

NCERT SOLUTIONS

CLASS-IX MATHS

CHAPTER-5 INTRODUCTION TO EUCLID'S GEOMETRY

Exercise 5:1

Question 1 :

State true or false for the following statements mentioned below with the reason:

a: Through a single point only one line can be passed.

b: Through two distinct lines there are infinite number of lines that can be passed.

c: A line that is terminated can be produced indefinitely on the both sides.

d: the radii of two circles are equal if the two circles are equal.

e: In the figure, if $XY=AB$ and $AB=PQ$, then $XY=PQ$



Answers:

a: The statement mentioned is False as there can be infinite number of lines that can be drawn through a single point.

b: The statement mentioned is false since through two distinct points there can be only one line that can be drawn.

c: The statement mentioned is True because a line that is terminated can be indefinitely produced on both sides. Since a line can be extended on both its sides infinitely.

d: The statement mentioned is true because the radii of two circles are equal when the two circles are equal. The circumference and the centre of both the circles coincide; hence the radius of the two circles should be equal.

e: The statement mentioned is true. According to Euclid's 1st axiom- "Things which are equal to the same thing are also equal to one another"

Question 2 :

Define the following terms and state if there are other terms that should be defined first? If so, what are they and how can those terms be defined?

A: Parallel lines

B: Perpendicular lines

C: Line segments

D: Radius of a circle

E: Square

Answer:

Yes there are other terms which need to be defined first, they are:

Plane: flat surfaces in which geometric figures can be drawn are known as plane.

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

Line: A collection of points that has only length and no breadth is known as a line. And it can be extended on both directions.

A: Parallel lines- Parallel lines are lines in which never intersect each other and are always at a perpendicular distance between them

which is constant distance. Parallel lines can be two or more lines.

B: Perpendicular lines- Perpendicular lines are lines which intersect each other in a plane at right angles then the lines are said to be perpendicular to each other.

C: Line Segment- When a line cannot be extended any further because of its two end points then the line is known as a line segment.

D: Radius of circle- A radius of a circle can be a line from any point on the circumference to the center of the circle.

E: Square- A quadrilateral in which all the four sides are said to be equal and each of its internal angle is right angles.

Question 3:

Consider the two postulates that are given below:

A: If there are any two given distinct points which are X and Y, will there exist a third point Z that will be between that of X and Y.

B: There are at least three points that exist and are not in the same line.

Do these postulates contain any undefined terms? Is there consistency form the postulates that are given? Do they follow from Euclid's postulates? Explain.

Answer:

The undefined terms in the postulates are:

There are many points that lie on a plane and here it is not mentioned whether the point Z lies between the line segment of X and Y or not.

It is not mentioned if the points that are given are on the same plane or not.

Yes, the given postulates are said to be consistent when it is dealt with the two situations given.

A: Point Z is said to be lying between and on the line segment joining X and Y.

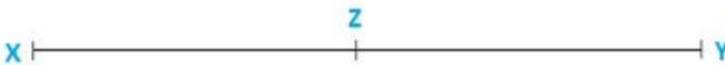
B: Point Z does not lie on the line segment joining X and Y.

No, the following postulates follow the axioms and do not follow from Euclid's postulates.

Question 4:

If a given point Z lies between the two points X and Y such that $XZ = YZ$, then prove that $XZ = \frac{1}{2} XY$. Explain the following by drawing its figure.

Answer:



Here, $XZ = YZ$

Adding XZ on both sides we get,

$$XZ + XZ = YZ + XZ$$

Also, $YX + XZ = XY$ (since it coincides with XY line segment)

Therefore, $2 XZ = XY$ (If equals are added to equals then the wholes are equals)

$$\Rightarrow XZ = \frac{1}{2} XY$$

Question 5:

Question 5:
 If a point Z lies between two points such that $XZ = YZ$ and $XZ = \frac{1}{2} XY$ then Point Z is the midpoint of the line segment XY. Prove that every line segment has one and only one mid-point.

Answer:



Let X and Y be the line segment and A and B be two different midpoints of X and Y.

Now,

Therefore, A and B are the midpoints of XY.

Therefore, $XA = AY$ and also $XB = BY$

Also, $AY + XA = XY$ (since it coincides with line segment XY)

Similarly, $BY + XB = XY$

Now,

$XA + XA = AY + XA$ (If equals are added to equals then the wholes are equals)

$$\Rightarrow 2 XA = XY \text{ ----- (1)}$$

Similarly,

$$2 XB = XY \text{ ----- (2)}$$

From (1) and (2)

$2 XA = 2 XB$ (Since they are equal to the same thing they are equal to one another)

$\Rightarrow XA = XB$ (Things which are double of the same thing are equal to one another)

Thus, A and B are the same points. This contradicts the fact that A and B are two different midpoints of X and Y. Thus, it is proved that every line segment has one and only one midpoint.

Question 6:

From the following figure given, if $PR = QS$, then prove that $PQ = RS$.



Answer:

Given, $PR = QS$

From the figure given,

$$PR = PQ + QR$$

$$QS = QR + RS$$

$$\Rightarrow PQ + QR = QR + RS$$

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

Subtracting QR on both sides we get

Subtracting QR on both sides we get,

$$PQ + QR - QR = QR + RS - QR$$

$$PQ = RS$$

Question 7:

Why is that the 5th Axiom in the Euclid's axioms considered to be a 'Universal Truth'?

Answer:

Axiom 5 states that "The whole is always greater than the part"

Take an example of a cake, when the whole cake is measured, it weighs 4 pounds but when a part of it is taken out and then measured. Its weight is then reduced when compared to the previous weight. Hence Euclid's Fifth axiom is a universal truth since it is possible for all things.

Exercise 5.2

Question 1:

Write a way in which Euclid's fifth postulate could be more understandable.

Answer:

Euclid's fifth postulates are about parallel lines.

Parallel lines are lines in which never intersect each other and are always at a perpendicular distance between them which is constant distance. Parallel lines can be two or more lines.

A: If X does not lie on the line A then we can draw a line through X which will be parallel to that of the line A .

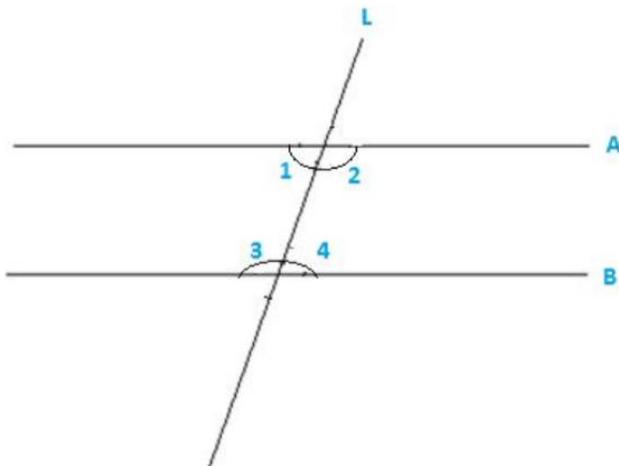
B: There can be only one line that can be drawn through the point X which is parallel to the line A .

Question 2:

Does Euclid's fifth postulate imply for the existence of parallel lines? Explain.

Answer:

Yes, Euclid's fifth postulate does imply for the existence of the parallel lines. If the sum of the interior angles is equal to the sum of the right angles then the two lines will not meet each other at any given point making them parallel with each other.



$$\angle 1 + \angle 3 = 180^\circ$$

Or $\angle 3 + \angle 4 = 180^\circ$

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