

2

Lines and Angles

Learning Objectives

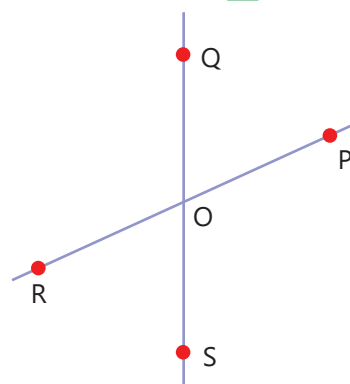
- 👉 Recognise points, lines, rays
- 👉 Understand line segments
- 👉 Identify and draw angles
- 👉 Classify different angles
- 👉 Measure angles with a protractor



Warm Up

Look at the picture below.

1. How many angles can you see in the figure?
2. Are opposite angles equal in size or different?



NCF 2023 Problem Solving CG-1 CG-6

Observe the world around you roads crossing each other, the edges of your notebook, the corners of a door or even the hands of a clock. Everywhere you look, you will find lines and angles. Lines help us understand length and direction, while angles tell us how two lines meet or turn. In this chapter, you will learn about different types of lines like parallel and intersecting lines and different kinds of angles like acute, right, obtuse and straight angles.

Point

In geometry, everything begins with a point. For example, place the tip of a sharp pencil on paper without moving it. The small mark you make is a **point**.

- ➔ A **point** shows an exact position or location in space.
- ➔ It has no length, no width and no thickness.
- ➔ A point is represented by a small dot and is usually named with a capital letter such as A, B or C.

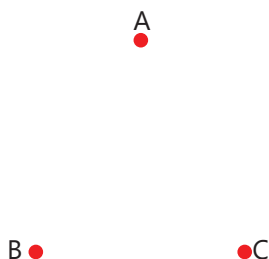


Fig. 2.1: Representing points



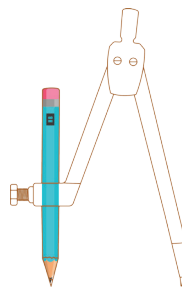
Did You Know?

NCF 2023 Curiosity and Inquiry CG-9

- ➔ A point tells us where something is, but it does not tell us how big it is.
- ➔ Many points together can form lines, shapes and figures.
- ➔ An infinite number of lines can be drawn to pass through a point in a plane.

Examples of points in real life:

- ➔ The sharpened end of a pencil
- ➔ The tip of a compass
- ➔ The tip of a needle



The tip of a compass



The sharpened end of a pencil



The pointed end of a needle



Mental Maths-1

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1. Put three dots on your notebook and name them P, Q, R.
2. Can you join them to make a triangle?
3. What happens if all three points lie on the same straight line?

Line Segment

A **line segment** is a part of a line that has two fixed endpoints. If we mark two points **A** and **B** on paper and join them with a straight line, then the figure \overline{AB} is called a **line segment**.

- It has a definite length.
- It is the shortest distance between its two endpoints.
- It can be measured using a ruler.
- We write it as \overline{AB} or \overline{BA} .



Fig. 2.2: A line segment



Mental Maths-2

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1. Draw two points P and Q in your notebook. Join them to make line segment PQ.
2. Measure its length using a ruler.
3. Can you say $PQ = QP$? Why or why not?

Line

A **line** is a straight path that goes on endlessly in both directions.

- It has no endpoints.
- It has no fixed length and cannot be measured.
- It is made up of countless points lying in a straight path.

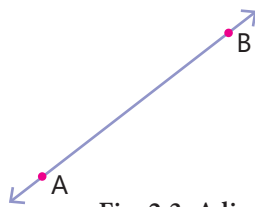


Fig. 2.3: A line path.

If you mark two points **A** and **B** on paper and draw a straight path through them, the line passing through A and B extends forever on both sides.

We write it as **line AB** or **line BA** and denote it as \overleftrightarrow{AB} .



Did You Know?

NCF 2023 Curiosity and Inquiry CG-9

- A line has no thickness.
- Sometimes a line is denoted by a letter like l or m .

Try This

1. Draw two points M and N on your notebook.
2. Place a ruler and draw a straight path through both points.
3. Extend the line on both sides and mark arrowheads. Name it \overleftrightarrow{MN} .

Ray

A **ray** is a part of a line that starts from one point and extends endlessly in one direction.

- It has one fixed endpoint.
- It goes on forever on the other side.
- A ray cannot be measured because it has no end.

If you mark two points **A** and **B** and draw a straight path starting from **A** and passing through **B**, then it is a **ray**.

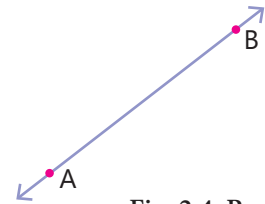


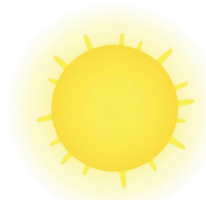
Fig. 2.4: Ray

We write it as \overrightarrow{AB} , which means the ray starts at **A** and passes through **B**.

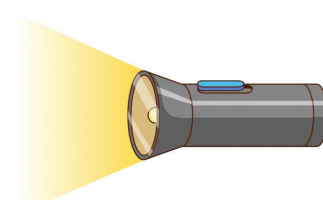
Try This

1. Mark a point O on your notebook.
2. Draw a line starting at O and passing through another point P.
3. Extend it only on one side beyond P and mark an arrowhead. This is **ray OP**.

Real-Life examples of rays:



Sunrays coming from the sun



A beam of light from a torch

Solved Examples

Example 1: Mark two points A and B on a sheet of paper. Join them with a straight path. What is the figure formed?

Solution: 

The figure formed is a line segment AB.

Example 2: Draw a point O and draw a straight path starting from O and passing through another point P. What is the figure formed?

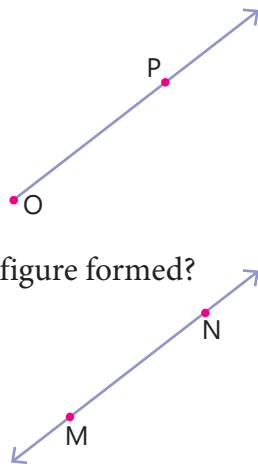
Solution:

The figure formed is a ray OP.

Example 3: Draw two points M and N. Extend the straight path through them endlessly in both directions. What is the figure formed?

Solution:

The figure formed is a line MN.



Example 4: In the given Fig., name:

- Five points
- A line

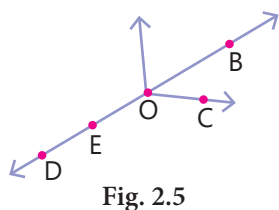


Fig. 2.5

- Four rays
- Five line segments

Solution:

- Five points: D, E, O, C and B.
- A line: \overleftrightarrow{BD}
- Four rays: \overrightarrow{OD} , \overrightarrow{OB} , \overrightarrow{OC} and \overrightarrow{ED} .
- Five line segments: \overline{DE} , \overline{EO} , \overline{OC} , \overline{BO} and \overline{DO} .

Example 5: Here is a ray \overrightarrow{OA} . It starts at O and passes through the point A. It also passes through the point B.

- Can you also name it as \overrightarrow{OB} ? Why?
- Can we write \overrightarrow{OA} as \overrightarrow{AO} ? Why or why not?

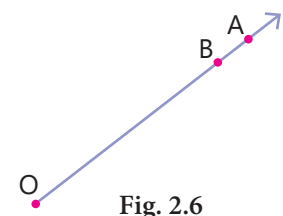


Fig. 2.6

Solution:

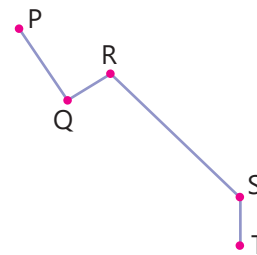
- Yes, since the ray starts at O and passes through both B and A, it can be named \overrightarrow{OB} .
- No, we cannot write \overrightarrow{OA} as \overrightarrow{AO} because rays are directional. The ray starts at point O and extends through A, so OA indicates the direction from O to A. Writing it as AO would imply the ray starts at A and goes towards O, which is incorrect in this context because O is the starting point.



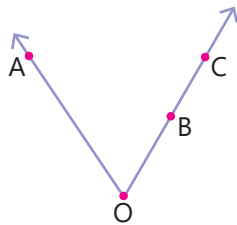
Exercise 2.1

NCF 2023 Practice and Reinforcement CG-1 CG-2 CG-3 CG-4

- Draw and name the following in your notebook:
 - A point
 - A line segment AB
 - A ray CD
 - A line EF
- Mark three points A, B, C on your notebook.
 - Join A and B. What figure is formed?
 - Join B and C. What figure is formed?
 - How many line segments can you make using these three points?
- What is the difference between a ray and a line segment?
- In the given Fig., name all the line segments. Which points lie on exactly one line segment? Which points lie on two line segments?



