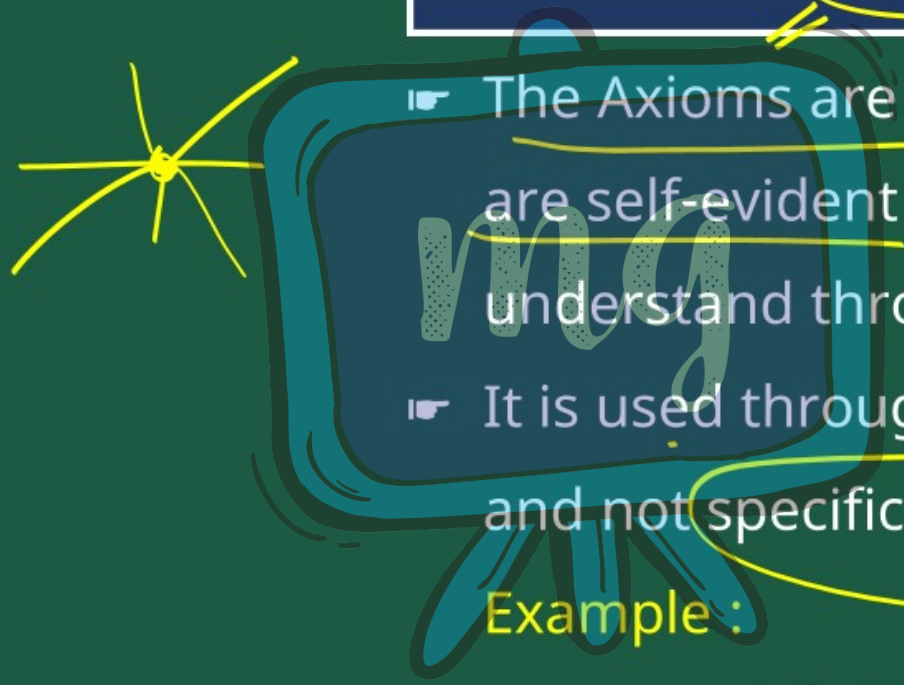
# AXIOMS



- The Axioms are such statements which are self-evident i.e. which we can understand through our intuition.
- It is used throughout the mathematics and not specifically linked to geometry.

Example :

Many straight lines can be drawn from any point.

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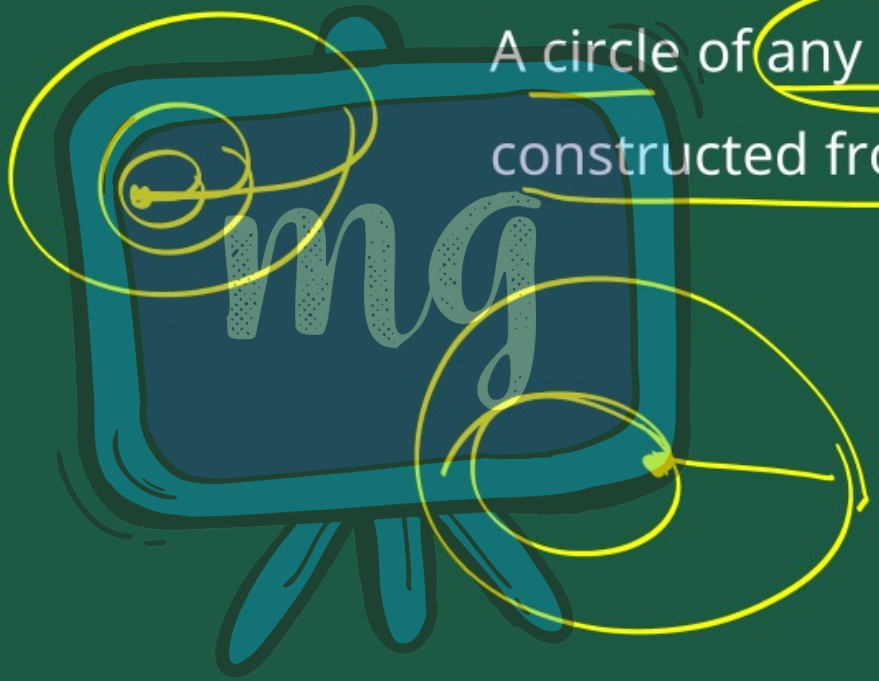
Example :

A circle of any radius can be constructed from any point.



