7

Chapter

Lines and Angles

We'll cover the following key points:

→ Pairs of angles

→ Parallel lines and transversal

→ Angles formed when a transversal cuts two parallel lines

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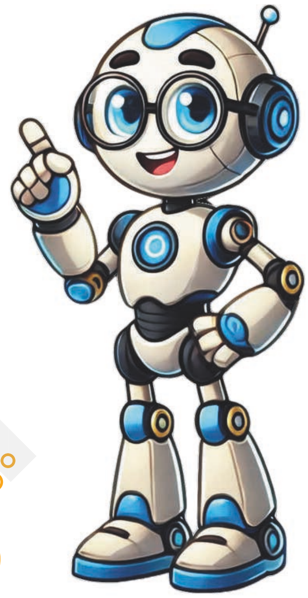


Hi, I'm EeeBee

Learning Outcomes

By the end of this chapter, students will be able to:

- Define and identify different types of lines, such as straight, curved, parallel, perpendicular, and intersecting lines.
- Understand and apply the concepts of angles, including acute, right, obtuse, and reflex angles.
- Measure angles accurately using a protractor and identify the types of angles based on their measure.
- Identify and understand the properties of parallel lines and their relationship with transversals, such as corresponding angles, alternate interior angles, and alternate exterior angles.
- Understand and apply the concept of complementary and supplementary angles, including solving problems involving these relationships.
- Solve problems involving vertical angles, and understand that vertical angles are equal.
- Recognize and apply the concept of angle sum property in polygons, particularly in triangles and quadrilaterals.
- Draw and label different types of angles and lines in geometric diagrams, accurately identifying their relationships.
- Understand and apply the concepts of symmetry and reflection in geometric shapes and lines.
- Solve real-life problems involving lines and angles, including in construction, design, and navigation, and relate these concepts to everyday situations.

Mind Map

LINES AND ANGLES

Related Angles

i. Complementary Angles

Sum of two angles is 90°

e.g.,

- 30° and 60°

  $30^\circ + 60^\circ = 90^\circ$
- 40° and 50°

  $40^\circ + 50^\circ = 90^\circ$

ii. Supplementary Angles

Sum of two angles is 180°

- 100° and 80°

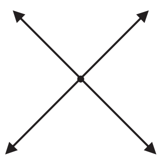
  $100^\circ + 80^\circ = 180^\circ$
- 90° and 90°

  $90^\circ + 90^\circ = 180^\circ$

Pair of lines

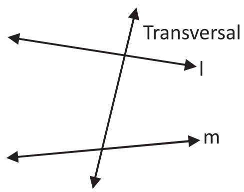
i. Intersecting lines

One point common

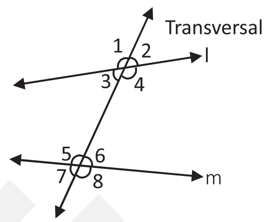


ii. Transversal

- A line intersects two or more lines at distinct points.

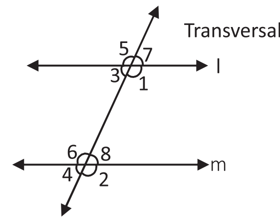


Angle made by transversal



Interior angles	∠3, ∠4, ∠5, ∠6
Exterior angles	∠1, ∠2, ∠7, ∠8
Pairs of Corresponding angles	∠1 and ∠5, ∠2 and ∠6, ∠3 and ∠7, ∠4 and ∠8
Pairs of Alternate interior angles	∠3 and ∠6, ∠4 and ∠5
Pairs of Alternate exterior angles	∠1 and ∠8, ∠2 and ∠7
Pairs of interior angles on the same side of the transversal	∠3 and ∠5, ∠4 and ∠6

Transversal of parallel lines



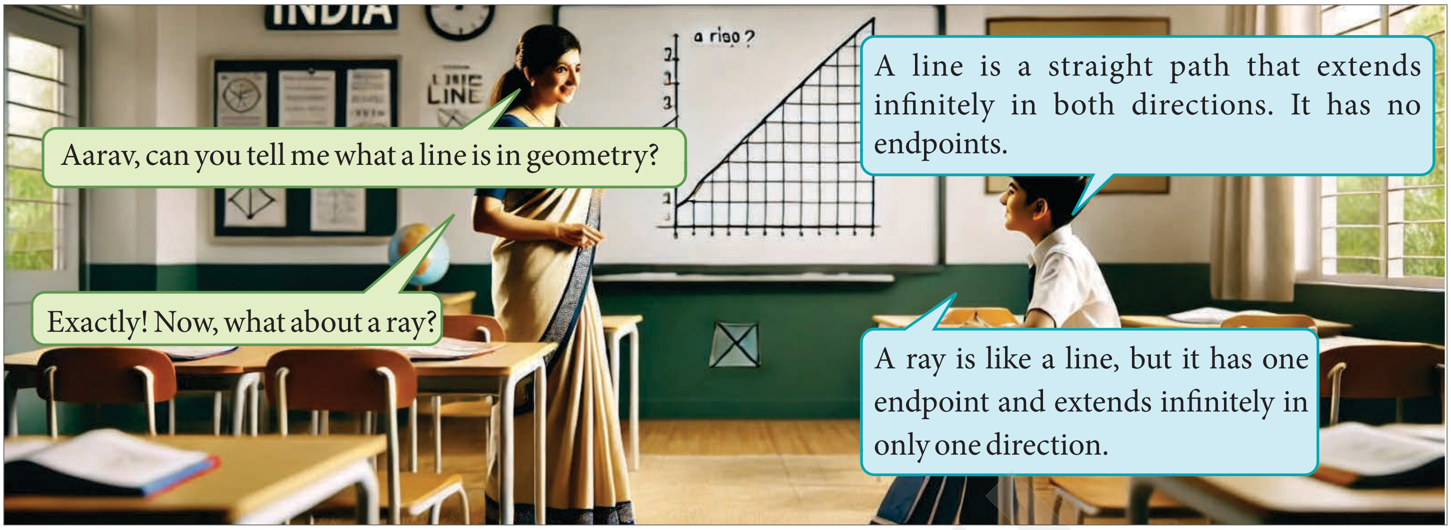
i. Corresponding angles equal.

ii. Alternate interior angles equal.

iii. Alternate exterior angles equal.

