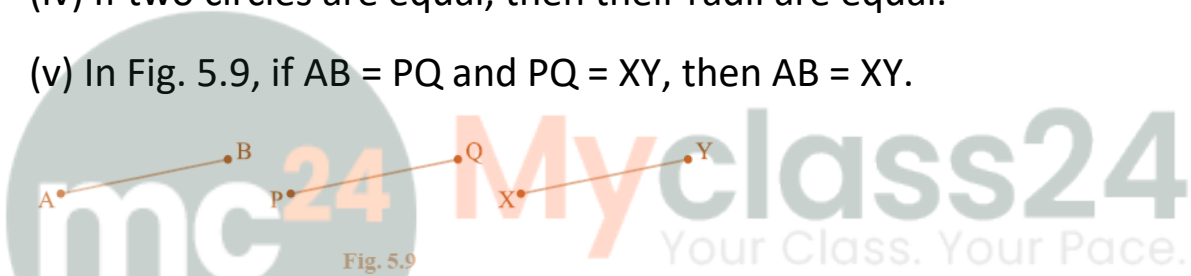


NCERT Solutions for Class 9 Maths Chapter 5 Introduction to Euclid Geometry Ex 5.1

Question 1.

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

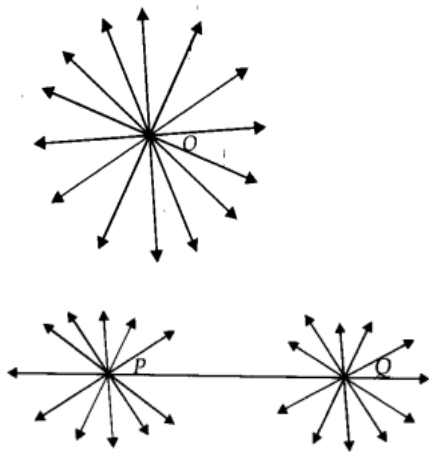
- (i) Only one line can pass through a single point.
- (ii) There are an infinite number of lines which pass through two distinct points.
- (iii) A terminated line can be produced indefinitely on both the sides.
- (iv) If two circles are equal, then their radii are equal.
- (v) In Fig. 5.9, if $AB = PQ$ and $PQ = XY$, then $AB = XY$.



Solution.

- (i) False

Reason : If we mark a point O on the surface of a paper. Using pencil and scale, we can draw infinite number of straight lines passing through O.



(ii) False

Reason : In the following figure, there are many straight lines passing through P. There are many lines, passing through Q. But there is one and only one line which is passing through P as well as Q.

(iii) True

Reason: The postulate 2 says that "A terminated line can be produced indefinitely."

(iv) True

Reason : Superimposing the region of one circle on the other, we find them coinciding. So, their centres and boundaries coincide.

Thus, their radii will coincide or equal.

(v) True

Reason : According to Euclid's axiom, things which are equal to the same thing are equal to one another

Question 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.

Yes, there are other terms that are needed to be defined first which are:

Plane: A plane is a flat surface on which geometric figures are drawn.

Point: A point is a dimensionless dot which is drawn on a plane surface.

Line: A line is collection of n number of points which can extend in both the directions and has only length or breadth.

Now,

(i) Parallel lines: When two or more lines do not intersect each other in a plane and perpendicular distance between them remains constant then they are said to be parallel lines.

(ii) Perpendicular lines: When two lines intersect each other making a right angle in a plane then they are said to be perpendicular to each other.

(iii) Line segment: A line segment is a part of a line with two end points and cannot be extended further. It has a definite length or breadth.

(iv) Radius of circle: The fixed distance between the centre and the circumference of the circle is called radius of the circle.

(v) Square: A square is a quadrilateral in which all the four sides are equal and each internal angle is a right angle.

Question 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.

Do these postulates contain any undefined terms? Are these postulates consistent?

Do they follow from Euclid's postulates? Explain.

Solution.

Undefined terms in the postulates:

→ Here, there is no information given about the plane whether the points are in same plane or not.

→ Also, n number of points lie in a plane. But here the position of the point C is not specified that whether it lies on the line segment joining AB or not.

Yes, these postulates are consistent when we deal with these two situations:

- (i) Point C is lying in between and on the line segment joining A and B.
- (ii) Point C not lies on the line segment joining A and B.

No, they don't follow from Euclid's postulates. They follow the axioms.

Question 4.

If a point C lies between two points A and B such that $AC = BC$, then prove that $AC = \frac{1}{2} AB$ Explain by drawing the figure.

Solution.

Here,

$$AC = BC$$



Now,

After adding AC both side, we get

$$AC + AC = BC + AC$$

Also,

$$BC + AC = AB \text{ (it coincides with the line segment AB)}$$

Therefore,

$$2AC = AB \text{ (Since, If equals are added to equals, the wholes are equal.)}$$

$$AC = \frac{1}{2} AB$$

Question 5.

In Question 4, point C is called a mid-point of line segment AB. Prove that every line segment has one and only one mid-point.

Solution.

Let A and B be the line segment and points P and Q be two different mid points of AB.



Now,

Hence,

P and Q are the midpoints of AB.

So,

$$AP = PB$$

And,

$$AQ = QB$$

And,

$$PB + AP = AB \text{ (It coincides with line segment AB)}$$

Similarly,

$$QB + AQ = AB$$

Now,

$AP + AP = AP + BP$ (Since, If equals are added to equals, the wholes are equal.)

$$2AP = AP \text{ (i)}$$

Similarly,

$$2AQ = AB \text{ (ii)}$$

From (i) and (ii),

$2AP = 2AQ$ (Since, things which are equal to same thing are equal to one another)

And as we know:

Things which are double of the same thing are equal to one another

Therefore,

$$AP = AQ$$

Thus, P and Q are the same points.

This contradicts the fact that P and Q are two different mid points AB.

Thus, it is proved that every line segment has one and only one mid-point.

Question 6.

In Fig. 5.10, if $AC = BD$, then prove that $AB = CD$.



Fig. 5.10

Solution.

Given: $AC = BD$

From the figure,

$$AC = AB + BC$$

$$BD = BC + CD$$

$$AB + BC = BC + CD$$

According to Euclid's axiom,

When two equals are subtracted from equals, remainders are also equal.

Subtracting BC both sides,

$$AB + BC - BC = BC + CD - BC$$

$$AB = CD$$

Question 7.

Why is Axiom 5, in the list of Euclid's axioms, considered a 'universal truth'? (Note that the question is not about the fifth postulate)

Solution. Axiom 5: The whole is always greater than the part.

Let us take an example of the cake. When it is whole it will measure 3 pound but when we took out a part from it and measure its weight then it would come out less than the previous one. Hence, the fifth axiom of Euclid is true for all the universal things. That is the reason that it is considered as a 'universal truth'