

CHAPTER 3

Geometry Of Straight Lines

CONTENTS

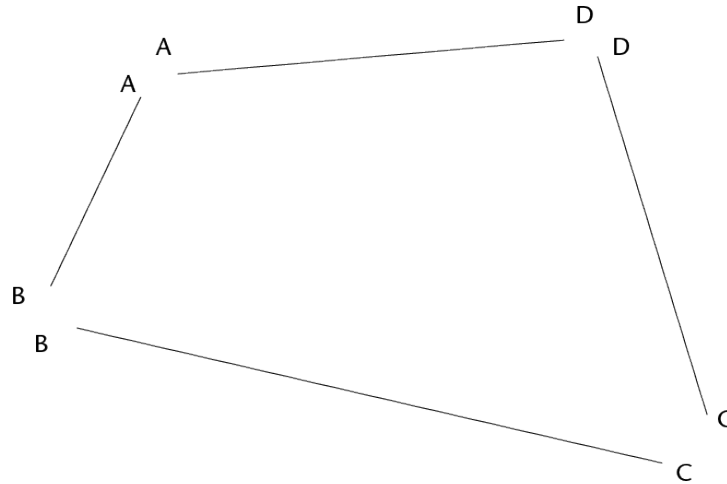
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You probably know exactly what is meant by a line. In this chapter, you will learn about line segments and rays and how they differ from lines. You will also learn more about parallel and perpendicular lines and how we indicate them on a diagram.

1 LINE SEGMENTS, LINES AND RAYS

Each side of a quadrilateral is a line segment.

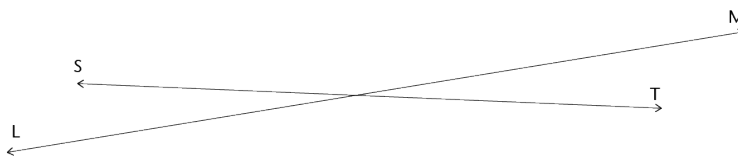


Note

A **line segment** has a definite starting point and a definite endpoint. We can draw and measure line segments.

1.1 Lines and rays

We can think of lines that have no ends, although we cannot draw them completely. We draw line segments to represent lines. When we draw a line segment to represent a line, we may put arrows at both ends to show that it goes on indefinitely on both sides.



Note

The word **line** is used to indicate a line that goes on in both directions. We can only see and draw part of a line. A line cannot be measured.

Note

We can also think of a line that has a definite starting point but goes on indefinitely at the other end. This is called a half-line or a **ray**.

We can draw the starting point and part of a ray, using an arrow to indicate that it goes on at the one end.

Ray PQ goes on towards the right:



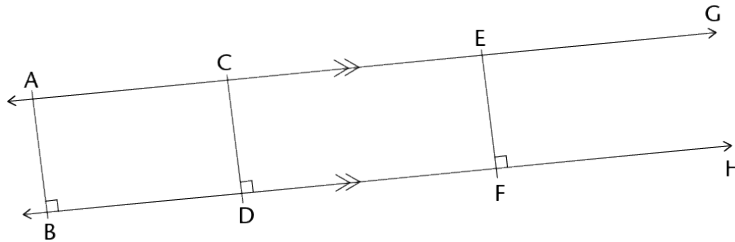
Ray DC goes on towards the left:



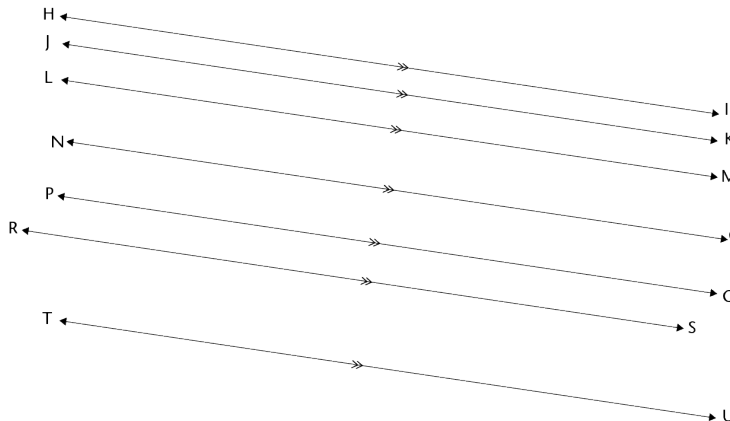
2 PARALLEL AND PERPENDICULAR LINES

2.1 Parallel lines

Two lines that are a constant distance apart are called parallel lines. Lines AG and BH below are parallel. The symbol \parallel is used to indicate parallel lines. We write: $AG \parallel BH$.

