NCERT Solutions for Class 9 Maths Chapter 5 – Introduction to Euclid's Geometry Exercise 5.1 and Exercise 5.2

Axiom 5.1 : Given two distinct points, there is a unique line that passes through them.

Euclid used his postulates and axioms prove other results by applying deductive reasoning called **theorems**

Theorem 5.1 : Two distinct lines cannot have more than one point in common.

Proof: Let l and m are two distinct lines

If possible let the two lines l and m intersect in two distinct points, P and Q.

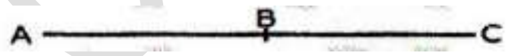
Therefore, p and Q lie on line l also p and Q lie on line mf

This contradict fact (axiom) that only one line can pass through two distinct points

So, two lines l and m have either P or Q on it

Hence, two distinct lines cannot have more than one point in common.

Q. If A, B and C are three points on a line, and B lies between A and C then prove that AB + BC = AC.



Solution: AC coincides with AB + BC.

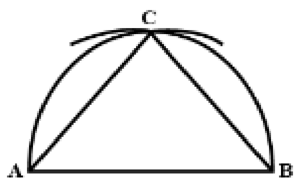
So, we apply Euclid's Axiom (4) says that **things which coincide with one another are equal to one another**.

Thus, it can be deduced that AB + BC = AC

Q. Prove that an equilateral triangle can be constructed on any given line segment.

Solution: According to Euclid's postulate we can draw a circle with any center and any radius

Now , Draw a line segment AB. Draw two circles with centers A and B of radius equal to length AB.



Joining AC and BC we get ∆ ABC

Now, AB = AC = radius and AB = BC = radius

According to Euclid's axiom that things which are equal to the same thing are equal to one another

So, we can conclude that AB = BC = AC. **Thus, ABC is an equilateral triangle**

NCERT Exercise. 5.1

1. Which of the following statements are true and which are false? Give reasons for your answers.

(i) Only one line can pass through a single point. **False**. This is because infinite lines can pass through a point

(ii) There are an infinite number of lines which pass through two distinct points. **False**. This because only one line can pass through two distinct points.

(iii) A terminated line can be produced indefinitely on both the sides. True this is because a line extended breathlessly.

(iv) If two circles are equal, then their radii are equal. True . This is because centers and circumference of two equal circles coincide with each other.

(v) if AB = PQ and PQ = XY, then AB = XY. True . This is because things which are equal to the same thing are equal to one another.

2. Give a definition for each of the following terms. Are there other terms that need to be defined first? What are they, and how might you define them?

(i) parallel lines (ii) perpendicular lines (iii) line segment (iv) radius of a circle (v) square

Solution: We first need to define Some terms like Line, Point and plane

Line is a collection of infinite points called collinear points. **Point** is a dot made by tip of pen and pencil having no dimensions. **Plane** is surface bounded by straight lines.

(I) Parallel Lines : Two or more lines do not have any common point are called parallel lines . The perpendicular distance between two parallel lines is always constant

(ii) Perpendicular lines: If two lines intersect each other at 90°, then these are called perpendicular lines.

(iii) Line segments: A part of straight-line having fix length is called line segment.

(iv) Radius of a circle : The distance between center and circumference of a circle is called radius of a circle.

(v) Square : A square is plane surface having same measures of angles and same length of bounders.

3. Consider two 'postulates' given below:

(i) Given any two distinct points A and B, there exists a third point C which is in between A and B.

(ii) There exist at least three points that are not on the same line.

(a) Do these postulates contain any undefined terms? (b) Are these postulates consistent? () Do they follow from Euclid's postulates? Explain

Ans: (a) Yes, these postulates contain undefined terms like **point and line**.

(b) These two statements are consistent as they Explain about two different situations without any logical contradictions.

(c) These statements do not follow Euclid's postulates . These are based on the Axiom 5.1: Given two distinct points, there is a unique brie that passes through them.

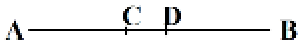
4. If a point C lies between two points A and B such that AC = BC, then prove that AC = ½ AB. Explain by drawing the figure.