Based on NCERT*

Introduction



Pairs of Angles

A combination of two angles is called a pair of angles.

There are five types of pairs of angles.

(*i*) Adjacent angles

(*ii*) Linear pair angles

(*iii*) Complementary angles

(*iv*) Supplementary angles

(*v*) Vertically opposite angles

Let us study them one by one.

Take a Task

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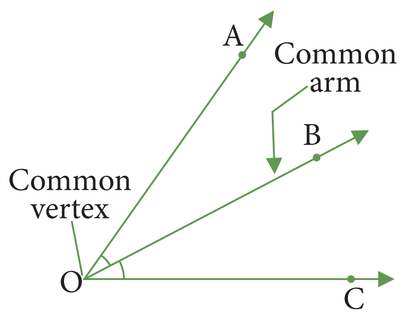
Adjacent Angles

Let us draw an angle, say ∠AOC and a ray OB in between the angle in such a way that two angles are formed with a common arm and common vertex as shown in the figure alongside.



Thus, two angles ∠AOB and ∠BOC are formed having common arm OB and vertex O. Now, these angles formed are said to be adjacent angles.

Two angles are said to be adjacent if they have a common vertex and a common arm between two other arms.

To Check Wheather Pairs of Angles are Adjacent

Working Rules

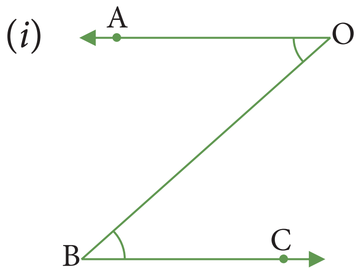
Step 1 : First, observe whether the two given angles have a common vertex.

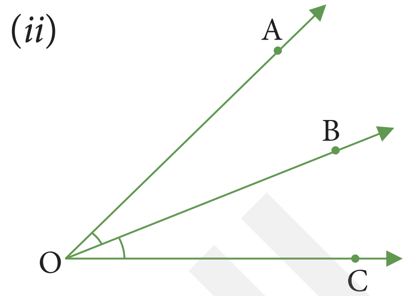
Step 2 : Then, observe whether the two angles have a common arm.

Step 3 : Lastly, observe if the other two arms (other than the common arm) are on the opposite sides of the common arm.

Step 4 : If all the above three steps are satisfied, then the angles formed are adjacent angles.

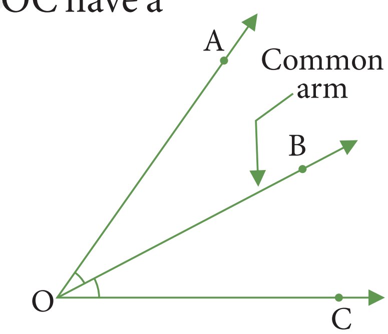
Example 1 : *Check whether the following pairs of angles are adjacent:*





Solution : (*i*) In the given figure, the two angles ∠AOB and ∠OBC do not have a common vertex. Hence, they are not said to be adjacent.

(*ii*) In the given figure, the two angles ∠AOB and ∠BOC have a common vertex 'O' and a common arm 'OB'. Also, the other two arms 'AO' and 'OC' are on the opposite sides of the common arm OB. As all the three conditions are satisfied, the two angles ∠AOB and ∠BOC are said to be adjacent.



Liner Pair

A pair of adjacent angles is said to form a linear pair, if their non-common arms lie on one line.

To Check whether Pairs of Angles are Linear

Step 1 : First, observe whether the two angles have a common vertex.

Step 2 : Then, observe whether the other two angles have a common side.

Step 3 : Lastly, observe whether the other two arms (other than the common arm) lie on one line (i.e. straight line).

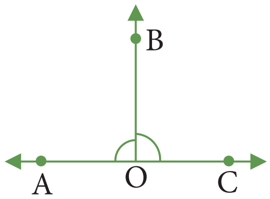
Step 4 : If all the above three steps are satisfied, then the pairs of angles are said to be linear.

Note

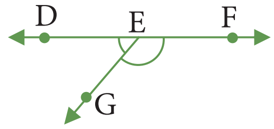
1. The sum of the measures of a linear pair angles is always 180°.
2. Linear pair angles are always adjacent.
3. Adjacent angles may or may not form a linear pair.

Example 2 : Check whether the following angles form a linear pair:

(*i*)



(*ii*)

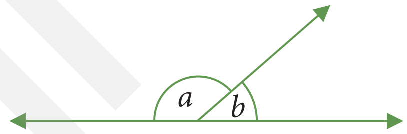


Solution : (*i*) In the given figure, the pair of angles (∠AOB, ∠BOC) has a common vertex O, a common arm OB and the other two arms OA and OC are on the same straight line AC.

Thus, ∠AOB and ∠BOC form a linear pair.

(*ii*) In the given figure, the pair of angles (∠DEG, ∠FEG) has a common vertex E, a common arm EG and the other two arms DE and EF are on the same straight line DF.

Thus, ∠DEG and ∠FEG form a linear pair.



Linear Pair

Working Rules

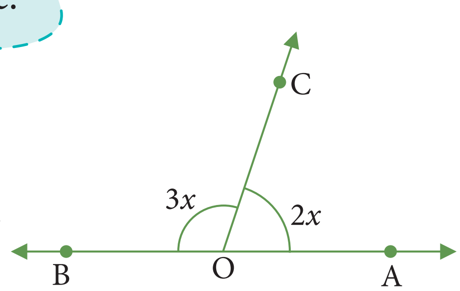
Step 1 : Check whether ∠a and ∠b form a linear pair or not.

Step 2 : If ∠a and ∠b form a linear pair, then ∠a + ∠b = 180°.

