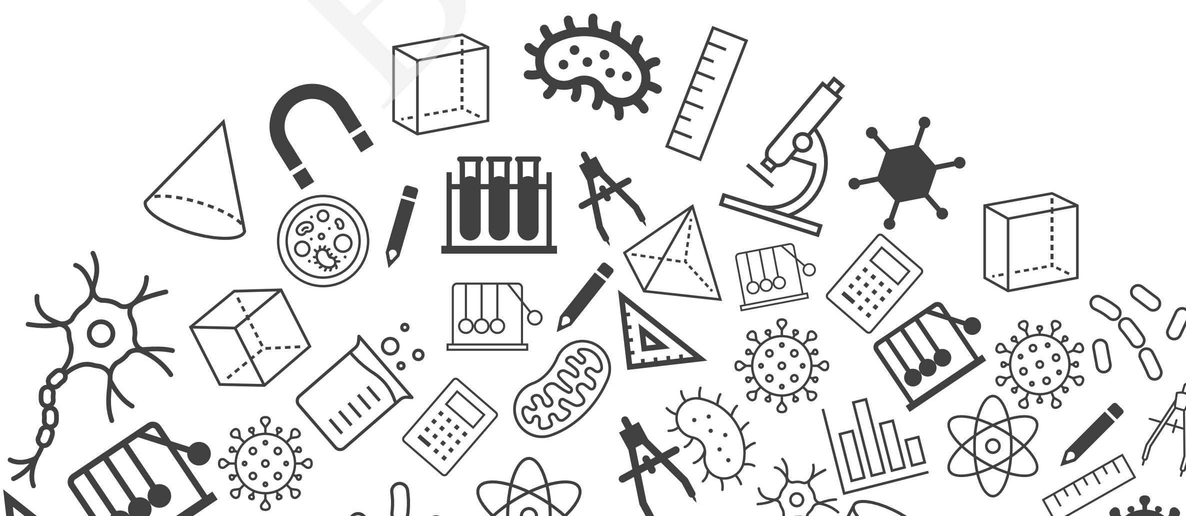
Grade 09

Mathematics Chapter Notes

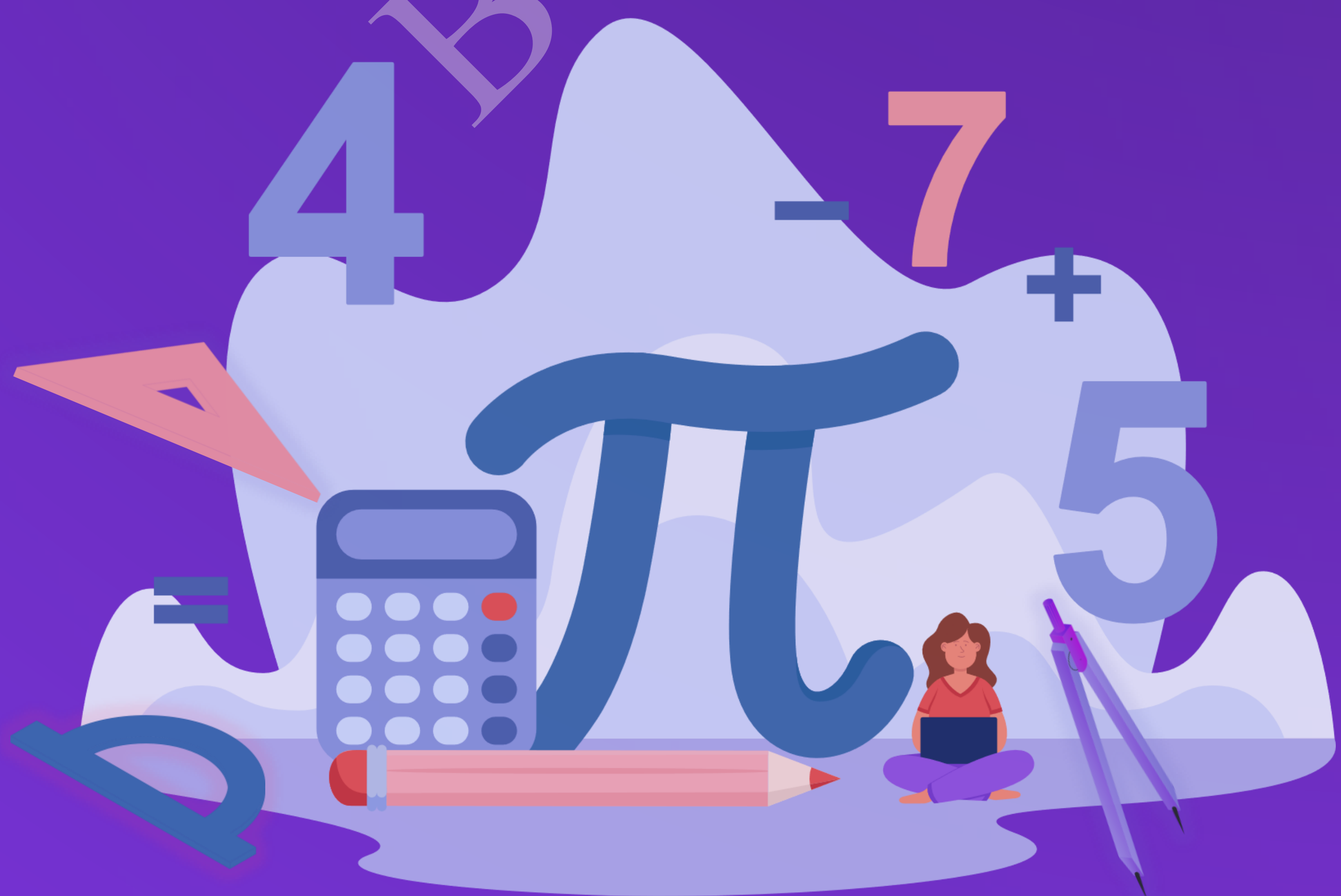


BYJU'S Classes

Chapter Notes

Introduction to Euclid’s Geometry

Grade 09



Topics to be Covered

1. Euclid's Elements

- 1.1 Euclid's definitions
- 1.2 Dimensions of Euclid's Elements

2. Euclid's Axioms

- 2.1 Axiom 1
- 2.2 Axiom 2
- 2.3 Axiom 3
- 2.4 Axiom 4
- 2.5 Axiom 5
- 2.6 Axiom 6
- 2.7 Axiom 7

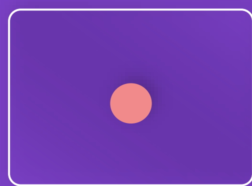
3. Euclid's Postulates

- 3.1 Postulate 1
- 3.2 Postulate 2
- 3.3 Postulate 3
- 3.4 Postulate 4
- 3.5 Postulate 5

1. Euclid’s Elements

1.1 Euclid’s definitions

Point

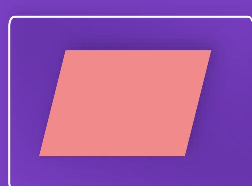


A point is that which has no part.

Line

- A line is breadthless length.
- The ends of a line are points.
- A straight line is a line which lies evenly with the points on itself.

