

Properties of Angles and Lines

IMPORTANT POINTS

1. Property : When two straight lines intersect:

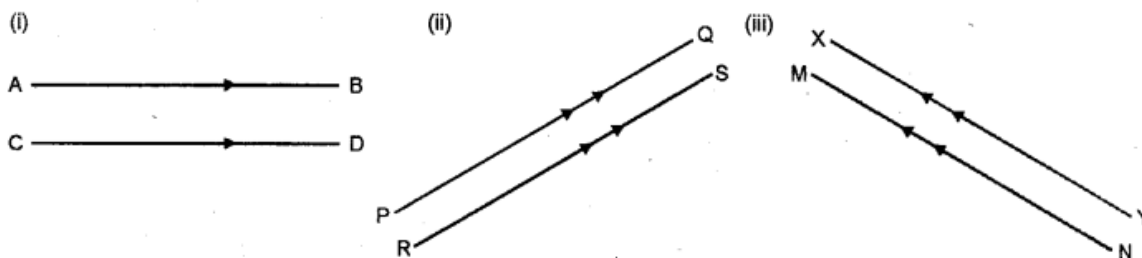
(i) sum of each pair of adjacent angles is always 180° .

(ii) vertically opposite angles are always equal. .

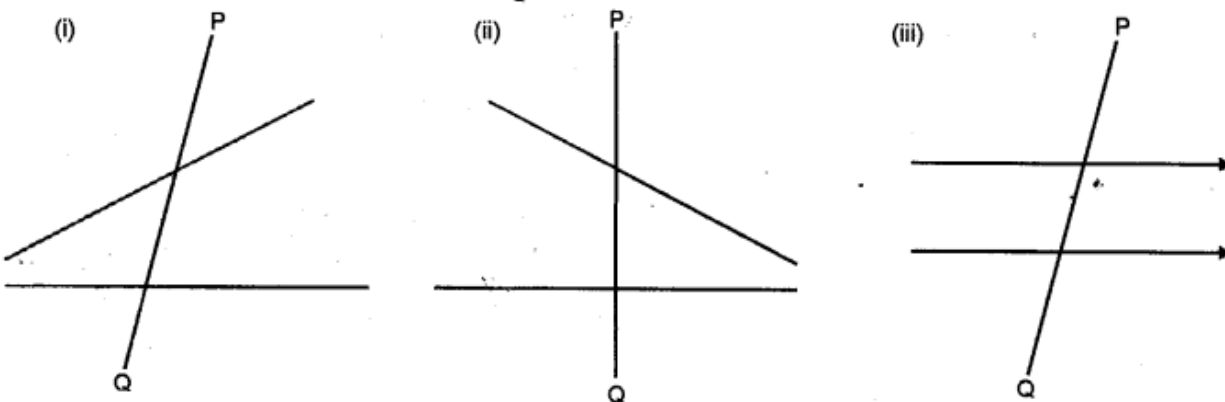
2. Property : If the sum of two adjacent angles is 180° , their exterior arms are always in the same straight line.

Conversely, if the exterior arms of two adjacent angles are in the same straight line ; the sum of angles is always 180°

3. Parallel Lines : Two straight lines are said to be parallel, if they do not meet anywhere, no matter how much they are produced in either direction.

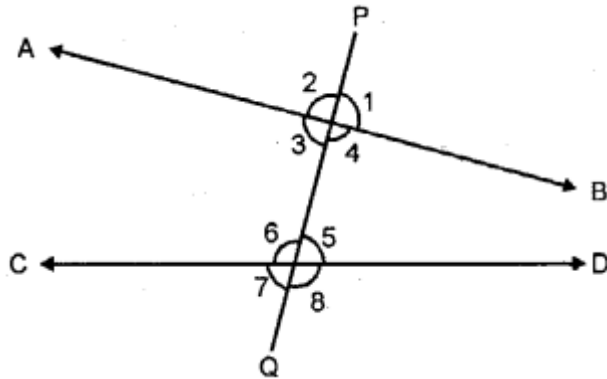


4. Concepts of Transversal Lines : When a line cuts two or more lines (parallel or non-parallel); it is called a transversal line or simply, a transversal. In each of the following figures : PQ is a transversal line.



5. Angles formed by two lines and their transversal line : When a transversal cuts two parallel or nonparallel lines; eight (8) angles are formed which are marked 1 to 8 in the adjoining diagram.

These angles can further be distinguished, as given below:



(i) **Exterior Angles** : Angles marked 1, 2, 7 and 8 are exterior angles.

(ii) **Interior Angles** : Angles marked 3, 4, 5 and 6 are interior angles.

(iii) **Exterior Alternate Angles** : Two pairs of exterior alternate angles are marked as : 2 and 8 ; and, 1 and 7.

(iv) **Interior Alternate Angles** : Two pairs of interior alternate are marked as : 3 and 5 ; and 4 and 6. In general, interior alternate angles are simply called as alternate angles only.

(v) **Corresponding Angles** : Four pairs of corresponding angles are marked as : 1 and 5 ; 2 and 6 ; 3 and 7 ; and 4 and 8.

(vi) **Co-interior or Conjoined or Allied Angles** : Two pairs of co-interior or allied angles are marked as : 3 and 6 ; and 4 and 5.

(vii) **Exterior Allied Angles** : Two pairs of exterior allied angles are marked as : 2 and 7 ; and 1 and 8.

EXERCISE 25 (A)

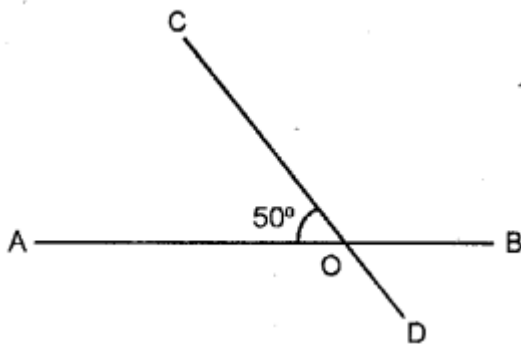
Question 1.

Two straight lines AB and CD intersect each other at a point O and angle AOC = 50° ; find :

(i) angle BOD

(ii) $\angle AOD$

(iii) $\angle BOC$



Solution:

(i) $\angle BOD = \angle AOC$

(Vertically opposite angles are equal)

$$\therefore \angle BOD = 50^\circ$$

(ii) $\angle AOD$

$$\angle AOD + \angle BOD = 180^\circ$$

$$\angle AOD + 50^\circ = 180^\circ \text{ [From (i)]}$$

$$\angle AOD = 180^\circ - 50^\circ$$

$$\angle AOD = 130^\circ$$

(iii) $\angle BOC = \angle AOD$

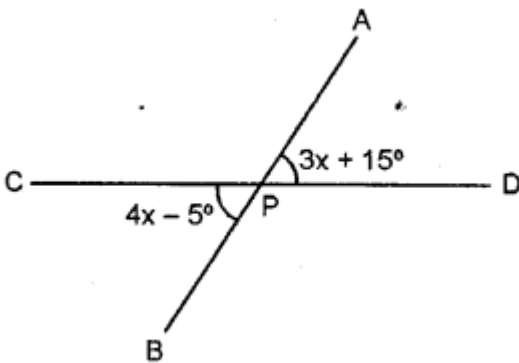
(Vertically opposite angles are equal)

$$\therefore \angle BOC = 130^\circ$$

Question 2.

The adjoining figure, shows two straight lines AB and CD intersecting at point P.

If $\angle BPC = 4x - 5^\circ$ and $\angle APD = 3x + 15^\circ$; find :



(i) the value of x.

(ii) $\angle APD$

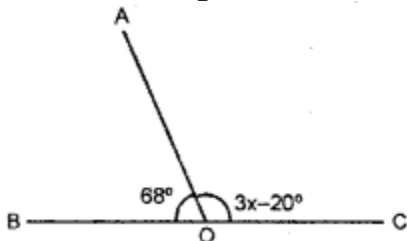
(iii) $\angle BPD$

(iv) $\angle BPC$

Solution:

Question 3.

The given diagram, shows two adjacent angles AOB and AOC, whose exterior sides are along the same straight line. Find the value of x.



