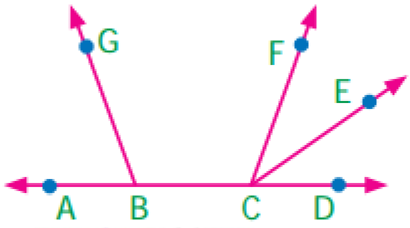
Chapter 5

Geometry

Ex 5.1

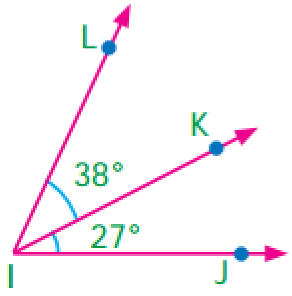
Question 1.
Name the pairs of adjacent angles.

Solution:
(i) ∠ABG and ∠GBC are adjacent angles.
(ii) ∠BCF and ∠FCD are adjacent angles.
(iii) ∠BCF and ∠FCE are adjacent angles.
(iv) ∠FCE and ∠ECD are adjacent angles.



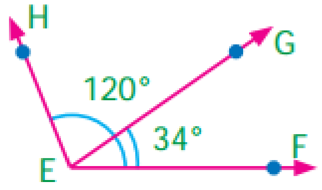
Question 2.
Find the angle ∠JIL from the given figure.

Solution:
∠LIK and ∠KIJ are adjacent angles.
∴ ∠JIL = ∠LIK + ∠KIJ
= 38° + 27°
= 65°
∴ ∠JIL = 65°



Question 3.
Find the angles ∠GEH from the given figure.

Solution:



∠HEF = ∠HEG + ∠GEF

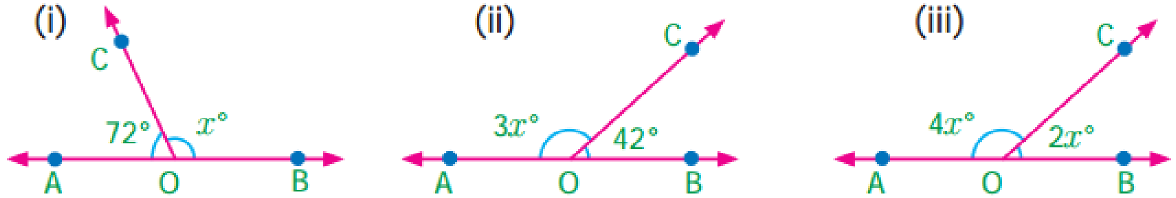
120° = ∠HEG + 34°

120°- 34° = ∠GEH + 34° – 34°

∠GEH = 86°

Question 4.

Given that AB is a straight line. Calculate the value of x° in the following cases.



Solution:

(i) Since the angles are linear pair ∠AOC + ∠BOC = 180°

72° + x° = 180°

72° + x° – 12° = 180°- 72°

x° = 108°

(ii) Since the angles are linear pair

∠AOC + ∠BOC = 180°

3x + 42° = 180°

$$3x^\circ + 42^\circ - 42^\circ = 180^\circ - 42^\circ$$

$$3x^\circ = 138^\circ$$

$$x^\circ = \frac{138^\circ}{3} = 46^\circ$$

$$\boxed{x^\circ = 46^\circ}$$

(iii) Since the angles are linear pair

∠AOC + ∠BOC = 180°

4x° + 2x° = 180°

6x° = 180°

x° = 180°

Question 5.

One angle of a linear pair is a right angle. What can you say about the other angle?

Solution:
If the angle are linear pair, then their sum is 180°.
Given one angle is right angle ie 90°.
∴ The other angle = 180° -90° = 90°
∴ The other angle also a right angle

Question 6.
If the three angles at a point are in the ratio 1 : 4 : 7, find the value of each angle?