Step 3 : Solve the equation and find the measure of each angle.

Example 3 : In the Fig, given at right, find the value of x.

(*i*) 18° (*ii*) 36° (*iii*) 72° (*iv*) 48°



Solution : We see that ∠AOC and ∠BOC form a linear pair.

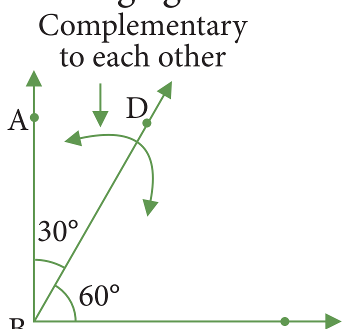
Thus, ∠AOC + ∠BOC = 180°

i.e. $2x + 3x = 180°$ or $5x = 180°^{36}$ or $x = 36°$

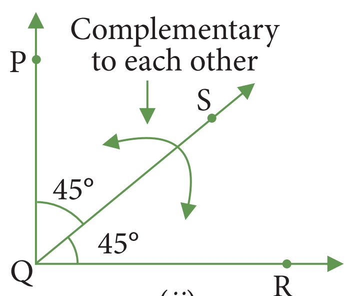
Complementary Angles

Two angles are said to be complementary, if the sum of their degree measures is 90°.

Look at the following figures.



(*i*)



(*ii*)

In *(i)*, the two angles 30° and 60° ; in *(ii)*, 45° and 45° are complementary to each other.

It is important to note that complementary angles need not be adjacent. It is only the sum of their degree measures that determines weather they are complementary or not.

To Find the Complements of the Angles

We know that if two angles are complementary, the sum of their degree measures is 90°.

When the measure of one angle is given, the measure of the other angles can be found out, such that the sum of their measures becomes 90°.

i.e., ***Complement angle = 90° – given angle***

Example 4 : *Find the complement of 10 °.*

Solution : The complement of 10° = 90° – 10° = 80°, because 80° + 10° = 90°.

Each angle is said to be complement of the other.

Supplementary Angles

Two angles are said to be supplementary, if the sum of their degree measures is 180°.

To Find the Supplements of the Angles

We know that if two angles are supplementary, sum of their degree measures is 180°.

When the measure of one angle is given, the measure of another angle is found such that the sum of their measures becomes 180°.

i.e., ***Supplement angle = 180° – given angle***

Example 5 : Find the supplement of 90°.

Solution : The supplement of 90° = 180° – 90°

= 90° , as 90° + 90° = 180°.

Example 6: Find the supplement of 0°.

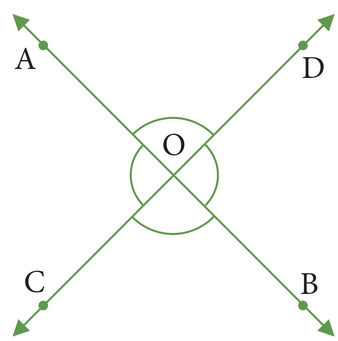
(*a*) 0° (*b*) 90° (*c*) 180° (*d*) None

Solution: Supplement angle of 0° = 180° – 0° = 180°

So, option (c) is correct

Vertically Opposite Angles

The angles opposite to the common vertex formed by the intersection of two lines having no common arm are known as vertically opposite angles.



Now, let us first prove that Vertically opposite angles are equal and then verify the proof.

Given : Two lines AB and CD are intersecting at a point O forming the vertically opposite angles such as (∠AOC, ∠BOD) and (∠AOD, ∠BOC).

To Prove: ∠BOD = ∠AOC and ∠AOD = ∠BOC

Proof: Here, ∠AOD and ∠BOD form a linear pair.

Therefore, ∠AOD + ∠BOD = 180° ... (*i*)

Similarly, ∠AOD and ∠AOC form a linear pair.

Therefore, ∠AOD + ∠AOC = 180° ...(*ii*)

From (*i*) and (*ii*), we get

$$\cancel{\angle AOD} + \angle BOD = \cancel{\angle AOD} + \angle AOC$$

or $$\angle BOD = \angle AOC$$

Similarly, we can prove that ∠AOD = ∠BOC

Therefore, vertically opposite angles are equal. **Hence proved.**

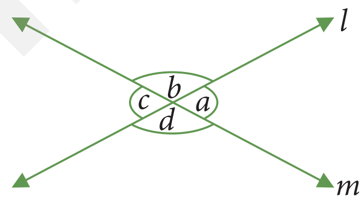
Now, let us verify that vertically opposite angles are equal.

First, draw a pair of intersecting lines, say *l* and *m*.

Mark the angles so obtained, say ∠*a*, ∠*b*, ∠*c* and ∠*d*.

Using protractor measure these angles.

Repeat the process for another pair of intersecting straight lines.



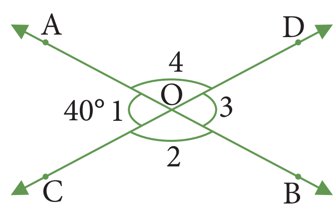
Now, considering the two situations, prepare a table as follows :

Situation	∠*a*	∠*b*	∠*c*	∠*d*
Case I	30°	150°	30°	150°
Case II	60°	120°	60°	120°

Here, we see that ∠*a* = ∠*c* and ∠*b* = ∠*d*.

Hence, the property "vertically opposite angles are equal", is verified.

Example 7 : In the figure, if ∠1 = 40°, find the measure of the other angles.



Solution : ∠AOC + ∠AOD = 180° (Linear pair)

or 40° + ∠AOD = 180° [∠1 = ∠AOC = 40° (given)]

or ∠AOD = 180° – 40° = 140°

AB and CD are two intersecting lines forming the angles opposite to the common vertex O and have no common arm.