Solution:

Since, the exterior arms of the adjacent angles are in a straight line ; the adjacent angles are supplementary

$$\therefore \angle AOB + \angle AOC = 180^\circ$$

$$\Rightarrow 68^\circ + 3x - 20^\circ = 180^\circ$$

$$\Rightarrow 3x = 180^\circ + 20^\circ - 68^\circ$$

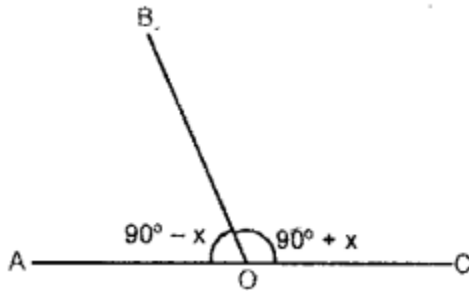
$$\Rightarrow 3x = 200^\circ - 68^\circ \Rightarrow 3x = 132^\circ$$

$$x = \frac{132}{3}^\circ = 44^\circ$$

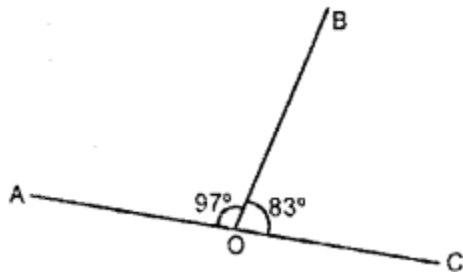
Question 4.

Each figure given below shows a pair of adjacent angles AOB and BOC. Find whether or not the exterior arms OA and OC are in the same straight line.

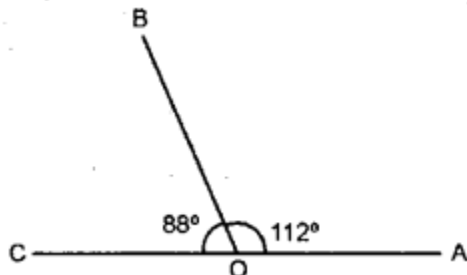
(i)



(ii)



(iii)



Solution:

(i) $\angle AOB + \angle COB = 180^\circ$

Since, the sum of adjacent angles AOB and COB = 180°

$$(90^\circ - x) + (90^\circ + x) = 180^\circ$$

$$\Rightarrow 90^\circ - x + 90^\circ + x = 180^\circ$$

$$\Rightarrow 180^\circ = 180^\circ$$

The exterior arms. OA and OC are in the same straight line.

(ii) $\angle AOB + \angle BOC = 97^\circ + 83^\circ = 180^\circ$

$\Rightarrow$ The sum of adjacent angles AOB and BOC is 180° .

$\therefore$ The exterior arms OA and OC are in the same straight line.

(iii) $\angle COB + \angle BOA = 88^\circ + 112^\circ = 200^\circ$; which is not 180° .

$\Rightarrow$ The exterior arms OA and OC are not in the same straight line.

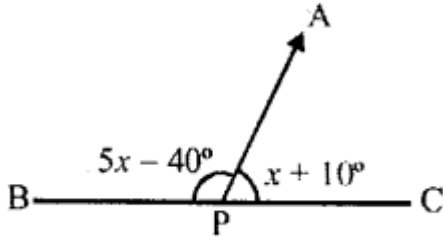
Question 5.

A line segment AP stands at point P of a straight line BC such that $\angle APB = 5x - 40^\circ$ and $\angle APC = x + 10^\circ$; find the value of x and angle APB.

Solution:

AP stands on BC at P and

$\angle APB = 5x - 40^\circ$, $\angle APC = x + 10^\circ$



(i) $\because$ APE is a straight line

$$\angle APB + \angle APC = 180^\circ$$

$$\Rightarrow 5x - 40^\circ + x + 10^\circ = 180^\circ$$

$$\Rightarrow 6x - 30^\circ = 180^\circ$$

$$\Rightarrow 6x = 180^\circ + 30^\circ = 210^\circ$$

$$x = \frac{210}{6} = 35^\circ$$

(ii) and $\angle APB = 5x - 40^\circ = 5 \times 35^\circ - 40^\circ$

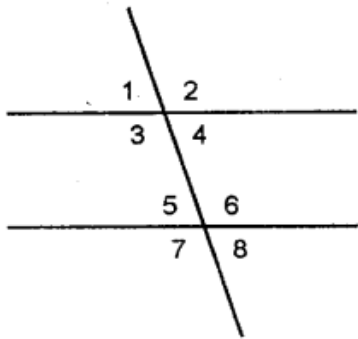
$$= 175^\circ - 40^\circ = 135^\circ$$

EXERCISE 25 (B)**Question 1.**

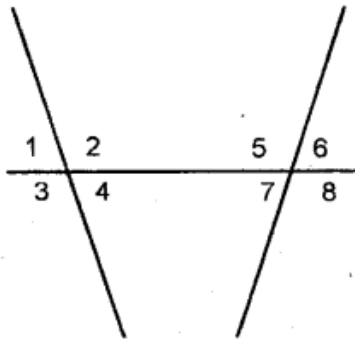
Identify the pair of angles in each of the figure given below :

adjacent angles, vertically opposite angles, interior alternate angles, corresponding angles or exterior alternate angles.

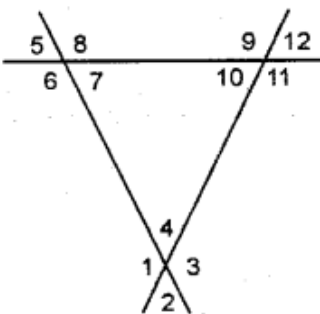
- (a) (i) $\angle 2$ and $\angle 4$ (ii) $\angle 1$ and $\angle 8$
 (iii) $\angle 4$ and $\angle 5$ (iv) $\angle 1$ and $\angle 5$
 (v) $\angle 3$ and $\angle 5$



- (b) (i) $\angle 2$ and $\angle 7$ (ii) $\angle 4$ and $\angle 8$
 (iii) $\angle 1$ and $\angle 8$ (iv) $\angle 1$ and $\angle 5$
 (v) $\angle 4$ and $\angle 7$



- (c) (i) $\angle 1$ and $\angle 10$ (ii) $\angle 6$ and $\angle 12$
 (iii) $\angle 8$ and $\angle 10$ (iv) $\angle 4$ and $\angle 11$
 (v) $\angle 2$ and $\angle 8$ (vi) $\angle 5$ and $\angle 7$



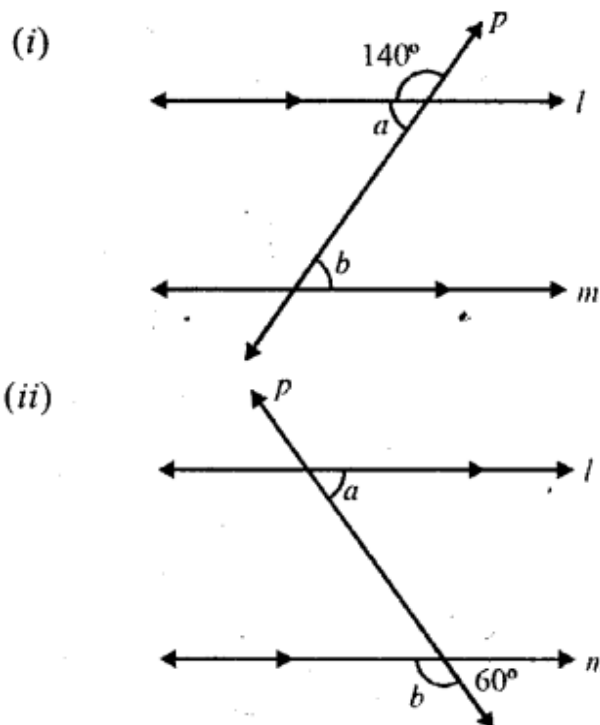
Solution:

- (a) (i) Adjacent angles
 (ii) Alternate exterior angles
 (iii) Interior alternate angles
 (iv) Corresponding angles
 (v) Allied angles
 (b) (i) Alternate interior angles
 (ii) Corresponding angles

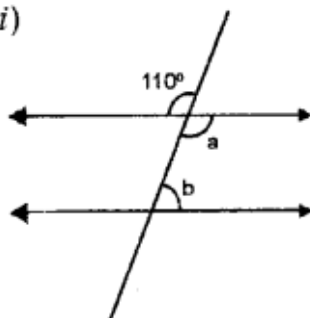
- (iii) Alternate exterior angles
- (iv) Corresponding angles
- (v) Allied angles.
- (c) (i) Corresponding
- (ii) Alternate exterior
- (iii) Alternate interior
- (iv) Alternate interior
- (v) Alternate exterior
- (vi) Vertically opposite

Question 2.

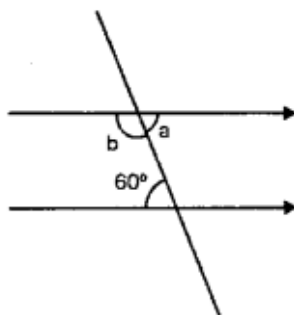
Each figure given below shows a pair of parallel lines cut by a transversal. For each case, find a and b , giving reasons.