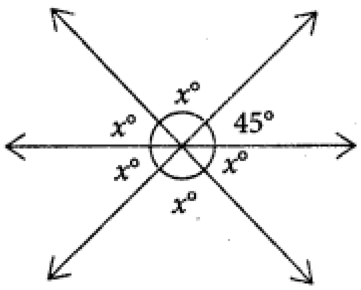
Solution:
We know that the sum of angles at a point is 360°.
Given the three angles are in the ratio 1:4:7.
Let the three angles be 1x, 4x, 7x.

$$\therefore x^\circ + 4x^\circ + 7x^\circ = 360^\circ$$
$$12x^\circ = 360^\circ$$
$$x^\circ = \frac{360^\circ}{12}$$
$$x = 30^\circ$$
$$\therefore 1x^\circ = 30^\circ$$
$$4x^\circ = 4 \times 30^\circ = 120^\circ$$
$$7x^\circ = 7 \times 30^\circ = 210^\circ.$$

∴ The three angles are 30°, 120° and 210°.

Question 7.
Three are six angles at a point. One of them is 45° and the other five angles are all equal. What is the measure of all the five angles.

Solution:
We know that the sum of angles at a point is 360°.
One angle = 45°
Let the equal angles be x° each
∴ x° + x° + x° + x° + x° + 45° = 360°
5x° + 45° – 45° = 360° – 45°



$5x° = 315°$

$$x° = \frac{315°}{5}$$

$$x° = 63°$$

∴ Measure of all 5 equal angles = 63°.

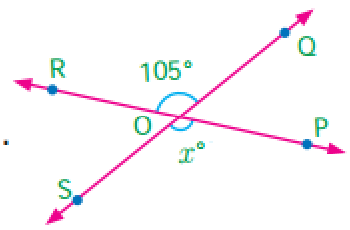
Question 8.
In the given figure, identify
(i) Any two pairs of adjacent angles.
(ii) Two pairs of vertically opposite angles.

Solution:
(i) (a) ∠PQT and ∠TOS are adjacent angles.
(b) ∠PQU and ∠UQR are adjacent angles.
(ii) (a) ∠PQT and ∠RQU are vertically opposite angles.
(b) ∠TQR and ∠PQU are vertically opposite angles.

Question 9.
The angles at a point are x°, 2x°, 3x°, 4x° and 5x°. Find the value of the largest angle?
Sum of angles at a point = 360°
∴ x° + 2x° + 3x° + 4x° + 5x° = 360°
15x° = 360°
x° = 360∘15
x° = 24°.
∴ The largest angle = 5x°
= 5 × 24° = 120°
The largest angle is 120°

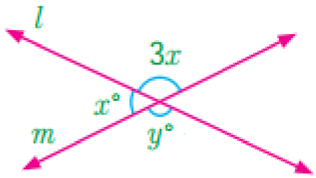
Question 10.
From the given figure, find the missing angle.

Solution:
Lines RP←→ and SQ←→ are interesting at 'O'



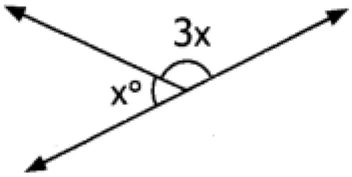
∴ Vertically opposite angles are equal.
∴ x = 105°
∴ Missing angle = 105°

Question 11.
Find the angles x° and y° in the figure shown.



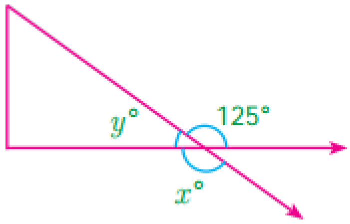
Solution:
Consider the line m.
x° and 3x° are linear pair of angles
∴ x° + 3x° = 180°

$$4x^\circ = 180^\circ$$
$$x^\circ = \frac{180^\circ}{4}$$
$$\boxed{x^\circ = 45^\circ}$$



x° = 45°
Also lines l and m intersects.
Vertically opposite angles are equal.
ie 3x° = y°
3 × 45° = y°
y = 135°
x° = 15° and
y° = 135°

Question 12.
Using the figure, answer the following questions.



(i) What is the measure of angle x°?
(ii) What is the measure of angle y°?

