

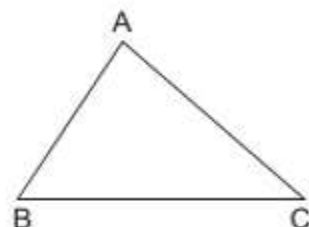
Unit 7 Constructions

In this unit you will:

- accurately construct geometric figures including circles, parallel and perpendicular lines
- use a compass, ruler, set square and protractor appropriately to construct geometric figures.

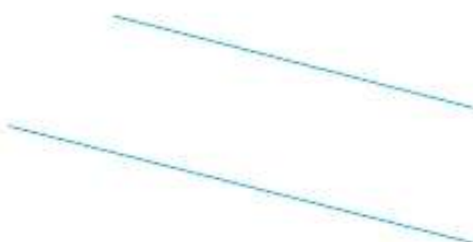
Getting started General rules

- Always use a sharp pencil.
- If you need to mark a point, make it small. This is so that it can mark a position accurately.
- We use capital letters to label points in geometrical drawings.



Activity 7.1 Recognising parallel and perpendicular lines

- Copy the point and line alongside onto lunch wrap or tracing paper.
 - Find the shortest distance from the point to the line.
 - Draw in the line that shows the shortest distance.
 - Use your protractor to measure the angle formed by the two lines.
 - Add a second point on the same side of the line and the same distance from the line. Add four more such points.
 - What do you notice about these points? Join the points.
- What is the distance between the lines alongside?
 - How did you measure this distance?
 - What do you notice about these lines?



Key ideas

- The shortest distance from a point to a line is the direct and straight length to the line, as shown here:
- These lines are *perpendicular* to each other. The angle formed by the two lines is 90° . We use the symbol \perp to show that two lines are perpendicular.
- We call the lines in Question 2 *parallel lines*. The perpendicular distance between two parallel lines is the same everywhere along the lines. We use the symbol \parallel to show that two lines are parallel.



Exercise 7.1 Perpendicular and parallel lines

Which of the following pairs of lines are:

1. perpendicular?

2. parallel?



a)



b)



c)



d)



e)



f)



g)

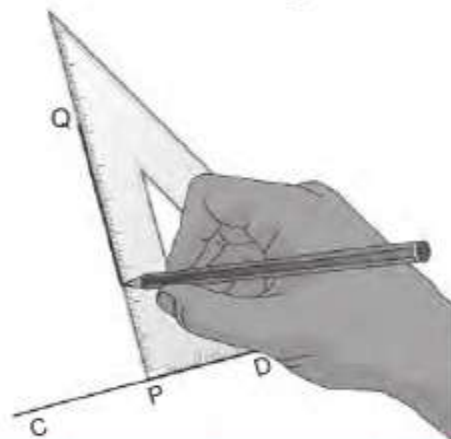
Activity 7.2

Constructing perpendicular lines using a set square

Draw two perpendicular lines. Follow the steps.

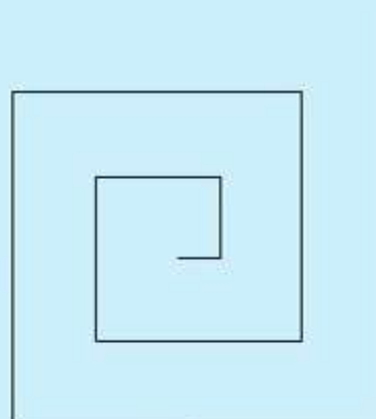
Step 1: Draw a line CD on your page.
Mark point P somewhere on the line.

Step 2: Construct a perpendicular line at P.
Place your set square in the position shown. Draw line segment $PQ \perp CD$.



Exercise 7.2 Angular spiral pattern

1. Copy the pattern. Start in the middle with a line segment of 1 cm. Make each additional perpendicular line segment 1 cm bigger than the previous one. Use your set square to make the perpendicular lines.
2. a) Construct your own pattern. Use perpendicular lines.
b) A friend wants to do the same construction. Write a list of clear instructions for them.