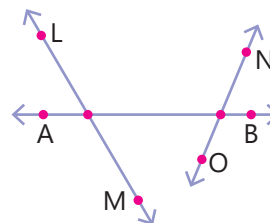
starting from point O. Are all these rays different? Why?



6. Draw a rough figure and label appropriately to show:
 - a. Line XY and line PQ intersecting at point M.
 - b. Two rays with a common starting point A.
 - c. A line segment AB with a point C lying on it.
 - d. A point P not lying on line RS.
7. On a line segment \overline{AB} , mark a point P such that P is between A and B.
 - a. Name the two line segments that are formed.

b. Can the point lie outside a line segment? Why or why not?

8. From the given figure, indicate:
 - a. line containing point N.
 - b. a line passing through L.
 - c. a line on which A lies.
 - d. two pairs of intersecting lines.



9. Write T for True and F for False:
 - a. A line segment has two endpoints.
 - b. A line has a definite length.
 - c. A ray has one endpoint.
 - d. A point has no size.

Angle

An **angle** is formed when two rays meet at a common endpoint.

- ➔ The common endpoint is called the **vertex**.
- ➔ The two rays are called the **arms** of the angle.
- ➔ We usually name an angle using three capital letters, with the vertex letter in the middle.
- ➔ An angle is the amount of turn or rotation needed to move the first ray to the second ray about the vertex.
- ➔ If two rays **OA** and **OB** meet at point **O**, the angle formed is written as $\angle AOB$ (or $\angle BOA$).

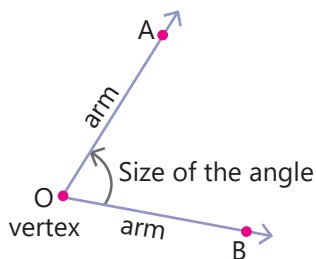


Fig. 2.7

Real-life examples of angles

The hands of a clock form an angle.	The blades of a pair of scissors form an angle.	The edges of an open book form an angle.



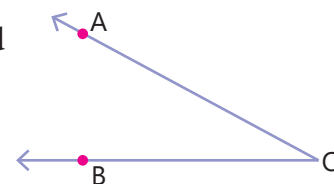
Mental Maths-3

NCF 2023 Confidence Building CG-1 CG-6

In $\angle PQR$, which point is the vertex?

Solved Examples

Example 6: Rays **OA** and **OB** meet at **O**. Name the angle, its vertex and its arms.



Solution:

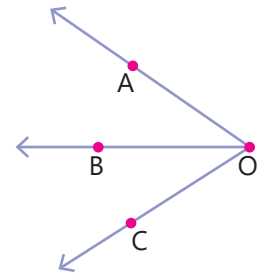
- ➔ Angle: $\angle AOB$ (or $\angle BOA$)
- ➔ Vertex: **O**
- ➔ Arms: **OA** and **OB**

Example 7: In the given figure, three rays **OA**, **OB**, **OC** meet at **O**. Can we write the angle as $\angle O$?

Solution:

No. There are three different angles at **O** ($\angle AOB$, $\angle BOC$, $\angle AOC$). Writing $\angle O$ is ambiguous.

We must keep the vertex in the middle and use three letters to show which angle.

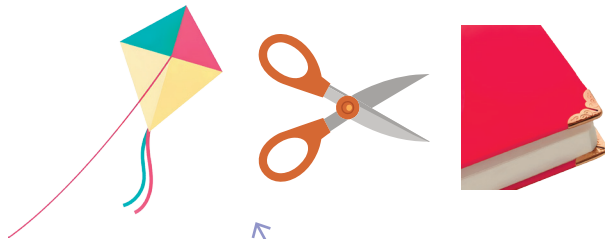


Exercise 2.2

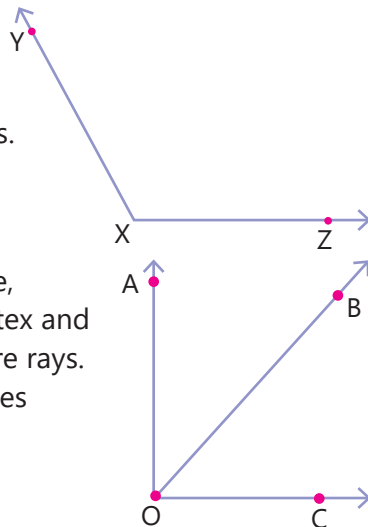
NCF 2025 Practice and Reinforcement



1. Look at the following pictures. Find the angles in each picture. Draw the rays forming one angle and name the vertex.



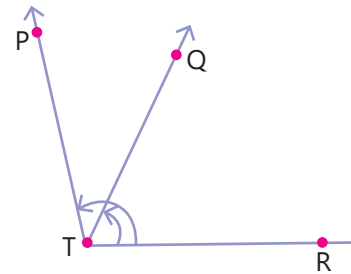
2. Write the name of the angle in two different ways.



3. In the given figure, point **O** is the vertex and **OA**, **OB** and **OC** are rays. Name all the angles formed.

4. Mark any four points **P**, **Q**, **R**, **S** in your notebook such that no three are in a straight line.
- a. Draw all possible lines through pairs of these points.
 - b. How many lines do you get?
 - c. Name at least three different angles formed using these points.
5. Name the angles marked in the given figure.

NCERT



Comparing Angles

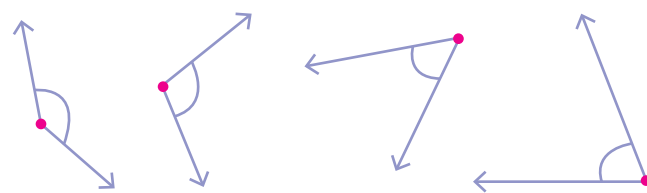
Angles can be large or small, depending on how much one ray has turned from the other at the vertex. The more the opening between the two arms, the larger the angle.

For example, the two arms of the compass act like the two rays that form an angle. The joint or hinge where the arms meet is the vertex of the angle. By opening



or closing the compass, the arms turn and create different angles.

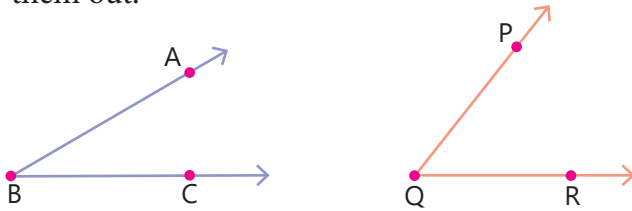
Look at the following angles. We can compare angles to see which is larger, smaller or if they are equal.



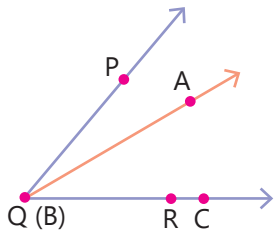
Comparing angles by Superimposition

This method involves placing one angle on top of another.

1. Draw the two angles on tracing paper and cut them out.



2. Place one angle over the other so their vertices and one of the arms overlap.

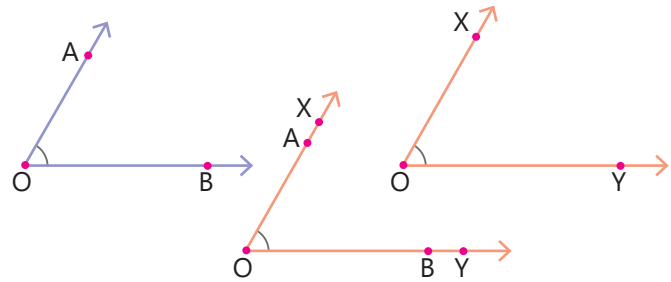


3. The angle whose second arm opens wider is the larger angle.

Equal Angles

Two angles are called equal angles if they have the same measure. The length of the arms does not affect the equality of angles. We can compare and check equality of angles by superimposition.

Now consider $\angle AOB$ and $\angle XOY$ in the figure. Which is greater?



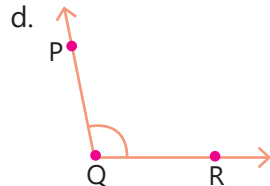
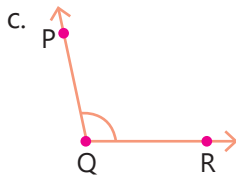
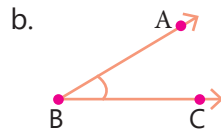
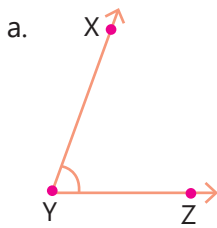
- ⇒ The arms of $\angle AOB$ (rays \vec{OA} and \vec{OB}) overlap exactly with the arms of $\angle XOY$ (rays \vec{OX} and \vec{OY}).
- ⇒ Both angles have the same amount of rotation from one arm to the other.
- ⇒ Hence, the two angles are equal in size.