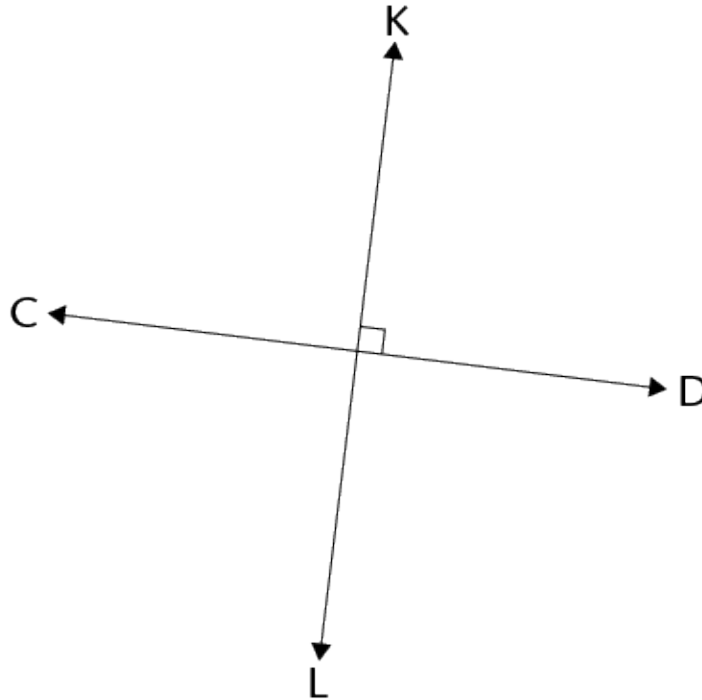


Here are some more parallel lines:



2.2 Perpendicular lines

Lines CD and KL below are perpendicular to each other. The symbol is used to indicate perpendicular lines. We write: $CD \perp KL$.



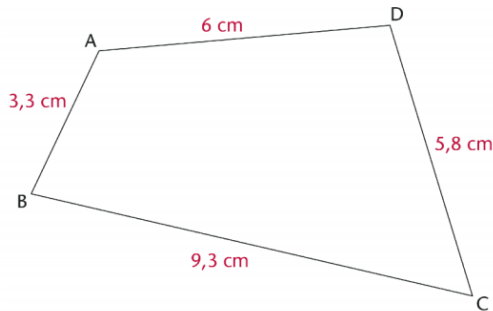
Note

Two lines that form right angles are **perpendicular** to each other.

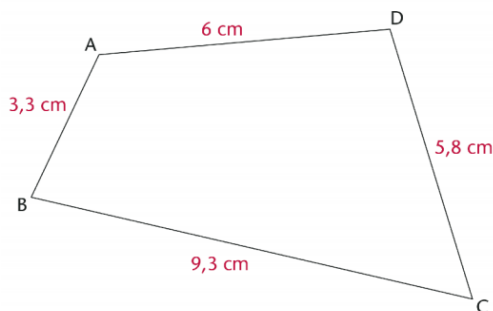
3 EXERCISES

3.1 Exercise 1

1. Consider the quadrilateral in the figure. The length of the line segment AB is $3,3\text{cm}$. Determine the length of the other line segments using the given ratio. Note! Each side of a quadrilateral is a line segment.



- 1.1 Line segment AD is 2 times longer than AB .
 - 1.2 Line segment DC is 2,5 times longer than AB .
 - 1.3 Line segment BC is 3 times longer than AB .
2. Consider the quadrilateral in the figure. The length of the line segment AB is $3,3\text{cm}$. Note! Each side of a quadrilateral is a line segment. Given that line segment AD is 12cm long. How many times longer is AD as compared to AB ?



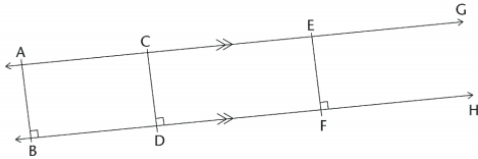
3.2 Exercise 2

1. We can think of lines that have no ends, although we cannot draw them completely. We draw line segments to represent lines. When we draw a line segment to represent a line, we may put arrows at both ends to show that it goes on indefinitely on both sides. We can draw the starting point and part of a ray, using an arrow to indicate that it goes on at the one end. A ray is a line with a definite starting point that goes on indefinitely in the other direction.