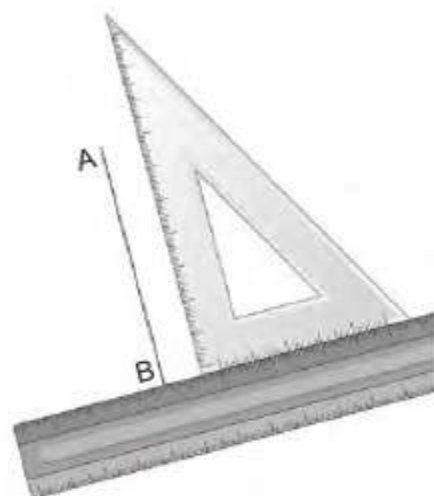
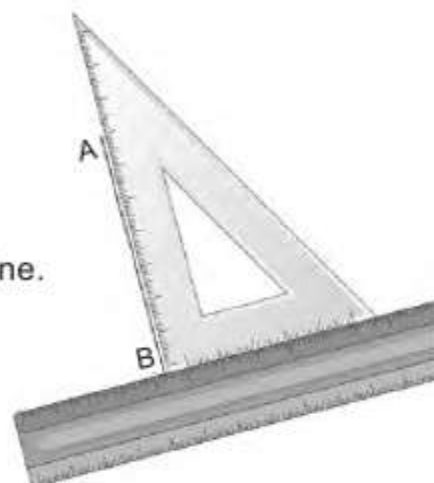
Activity 7.3 Constructing parallel lines using a set square and a ruler

Draw two parallel lines. Follow the steps.

Step 1: Draw line segment AB on your page.

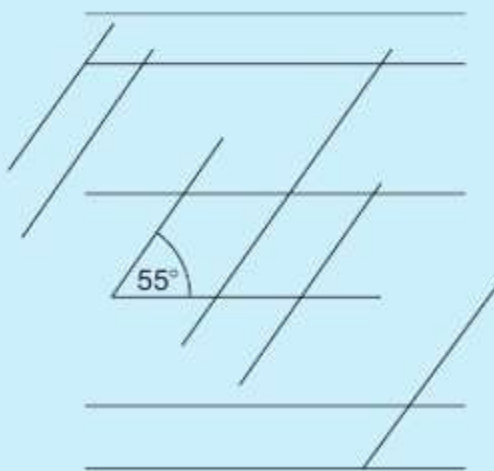
Step 2: Construct a parallel line to AB. Place the set square with the base along line AB as if you were going to draw a perpendicular line.

Step 3: Place a ruler along the perpendicular side of the set square. Hold the ruler firmly in place. Slide the set square along the ruler until the base is in the correct position for the parallel line.



Exercise 7.3 Practising parallel lines

1. Draw an angle of 55° . Now make a pattern. Fill your page with lines that are parallel to the arms of the angle, similar to the pattern alongside.
2. Now fill your page with your own pattern of parallel and perpendicular lines.



Activity 7.4 Using a compass to construct a circle

The compass is a tool or instrument we use to construct accurate circles.

1. Draw a circle with a compass. Follow the steps.

Step 1: Put the two arms of the compass together. The tip of the pencil should be just a little longer than the point of the compass. Tighten the hold for the pencil.

Step 2: Open the arms of the compass to half the width you want for your circle.

Step 3: Place the sharp point on the paper at the place where you want the centre of your circle.

Step 4: Rotate the compass on its point, with the pencil end drawing the circle.

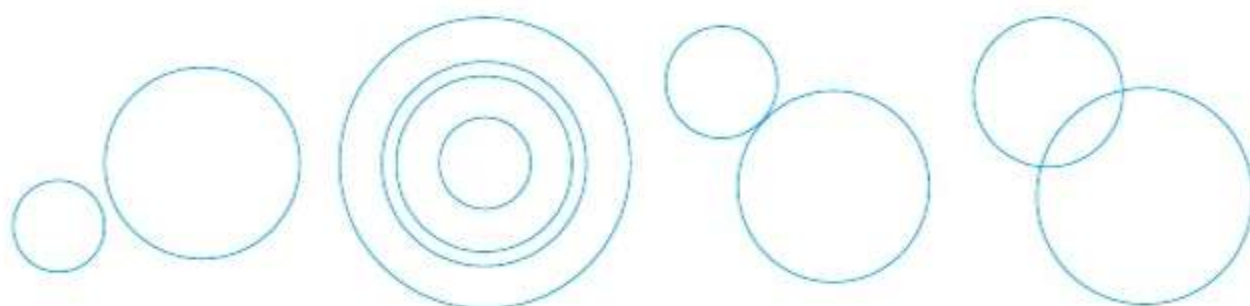


2. Use your compass to practise drawing circles. Find your own best way to hold the compass down while you draw a circle.