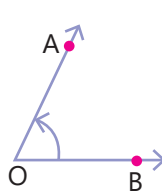
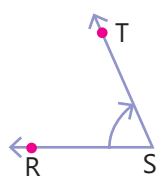
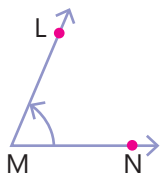
Exercise 2.3

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1. Look at the following angles. Arrange them in order from smallest to largest.

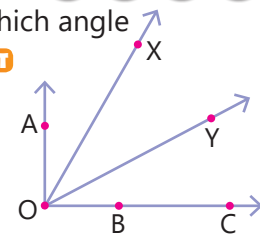


2. Identify equal angles in the following:



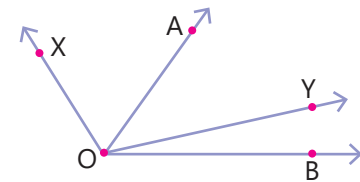
3. In each case, determine which angle is greater and why. **NCERT**

- $\angle AOB$ or $\angle XOY$
- $\angle AOB$ or $\angle XOB$
- $\angle XOB$ or $\angle XOC$



Discuss with your friends on how you decided which one is greater.

4. Which angle is greater: $\angle XOY$ or $\angle AOB$? Give reasons. **NCERT**



5. Write T for true and F for false statements:

- If the arms of an angle are made longer, the size of the angle increases.
- Two angles are equal if their measures are the same.

Comparing Angles without Superimposition

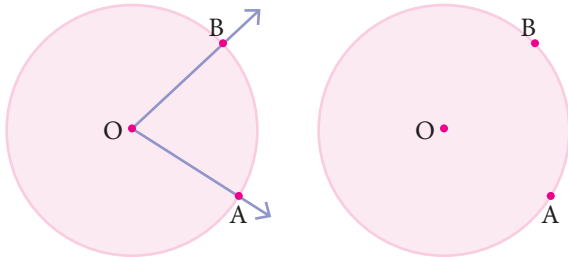
So far, we compared angles by placing one on top of the other (superimposition). But what if we cannot trace or overlap them? Can we still find out which angle is bigger? Yes!

Using a Circle Method

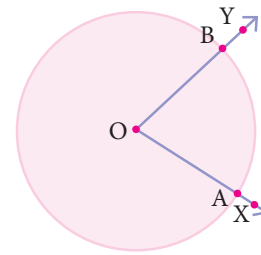
- ➔ If you have a transparent circular sheet (like a paper disc).
- ➔ Place the centre of the circle at the vertex of the angle.
- ➔ Mark the points where the two arms of the angle cut the circle.
- ➔ The bigger the arc between the two points, the larger the angle.

For example,

1. Place the circle on one angle with its centre at the vertex. Mark the two points where the arms meet the circle (say A and B).



2. Now place the same circle on another angle with the same vertex position. Mark where the arms meet the circle (say X and Y).



3. Compare the arcs AB and XY.
 - ➔ If AB covers more of the circle, $\angle AOB$ is larger.
 - ➔ If XY covers more, then $\angle XOY$ is larger.
 - ➔ If both arcs are equal, the angles are equal.

Note:

- ➔ Making the arms longer does not increase the size of the angle.
- ➔ The turn or opening decides the angle, not the length of its arms.

Try This

Draw two angles of your choice. Cut out a circular piece of paper. Place its centre on the vertex of two different angles and compare.



Maths Lab Activity-1

Making Rotating Arms

Objective: To understand how angles can be formed, compared and identified using a simple working model.

Materials Required:

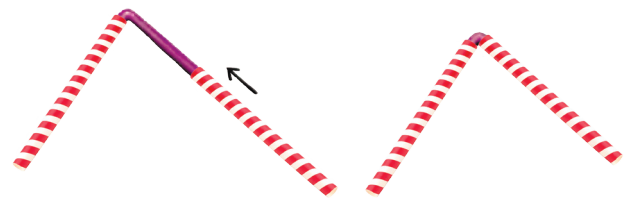
- ➔ 2 paper straws
- ➔ 1 paper clip
- ➔ 1 piece of cardboard
- ➔ Pencil, scale and scissors



Procedure

1. Take two paper straws and a paper clip.
2. Insert the two straws into the arms of the paper clip.

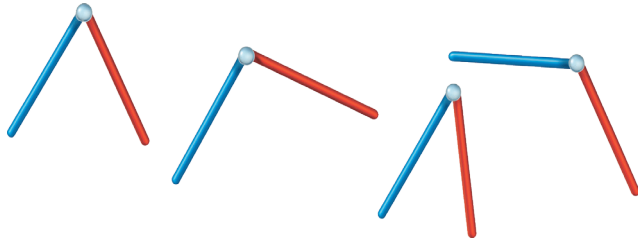
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3. Adjust the straws so that they can rotate freely around the clip.
4. Your rotating arms model is ready.

Activity 1 – Comparing Angles

- ➔ Make several rotating arms with different openings between the straws.



- ➔ Arrange them from smallest to largest angle using visual comparison or superimposition.

Activity 2 – Angle Slit Test

1. Take a piece of **cardboard** and cut a slit in the shape of an angle (by tracing one rotating arm).
2. Shuffle all your rotating arms.
3. Try to pass each rotating arm through the slit.
 - ➔ If the arms are smaller than the slit angle → they will not pass.

- ➔ If the arms are larger than the slit angle → they will not pass.
- ➔ If the arms are equal to the slit angle → they will pass exactly.



Objective: The model shows that the size of an angle depends only on the opening between its arms, not on the length of the arms.

Conclusion: This activity helps us compare and identify angles practically. Equal angles can be recognised when the rotating arms pass through the slit of the same angle.

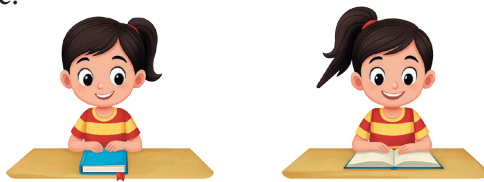
Special Types of Angles

Let us look at some special types of angles.

Straight Angle

A **straight angle** is formed when the two arms of an angle lie along the same straight line but extend in opposite directions. Think of opening the cover of a book until it lies completely flat on a table.

- ➔ The hinge of the book works as the vertex of the angle.
- ➔ The edges of the covers act as the arms of the angle.



When the book is fully open and flat, the angle made is a **straight angle**.



Mental Maths-4

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Count how many right angles are present in:

- a. The blackboard of your classroom.
- b. The doors of your classroom.



Activity-1

NCF 2023 Hands-on Learning CG-2 CG-3 CG-4 CG-6

Objective: To see how a straight angle is formed using a simple drawing.

Materials Required:

- ➔ A sheet of paper
- ➔ A ruler
- ➔ A pencil

Steps:

1. Mark a point **O** in the centre of the paper.
2. Draw a ray \overrightarrow{OA} starting from **O**.
3. Extend the line in the opposite direction to get ray \overrightarrow{OB} .



4. Now the $\angle AOB$ is a **straight angle** because arms **OA** and **OB** lie in a straight line.

Right Angle

A **right angle** is an angle that measures one-quarter of a full turn.

- ➔ It looks like the letter **L**.
- ➔ You can see right angles in many everyday objects.

Examples of right angles:

- The hands of a clock at 3:00 or 9:00.



- The edges of a book where two sides meet.
- The corner where two walls join in a room.

When two lines meet to form a right angle, we call them **perpendicular lines**. The symbol used to represent perpendicular lines is \perp .



Quick Check

Count how many right angles you can find in:

- The corners of your notebook or textbook.
- The tiles on the floor.
- The screen of your mobile phone or television.
- The edges of a cupboard or table.
- The corners of a blackboard or whiteboard.



Activity-2

NCF 2023 Hands-on Learning CG-2 CG-3 CG-4 CG-6

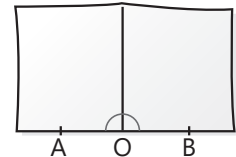
Objective: To explore how a right angle is formed.

Materials Required:

- A sheet of paper
- A pencil

Steps:

- Take a sheet of paper.
- Fold it once so that one edge perfectly overlaps another.
- Unfold the paper. The crease forms a **right angle**.
- A right angle divides a straight angle into two equal parts.