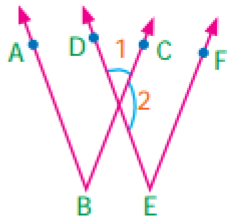
Solution:
From the figure x° and 125° are vertically opposite angles. So they are equal ie
ie x° = 125°

Also y° and 125° are linear pair of angles.
∴ $y° + 125° = 180°$
$y° + 125° – 125° = 180° - 125°$
$y° = 55°$
$x° = 125°$,
$y° = 55°$

Question 13.
Adjective angles have
(i) No common interior, no common arm, no common vertex.
(ii) One common vertex, one common arm, common interior
(iii) One common arm, one common vertex, no common interior.
(iv) One common arm, no common vertex, no common interior.

Solution:
(iii) one common arm, one common vertex, no common interior

Question 14.
In the given figure the angles ∠1 and ∠2 are
(i) Opposite angles
(ii) Adjacent angles
(iii) Linear angles
(iv) Supplementary angles



Solution:
(iii) Linear pair

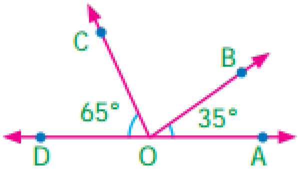
Question 15.
Vertically opposite angles are
(i) not equal in measure
(ii) Complementary
(iii) supplementary
(iv) equal in measure

Solution:
(iv) equal in measure

Question 16.
The sum of all angles at a point is
(i) 360°
(ii) 180°
(iii) 90°
(iv) 0°

Solution:
(i) 360°

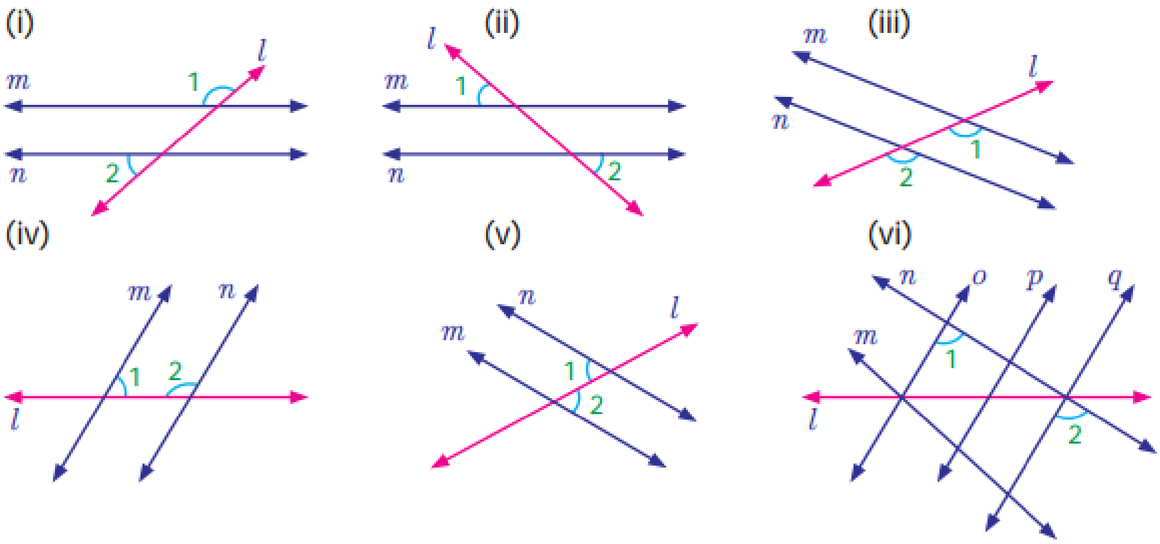
Question 17.
The measure of ∠BOC is
(i) 90°
(ii) 180°
(iii) 80°
(iv) 100°



Solution:
(iii) 80°

Ex 5.2

Question 1.
From the figures name pair of angles.



Solution:

(i) m and n are parallel lines and l is the transversal.
∴ ∠1 and ∠2 are exterior angles on the same side of the transversal.

(ii) m and n are parallel lines and l is the transversal
∠1 and ∠2 are alternate exterior angles.