Make sure that the point of your compass is stuck in firmly when you rotate it.

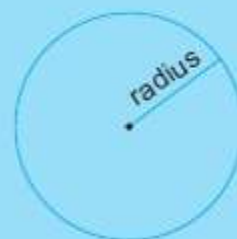


3. Use your compass to construct big and small circles. Construct them inside and outside one another, touching or crossing. Make the circles as big or as small as you wish.



Key ideas

- We use the point of the compass to mark the *centre* of the circle. We use the pencil to draw the *circumference*.
- You can change the size of your circle by changing the width of your compass. We call the distance from the centre of the circle to the circumference the *radius*.



Activity 7.5

Constructing circles of particular sizes

Construct a circle with a radius of 5 cm. Follow the steps.

- Step 1:** Use a ruler to measure a distance of 5 cm between your compass point and pencil.



- Step 2:** Place your compass point where you want the centre of your circle to be.

- Step 3:** Draw your circle by rotating the pencil around the compass point.

Exercise 7.4

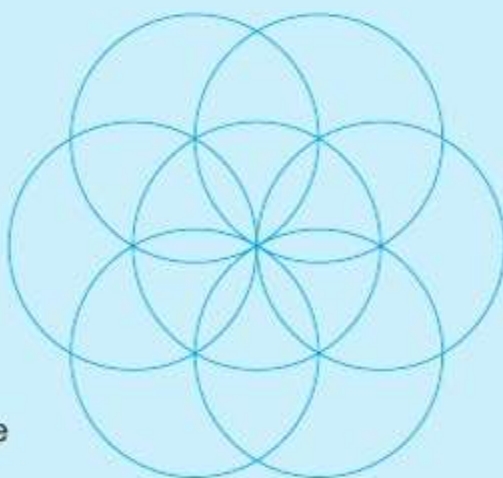
Circle designs

1. Make this design. Follow the instructions.

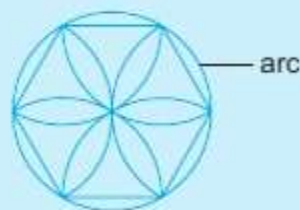
- Step 1:** Draw a circle with a radius of 3 cm in the centre of your page.

- Step 2:** Keeping the radius 3 cm, place the point of the compass anywhere on the circumference of the circle. Draw another circle.

- Step 3:** At every point where the second circle cuts the circumference of the first circle, place the point of the compass and draw another circle.



2. The next design only uses parts of a circle. We call a part of the circumference of a circle an *arc*. Use circles with a radius of 5 cm to make this design.



3. Construct a circle with a radius of 3 cm. Use your compass.
- What is the longest line that we can draw from one point on the circle to another?
 - How does the longest line compare in length to the radius of the circle?

Activity 7.6**Following instructions for geometric figures**

1. Follow the instructions to construct the figure. Draw a rough sketch from the instructions to plan your construction.

Step 1: Draw line segment $CD = 6$ cm.

Step 2: Construct angle $\hat{BCD} = 115^\circ$. Make line $BC = 6$ cm.

Step 3: Construct BA parallel to CD with $BA = 6$ cm.

Step 4: Join AD .

2. What do we call this quadrilateral?

Exercise 7.5**Constructions**

1. a) Construct the figure. Follow the instructions. Draw a rough sketch to help.

Step 1: Draw line segment $AB = 5$ cm.

Step 2: Construct DA perpendicular to AB at point A . Construct CB perpendicular to AB at point B . Make $DA = 5$ cm and $BC = 5$ cm.

Step 3: Join DC . Check that $DC \parallel AB$ and that $DC = 5$ cm.

Step 4: Draw in the lines DB and AC . Name the point where they intersect E .

Step 5: Draw a circle using E as the centre. Use AE as the radius.

- b) Describe the shape you have constructed.