Therefore, $\angle AOC = \angle BOD$ (Vertically opposite angles)

So, $\angle BOD = 40°$

Now, $\angle BOD + \angle BOC = 180°$ (Linear pair)

or $40° + \angle BOC = 180°$

or $\angle BOC = 140°$

Now, we get $\angle 1 = \angle 3 = 40°$

and $\angle 2 = \angle 4 = 140°$

Check Your Progress

Experiential Learning

Which of the following statements is/are "True' or 'False'?

(*a*) The sum of two angles which form a linear pair is always equal to 180°. ☐

(*b*) The complement of 90° is 90°. ☐

(*c*) The supplement of an acute angle is always an obtuse angle. ☐

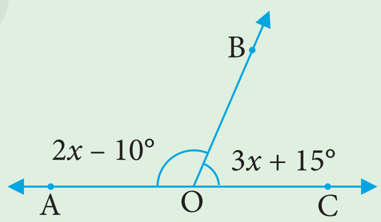
(*d*) The supplement of a right angle is also a right angle. ☐

Exercise 7.1

1. In the figure given at right, the value of *x* is

(*i*) 70° (*ii*) 25°

(*iii*) 80° (*iv*) 35°



2. An angle is of 75°. Find its complement.

3. One of the angles of a linear pair is 72°. Find the other angle.

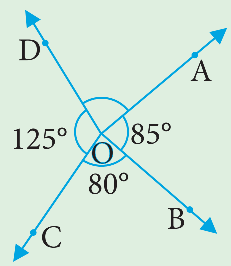
(*i*) 72° (*ii*) 108° (*iii*) 144° (*iv*) 18°

4. From the given figure, answer the following questions:

(*i*) Do $\angle AOB$ and $\angle BOC$ form a linear pair?

(*ii*) Are $\angle AOB$ and $\angle COD$ vertically opposite angles?

(*iii*) Do $\angle AOD$ and $\angle DOC$ form a linear pair?



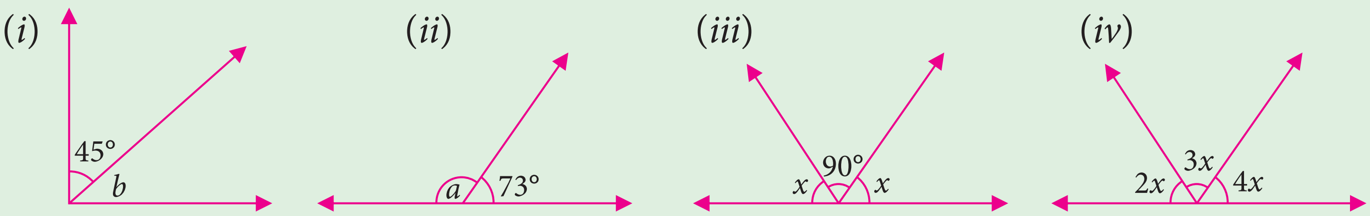
5. Write the complement of each of the following angles:

(*i*) 53° (*ii*) 66° (*iii*) 90° (*iv*) 12° (*v*) 39°

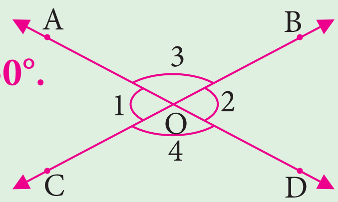
6. Write the supplement of each of the following angles:

(*i*) 150° (*ii*) 100° (*iii*) 163° (*iv*) 92° (*v*) 180°

7. Find the value of a, b or x in each of the following :

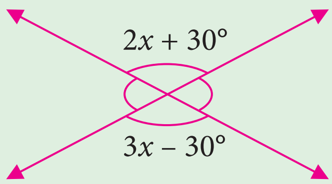


8. In the following figure find the measure of other angles, if $\angle 1 = 50°$.

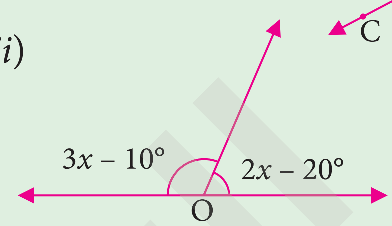


9. Find the value of x in each figure :

(i)



(ii)



10. An angle is five times of its supplement. Find the angle.

Parallel Lines and Transversal

Parallel Lines

Two lines in a place are called parallel, if they do not meet when produced indefinitely on either side.

Example : Railway lines, opposite edges of a scale, a blackboard or the floor of a classroom are examples of parallel lines.

Two or more straight lines are said to be parallel to each other if they lie in the same plane and do not meet when produced on either side.

In Figure 1, line l is parallel to line m and we write it as $l \parallel m$.

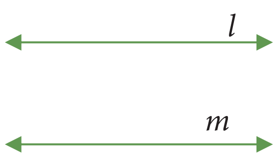


Fig. 1

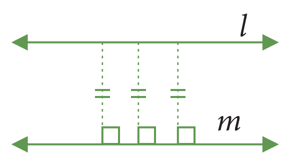


Fig. 2

Note : The distance between the parallel lines is same everywhere (Fig.2).

Transversal

A line that intersects two or more lines at distinct points is transversal.

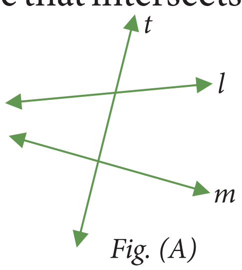


Fig. (A)

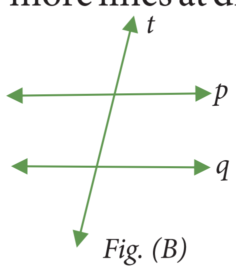


Fig. (B)

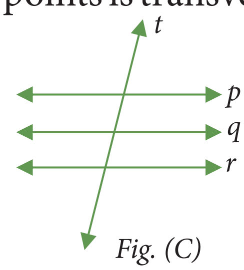


Fig. (C)

Take a Task

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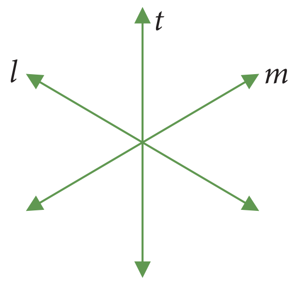
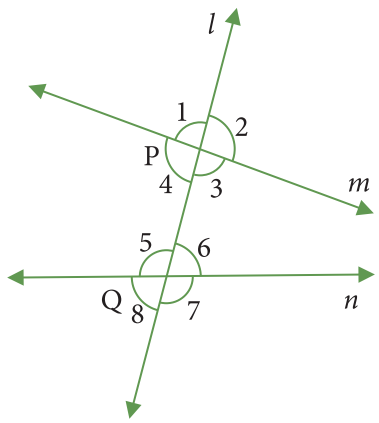
Figure (A) shows a pair of non-parallel lines l and m cut by a transversal t.
Figure (B) shows a pair of parallel lines p and q cut by a transversal t.
Figure (C) shows three parallel lines p,q and r cut by a transversal t.