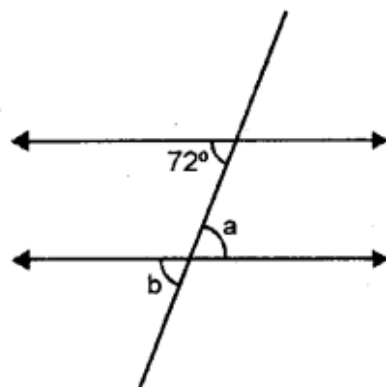
(iii)



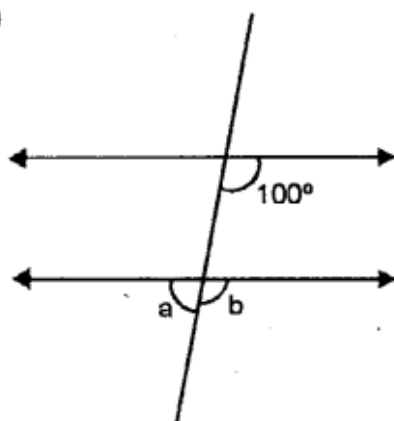
(iv)



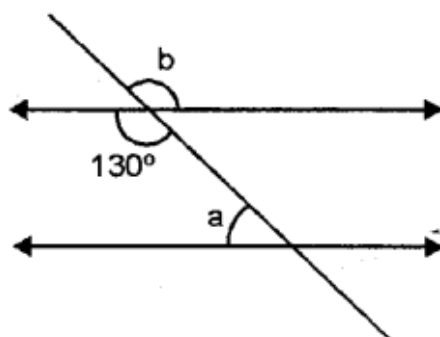
(v)



(vi)

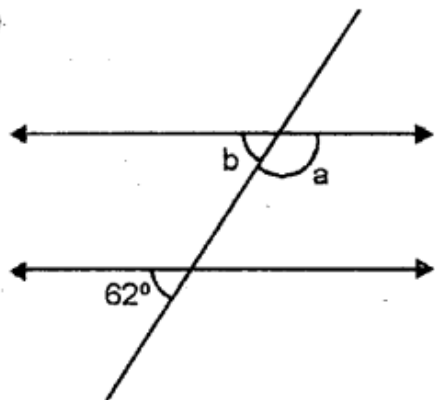


(vii)



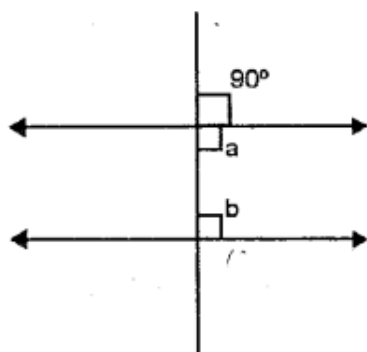
- (i) $a + 140^\circ = 180^\circ$ (Linear pair)
 $\therefore a = 180^\circ - 140^\circ = 40^\circ$
 But $b = a$ (alternate angles)
 $= 40^\circ$
 $\therefore a = 40^\circ, b = 40^\circ$
- (ii) $\because l \parallel m$ and p intersects them
 $b + 60^\circ = 180^\circ$ (Linear pair)
 $\therefore b = 180^\circ - 60^\circ = 120^\circ$
 and $a = 60^\circ$ (corresponding angle)
 $\therefore a = 60^\circ, b = 120^\circ$
- (iii) $a = 110^\circ$ [Vertically opp. angles]
 $b = 180^\circ - a$ [Co-interior angles]
 $= 180^\circ - 110^\circ = 70^\circ$
- (iv) $a = 60^\circ$ [Alternate int. angles]
 $b = 180^\circ - a$ [Co-interior angles]
 $= 180^\circ - 60^\circ = 120^\circ$
- (v) $a = 72^\circ$ [Alternate int. angles]
 $b = a$ [Vertically opp. angles]
i.e., $b = 72^\circ$
- (vi) $b = 100^\circ$ [Corresponding angles]
 $a = 180^\circ - b$ [Linear Pair of angles]
 $a = 180^\circ - 100^\circ = 80^\circ$
- (vii) $a = 180^\circ - 130^\circ = 50^\circ$ [Co-interior angle]
 $b = 130^\circ$ [Vertically opposite angles]
- (viii) $b = 62^\circ$ [Corresponding angles]
 $a = 180^\circ - b$ [Linear pair of angles]
 $a = 180^\circ - 62^\circ = 118^\circ$
- (ix) $a = 180^\circ - 90^\circ$ [Linear pair of angles]
 $= 90^\circ$
 $b = 90^\circ$ [Corresponding angles]

(viii)



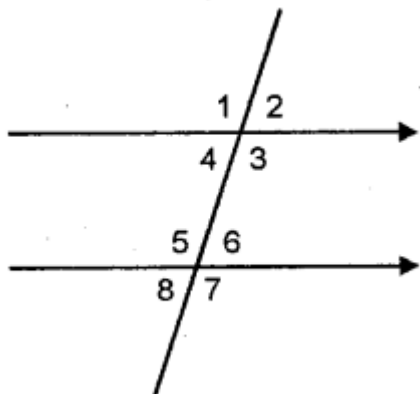
Solution:

(ix)



Question 3.

If $\angle 1 = 120^\circ$, find the measures of : $\angle 2$, $\angle 3$, $\angle 4$, $\angle 5$, $\angle 6$, $\angle 7$ and $\angle 8$. Give reasons.



Solution:

$l \parallel m$ and p is their transversal and $\angle 1 = 120^\circ$

$\angle 1 + \angle 2 = 180^\circ$ (Straight line angle)

$$\therefore 120^\circ + \angle 2 = 180^\circ \Rightarrow \angle 2 = 180^\circ - 120^\circ = 60^\circ$$

$$\therefore \angle 2 = 60^\circ$$

But $\angle 1 = \angle 3$ (Vertically opposite angles)

$$\therefore \angle 3 = \angle 1 = 120^\circ$$

Similarly $\angle 4 = \angle 2$

(Vertically opposite angles)

$$\therefore \angle 4 = 60^\circ$$

$\angle 5 = \angle 1$ (Corresponding angles)

$$\therefore \angle 5 = 120^\circ$$

Similarly $\angle 6 = \angle 2$ (Corresponding angles)

$$\therefore \angle 6 = 60^\circ$$

$\angle 7 = \angle 5$ (Vertically opposite angles)

$$\therefore \angle 7 = 120^\circ$$

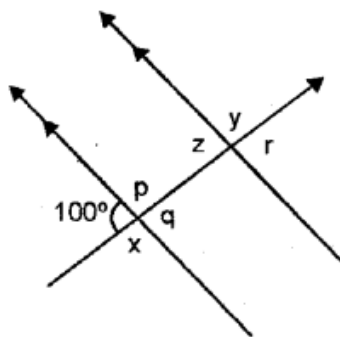
and $\angle 8 = \angle 6$ (Vertically opposite angles)

$$\therefore \angle 8 = 60^\circ$$

Hence $\angle 2 = 60^\circ$, $\angle 3 = 120^\circ$, $\angle 4 = 60^\circ$, $\angle 5 = 120^\circ$, $\angle 6 = 60^\circ$, $\angle 7 = 120^\circ$ and $\angle 8 = 60^\circ$

Question 4.

In the figure given below, find the measure of the angles denoted by x, y, z, p, q and r .



Solution:

$$x = 180 - 100 \text{ [L.P. of angles]} = 80^\circ$$

$$y = x \quad \text{[Alternate ext. angles]} \\ = 80^\circ$$

$$z = 100^\circ \quad \text{[Corresponding angles]}$$

$$p = x \quad \text{[Vertically opp. angles]} \\ = 80^\circ$$

$$q = 100^\circ \quad \text{[Vertically opp. angles]}$$

$$r = q \quad \text{[Corresponding angles]} \\ = 100^\circ$$

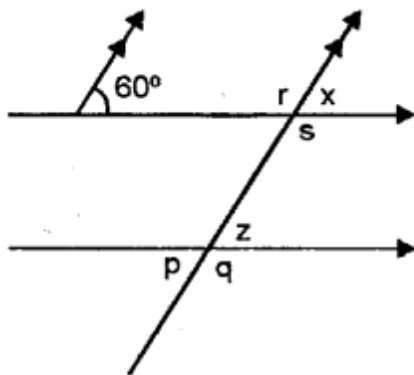
Question 5.