Plane/Surface

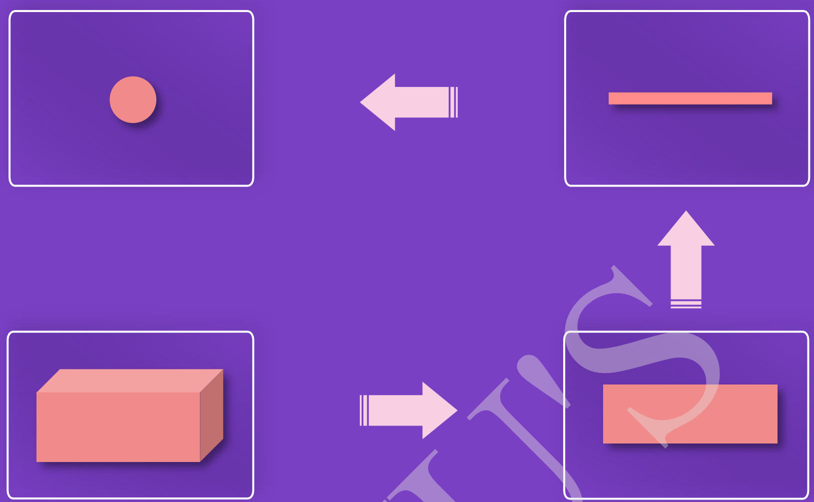


- A surface is that which has length and breadth only.
- The edges of a surface are curves or straight lines.
- A plane surface is a surface which lies evenly with the straight lines on itself.

1. Euclid's Elements

1.2 Dimensions of Euclid's elements

- In going three steps from solids to points (solids-surfaces-lines-points), we lose one extension, also called a dimension.



- A point has no dimension.
- A line has a dimension of one (1D) because only one coordinate is needed to specify a point on it.
- A surface such as a plane has a dimension of two (2D) because two coordinates are needed to specify a point on it.
- A solid is three-dimensional (3D) because three coordinates are needed to locate a point within these spaces.

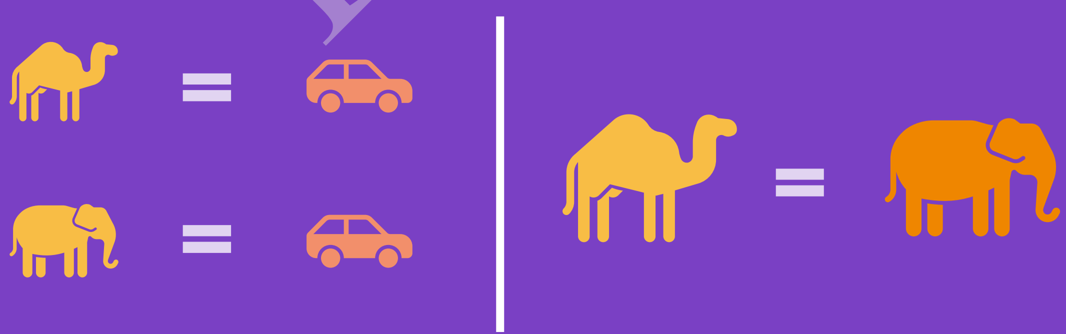
Though Euclid defined a point, a line, and a plane, the definitions are not accepted by mathematicians. Therefore, these terms are now taken as undefined.

2. Euclid’s Axioms

- Euclid assumed certain properties, which were not to be proved. These assumptions are actually ‘obvious universal truths.’
- Common notions (often called **axioms**) are assumptions used throughout mathematics which are not specifically linked to geometry.
- A system of axioms is called consistent if it is impossible to deduce from these axioms a statement that contradicts any axiom or previously proved statement.

2.1 Axiom 1

Things which are equal to the **same thing** are equal to one another.



Example:

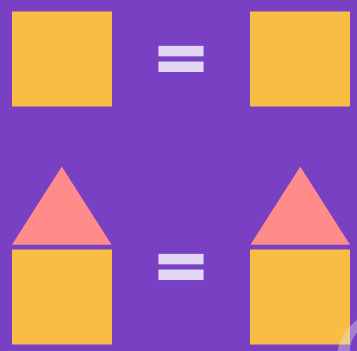
If $a = b$ and $c = b$

then $a = c$

2. Euclid's Axioms

2.2 Axiom 2

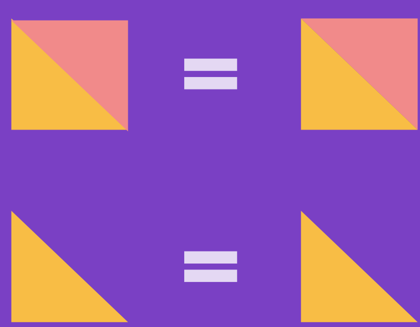
If equals are added to equals, the wholes are equal.