Note : In Figure the line t is not a transversal as it does intersect lines l and m at different points.

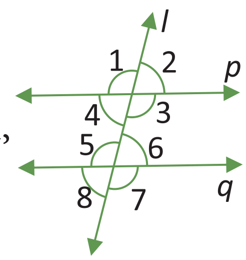
Angles Made by a Transveral

When a transversal cuts two or more straight lines, the angles formed are identified by different names by virtue of their position. In Figure transveral l intersects straight lines m and n at P and Q, respectively. The eight angles marked 1 to 8 have their special names.



Name	Angles
Interior angles	$\angle 3, \angle 4, \angle 5, \angle 6$
Exterior angles	$\angle 1, \angle 2, \angle 7, \angle 8$
Pairs of corresponding angles	$\angle 1$ and $\angle 5$, $\angle 2$ and $\angle 6$ $\angle 3$ and $\angle 7$, $\angle 4$ and $\angle 8$
Pairs of alternate interior angles	$\angle 3$ and $\angle 5$, $\angle 4$ and $\angle 6$
Pairs of alternate exterior angles	$\angle 1$ and $\angle 7$, $\angle 2$ and $\angle 8$
Pairs of interior angles on the same side of the transversal	$\angle 3$ and $\angle 6$, $\angle 4$ and $\angle 5$

Angles Formed When a Transversal Cuts Two Parallel Lines



In Figure $p \parallel q$ and transversal l cuts p and q forming angles as shown. Then,

1. the angles of each pair of corresponding angles are equal,
   i.e., $\angle 1 = \angle 5, \angle 2 = \angle 6, \angle 3 = \angle 7$ and $\angle 4 = \angle 8$.
2. the angles of each pair of alternate interior angles are equal,
   i.e., $\angle 3 = \angle 5$ and $\angle 4 = \angle 6$.
3. the sum of each pair of interior angles on the same side of the transversal is 180°,
   i.e., $\angle 3 + \angle 6 = 180°$ and $\angle 4 + \angle 5 = 180°$.

Take a Task

Watch Remedial

The above results may be summarised as follows.

- If two parallel lines are intersected by *a* transversal, then:
  - the angles of each pair of corresponding angles are equal,

- the angles of each pair of alternate interior angles are equal,
- the sum of each pair of interior angles on the same side of the transversal is 180°.

- **Conversely,** if two lines are intersected by a transversal such that:
  - the angles of any pair of corresponding angles are equal, or
  - the angles of any pair of alternate interior angles are equal, or
  - the sum of any pair of interior angles on the same side of the transversal is 180°, then the two lines are parallel.

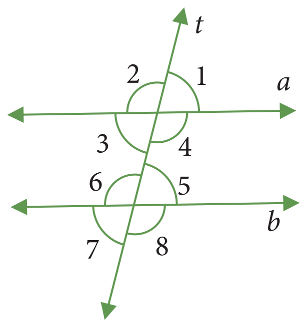
Check Your Progress

Experiential Learning

Fill in the blanks.

1. If two parallel lines are cut by a transversal, then each pair of corresponding angles is ______________ .
2. Two lines that are cut by a transversal are parallel, if the sum of any pair of interior angles on the same side of the transversal is ______________ .
3. If two lines are intersected by a transversal such that corresponding angles are equal, then the given lines are ______________ .

Example 8 : If Figure $a \parallel b$ and t is the transversal. If $\angle 1 = 50°$, find the measure of all the other angles marked in the figure.



Solution :

$\angle 1 + \angle 2 = 180°$ [Linear pair]

$\Rightarrow 50° + \angle 2 = 180°$ [$\because \angle 1 = 50°$, given]

$\Rightarrow \angle 2 = 180° - 50°$

$\Rightarrow \angle 2 = 130°$ ...(*i*)

$\angle 3 = \angle 1$ [Vertically opposite angles]

$\Rightarrow \angle 3 = 50°$ [$\because \angle 1 = 50°$, given]... (*ii*)

$\angle 4 = \angle 2$ [Vertically opposite angles]

$\Rightarrow \angle 4 = 130°$ [Using (*i*)] ... (*iii*)

$\angle 5 = \angle 1$ [Corresponding angles, $a \parallel b$]

$\Rightarrow \angle 5 = 50°$ [$\because \angle 1 = 50°$, given]

$\angle 6 = \angle 2$ [Corresponding angles, $a \parallel b$]

$\Rightarrow \quad \angle 6 = 130°$ [Using (*i*)]

$\angle 7 = \angle 3$ [Corresponding angles $a \parallel b$]

$\Rightarrow \quad \angle 7 = 50°$ [Using (*ii*)]

$\angle 8 = \angle 4$ [Corresponding angles $a \parallel b$]

$\Rightarrow \quad \angle 8 = 130°$ [Using (*iii*)]

Thus, $\angle 2 = 130°, \angle 3 = 50°, \angle 4 = 130°, \angle 5 = 50°, \angle 6 = 130°, \angle 7 = 50°$ and $\angle 8 = 130°$.

Example 9 : In Figure. If AB || CD, $\angle APQ = 60°$ and $\angle PRD = 125°$, find x and y.