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# THEOREM

Theorems are statements whose truth can be proved.

Example :

The sum of the three interior angles of a triangle is 180°.




$a+b+c=180^\circ$

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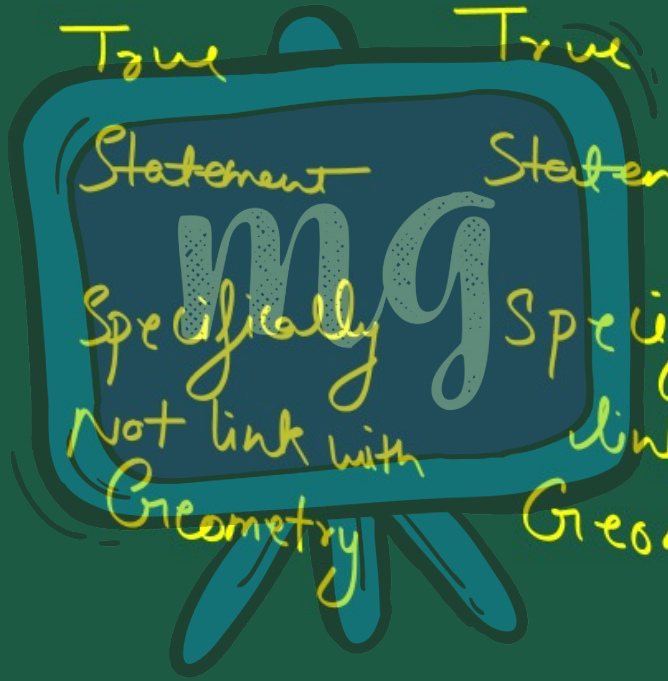
| Axioms | Postulates | Theorem |
| --- | --- | --- |
| True | True | True |
| Statement | Statement | Statement |
| Specifically Not link with Geometry | Specifically link with Geometry | Proved |



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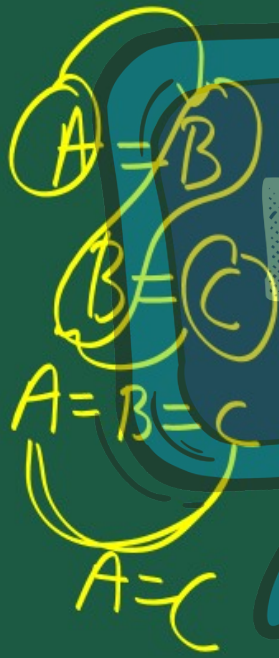
# EUCLID'S AXIOMS




Euclid wrote some axioms in his book Elements which are as follows:

1. Things which are equal to the same thing are equal to each other.

Example :

If A = B and C = B i.e. A and C are equal to B, then A and C will be equal.

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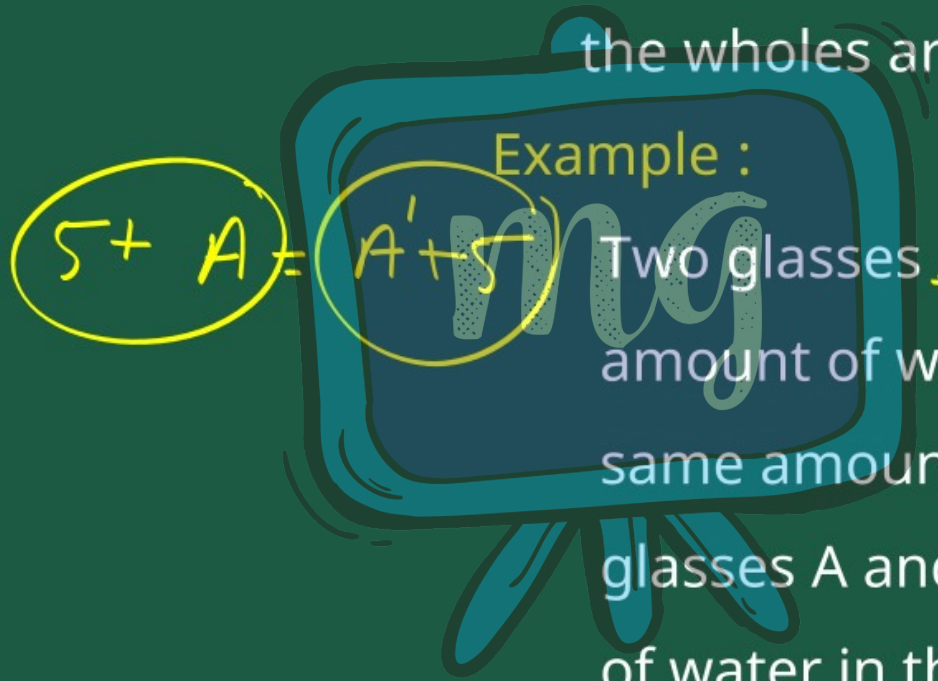
2. If equals are added to equals, then the wholes are also equal.