Solution: It is given that, AC = BC => AC + AC = BC + AC (Equals are added on both sides) ………….(i)

But, BC + AC = AB as AC and BC coincides with AB. [Things which coincide with one another are equal to one another.] BC + AC = AB ---------------(ii)

Therefore, from equations (i) and (ii), we obtain AC + AC= AB => 2AC = AB => AC = 1/2 AB

5. If point C is a mid-point of line segment AB, prove that every line segment has one and only one mid-point.

Solution: Let there be two mid-points, C and D. 

C is the mid-point of AB. So, AC = CB => AC + AC = BC + AC (Equals are added on both sides) ………..(1)

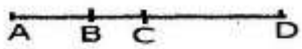
Here, (BC + AC) coincides with AB. It is known that things which coincide with one another are equal to one another. BC + AC = AB ………….. (2)

Therefore, from equations (1) and (2), AC = ½ AB ………………..(3)

Similarly, by taking D as the mid-point of AB, it can be proved that AD = ½ AB ………… (4)

From equation (3) and (4), we obtain AC = AD (Things which are equal to half the same thing are equal to one another.)

This is possible only when point C and D are representing a single point. Hence, there can be only one mid-point of a given line segment.

6. In the following figure, if AC = BD, then prove that AB = CD. 

Solution: It is given that AC = BD

According to Euclid's axiom, when equals are subtracted from equals, the remainders are also equal,

So, => AC - BC = CD – BC => AB = CD

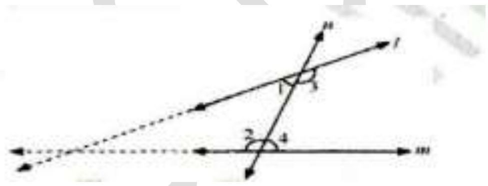
7. Why is Axiom 5, The whole is greater than the part., considered a 'universal truth'?

Answer : Axiom 5 states that the whole is greater than the part. This axiom is known as a universal truth because it holds true in every field, and not just in the field of mathematics. For example A cake is greater than any part of cake. Population of India is larger than any states of India.

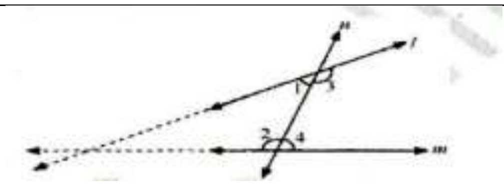
EXERCISE 5.2

1. How would you rewrite Euclid’s fifth postulate so that it would be easier to understand?

Ans: If a line intersects two lines in such a way that sum of the pairs of the interior angles of one side is less than 180^0 , then two lines meet on that side if produced indefinitely.



2. Does Euclid’s fifth postulate imply the existence of parallel lines? Explain.

Answer: Yes. According to Euclid's 5th postulate, when a line n falls on l and m in such a way (< 1 + < 2) < 180^0 they will intersecting lines and meet at a point side of <1 and < 2 If (< 3 + < 4) > 180 , producing line l and m further cannot in the side of <3 and <4 .	

Sample Question 9th Equid's Geometry

1 . Ram and Ravi have the same weight. If they each gain weight by 2 kg, how will their new weights be compared?

Solution: Let x kg be the weight each of Ram and Ravi. On gaining 2 kg, weight of Ram and Ravi will be (x+ 2) each.

According to Euclid's second axiom, when equals are added to equals, the wholes are equal. So, weight of Ram and Ravi are again equal.

2. Solve the equation a - 15 = 25 and state which axiom you use here.

Solution: 15 = 25.

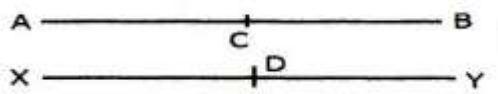
On adding 15 to both sides, we have a 15 + 15 = 25 + 15 = 40 (using Euclid's second axiom). Or a = 40

3. if < 1 = < 3, < 2 = < 4 and < 3 = <4, write the relation between <1 and <2, using an Euclid's axiom.

Solution: Here, < 3 = < 4 and < 1 = <3 and < 1 = < 4.

Euclid's first axiom says, the things which are equal to equal thing are equal to one another, So, < 1 = < 2

4. In fig We have: AC = XD, C is the mid-point of AB and D is the mid-point of XY. Using Euclid's axiom, show that AB = XY.



Solution: AB = 2AC (C is the mid-point of AB)

XY = 2XD (D is the mid-point of XY) Also, AC = XD (Given)

Therefore, AB = XY, because things which are double of the same things are equal to one another,