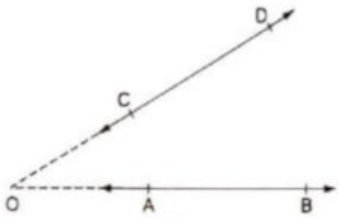
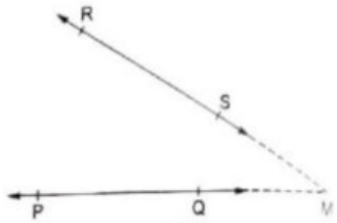
12 Parallel Lines

Let us draw two straight lines *AB* and *CD*, as shown in the figure (i). We find that these lines, when produced towards the left, meet at a point *O*.



(i)



(ii)

Again, let us draw straight lines *PQ* and *RS*, as shown in the figure (ii). These lines, when produced towards the right, meet at a point *M*.

However, there are examples of lines which when produced indefinitely in either direction do not meet. Such lines are known as *parallel lines*.

The opposite edges of a blackboard, the opposite edges of a ruler, railway lines, etc. are all examples of *parallel lines*.

(i)

(ii)

(iii)

PARALLEL LINES *Two lines in a plane which do not meet even when produced indefinitely in either direction, are known as parallel lines.*

If l and m are two parallel lines, we write $l \parallel m$ and read it as l is parallel to m.

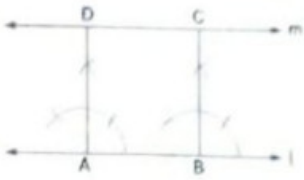
Clearly, when $l \parallel m$, we have, $m \parallel l$.

DISTANCE BETWEEN TWO PARALLEL LINES Let us draw two lines l and m such that $l \parallel m$. Take any point A on one of these lines, say l. At A, draw AD perpendicular to l, meeting m at D.

Measure the length of the line segment AD.

This length AD is called the *perpendicular distance* between l and m at the point A.

Let us take any other point B on l. From B, draw BC perpendicular to l, meeting m at C. Measure the length of the line segment BC.



We find that $AD = BC$.

Thus, the perpendicular distance between l and m at the point A is the same as that at B.

Actually speaking, *the perpendicular distance between two parallel lines is the same throughout*. This distance is called *the distance between two parallel lines*.

Thus, parallel lines are the same distance apart throughout.

Why railway lines are made parallel

The wheels of a railway engine and those of the bogies are attached by axles of a fixed length. So, the distance between each pair of opposite wheels remains fixed.

Therefore, the rails on which these wheels roll, must be at a constant distance from each other.

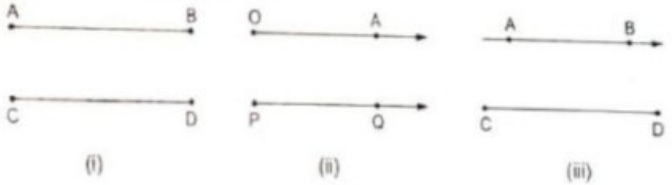
Hence, the opposite rails must be parallel.

Parallel segments and parallel rays

(i) Two segments are parallel, if the corresponding lines determined by them are parallel [figure (i)].

(ii) Two rays are parallel, if the corresponding lines determined by them are parallel [figure (ii)].

(iii) One segment and one ray are parallel, if the corresponding lines determined by them are parallel [figure (iii)].



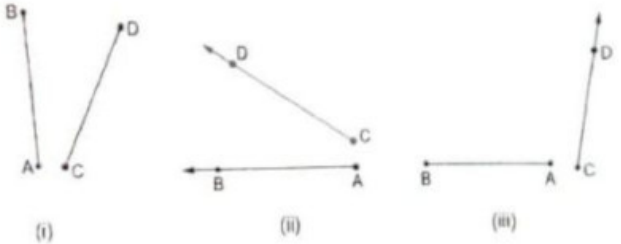
Now, consider the following questions:

(i) If two segments do not intersect, are they parallel?

(ii) If two rays do not intersect, are they parallel?

(iii) If a ray and a segment do not intersect, are they parallel?

See the figures given below.



In the figure (i), we observe that the segments AB and CD do not intersect. But, the corresponding lines determined by them will clearly intersect. So, the segments AB and CD are not parallel.

Similarly, in the figure (ii), the rays AB and CD do not intersect and yet they are not parallel.

And, in the figure (iii), the segment AB and the ray CD do not intersect. But, they are not parallel.

Thus, we conclude that *if two segments do not intersect, we cannot say that they are parallel.*

The same is true for two rays as well as for one ray and one segment.