Example :

Two glasses A and A' have the same amount of water. Now if we add the same amount of water B to both glasses A and A', the final amount of water in the jars will be the same.

A + B will be equal to A' + B.

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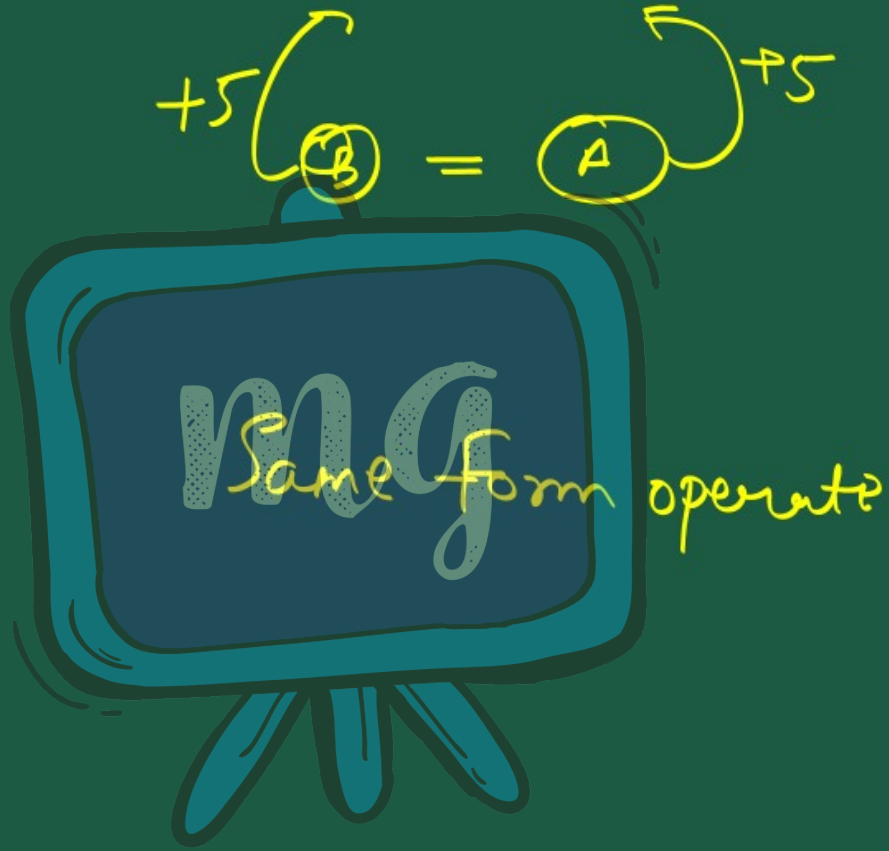