Example:
If $a = b$ and c is added on both sides
then $a + c = b + c$

2.3 Axiom 3

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

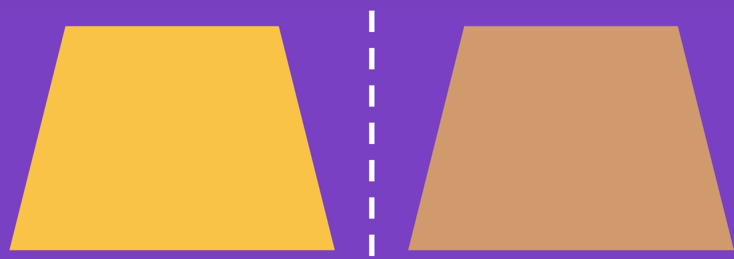


Example:
If $a = b$ and c is subtracted from both sides
then $a - c = b - c$

2. Euclid's Axioms

2.4 Axiom 4

Things which coincide with one another are equal to one another.



Example:

$a = a$

2.5 Axiom 5

The whole is greater than the part.

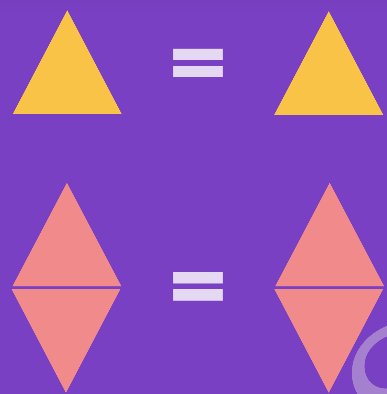
Example:

$a > \frac{a}{2}$

2. Euclid's Axioms

2.6 Axiom 6

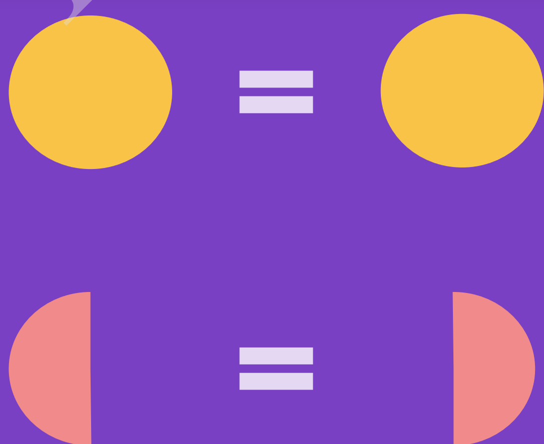
Things which are double of the same things are equal to one another.



Example:
$2a = 2a$

2.7 Axiom 7

Things which are halves of the same things are equal to one another.



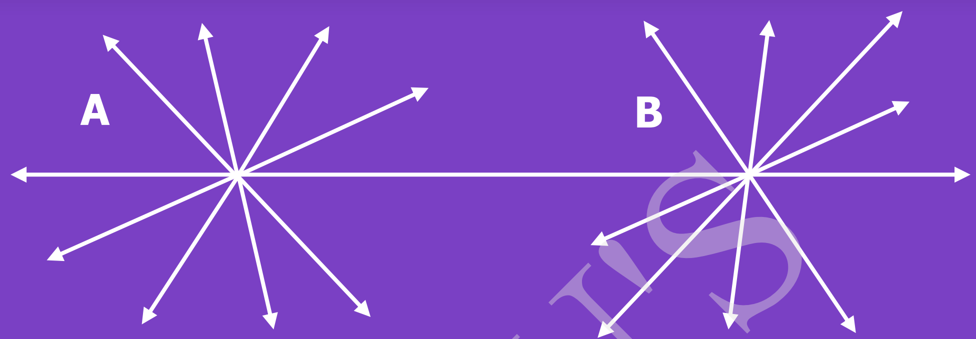
Example:
$\frac{a}{2} = \frac{a}{2}$

3. Euclid's Postulates

Assumptions used throughout mathematics which are specifically linked to geometry are known as postulates.