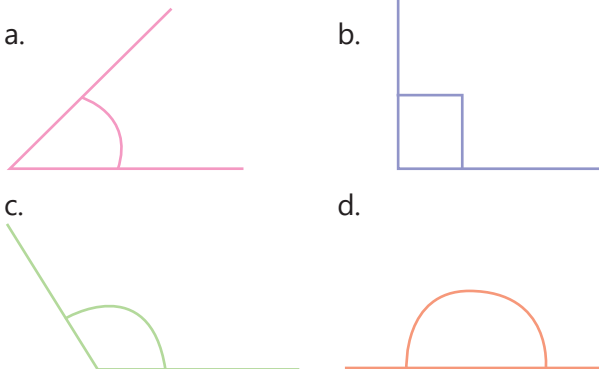


Exercise 2.4

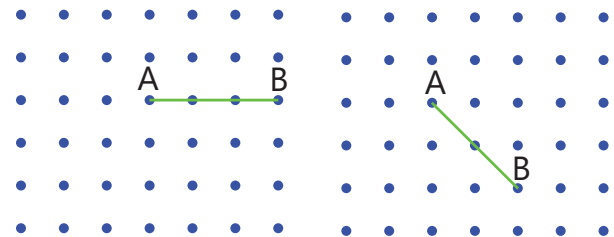
NCF 2023 Practice and Reinforcement CG-1 CG-2 CG-3 CG-4

- Fill in the blanks:
 - Two right angles together make a angle.
 - A straight angle is equal to right angles.
 - The symbol used to show perpendicular lines is

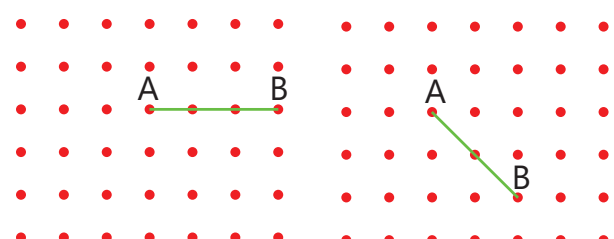
- Look at the following figures. Identify the right angle.



- Join A to other grid points in the figures by a straight line to get a straight angle. What are all the different ways of doing it? **NCERT**



- Now join A to other grid points in the figure by a straight line to get a right angle. What are all the different ways of doing it? **NCERT**

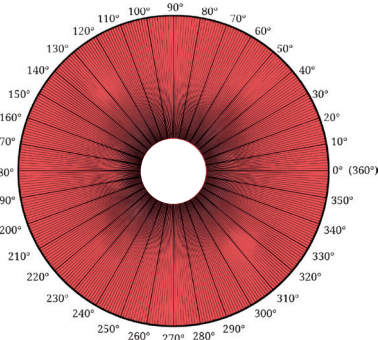


Measuring Angles

To measure angles, mathematicians divided a circle into 360 equal parts.

➔ Each part is called a **degree**, written with the symbol $^{\circ}$.

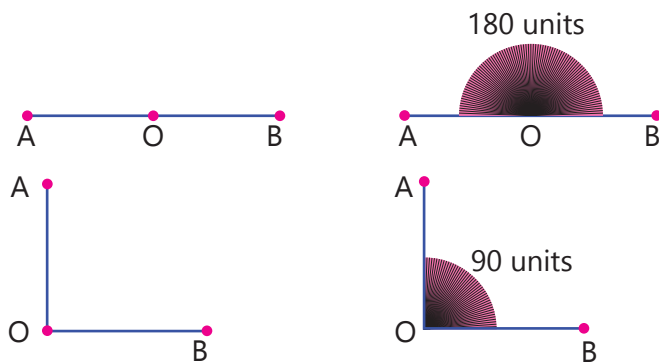
➔ The angle at the centre of the circle is used as the reference for these measurements.



➔ A full turn = 360°

➔ A half turn = 180° (straight angle)

➔ A quarter turn = 90° (right angle)



Maths Lab Activity-2

NCF 2025 Experiential Learning CG-3 CG-4 CG-6 CG-8

Objective: To understand right angle (90°), straight angle (180°) and full angle (360°) using the hands of a clock.

Materials Required: A working clock

Procedure

- Quarter Turn (90° – Right Angle):
 - ➔ Set the clock hands at 3:00 or 9:00.
 - ➔ The hands form a right angle (90°).
- Half Turn (180° – Straight Angle):
 - ➔ Set the clock hands at 6:00.
 - ➔ The hands are in a straight line, forming a straight angle (180°).

3. Full Turn (360° – Complete Angle):

- ➔ Set the clock hands at 12:00.
- ➔ Move the minute hand one full round back to 12.
- ➔ This makes a full angle of 360° .

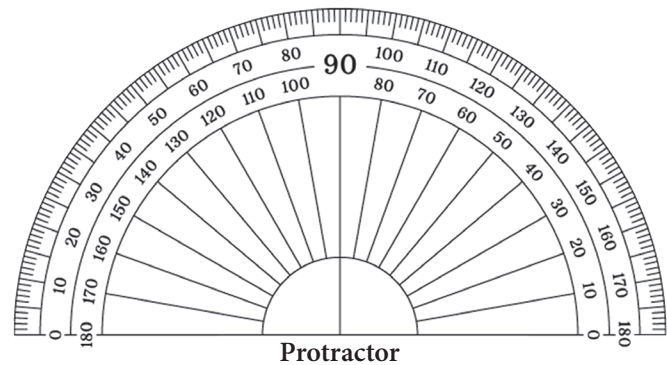
Objective:

- ➔ At 3:00 or 9:00 → 90° (Right Angle)
- ➔ At 6:00 → 180° (Straight Angle)
- ➔ At 12:00 after a full turn → 360° (Full Angle)

Conclusion: A clock face is a simple and effective way to visualise quarter turn, half turn and full turn, which correspond to 90° , 180° and 360° .

Protractor

A **protractor** is a common tool used to measure angles in degrees ($^{\circ}$). It is usually made of transparent plastic in the shape of a half-circle or a full circle.



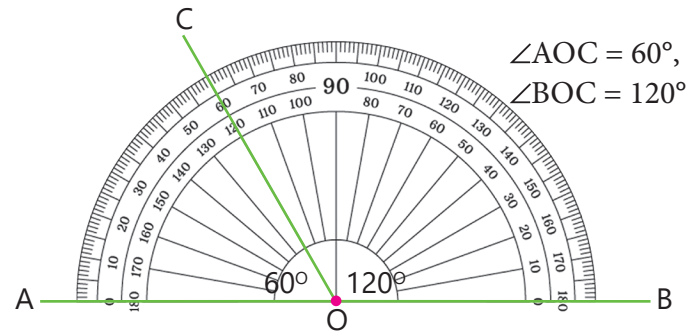
Protractor

It has three main parts:

- Base Line:** The straight edge at the bottom of the protractor, used to place along one arm of the angle.
- Centre Point:** The small mark at the middle of the base line, to be placed on the vertex of the angle.
- Degree Scale:** The curved edge with markings from 0° to 180° .
 - ➔ The **outer scale** starts from 0° on the left and goes to 180° on the right.
 - ➔ The **inner scale** starts from 0° on the right and goes to 180° on the left.
 - ➔ This double numbering helps measure angles that open in either direction.

How to Use a Protractor

1. Place the **centre point** of the protractor on the **vertex** of the angle.
2. Align one arm of the angle with the **0° mark** on the base line.
3. Look at where the other arm meets the scale. The number at this point is the **measure of the angle**.



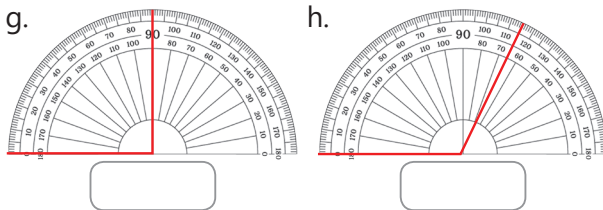
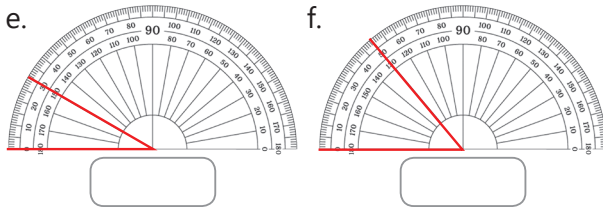
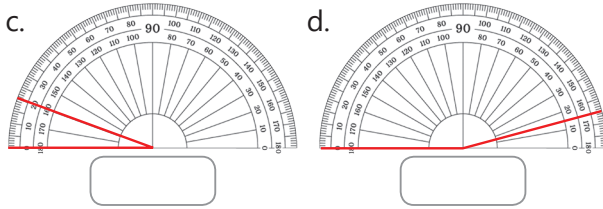
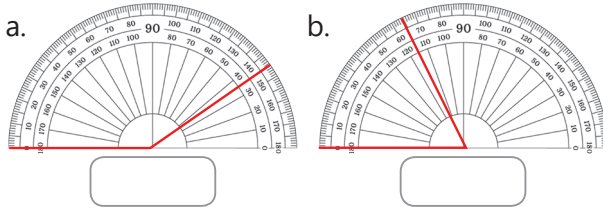
In the figure, $\angle AOB = 180^\circ$, $\angle AOC = 60^\circ$, $\angle BOC = 120^\circ$.