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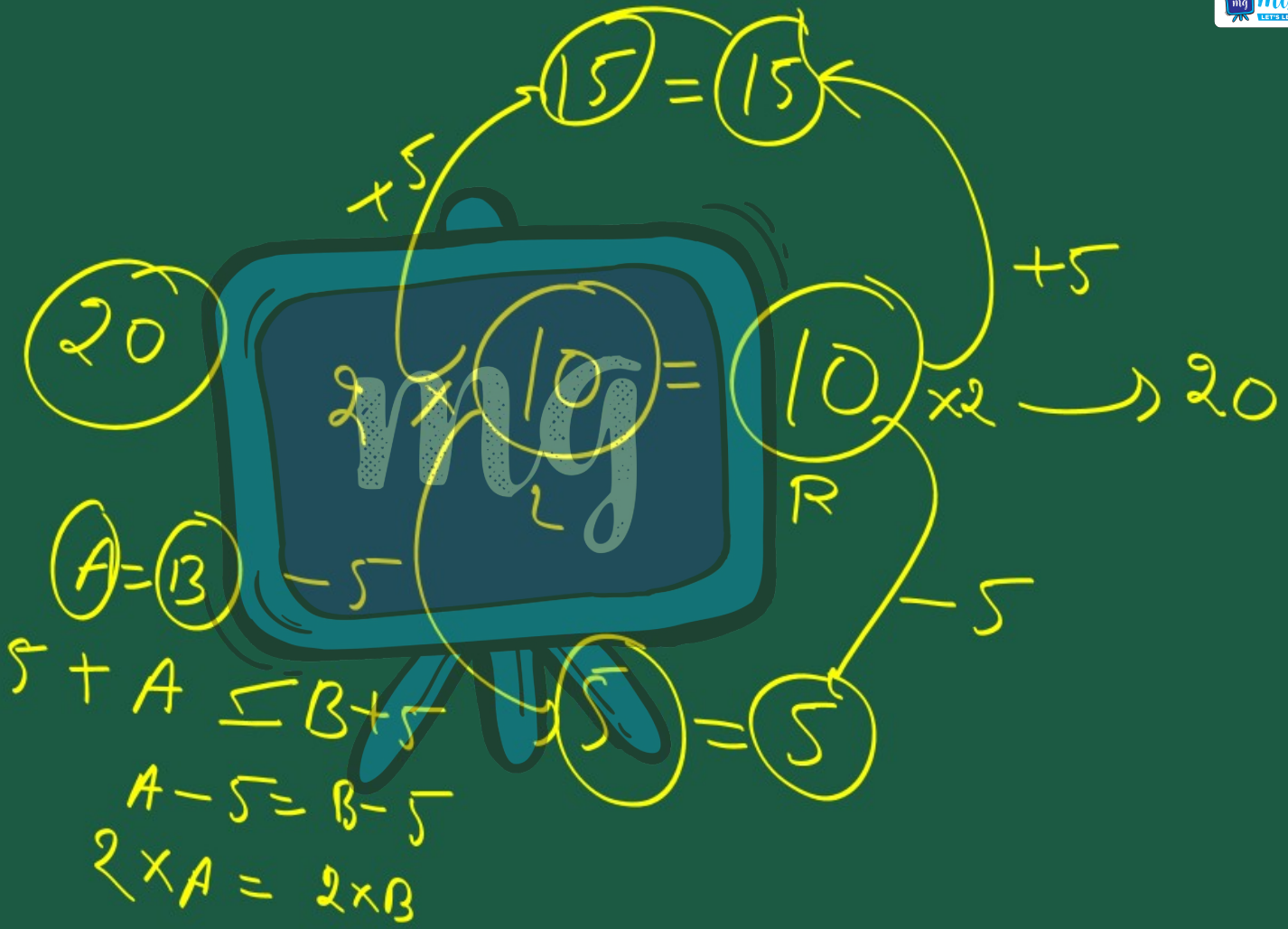

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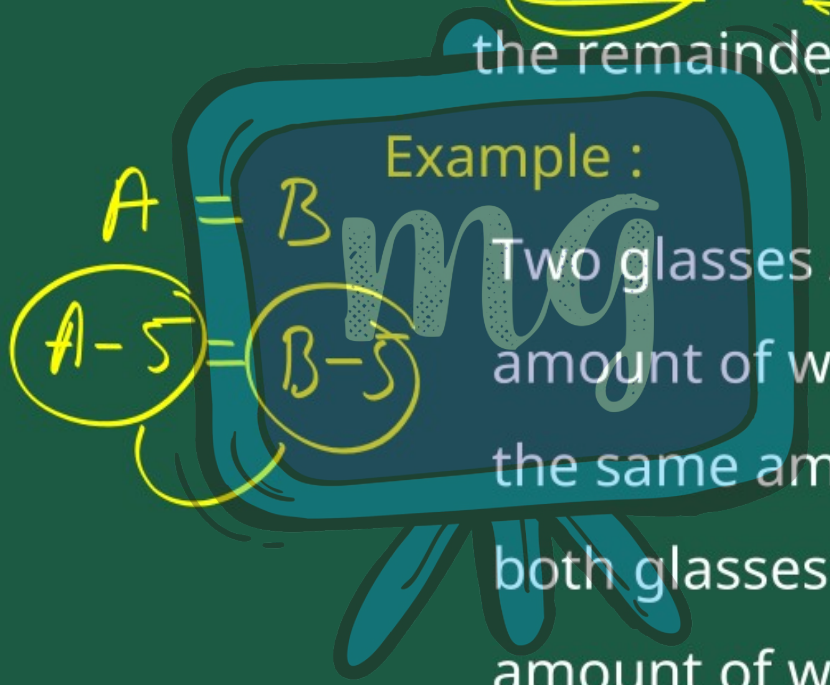
3. If equals are subtracted from equals, the remainders are also equal.