3.1 Postulate 1

A straight line may be drawn from any one point to any other point.

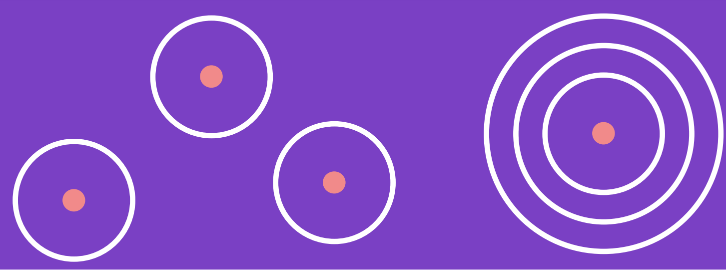


3.2 Postulate 2

A terminated line can be produced indefinitely.

3.3 Postulate 3

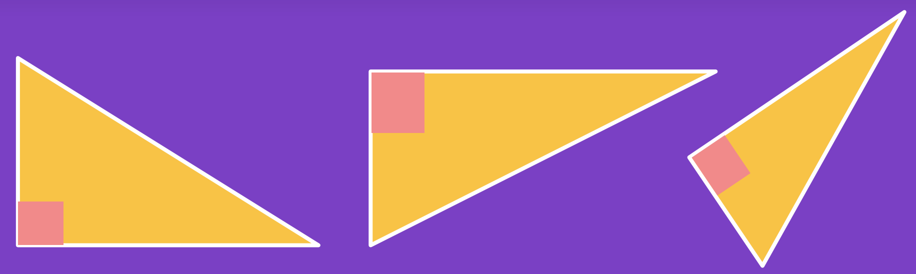
A circle can be drawn with any centre and any radius.



3. Euclid's Postulates

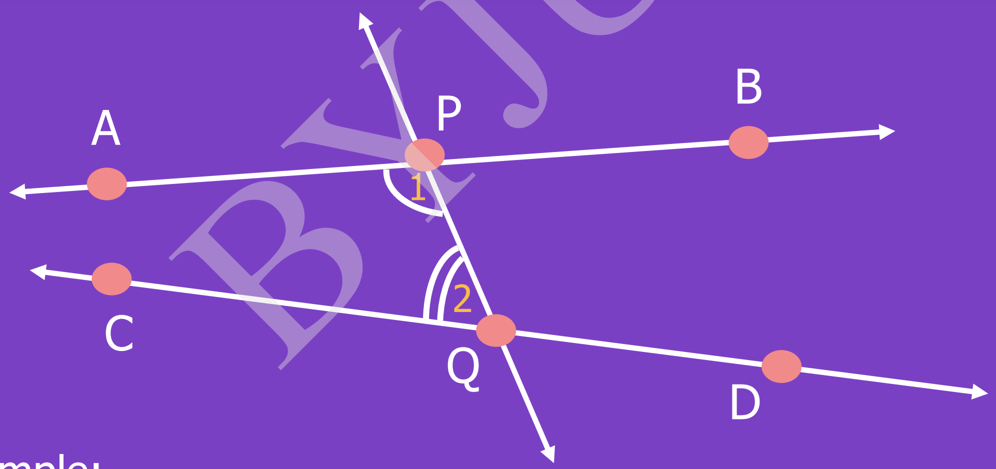
3.4. Postulate 4

All right angles are equal to one another.