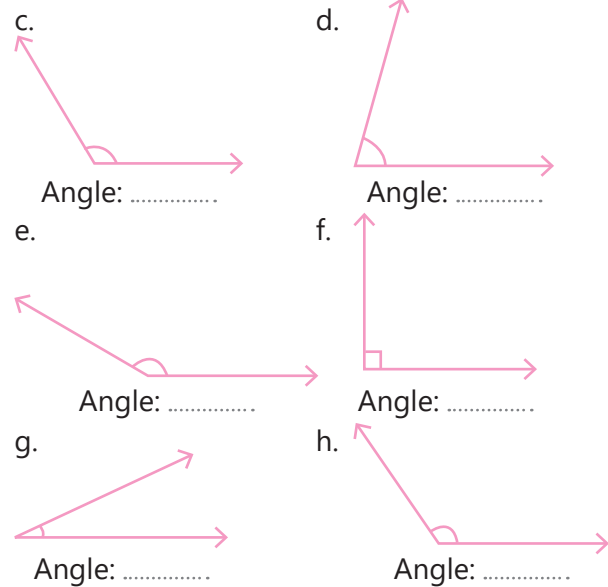
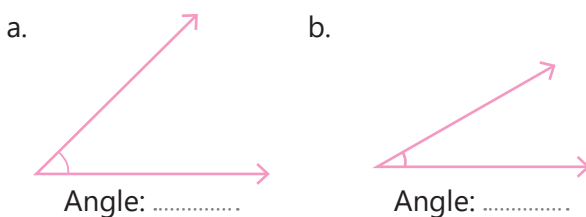
Exercise 2.5

NCF 2023 Practice and Reinforcement CG-1 CG-2 CG-3 CG-4

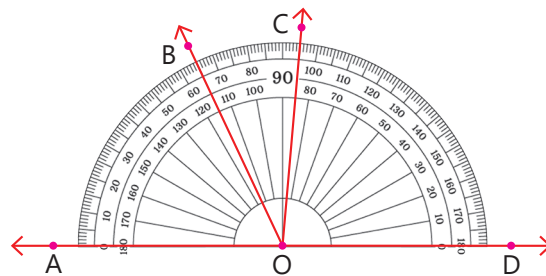
1. Read the correct measurement of the angle in degrees ($^\circ$). Write your answer in the blank box provided.



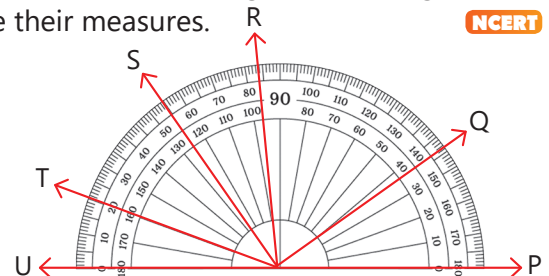
2. Measure each angle using a protractor.



3. Write the degree measures of $\angle AOB$, $\angle AOC$, $\angle COD$ and $\angle BOD$.



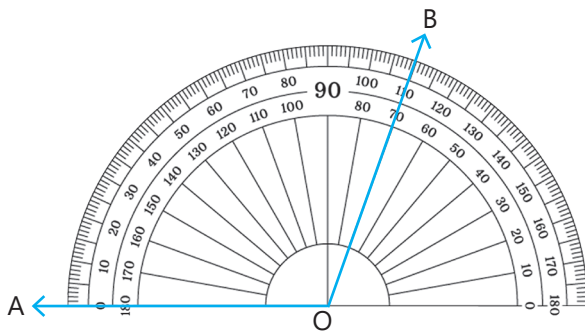
4. Name the different angles in the figure and write their measures.





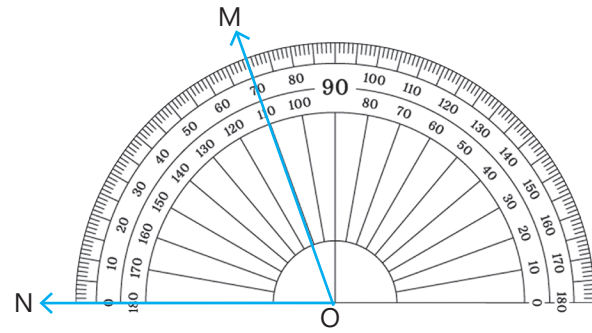
Maths Lab Activity-3

A student measured the following angles, but made mistakes while using the protractor. Carefully check each figure and answer the questions mentally.



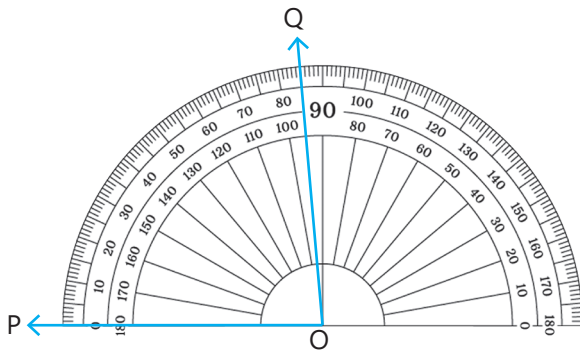
Incorrect: $\angle AOB = 70^\circ$

Correct:



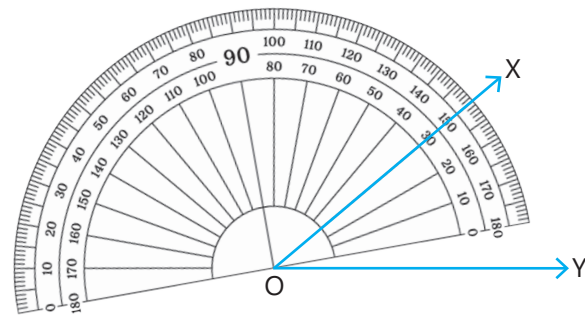
Incorrect: $\angle MON = 110^\circ$

Correct:



Incorrect: $\angle POQ = 105^\circ$

Correct:



Incorrect: $\angle XOY = 30^\circ$

Correct:

Drawing Angles Using a Protractor

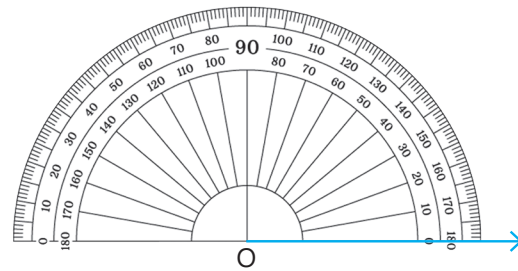
A protractor is not only used to measure angles but also to draw them accurately. Follow these steps to draw angles of different sizes:

Steps to draw an angle

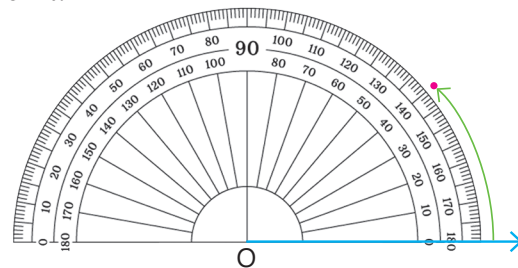
1. Use a ruler to draw a straight line. Mark one end as the vertex (O).



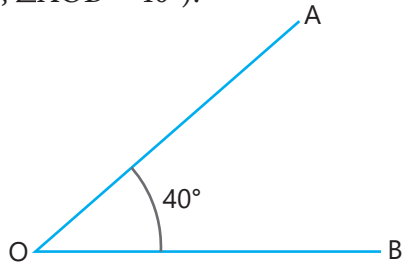
2. Put the **centre point** of the protractor at O. Align the **base line** of the protractor with the line you drew.



3. Look for the required angle measure (e.g., 40°) on the degree scale. Put a small dot at that point.



4. Remove the protractor and draw a line from O through the dot. Label the angle (e.g., $\angle AOB = 40^\circ$).



Solved Examples

Example 8: Use a protractor and ruler to draw angles having the following degree measures:

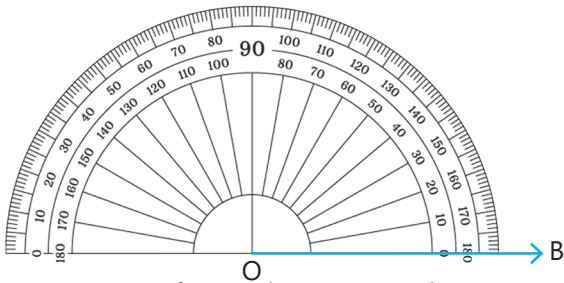
- a. 60° b. 110°

Solution: a. Let us draw $\angle 60^\circ$ using protractor and ruler.