Using the given figure, fill in the blanks.

$$\angle x = \dots\dots\dots ; \angle z = \dots\dots\dots ;$$

$$\angle p = \dots\dots\dots ; \angle q = \dots\dots\dots ;$$

$$\angle r = \dots\dots\dots ; \angle s = \dots\dots\dots ;$$



Solution:

$$x = 60^\circ \quad [\text{Corresponding angles}]$$

$$z = x \quad [\text{Corresponding angles}]$$

$$= 60^\circ$$

$$p = z \quad [\text{Vertically opp. angles}]$$

$$= 60^\circ$$

$$q = 180 - p \quad [\text{Linear Pair of angles}]$$

$$= 180 - 60 = 120^\circ$$

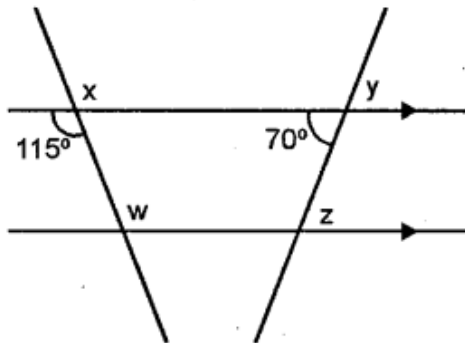
$$r = 180 - x \quad [\text{Linear Pair of angles}]$$

$$= 180 - 60 = 120^\circ$$

$$s = r \quad [\text{Vertically opp. angles}] = 120^\circ$$

Question 6.

In the given figure, find the angles shown by x, y, z and w . Give reasons.



Solution:

$$x = 115^\circ$$

$$y = 70^\circ$$

$$z = 70^\circ$$

$$w = 115^\circ$$

[Vertically of angles]

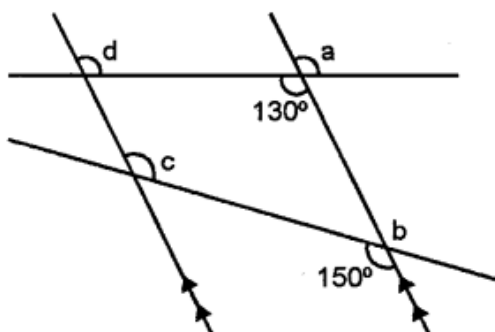
[Vertically opp. angles]

[Alternate int. angles]

[Alternate int. angles]

Question 7.

Find a, b, c and d in the figure given below :



Solution:

$$a = 130^\circ$$

$$b = 150^\circ$$

$$c = 150^\circ$$

$$d = 130^\circ$$

[Vertically opp. angles]

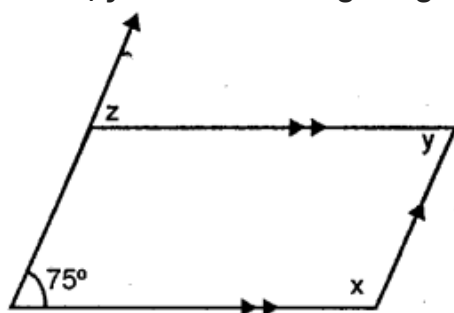
[Vertically opp. angles]

[Alternate interior angles]

[Alternate interior angles]

Question 8.

Find x , y and z in the figure given below :



Solution:

$$x = 180 - 75$$

$$= 105^\circ$$

$$y = 180 - x$$

$$= 180 - 105 = 75^\circ$$

$$z = 75^\circ$$

[Co-interior angles]

[Co-interior angles]

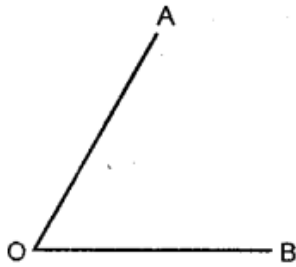
[Corresponding angles]

EXERCISE 25 (C)

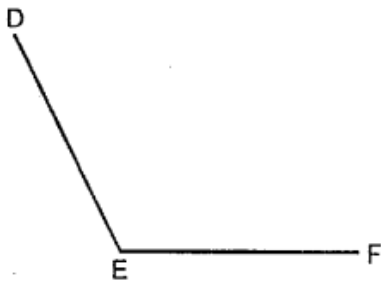
Question 1.

In your note-book copy the following angles using ruler and a pair compass only.

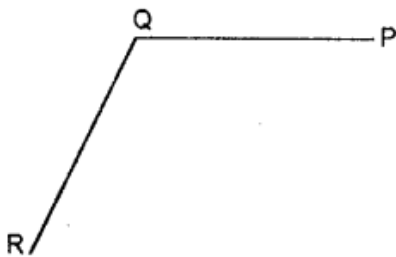
(i)



(ii)



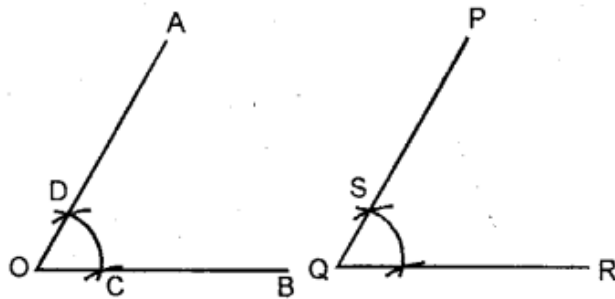
(iii)



Solution:

(i) Steps of Construction :

1. At point Q, draw line $QR = OB$.



2. With O as centre, draw an arc of any suitable radius, to cut the arms of the angle at C and D.

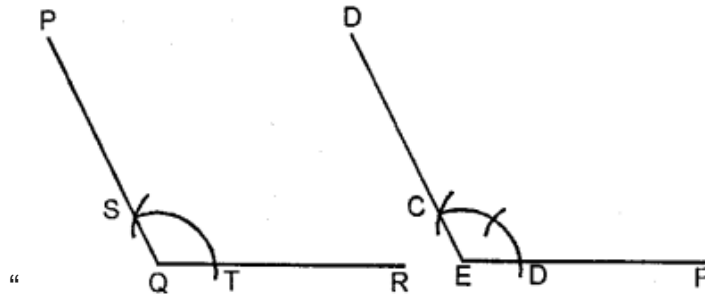
3. With Q as centre, draw the arc of the same size as drawn for C and D. Let this arc cuts line QR at point T.

4. In your compasses, take the distance equal to distance between C and D; and then with T as centre, draw an arc which cuts the earlier arc at S.

5. Join QS and produce upto a suitable point P. $\angle PQR$ so obtained, is the angle equal to the given $\angle AOB$.

(ii) Steps of Construction :

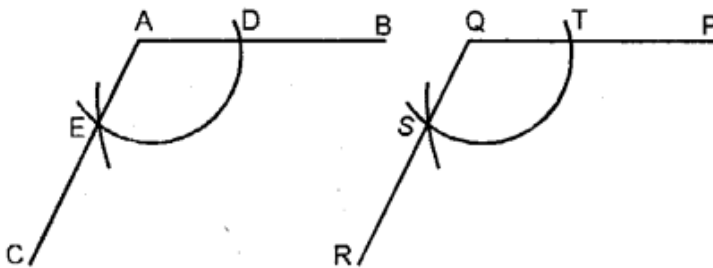
1. At point E, draw line EF.



2. With E as centre, draw an arc of any suitable radius, to cut the arms of the angle at C and D.
3. With Q as centre, draw the arc of the same size as drawn for C and D. Let this arc cut line QR at point T.
4. In your compasses, take the distance equal to distance between C and D ; and then with T as centre, draw an arc which cuts the earlier arc at S.
5. Join QS and produce upto a suitable point R. $\angle PQR$, so obtained, is the angle equal to the given $\angle DEE$

(iii) Steps of Construction :

1. At point A draw line $AB = QP$



2. With Q as centre, draw an arc of any suitable radius, to cut the arms of the angle A + C and D.
3. With A as centre, draw the arc of the same size as drawn for C and D. Let this arc cut line AB at D.
4. In your compasses, take the distance equal to distance between 7 and 5 ; and then with D as centre, draw an arc which cuts the earlier arc at E.
5. Join AE and produced upto a suitable point C. $\angle BAC$, so obtained is the angle equal to the given $\angle PQR$.

Question 2.

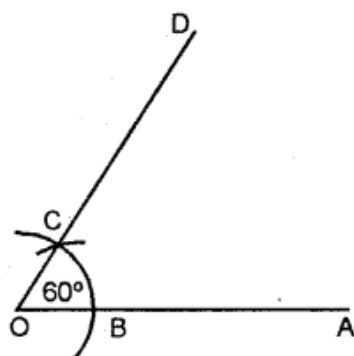
Construct the following angles, using ruler and a pair of compass only

- (i) 60°
- (ii) 90°
- (iii) 45°
- (iv) 30°
- (v) 120°
- (vi) 135°
- (vii) 15°

Solution:

(i) Steps of Construction :

To Construct an angle of 60° .