2. a) Follow the instructions to construct the figure. Draw a rough sketch.

Step 1: Draw $BD = 6$ cm. Mark point E at the midpoint of BD .

Step 2: Draw AC perpendicular to BD and passing through point E . Make line $AE = 3,5$ cm and line $EC = 7,5$ cm.

Step 3: Join $ABCD$.

- b) What do we call this quadrilateral?

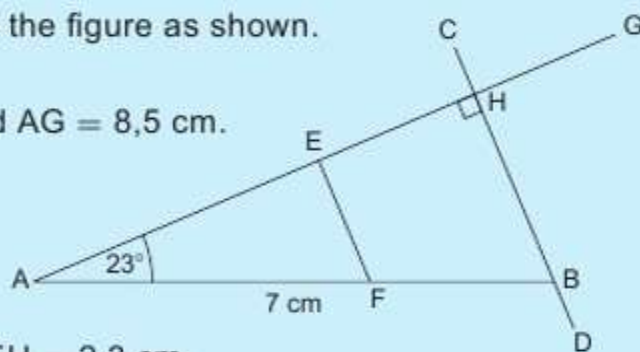
3. Follow the instructions to construct the figure as shown.

Step 1: Construct $AB = 7$ cm.

Step 2: Construct $\hat{BAG} = 23^\circ$ and $AG = 8,5$ cm.

Step 3: Construct $CD \perp AG$ with CD passing through B . CD and AG intersect at point H .

Step 4: Construct $EF \parallel CD$ with $EH = 2,3$ cm.

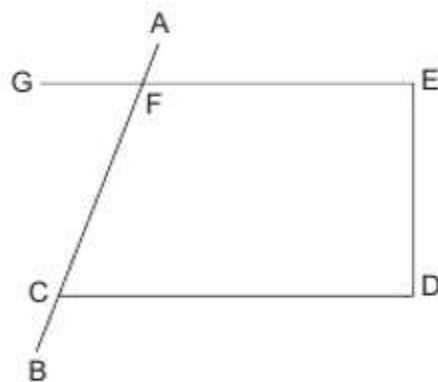


Summary

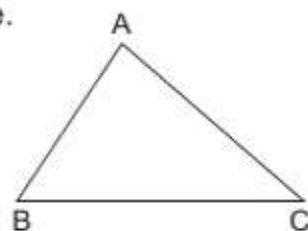
- Lines that are *perpendicular* to each other form an angle of 90° .
- Lines that are *parallel* to each other have the same perpendicular distance between them everywhere along the lines.
- The compass is a tool or instrument we use to construct accurate circles.
- We use the point of the compass to mark the *centre* of the circle. We use the pencil to draw the *circumference*.
- We call a part of the circumference of a circle an *arc*.
- The distance from the centre of the circle to the circumference is the *radius*.

Check what you know

1. Draw a pair of lines that are:
 - a) perpendicular
 - b) parallel
 - c) not parallel or perpendicular
2. Look at the figure. Answer the questions.
Check your answers. Use your instruments.



- a) Name a pair of parallel lines.
 - b) Name a pair of perpendicular lines.
 - c) Measure $\angle FCD$.
 - d) Measure $\angle GFC$.
 - e) Measure $\angle EFC$.
3. Draw any acute-angled triangle such as the one alongside.



- a) Draw perpendicular lines from BC to A, from AB to C and from AC to B. What do you notice?
 - b) Draw another triangle ABC. Check whether what you observed in a) happens again.
4. a) Two circles are drawn through a single point. How many more circles can you draw through the same point? Show your answer. First draw freehand circles. Then draw compass constructions.



- b) How many circles can we draw through two points?
- c) How many circles can we draw through three points?

5. Construct the figure. Follow the instructions.

Step 1: Construct $BC = 7$ cm.

Step 2: Construct $\hat{ABC} = 60^\circ$ with $AB = 7$ cm.

Step 3: Construct $\hat{ACB} = 60^\circ$ with $AC = 7$ cm.

Step 4: Construct $AD \perp BC$. Construct $BE \perp AC$. Construct $CF \perp AB$.

Step 5: Name the point where AD , BE and CF intersect, G .

Step 6: Construct a circle with G as the centre and GE as the radius.

Describe the figure that you have constructed.