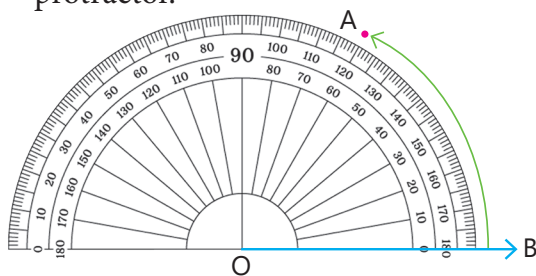
Step 1: Using a ruler, draw a straight line. Label two points on this line as O (the vertex) and B. This line, OB will be the base of the angle.



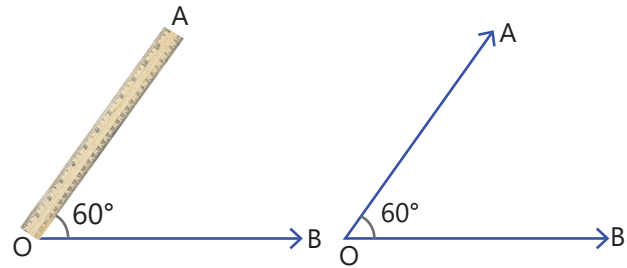
Step 2: Place the centre point of the protractor on O (the vertex of the angle). Align the baseline of the protractor with the line OB. Ensure that the protractor's 0° mark is aligned with OB.



Step 3: Starting from the 0° on the protractor, count along the scale to 60° . Place a small dot or mark A at the 60° position on the protractor.



Step 4: Remove the protractor. Using a ruler, draw a straight line from O through the mark you made.

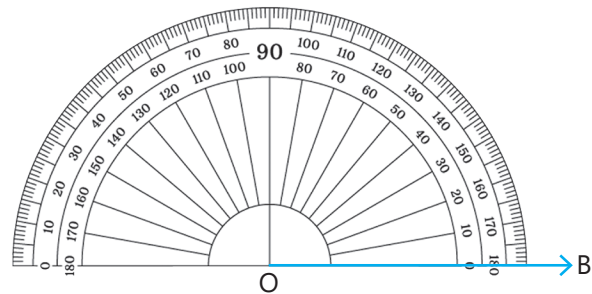


b. Let us draw $\angle 110^\circ$ using protractor and ruler.

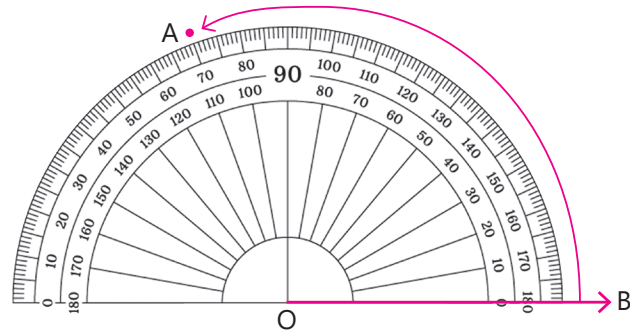
Step 1: Using a ruler, draw a straight line. Label two points on this line as O (the vertex) and B. This line, OB will be the base of the angle.



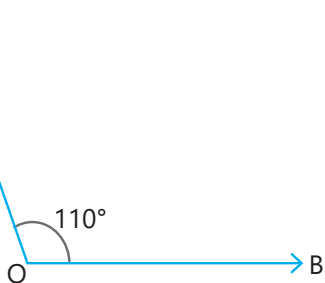
Step 2: Place the centre point of the protractor on O. Align the baseline of the protractor with the line OB. Ensure that the protractor's 0° mark is aligned with OB.



Step 3: Starting from the 0° on the protractor, count along the scale to 110° . Place a small dot or mark A at the 110° position on the protractor.



Step 4: Remove the protractor. Using a ruler, draw a straight line from O through the mark you made.



Did You Know?

NCF 2023 Curiosity and Inquiry CG-9

An **angle bisector** is a line or ray that divides an angle into **two equal parts**.

- ➔ Each of the two new angles has the same measure.
- ➔ For example, if a 90° angle is bisected, we get two equal angles of 45° each.



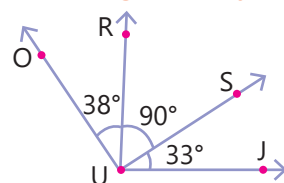
Exercise 2.6

NCF 2023 Practice and Reinforcement CG-1 CG-2 CG-3 CG-4

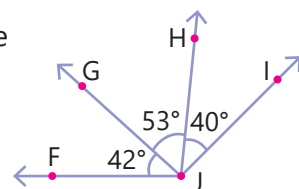
Use a ruler to draw the baseline and a protractor to measure the given angles. Label each angle clearly.

1. Draw the following angles:
 - a. 25°
 - b. 40°
 - c. 65°
2. Draw the following angles:
 - a. 90°
 - b. 120°
 - c. 135°
3. Draw the following angles:
 - a. 180°
 - b. 210°
 - c. 300°
4.
 - a. Draw an angle of 75° and name it $\angle ABC$.
 - b. Draw $\angle PQR = 110^\circ$.
 - c. Draw two angles of 45° each. Use your protractor to check if they together form a right angle.

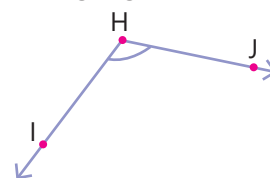
- b. What is the measure of $\angle RUJ$?



- c. What is the measure of $\angle FJI$?

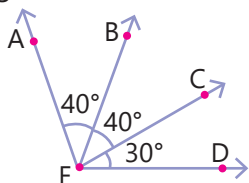


6. Draw an angle whose degree measure is the same as the angle given below. NCERT



Also, write down the steps you followed to draw the angle.

5. Find the measure of the angles.
 - a. What is the measure of $\angle AEC$?



Challenge Zone

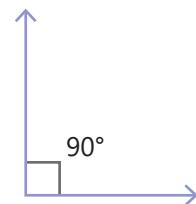
NCF 2023 Numeracy Skills CG-6 CG-7

Draw an angle of 150° . Use your protractor to bisect it. What is the measure of each part?

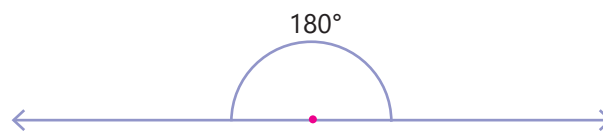
Types of Angles and their Measures

Angles can be classified based on their size or degree measure.

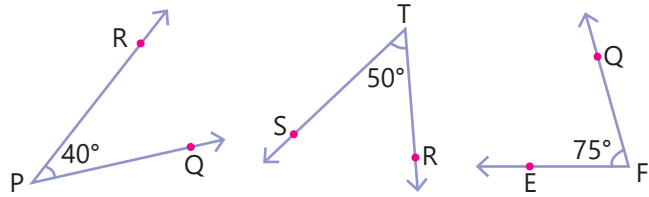
Right Angle: An angle that is exactly one-quarter of a full turn. It measures 90° .



Straight Angle: An angle whose arms form a straight line. It measures 180° .

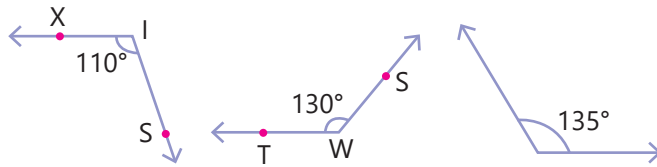


Acute Angle: An angle that measures greater than 0° but less than 90° .



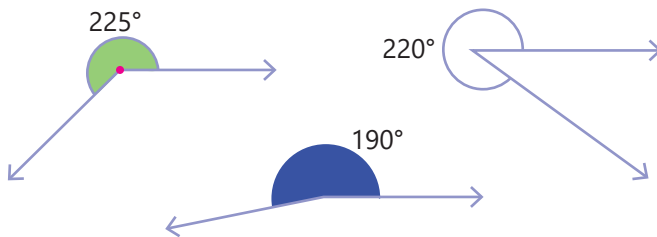
Examples of acute angles

Obtuse Angle: An angle that measures greater than 90° but less than 180° .



Examples of obtuse angles

Reflex Angle: An angle that measures greater than 180° but less than 360° .