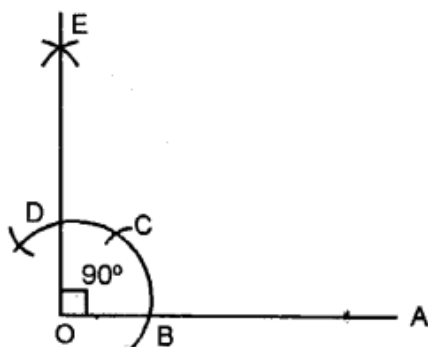


1. Draw a line OA of any suitable length.
2. At O , draw an arc of any size to cut OA at B .
3. With B as centre, draw the same size arc, to cut the previous arc at C .
4. Join OC and extend upto a suitable point D . Then, $\angle DOA = 60^\circ$.

(ii) Steps of Construction :

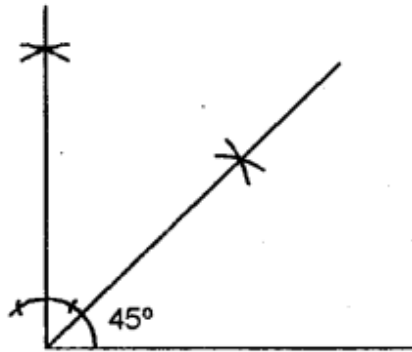
To construct an angle of 90° .

Let OA be a line and at point O , 90° angle is to be drawn.



1. With O as centre, draw an arc to cut OA at B .
2. With B as centre, draw the same size arc to cut the previous arc at C .
3. Again with C as centre and with the same radius, draw one more arc to cut the first arc at D .

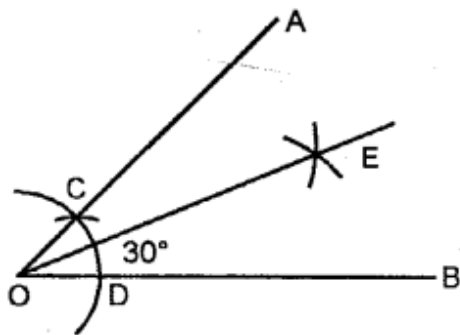
4. With C and D as centres, draw two arcs of equal radii to cut each other at point E.
 5. Join O and E. Then, $\angle AOE = 90^\circ$.
- (iii) Draw an angle of 90° as in question (ii) and bisect it. Each angle so obtained will be 45° .



(iv) **Steps of Construction :**

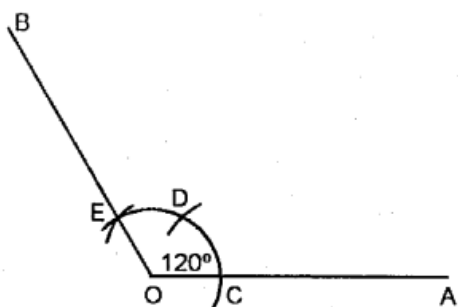
To construct an angle of 30° .

1. Draw an angle of 60° as drawn as in Q. No. (i).
2. Bisect this angle to get two angles each of 30° . Thus, $\angle EOB = 30^\circ$.



(v) Steps of Construction :

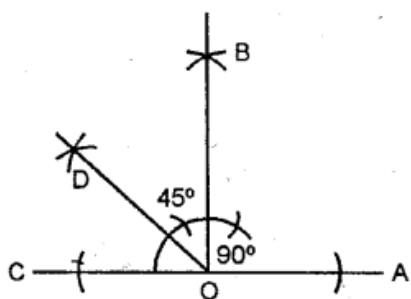
To construct an angle of 120° .



1. With centre O on the line OA, draw an arc to cut this line at C.
2. With C as centre, draw a same size arc which cuts the first arc at point D.
3. With D as centre, draw one more arc of same size which cuts the first arc at E.
4. Join OE and produce it upto point B. Then, $\angle AOB = 120^\circ$.

(vi) Steps of Construction :

To construct an angle of 135° .



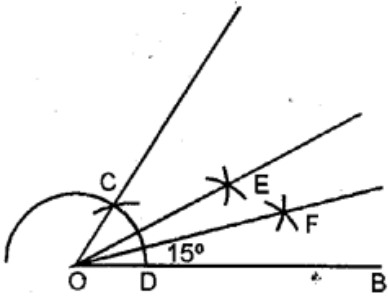
1. Draw an angle $\angle BOA = 90^\circ$ at point O of given line AC
2. Bisect the angle BOC on the other side of OB, which is also 90° .

Thus, $\angle BOD = \angle COD = 45^\circ$

And, $\angle AOD = 90^\circ + 45^\circ = 135^\circ$.

(vii) Steps of Construction :

To construct an angle of 15° .



1. Draw an angle of 60° as drawn above.
2. Bisect this angle to get two angles each of 30° . Thus, $\angle EOB = 30^\circ$.
3. Bisect this angle $\angle EOB$ to get two angles each of 15° . $\angle EOB = 15^\circ$.

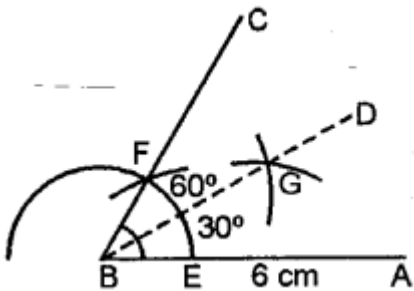
Question 3.

Draw line $AB = 6\text{cm}$. Construct angle $ABC = 60^\circ$. Then draw the bisector of angle ABC .

Solution:

Steps of Construction :

1. Draw a line segment $AB = 6\text{ cm}$.



2. With the help of compass construct $\angle CBA = 60^\circ$.
3. Bisect $\angle CBA$, with the help of compass, take any radius which meet line AB and BC at point E and F .
4. Now, with the help of compass take radius more than $\frac{1}{2}$ of EF and draw two arcs from point E and F , which intersect both arcs at G , proceed BG toward D $\angle DBA$ is bisector of $\angle CBA$.

Question 4.

Draw a line segment $PQ = 8\text{cm}$. Construct the perpendicular bisector of the line segment PQ . Let the perpendicular bisector drawn meet PQ at point R . Measure the lengths of PR and QR . Is $PR = QR$?

Solution:

Steps of Construction :

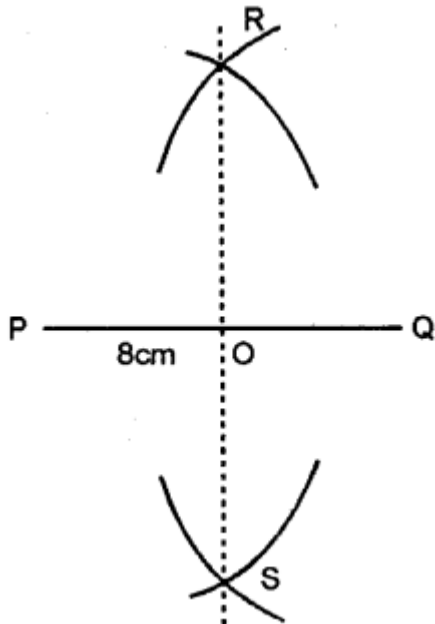
1. With P and Q as centres, draw arcs on both sides of PQ with equal radii. The radius

should be more than half the length of PQ.

2. Let these arcs cut each other at points R and S

3. Join RS which cuts PQ at D.

Then $RS = PQ$ Also $\angle POR = 90^\circ$.



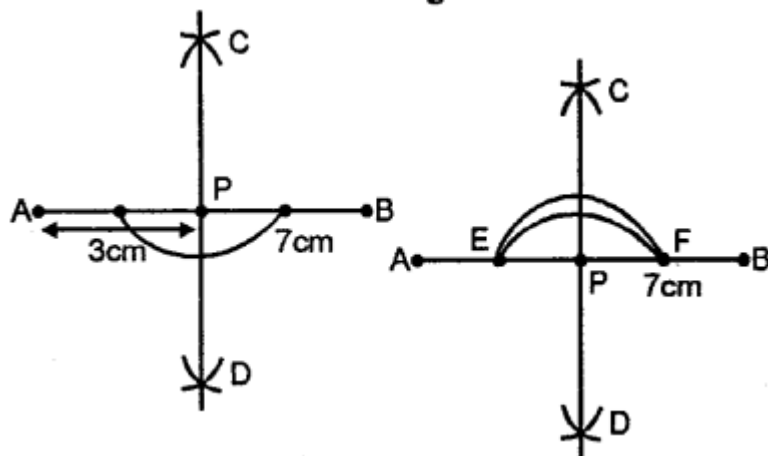
Hence, the line segment RS is the perpendicular bisector of PQ as it bisects PQ at P and is also perpendicular to PQ. On measuring the lengths of $PR = 4\text{cm}$, $QR = 4\text{cm}$ Since $PR = QR$, both are 4cm each
 $\therefore PR = QR$.

Question 5.