Solution :

$\angle x = \angle APQ$ [Alternate angles, AB || CD]

$\Rightarrow \quad \angle x = 60°$ [$\because APQ = \angle 60°$, (given)]

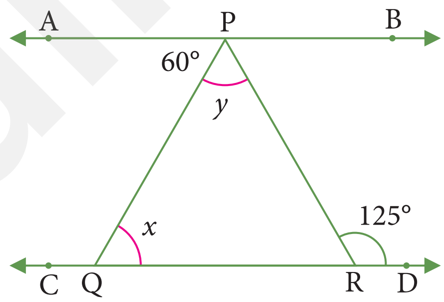
$\angle APR = \angle PRD$ [Alternate angles, AB || CD]

$\Rightarrow \quad \angle APQ + \angle QPR = \angle PRD$

$\Rightarrow \quad 60° + y = 125°$

$\Rightarrow \quad y = 125° - 60° = 65°$

Hence, $x = 60°$ and $y = 65°$.



Example 10 : In Figure AB || CD. Find the values of x, y and z.

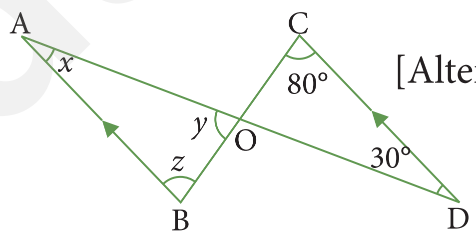
Solution :

$\angle BAD = \angle ADC$ [Alternate angles, AB || CD]

$\Rightarrow \quad x = 30°$ ...(*i*)

$\Rightarrow \quad \angle ABC = \angle DCB$ [Alternate angles, AB || CD]

$\Rightarrow \quad z = 80°$ ...(*ii*)



In ΔAOB, we have

$x + y + z = 180°$ [Sum of angles of a triangle]

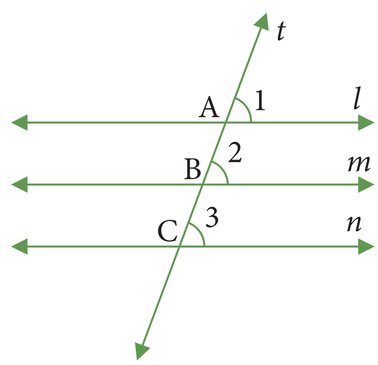
$\Rightarrow \quad 30° + y + 80° = 180°$ [Using (*i*)]

$\Rightarrow \quad 110° + y = 180°$

$\Rightarrow \quad y = 180° - 110° = 70°$

Hence, $x = 30°$, $y = 70°$ and $z = 80°$.

Example 11 : Prove that two lines which are parallel to the same given line are parallel to each other.



Solution : Let two lines l and m be parallel to the same given line n, *i.e.*, $l \parallel n$ and $m \parallel n$.

Draw a transversal t, intersecting l, m and n at A, B and C, respectively.

Since $l \parallel n$ and transversal t cuts them at A and C, respectively.

$\therefore \quad \angle 1 = \angle 3$ [Corresponding angles] ..(i)

Also $m \parallel n$ and transversal t cuts them at B and C, respectively.

$\therefore \quad \angle 2 = \angle 3$ [Corresponding angles]...(ii)

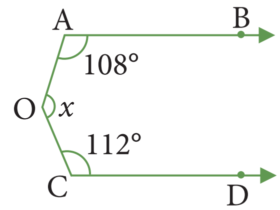
$\therefore \quad \angle 1 = \angle 2$ [Using (i) and (ii)]

But $\angle 1$ and $\angle 2$ are corresponding angles formed when tranversal t cuts l at A and m at B.

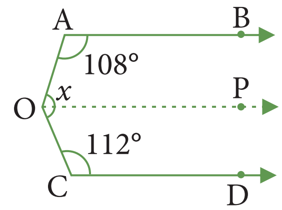
$\therefore \quad l \parallel m$ **Hence Proved.**

Note : The above property can be extended to more than two lines also.

Example 12 : In Figure, CD || AB. Find the value of x.



Solution : Through O, draw OP || AB (Fig.).



CD || AB [Given]

$\therefore$ OP || CD [Lines which are parallel to the same line are parallel to each other.]

$\therefore \quad \angle POC + \angle DCO = 180°$ [Cointerior angles, OP || CD]

$\Rightarrow \quad \angle POC + 112° = 180°$

$\Rightarrow \quad \angle POC = 68°$ ...(i)

Again, $\angle BAO + \angle POA = 180°$ [Cointerior angles, OP || AB]

$\Rightarrow \quad 108° + \angle POA = 180°$

$\Rightarrow \quad \angle POA = 72°$ ...(ii)

Now, $\quad x = \angle POC + \angle POA$

$\Rightarrow \quad x = 68° + 72°$ [Using (i) and (ii)]

$\Rightarrow \quad x = 140°$

Hence, $x = 140°$.

Check Your Progress

Experiential Learning

1. In the given figures, AB || CD. Find the value of x.

(*a*)

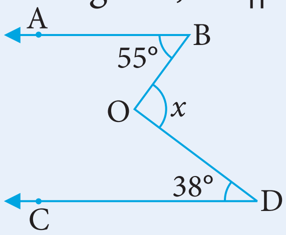


Fig. 1*a*

(*b*)

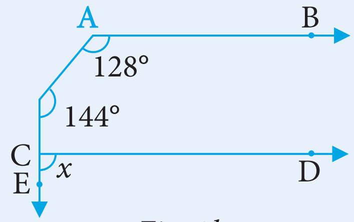
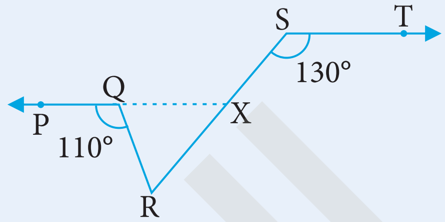


Fig. 1*b*

2. In Figure, if PQ || ST, $\angle PQR = 110°$, and $\angle RST = 130°$, find $\angle QRS$.

[Hint: Produce PQ to intersect SR at X.]