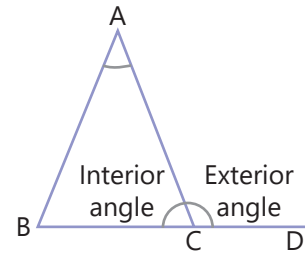
Examples of reflex angles

Interior and Exterior Angles

When two lines or rays meet at a point, they form **two types of angles:** interior and exterior angles.

Interior Angle: The angle formed **inside** the two arms is called the **interior angle**. It is the smaller angle at the vertex.

Exterior Angle: The angle formed **outside** the two arms is called the **exterior angle**. An exterior angle and its corresponding interior angle always form a linear pair, meaning they add up to 180° .

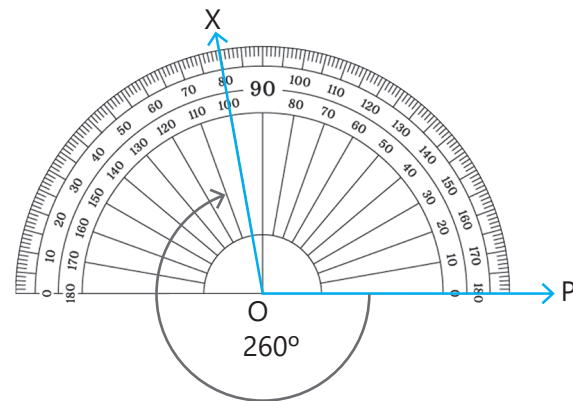


How to Measure a Reflex Angle

You can measure a reflex angle with a 180° protractor by following these steps:

Step 1: Place the protractor's centre point on the vertex of the angle. Align one arm of the angle with the baseline of the protractor.

Step 2: Read the degree measure of the smaller (internal) angle. For example, measure the smaller angle as 100° .



Step 3: Subtract the smaller angle from 360° to find the reflex angle.

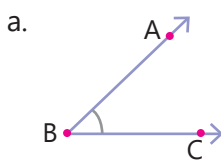
$$\begin{aligned} \text{Reflex Angle} &= 360^\circ - \text{Internal Angle} \\ &= 360^\circ - 100^\circ = 260^\circ. \end{aligned}$$



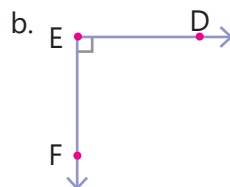
Exercise 2.7

NCF 2023 Practice and Reinforcement CG-1 CG-2 CG-3 CG-4

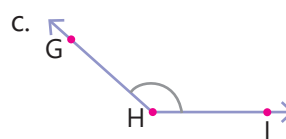
1. Classify these angles as acute, right, obtuse or reflex angles.



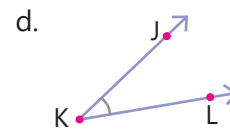
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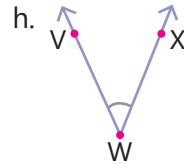
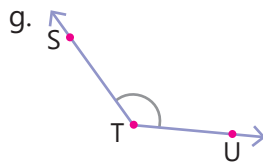
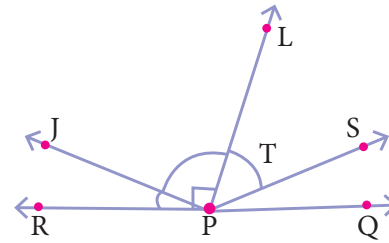
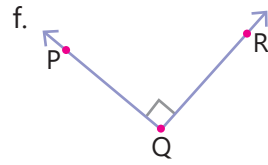
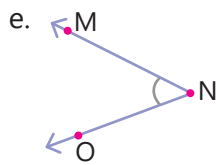
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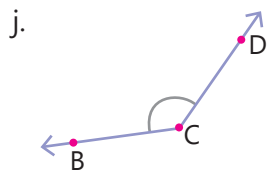
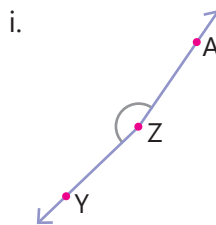


c. $\angle JPR =$

d. $\angle SPQ =$

e. $\angle JPS =$

f. $\angle LPQ =$



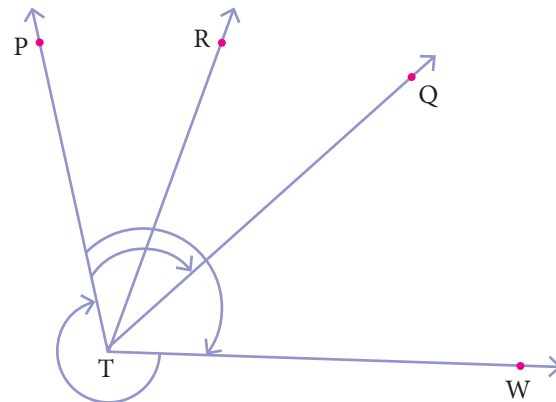
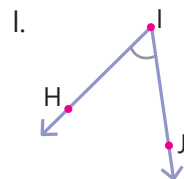
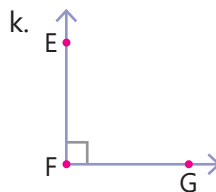
3. Use a protractor to find the measure of each angle. Then classify each angle as acute, obtuse, right or reflex. NCERT

a. $\angle PTR$

b. $\angle PTQ$

c. $\angle PTW$

d. $\angle WTP$



2. Look at the figures and identify the angles as acute, right, obtuse, reflex or straight.

a. $\angle T =$

b. $\angle RPQ =$



Points to Remember

NCF 2023 Memory Retention

- ➔ A point is a specific location with no size.
- ➔ A line extends endlessly in both directions.
- ➔ A line segment has two end points.
- ➔ A ray has one starting point and extends endlessly in one direction.
- ➔ An angle is formed when two rays meet at a vertex.

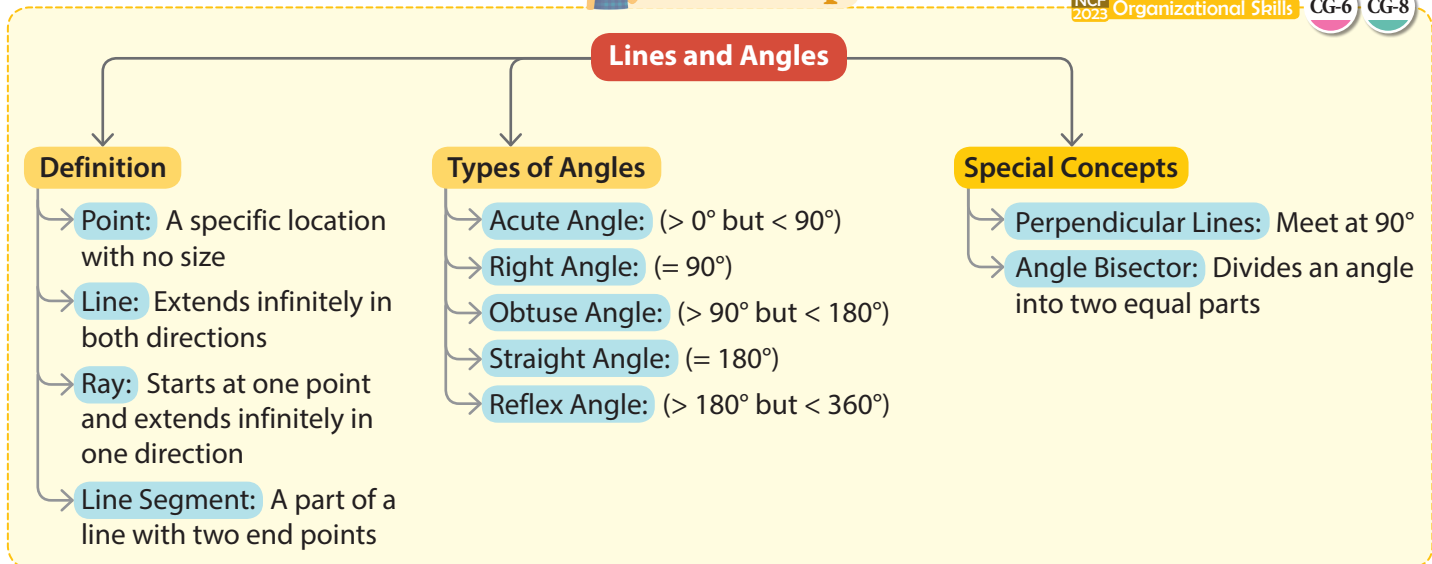
- ➔ Angles are measured in degrees ($^{\circ}$).
- ➔ Types of angles:
 - **Acute Angle:** An angle that measures less than 90° .
 - **Right Angle:** An angle that measures exactly 90° .
 - **Obtuse Angle:** An angle that measures more than 90° but less than 180° .