Example :

Two glasses A and A' have the same amount of water. Now if we take out the same amount of water B from both glasses A and A', then the final amount of water in the jar will be the same. A – B will be equal to A' – B.

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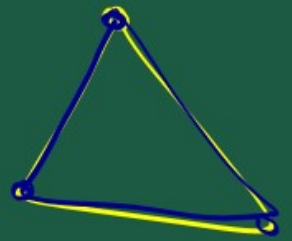
4. Things that coincide with each other are equal to each other.

Example :

If two triangles coincide with each other then they are equal.



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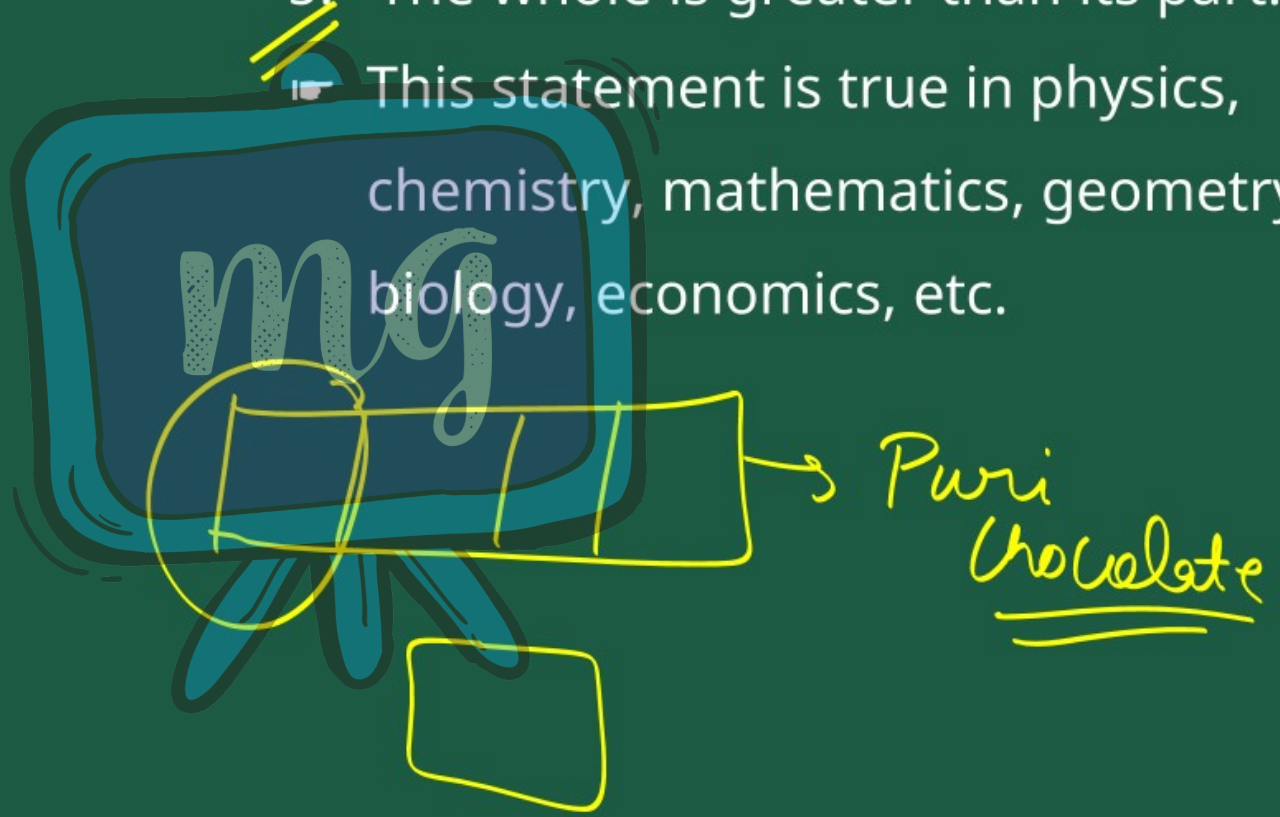
5. The whole is greater than its part.