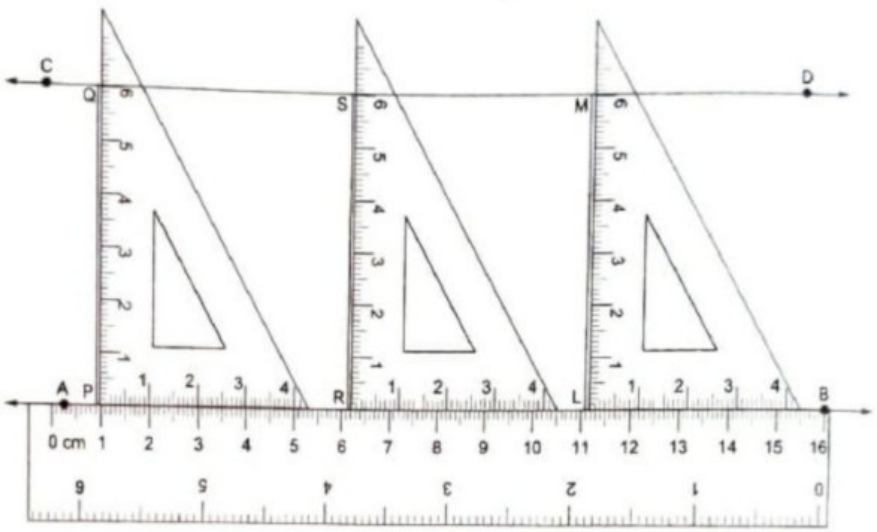
How to test whether given lines are parallel

By using set squares we can test whether the given lines AB and CD are parallel or not. We proceed in the manner given below:

Method Place the ruler so that one of its measuring edges lies along the line AB. Hold it firmly with one hand. Now place a set square with one arm of the right angle coinciding with the edge of the ruler. Draw the line segment PQ along the edge of the set square as shown in the figure.

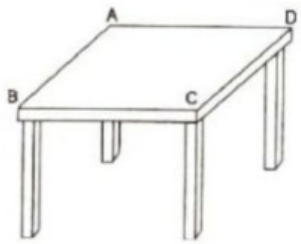
Slide the set square along the ruler and draw some more segments RS and LM, as shown in the figure.

If $PQ = RS = LM$ then $AB \parallel CD$, otherwise AB is not parallel to CD.

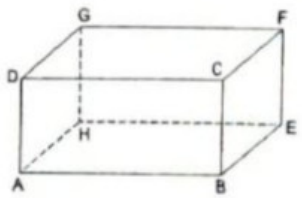


EXERCISE 12

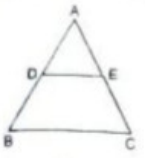
1. In the figure of a table given below, name the pairs of parallel edges of the top.



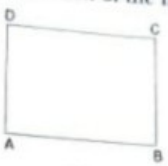
2. Name the groups of all possible parallel edges of the box whose figure is shown below.



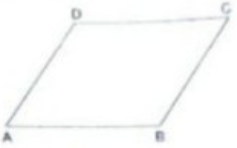
3. Identify parallel line segments in each of the figures given below:



(i)

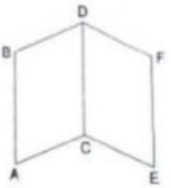


(ii)



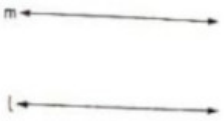
(iii)

(iv)



(v)

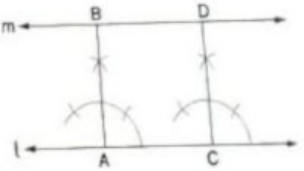
4. Find the distance between the parallel lines l and m, using a set square.



(i)

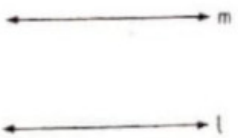
(ii)

5. In the figure, $l \parallel m$. If $AB \perp l$, $CD \perp l$ and $AB = 2.3$ cm, find CD.



6. In the figure, do the segments AB and CD intersect? Are they parallel? Give reasons for your answer.

7. Using a set square and a ruler, test whether $l \parallel m$ in each of the following cases:



(i)

(ii)

8. Which of the following statements are true and which are false?
   (i) Two lines are parallel if they do not meet, even when produced.
   (ii) Two parallel lines are everywhere the same distance apart.
   (iii) If two line segments do not intersect, they are parallel.
   (iv) If two rays do not intersect, they are parallel.

Note: Do all work in maths geometry copy