- **Straight Angle:** An angle that measures exactly 180° .
 - **Reflex Angle:** An angle that measures more than 180° but less than 360° .
 - **Complete Angle:** An angle that measures exactly 360° .
- ⇒ Perpendicular lines meet at a right angle.



Mind Map

NCF 2023 Organizational Skills CG-6 CG-8



Chapter Drill

A. Choose the correct option.

- A line segment has:

a. One endpoint	<input type="radio"/>	b. Two endpoints	<input type="radio"/>	c. No endpoints	<input type="radio"/>	d. Infinite endpoints	<input type="radio"/>
-----------------	-----------------------	------------------	-----------------------	-----------------	-----------------------	-----------------------	-----------------------
- Which of these has only one fixed endpoint?

a. Line	<input type="radio"/>	b. Ray	<input type="radio"/>	c. Line segment	<input type="radio"/>	d. Point	<input type="radio"/>
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- The symbol \perp is used to show:

a. Parallel lines	<input type="radio"/>	b. Perpendicular lines	<input type="radio"/>
c. Intersecting lines	<input type="radio"/>	d. Equal lines	<input type="radio"/>
- The angle formed by the hands of a clock at 3 o'clock is:

a. 60°	<input type="radio"/>	b. 90°	<input type="radio"/>	c. 120°	<input type="radio"/>	d. 180°	<input type="radio"/>
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- Which of these is a straight angle?

a. 45°	<input type="radio"/>	b. 90°	<input type="radio"/>	c. 120°	<input type="radio"/>	d. 180°	<input type="radio"/>
---------------	-----------------------	---------------	-----------------------	----------------	-----------------------	----------------	-----------------------
- A complete angle measures:

a. 90°	<input type="radio"/>	b. 180°	<input type="radio"/>	c. 270°	<input type="radio"/>	d. 360°	<input type="radio"/>
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7. Which of the following cannot be measured with a ruler?
 a. Line segment b. Line c. Point d. None of these
8. An angle less than 90° is called:
 a. Acute b. Obtuse c. Right d. Reflex
9. If $\angle A = 100^\circ$, then it is:
 a. Acute angle b. Right angle c. Obtuse angle d. Reflex angle
10. Two angles that form a straight line together are called:
 a. Complementary b. linear pair or supplementary
 c. Equal d. Right

B. Fill in the blanks.

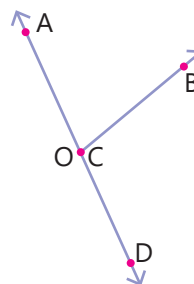
- A point shows an exact in space.
- A line has no fixed and extends endlessly.
- A ray has one fixed and extends endlessly in one direction.
- A straight angle is equal to right angles.
- The tool used to measure angles is called a
- An angle greater than 180° but less than 360° is called a angle.

C. Match the following.

- | | |
|------------------------------------|-------------------|
| 1. 90° | a. Straight angle |
| 2. 180° | b. Reflex angle |
| 3. 360° | c. Right angle |
| 4. $> 90^\circ$ but $< 180^\circ$ | d. Complete angle |
| 5. $< 90^\circ$ | e. Obtuse angle |
| 6. $> 180^\circ$ but $< 360^\circ$ | f. Acute angle |

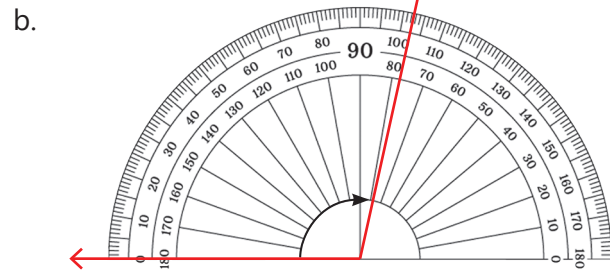
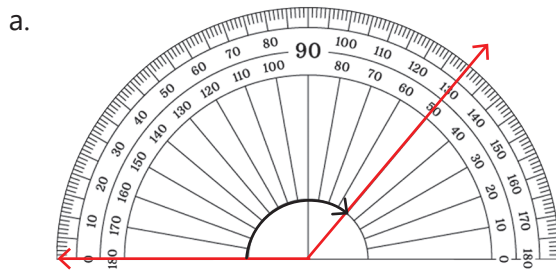
D. Very short answer type questions.

- Define a line segment.
- Write one real-life example of a ray.
- What is the vertex of an angle?
- Write the measure of a straight angle.
- Look at the following figure and name all the rays originating from:
- Look at the figure and name the following:

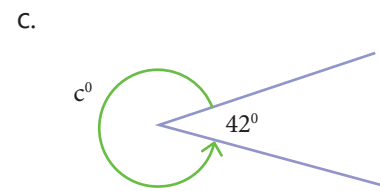
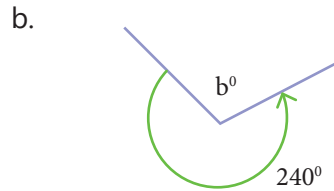
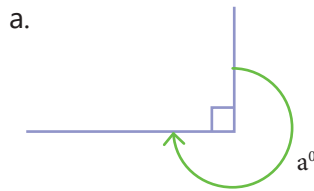


E. Short answer questions.

1. What is the relation between an interior and exterior angle at a vertex?
2. Write two examples of right angles from daily life.
3. Draw a right angle and label it as $\angle ABC$.
4. Draw an acute angle and label it as $\angle XYZ$.
5. What is the size of the angle being measured?

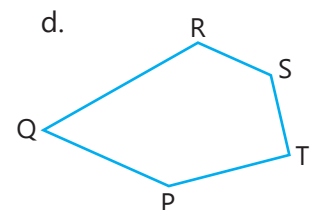
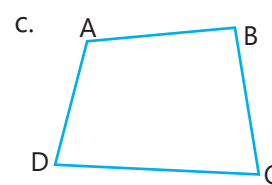
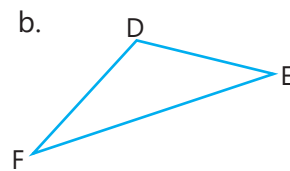
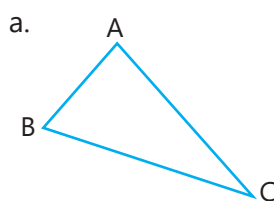


6. Find the size of the unknown angle in the following.



F. Long answer questions.

1. Draw angles with the following degree measures:
 - a. 60°
 - b. 45°
 - c. 180°
2. Construct an angle of 75° using a protractor and label it $\angle ABC$. Describe the steps taken.
3. Draw rough diagrams of two angles such that they have:
 - a. One point in common.
 - b. Two points in common.
 - c. Three points in common.
 - d. Four points in common.
 - e. One ray in common.
4. How many right angles do you make if you start facing:
 - a. south and turn clockwise to west?
 - b. north and turn anti-clockwise to east?
 - c. west and turn to west?
 - d. south and turn to north?
5. Measure all angles of the following figures. Use three-point notation to write down your answers.



Real-Life Based Questions

NCF 2023 Application Skills CG-2 CG-4 CG-5 CG-10

- A. The corner of your classroom blackboard shows an angle. Identify the type of angle.
- B. The blades of a fan form angles as they rotate. Classify the angles formed when two blades meet.

Competency-Based Questions

A. Higher Order Thinking Skills



NCF 2023 Critical Analysis CG-6 CG-7 CG-8

1. Can two obtuse angles be complementary? Why or why not?
2. An angle measures 40° . Without using a protractor, explain how you can construct its supplementary angle.

B. Case Study Based Questions

NCF 2023 Logical reasoning and interpretation CG-2 CG-5 CG-6

A carpenter is making a wooden frame for a window. He measures each corner to ensure it is a right angle.

1. Why must all corners of the window be right angles?
2. What will happen if one corner is an obtuse angle?

C. Assertion & Reason Questions

NCF 2023 Integrated Learning CG-6 CG-7

Each question consists of two statements, namely, **Assertion (A)** and **Reason (R)**. For selecting the correct answer, use the following code:

- A. Both Assertion and Reason are true and Reason is the correct explanation.
- B. Both Assertion and Reason are true, but Reason is not the correct explanation.
- C. Assertion is true, but Reason is false.
- D. Both Assertion and Reason are false.

1. **Assertion (A):** A straight angle measures 180° .
Reason (R): A straight angle is formed when two rays overlap each other.
2. **Assertion (A):** A line has no endpoints.
Reason (R): A line can be measured using a ruler.
3. **Assertion (A):** A reflex angle is larger than a straight angle.
Reason (R): Reflex angles always measure more than 180° .

Subject Integration Question

NCF 2023 Interdisciplinary Learning CG-10

1. Use a protractor to design a rangoli pattern using acute and obtuse angles.
2. Mark directions North, East, South, West on paper. Identify the angles formed between them.

ART

GEOGRAPHY