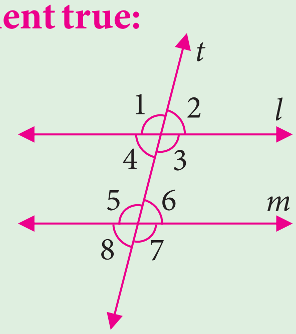
Exercise 7.2

1. State the property used in each of the following to make the statement true:

(*a*) If $l \parallel m$, then $\angle 3 = \angle 7$.

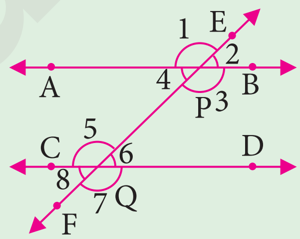
(*b*) If $\angle 3 = \angle 5$, then $l \parallel m$.

(*c*) If $\angle 3 + \angle 6 = 180°$, then $l \parallel m$.

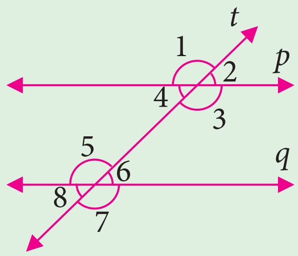


2. In Figure AB || CD. EF intersects them at P and Q, respectively.

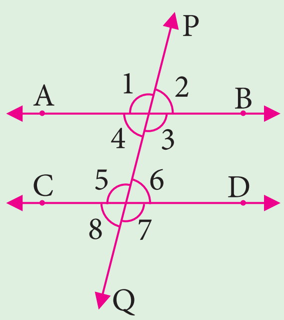
If $\angle 1 = 130°$, find all the other angles.



3. In Figure , $p \parallel q$ and t is a transversal such that $\angle 1 = 135°$. Find the measures of $\angle 2$, $\angle 3$, $\angle 4$, $\angle 5$, $\angle 6$, $\angle 7$ and $\angle 8$.



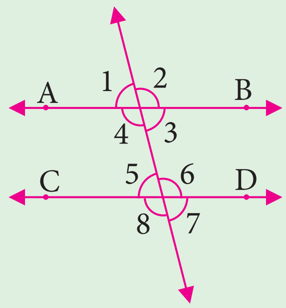
4. In Figure, AB || CD and PQ is the transversal. If $\angle 1 : \angle 2 = 3 : 2$, find the measure of all the angles from 1 to 8.



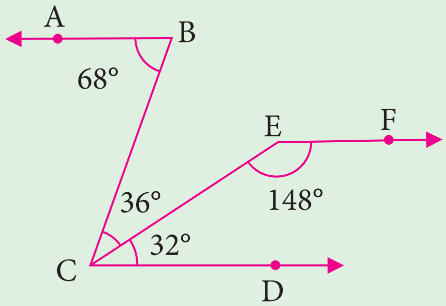
5. In Figure, AB || CD. If $\angle 1 = (3x-10)^\circ$ and $\angle 7 = (5x-30)^\circ$, find the measure of $\angle 1$ and $\angle 7$.

[Hint : $\angle 1 = \angle 3$ (verically opposite angles) $\Rightarrow$ $\angle 3 = (3x-10)^\circ$.

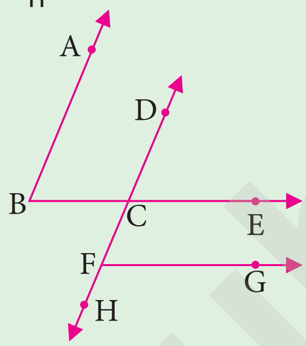
$\angle 3 = \angle 7$ (corresponding angles) $\Rightarrow 3x - 10 = 5x - 30$.]



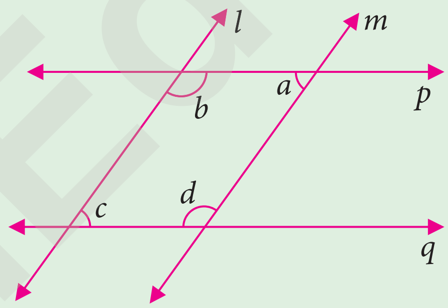
6. In Figure, show that AB || EF.



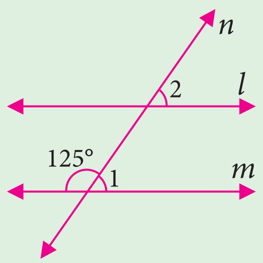
7. In Figure, AB || DH and BC || FG. If $\angle ABC = 60^\circ$, find $\angle GFH$.

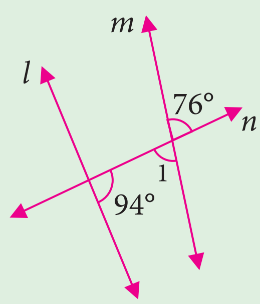


8. In Figure, $l \parallel m$ and $p \parallel q$. Find the measure of $\angle a$, $\angle b$, $\angle c$ and $\angle d$.



9. In the given figures, decide whether l is parallel to m or not.





Chapter-end Exercise

Gap Analyzer™

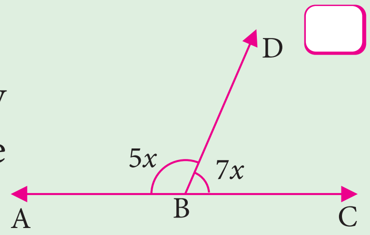
A. Tick (✓) the correct option:

1. Two adjacent angles have:

   (*a*) two common arms ☐ (*b*) a common vertex ☐

   (*c*) a common arm for angle bisector ☐ (*d*) All of these ☐

2. In the adjoining figure, two marked angles are supplementary to each other. If the angle measuring $2x$ is halved, then the measure of the other angle:



   (*a*) becomes double ☐ (*b*) becomes $5x$ ☐

   (*c*) becomes half ☐ (*d*) becomes $4x$ ☐

3. The two angles measuring $4x$ and $6x$ are adjacent angles. If the smaller angle is expanded by 10°, the two angles become complementary to each other.