- This statement is true in physics, chemistry, mathematics, geometry, biology, economics, etc.



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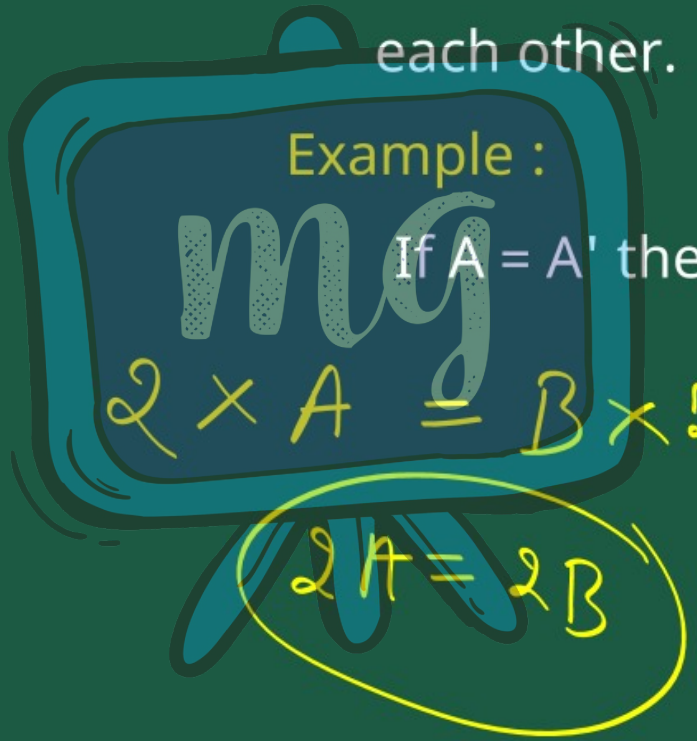
6. Twice the same thing is equal to each other.



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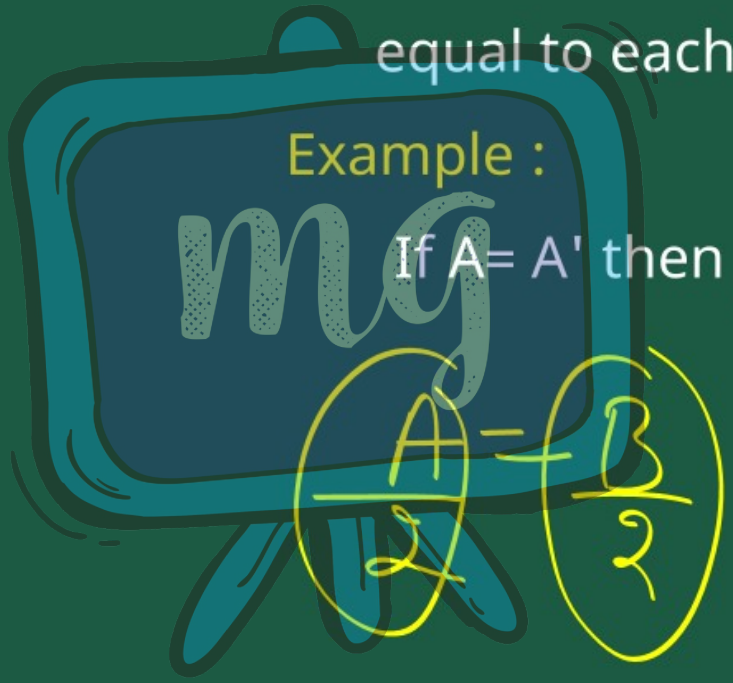
7. Halves of the same objects are equal to each other.

Example :

If A= A' then $\frac{1}{2}$ A = $\frac{1}{2}$ A'



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# LEARNING OUTCOMES

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1. Euclid's Geometry
2. Euclid's Definitions
3. Euclid's Assumptions

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# ASSESSMENT

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1 The dimension of a point is .....

A One

B Two

C Three

D Zero

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# ASSESSMENT

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2 Which of the following requires proof?

A Definition

B Postulate

C Theorem

D Axiom