Draw a line segment $AB = 7\text{cm}$. Mark a point P on AB such that $AP = 3\text{cm}$. Draw perpendicular on to AB at point P.

Solution:

1. Draw a line segment $AB = 7\text{cm}$.



2. Out point from AB – $AP = 3\text{cm}$

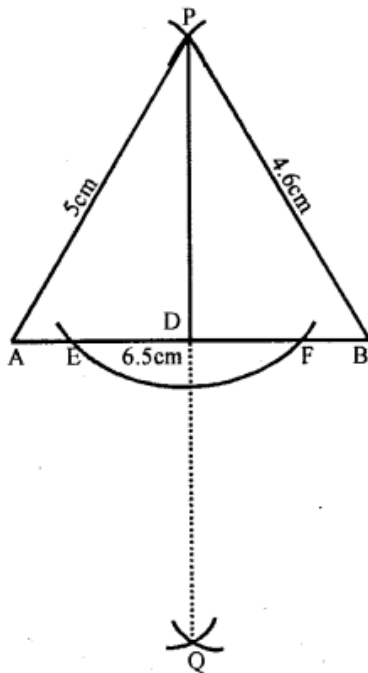
3. From point P, cut arc on out side of AB, E and F.

4. From point E & F cut arcs on both sides intersecting each other at C & D.
5. Join point P, CD.
6. Which is the required perpendicular.

Question 6.

Draw a line segment $AB = 6.5$ cm. Locate a point P that is 5 cm from A and 4.6 cm from B. Through the point P, draw a perpendicular on to the line segment AB.

Solution:



Steps of Construction :

- (i) Draw a line segment $AB = 6.5$ cm
- (ii) With centre A and radius 5 cm, draw an arc and with centre B and radius 4.6 cm, draw another arc which intersects the first arc at P.
Then P is the required point.
- (iii) With centre A and a suitable radius, draw an arc which intersects AB at E and F.
- (iv) With centres E and F and radius greater than half of EF, draw the arcs which intersect each other at Q.
- (v) Join PQ which intersects AB at D.
Then PD is perpendicular to AB.

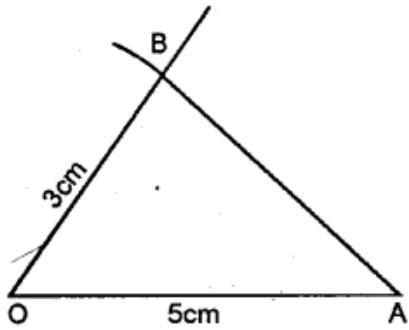
EXERCISE 25 (D)

Question 1.

Draw a line segment $OA = 5$ cm. Use set-square to construct angle $AOB = 60^\circ$, such that $OB = 3$ cm. Join A and B ; then measure the length of AB.

Solution:

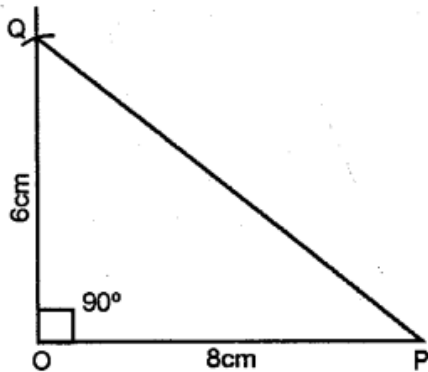
Measuring the length of $AB = 4.4\text{cm}$. (approximately)



Question 2.

Draw a line segment $OP = 8\text{cm}$. Use set-square to construct $\angle POQ = 90^\circ$; such that $OQ = 6\text{ cm}$. Join P and Q; then measure the length of PQ.

Solution:

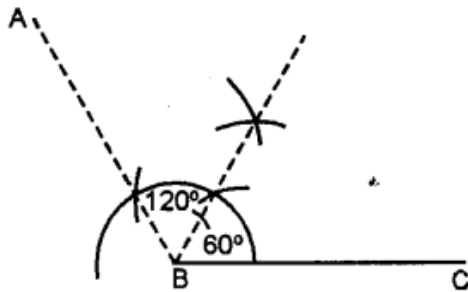


Measuring $PQ = 10\text{ cm}$.

Question 3.

Draw $\angle ABC = 120^\circ$. Bisect the angle using ruler and compasses. Measure each angle so obtained and check whether or not the new angles obtained on bisecting $\angle ABC$ are equal.

Solution:



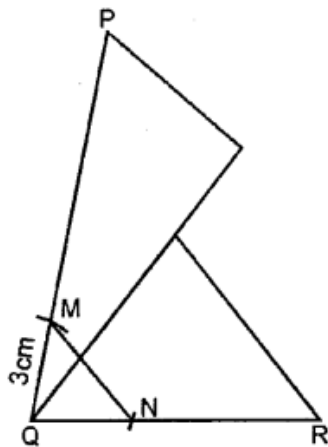
Measuring each angle = 60°

Yes, angles obtained in $\angle ABC$ bisecting are equal.

Question 4.

Draw $\angle PQR = 75^\circ$ by using set- squares. On PQ mark a point M such that $MQ = 3$ cm. On QR mark a point N such that $QN = 4$ cm. Join M and N. Measure the length of MN.

Solution:

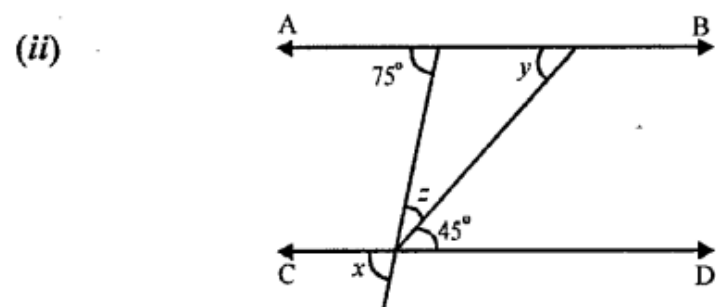
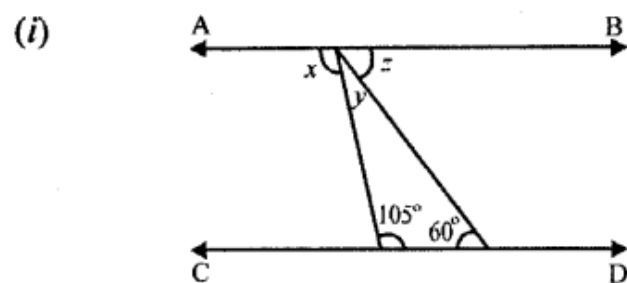


Length of $MN = 4.3$ cm

REVISION EXERCISE

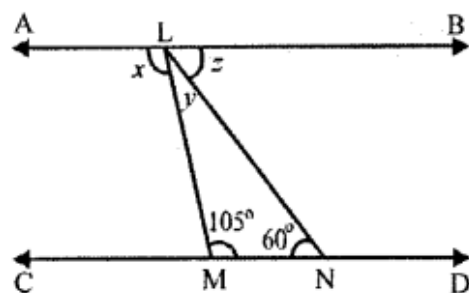
Question 1.

In the following figures, AB is parallel to CD; find the values of angles x, y and z :



Solution:

(i) In the figure (i)



$AB \parallel CD$

and LM is its transversal

$$\therefore \angle ALM = \angle LMN \quad (\text{Alternate angles})$$

$$\Rightarrow \angle x = 105^\circ$$

$$\therefore x = 105^\circ$$

Similarly $AB \parallel CD$ and LN is its transversal

$$\therefore \angle BLN = \angle LNM \quad (\text{Alternate angles})$$

$$\therefore \angle z = 60^\circ$$

$$\therefore z = 60^\circ$$

But $x + y + z = 180^\circ$ (Straight line angles)

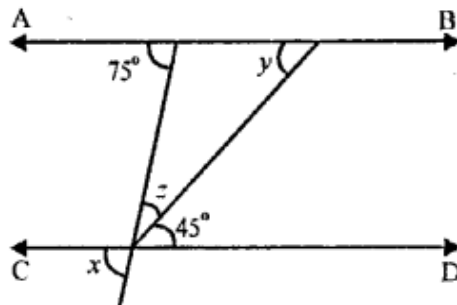
$$\Rightarrow 105^\circ + y + 60^\circ = 180^\circ$$

$$\Rightarrow y + 165^\circ = 180^\circ$$

$$\Rightarrow y = 180^\circ - 165^\circ = 15^\circ$$

Hence $x = 105^\circ$, $y = 15^\circ$ and $z = 60^\circ$

(ii) In figure (ii)



$AB \parallel CD$

MN is its transversal

$$\therefore \angle LNM = \angle NMD \quad (\text{Alternate angles})$$

$$= y = 45^\circ$$

and $AB \parallel CD$ and LM is its transversal

$$\therefore \angle ALM = \angle CMP \quad (\text{Corresponding angles})$$

$$\Rightarrow 75^\circ = x$$

$$\therefore x = 75^\circ$$

and $\angle ALM = \angle LMD$ (Alternate angles)

$$\therefore 75^\circ = z + 45^\circ$$

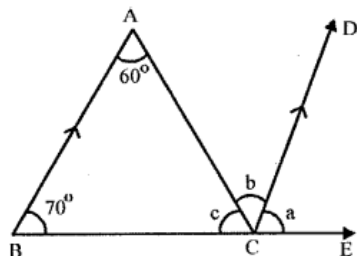
$$\Rightarrow z = 75^\circ - 45^\circ = 30^\circ$$

Hence $x = 75^\circ$, $y = 45^\circ$ and $z = 30^\circ$

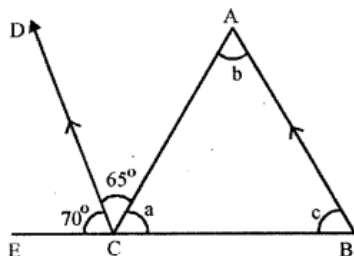
Question 2.