   The greater angle of the two angles measures:

   (*a*) 54° ☐ (*b*) 60° ☐ (*c*) 48° ☐ (*d*) 52° ☐

4. The difference between the sums of two supplementary angles and two complementary angles is:

   (*a*) 90° ☐ (*b*) 45° ☐ (*c*) 0° ☐ (*d*) 1° ☐

B. True / False

Knowledge Application

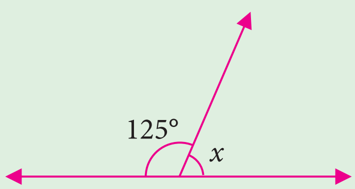
1. Two adjacent angles sometimes form a linear pair. ☐
2. Two obtuse angles can be supplementary. ☐
3. Two supplementary angles form a linear pair. ☐
4. If an angle is less than 90°, its supplement will also be less than 90°. ☐
5. If an angle is greater than 45°, its complement will be less than 45°. ☐

C. Answer the following questions :

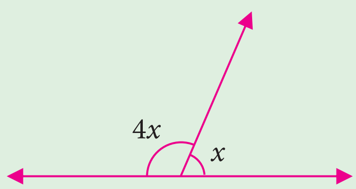
Problem Solving

1. Find the degree measure of each angle in the following linear pairs :

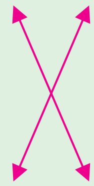
   (*i*)



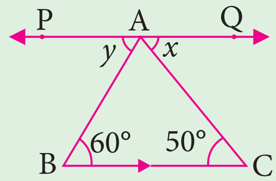
   (*ii*)



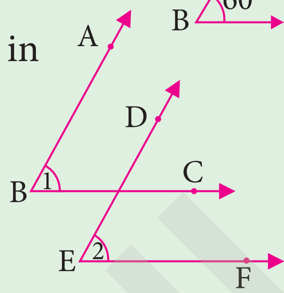
2. In the adjoining figure, mark the vertically opposite angles. Which of these are equal to one another?



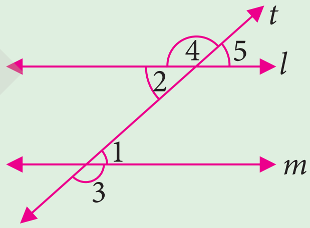
3. In the adjoining figure, find x and y, if PQ || BC.



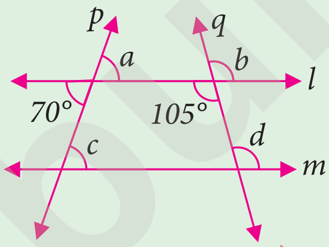
4. The arms of two angles are parallel as shown in the following figure. If $\angle 1 = 70°$, find $\angle 2$.



5. In the adjacent figure, if $l \parallel m$ and $\angle 1 = 43°$, find the measures of $\angle 2, \angle 3, \angle 4$ and $\angle 5$.



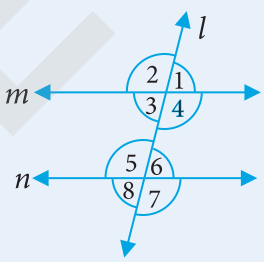
6. In the figure given at here, $l \parallel m$ and p, q are two transversals. Find the values of a, b, c, d.



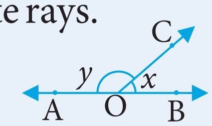
Mental Maths

Critical Thinking

1. In the following figure: $\angle 3 = 61°$ and $\angle 7 = 118°$. Is line $m \parallel n$?



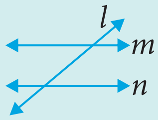
2. An angle is equal to five times its complement. Determine its measure.
3. In the following figure OA and OB are opposite rays.
   (*i*) If $x = 75°$, what is the value of y?
   (*ii*) If $y = 110°$, what is the value of x?

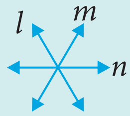


HOTS (Higher Order Thinking Skills)

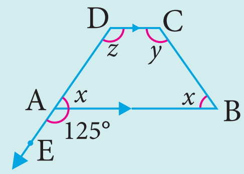
Critical Thinking

1. Reena has drawn figure (*i*) and Sunita has drawn figure (*ii*) as shown below. Both of them have marked line *l* as the transversal. Who is wrong and why ?

(*i*) 

(*ii*) 

2. In the given figure, AB || CD and DA has been produced to E, so that ∠BAE = 125°.



If ∠BAD = *x*, ∠ABC = *x*, ∠BCD = *y* and ∠ADC = *z*, find the values of *x*, *y*, *z*.

Assertion and Reason

Experiential Learning

In each of the following questions, an Assertion (A) and a corresponding Reason (R) supporting it is given:

Study both the statements and state which of the following is correct:

(*a*) Both A and R are true and R is the correct explanation of A.

(*b*) Both A and R are true but R is not the correct explanation of A.

(*c*) A is true but R is false.

(*d*) A is false but R is true.

1. **Assertion (A) :** Linear pair angles are always adjacent.
   Reason (R) : Adjacent angles may or may not form a linear pair.
2. **Assertion (A) :** The angles which form a linear pair are always supplementary.
   Reason (R) : The supplement angle of 90° is 90°.
3. **Assertion (A) :** Vertically opposite angles are always equal.
   Reason (R) : If two lines are parallel, the perpendicular distance between them remains change.
4. **Assertion (A) :** Two obtuse angles can be supplementary.
   Reason (R) : Adjacent angles can be complementary.
5. **Assertion (A) :** If an angle is greater than 45°, its complement will be less than 45°.
   Reason (R) : If two lines 1_1 and l_2 are perpendicular to a line *t*, then $L_1 \perp \tau L_2$.