

5.1

I

(i) False, Since through a single point, infinite numbers of lines can pass. In the following fig, it can be seen that there are infinite numbers of lines passing through a single point P.

(ii) False, since through two distinct points, only one line can pass.

(iii) True, A terminated line can be produced indefinitely on both the side.

(iv) True, If two circles are equal, then their centre and circumference will coincide and hence, the radii will also be equal.

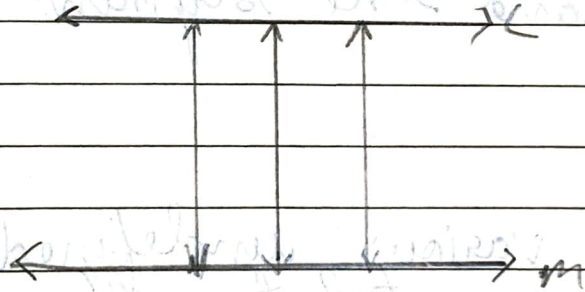
(v) True, It is given that AB and XY are two terminated lines and both are equal to a third line PQ. Euclid's first axiom states that things which are equal to the same things are equal to one another. Therefore, the line AB and XY will be equal to each other.

II

i) Parallel lines

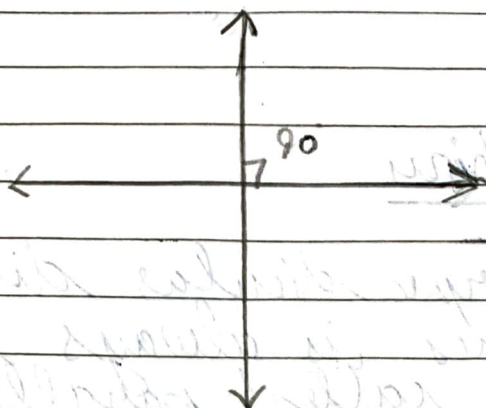
If the perpendicular distance between two lines is always constant then these are called parallel lines. In other words never intersect each other are called parallel lines.

To define parallel lines we must know about point, lines and distance between the lines and the point of intersection.



ii) Perpendicular lines

If two lines intersect each other at  $90^\circ$  they are called perpendicular lines. We are required to define line and the angle before defining perpendicular lines.



### (iii) Line Segment

A straight line drawn from any point to any other point is called as line segment. To define a line segment, we must know about point and line segment.

### III

There are various undefined terms in the given postulates. The given postulates are consistent because they refer to two different situations. Also, it is impossible to deduce any statement that contradicts any well known axioms and postulates. These postulates do not follow from Euclid's postulates. They follow from the axiom "Given two distinct points there is a unique line that passes through them".

IV

It is given that,

$$AC = BC$$

$$A + C = B + C$$

$$AC + AC = BC + AC$$

on both sides) (1)  $(AC + AC)$  coincides with  $AB$ . It is known that things which coincide with one another are equal to one another.

$$\therefore BC + AC = AB$$

It is also known that which are equal to the same things are equal to one another. Therefore, from equations (1) and (2), we obtain

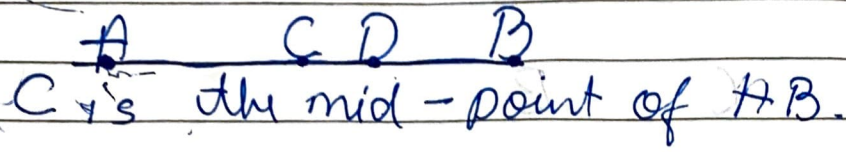
$$AC + AC = AB$$

$$2AC = AB$$

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

V

Ans- let there be two mid-points, C and D



$$AC = CB$$

$$AC + AC = BC + AC \quad (\text{Equals are added on both sides})$$

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

$$\therefore BC + AC = AB$$

It is also known that things which are equal to the same things are equal to one another. Therefore, from equation (1) and (2), we obtain

$$AC + AC = AB$$

$$2AC = AB$$

Similarly, by taking D as the mid-point of AB, it can be proved that  $2AD = AB$ .

From equation

$2AC = 2AD$  and  $AC = AD$ . This is possible only when point C and D are representing a single point.

Hence, our assumption is wrong and there can be only one mid-point of a given line segment.

VI

As: From the fig, it can be observed that  $AC = AB + BC$

$$BD = BC + CD$$

It is given that  $AC = BD$

$$AB + BC = BC + CD \quad (1)$$

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

Subtracting BC from equation (1), we obtain

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

$$AB = CD$$

III

Axiom 5 states that the whole is greater than the part. This axiom is known as a universal truth because it holds true in any field, and not just in the field of mathematics. Let us take two cases - one in the field of mathematics, and one other than that.

Let  $t$  represent a whole quantity and only  $a, b, c$  are parts of it  $t = a + b + c$

Clearly,  $t$  will be greater than all its parts  $a, b,$  and  $c$ .

Therefore, it is rightly said that whole is greater than the part.

Case II

Let us consider the continent Asia. Then let us consider a country India which belongs to Asia. India is a part of Asia and it can also be observed that Asia is greater than India. That is why we can say that the whole is greater than the part.

This is true for anything in any  
part of the world and is thus  
a universal truth.