3.5. Postulate 5

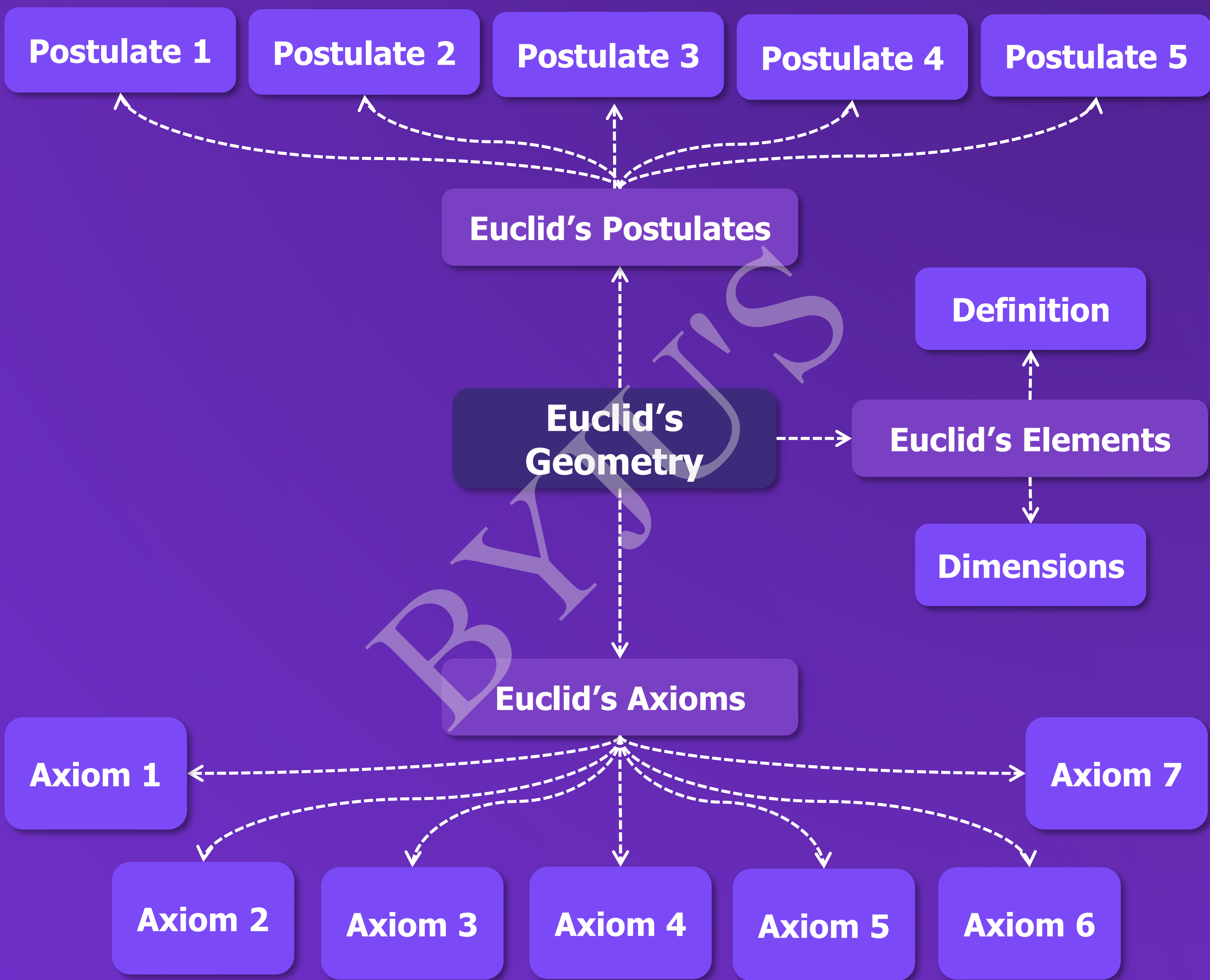
When the sum of co-interior angles is less than 180°, the two lines intersect at a point.



Example:
$\angle 1 + \angle 2$ is less than 180° and hence lines AB and CD will eventually intersect on the left side of PQ.

The statements that can be proved are called propositions or theorems.

Mind Map



Postulate 1
Postulate 2
Postulate 3
Postulate 4
Postulate 5
Euclid's Postulates
Definition
Euclid's Geometry
Euclid's Elements
Dimensions
Euclid's Axioms
Axiom 1
Axiom 7
Axiom 2
Axiom 3
Axiom 4
Axiom 5
Axiom 6