In each of the following figures, BA is parallel to CD. Find the angles a, b and c:

(i)



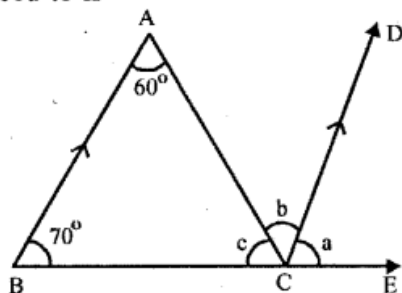
(ii)



Solution:

(i) In the figure (i)

ABC is a triangle and $CD \parallel BA$, BC is produced to E



$$\angle A = 60^\circ, \angle B = 70^\circ$$

$\because AB \parallel DC$ and BE is its transversal

$$\therefore \angle DCE = \angle ABC \quad (\text{corresponding angles})$$

$$\Rightarrow a = 70^\circ$$

$$\therefore a = 70^\circ$$

Similarly, $AB \parallel DC$ and AC is its transversal

$$\therefore \angle ACD = \angle BAC \quad (\text{Alternate angles})$$

$$\Rightarrow b = 60^\circ$$

$$\therefore b = 60^\circ$$

$$\text{But } a + b + c = 180^\circ \quad (\text{Straight line angle})$$

$$\Rightarrow 70^\circ + 60^\circ + c = 180^\circ$$

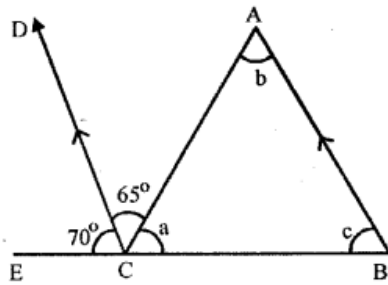
$$\Rightarrow 130^\circ + c = 180^\circ$$

$$\Rightarrow c = 180^\circ - 130^\circ = 50^\circ$$

Hence $a = 70^\circ$, $b = 60^\circ$ and $\angle c = 50^\circ$

(ii) In figure (ii),

$AB \parallel DC$ and AC is its transversal



$$\therefore \angle BAC = \angle ACD \quad (\text{Alternate angles})$$

$$\Rightarrow b = 65^\circ$$

Again $AB \parallel DC$ and BCE is its transversal

$$\therefore \angle ABC = \angle DCE$$

$$\Rightarrow c = 70^\circ$$

$$\text{But } \angle ACB + \angle ACD + \angle DCE = 180^\circ$$

(Straight line angle)

$$\therefore a + 65^\circ + 70^\circ = 180^\circ$$

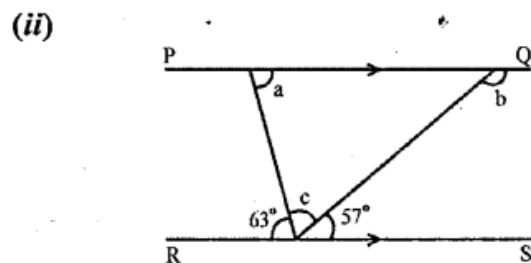
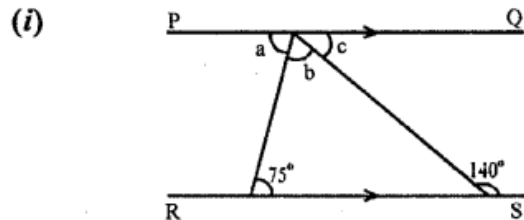
$$\Rightarrow a + 135^\circ = 180^\circ$$

$$\Rightarrow a = 180^\circ - 135^\circ = 45^\circ$$

$$\text{Hence } a = 45^\circ, b = 65^\circ \text{ and } c = 70^\circ$$

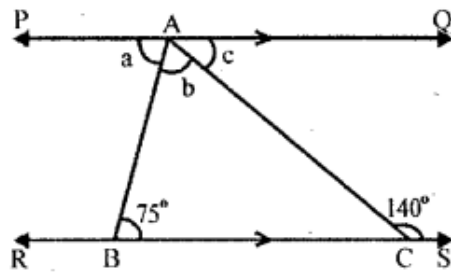
Question 3.

In each of the following figures, PQ is parallel to RS . Find the angles a , b and c :



Solution:

(i) In the figure (i),
 $PQ \parallel RS$, $\angle B = 75^\circ$, $\angle ACS = 140^\circ$



AB is its transversal

$$\therefore \angle PAB = \angle ABC$$

$$\Rightarrow a = 75^\circ$$

Again $PQ \parallel RS$ and AC is its transversal

$$\therefore \angle QAC + \angle ACS = 180^\circ \text{ (Co-interior angles)}$$

$$\Rightarrow c + 140^\circ = 180^\circ$$

$$\Rightarrow c = 180^\circ - 140^\circ = 40^\circ$$

$$\text{But } a + b + c = 180^\circ \text{ (Straight line angles)}$$

$$\therefore 75^\circ + b + 40^\circ = 180^\circ$$

$$\Rightarrow b + 115^\circ = 180^\circ$$

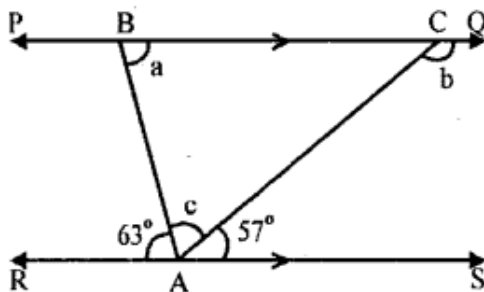
$$\Rightarrow b = 180^\circ - 115^\circ = 65^\circ$$

$$\text{Hence } a = 75^\circ, b = 65^\circ, c = 40^\circ$$

(ii) In the figure (ii),

$PQ \parallel RS$.

$$\therefore \angle BAR = 63^\circ, \angle CAS = 57^\circ$$



$\therefore PQ \parallel RS$ and AB is its transversal

AB is its transversal.

$\therefore \angle CBA = \angle BAR$ (Alternate angles)

$$\Rightarrow a = 63^\circ$$

$\therefore PQ \parallel RS$ and CA is its transversal.

$\therefore \angle QCA + \angle CAS = 180^\circ$ (Co-interior angles)

$$\Rightarrow b + 57^\circ = 180^\circ$$

$$\Rightarrow b = 180^\circ - 57^\circ = 123^\circ$$

But $\angle CAS + \angle CAB + \angle BAR = 180^\circ$

(Straight line angles)

$$\Rightarrow 57^\circ + c + 63^\circ = 180^\circ$$

Question 4.

Two straight lines are cut by a transversal. Are the corresponding angles always equal?

Solution:

If a transversal cuts two straight lines, their the corresponding angles are not equal unless the lines are not parallel. One in case of parallel lines, the corresponding angles are equal.

Question 5.

Two straight lines are cut by a transversal so that the co-interior angles are supplementary. Are the straight lines parallel ?

Solution:

A transversal intersects two straight lines and co-interior angles are supplementary

$\therefore$ By deflations, the lines will be parallel.

Question 6.

Two straight lines are cut by a transversal so that the co-interior angles are equal. What must be the measure of each interior angle to make the straight lines parallel to each other ?