- 1.1 Can you draw a whole line? Explain.
- 1.2 Can you draw a whole ray? Explain.
- 1.3 Do line segments XY and GH meet anywhere?
- 1.4 Do lines KL and NP meet anywhere?
- 1.5 Do rays AB and CD meet anywhere?
- 1.6 Do rays FT and MW meet anywhere?
- 1.7 Do rays JK and RS meet anywhere?

3.3 Exercise 3

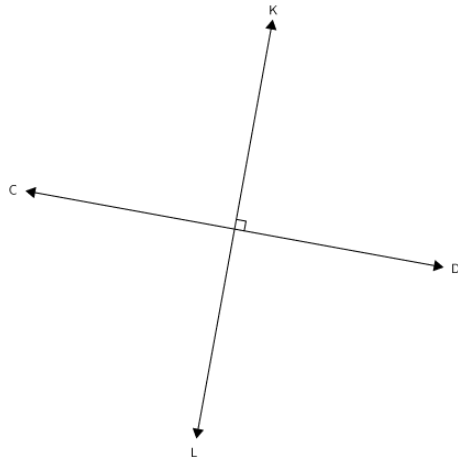
1. Two lines that are a constant distance apart are called parallel lines. Lines AG and BH shown in the figure are parallel. The symbol \parallel is used to indicate parallel lines. We write: $AG \parallel BH$. The distance between the two lines at A and B is $19mm$.



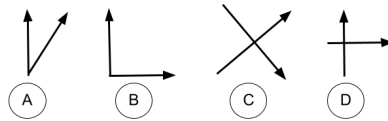
- 1.1 Determine the distance between the two lines at C and D .
- 1.2 Determine the distance between the two lines at E and F .
- 1.3 Will parallel lines meet somewhere?
- 1.4 Do you think lines PQ and ST are parallel? How can you check?
- 1.5 Can two line segments be parallel?
- 1.6 Are line segments DK and FS parallel?
- 1.7 Are line segments MN and AB parallel?
- 1.8 Can a line be parallel on its own?

3.4 Exercise 4

1. Lines CD and KL below are perpendicular to each other. The symbol \perp is used to indicate perpendicular lines. We write: $CD \perp KL$.



- 1.1 How many angles are formed at the point where the above two lines meet?
- 1.2 Can you draw two rays that have the same starting point, and are parallel to each other?
2. Which of the options given in the figure can be described by the following sentences?



- 2.1 Two rays that have the same starting point.
- 2.2 Two rays that are perpendicular to each other and have the same starting point.
- 2.3 Two rays that meet, but not at their starting points.
- 2.4 Two rays that meet but not at their starting points, and that are perpendicular to each other.

4 ANSWERS TO EXERCISES

4.1 Exercise 1

1.1 $AD = 6,6 \text{ cm}$

1.2 $DC = 8,25 \text{ cm}$

1.3 $BC = 9,9 \text{ cm}$

2. Ratio = $\frac{AD}{AB} = \frac{12}{3,3} = 3,64$

4.2 Exercise 2

1.1 No. It is not possible to draw the whole line, because it has no definite starting point or endpoint.

1.2 No. You can only show the starting point of a ray. You can't show where it ends.

1.3 No. They have starting points and endpoints. All of both line segments are shown, and they don't meet.

1.4 Yes. They will meet if the part that is shown is extended to the left. Larger parts of the lines are then shown.

1.5 No. They go in different directions.

1.6 Yes. If both are extended in the direction of the arrows, they will meet.

1.7 No. The arrows point in opposite directions. The bottom ray extended will miss the top one.

4.3 Exercise 3

1.1 19 mm

1.2 19 mm

1.3 No. There is equal distance between them all the time. They will never meet.

1.4 Draw a few lines to cut the lines at right angles so that you can measure the perpendicular distance between the lines at several places. If the lines are the same distance apart, they are parallel. PQ and ST are not parallel.

1.5 Yes

1.6 Yes, the length of AB = the length of CD

1.7 Yes, it looks like it.

1.8 No. A line can only be parallel to another line.

4.4 Exercise 4

1.1 four angles

1.2 Yes. If they go in opposite directions.

2.1 A and B

2.2 B only

2.3 C and D

2.4 D only