Solution:

A transversal intersects two straight lines and co-interior angles are equal to each other,

$\therefore$ The two straight lines are parallel Their sum of co-interior angles = 180°

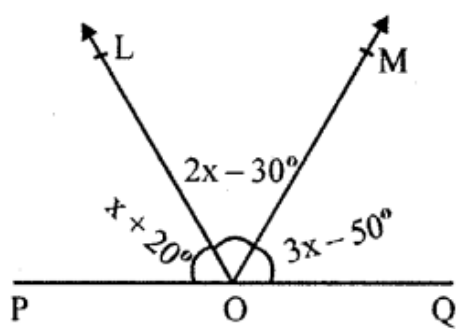
But both angles are equal

$\therefore$ Each angle will be $\frac{180}{2}^\circ = 90^\circ$

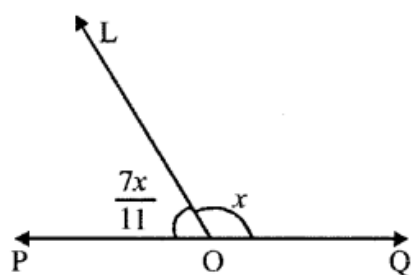
Question 7.

In each case given below, find the value of x so that POQ is straight line

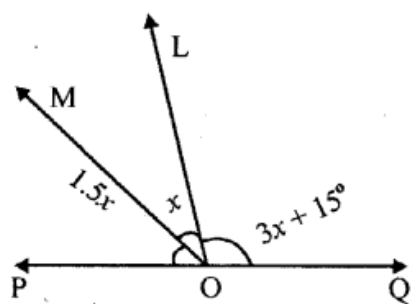
(i)



(ii)



(iii)



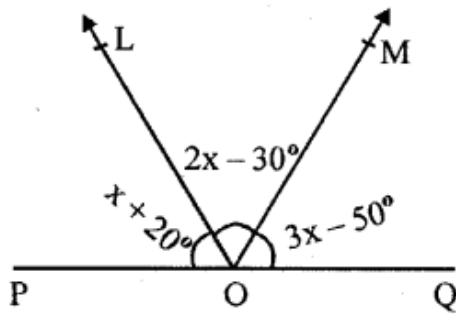
In each case, POQ is a straight line

(i) In figure (i)

$\therefore$ POQ is a straight line

$$\therefore \angle POL + \angle LOM + \angle MOQ = 180^\circ$$

(Straight line angles)



$$\Rightarrow x + 20^\circ + 2x - 30^\circ + 3x - 50^\circ = 180^\circ$$

$$\Rightarrow 6x + 20^\circ - 80^\circ = 180^\circ \Rightarrow 6x - 60^\circ = 180^\circ$$

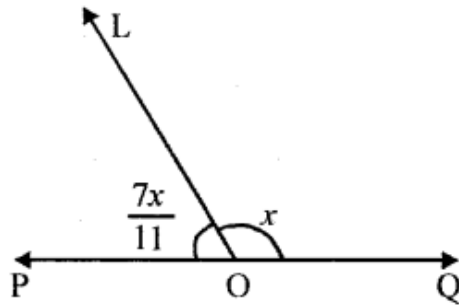
$$\Rightarrow 6x = 180^\circ + 60^\circ = 240^\circ \Rightarrow x = \frac{240^\circ}{6}$$

$$\Rightarrow x = 40^\circ$$

$$\therefore x = 40^\circ$$

(ii) $\therefore$ POQ is a straight line

$$\therefore \angle POL + \angle LOQ = 180^\circ$$



$$\Rightarrow \frac{7x}{11} + x = 180^\circ$$

$$\Rightarrow \frac{7x + 11x}{11} = 180^\circ$$

$$\Rightarrow \frac{18x}{11} = 180^\circ$$

$$\Rightarrow x = \frac{180^\circ \times 11}{18} = 110^\circ$$

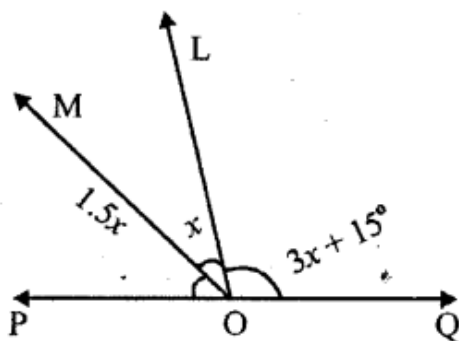
$$\therefore x = 110^\circ$$

(iii) $\because$ POQ is a straight line

$$\therefore \angle POM + \angle MOL + \angle LOQ = 180^\circ$$

$$\Rightarrow 1.5x + x + 3x + 15^\circ = 180^\circ$$

(Straight line angle)



$$\begin{aligned}
 5.5x + 15^\circ &= 180^\circ \\
 \Rightarrow 5.5x &= 180^\circ - 15^\circ \\
 \Rightarrow 5.5x &= 165^\circ \\
 \Rightarrow x &= \frac{165}{5.5} = \frac{165 \times 10}{55} = 30 \\
 \therefore x &= 30^\circ
 \end{aligned}$$

Question 8.

in each case, given below, draw perpendicular to AB from an exterior point P

(i)

• P

A ————— B

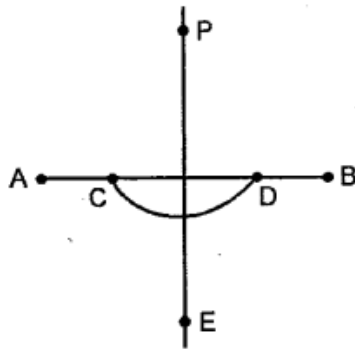
(ii)

P

A ————— B

Solution:

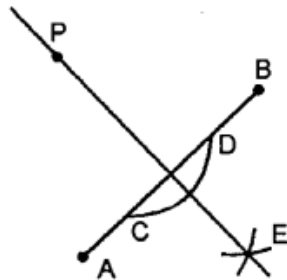
(i)



Steps of Construction :

1. From point P, draw an arc CD at line AB
2. From point C and D draw arcs which intersect each other at point E, now draw PE, perpendicular to AB.

(ii)



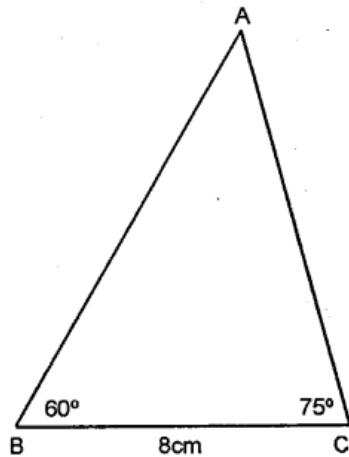
Steps of Construction :

1. From point P, draw an arc CD at line AB.
2. From point C and D draw arcs which intersect each other at Point E, now draw PE, perpendicular to AB.

Question 9.

Draw a line segment $BC = 8$ cm. Using set-squares, draw $\angle CBA = 60^\circ$ and $\angle BCA = 75^\circ$. Measure the angle BAC. Also measure the lengths of AB and AC.

Solution:



Length AB = 11 cm

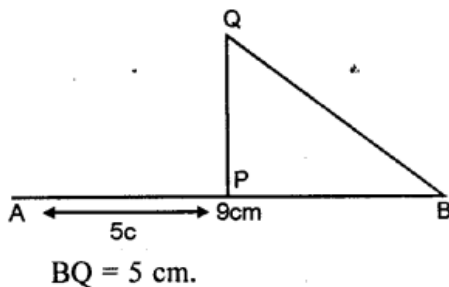
Length AC = 9.8 cm

$\angle BAC = 45^\circ$.

Question 10.

Draw a line AB = 9 cm. Mark a point P in AB such that AP = 5 cm. Through P draw (using set-square) perpendicular PQ = 3 cm. Measure BQ.

Solution:



Question 11.

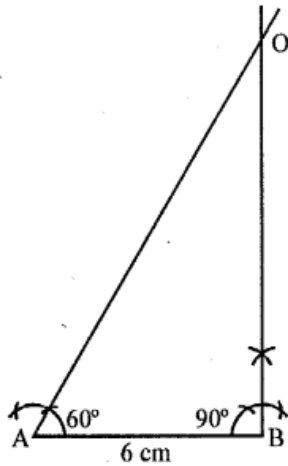
Draw a line segment AB = 6 cm. Without using set squares, draw angle OAB = 60° and angle OBA = 90° . Measure angle AOB and write this measurement.

Solution:

Steps of construction :

- (i) Draw a line segment $AB = 6$ cm.
- (ii) At A, draw a ray making an angle of 60° with the help of compass.
- (iii) At B, draw another ray making an angle of 90° which meet each other at O.

Now on measuring $\angle AOB$, it is 30°



Question 12.

Without using set squares, construct angle $ABC = 60^\circ$ in which $AB = BC = 5$ cm. Join A and C and measure the length of AC.

Solution:

Steps of construction :

- (i) Draw a angle $ABC = 60^\circ$.
Such that $AB = BC = 5$ cm.
- (ii) Join AC, on measuring, the length of $AC = 5$ cm.