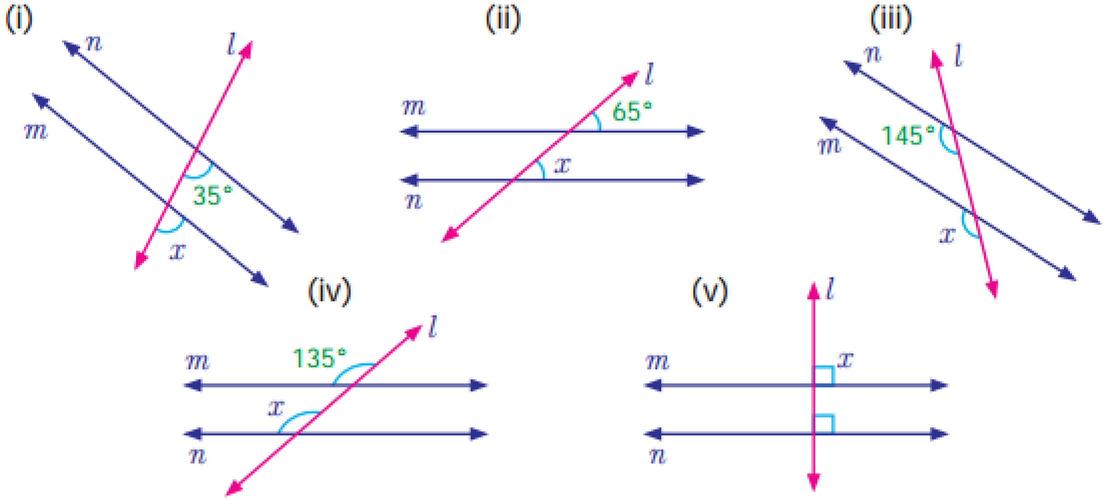
(iii) m and n are parallel lines l is the transversal
∠1 and ∠2 are corresponding angles.

(iv) m and n are parallel lines l is the transversal.
∠1 and ∠2 are interior angles on the same side of the transversal.

(v) m and n are parallel lines and l is the transversal.
∠1 and ∠2 are alternate interior angles.

(vi) o and q are parallel lines and n is the transversal.
∠1 and ∠2 are corresponding angles.

Question 2.
Find the measure of angle x in each of the following figures.



Solution:
(i) m and n are parallel lines and l is the transversal.
x° and 35° are corresponding angles and so they are equal.
∴ x = 35°

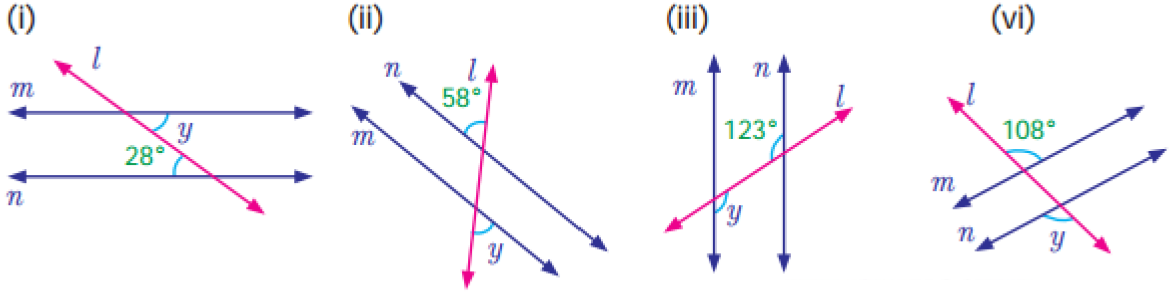
(ii) m and n are parallel lines and l is the transversal.
∴ x = 65°
[∴ corresponding angles are equal].

(iii) n and m are parallel lines and l is the transversal.
Corresponding angles are equal
∴ x = 145°

(iv) m and n are parallel lines and l is the transversal.
Corresponding angles are equal
∴ x = 135°

(v) m and n are parallel lines, l is the transversal perpendicular to both the lines
∴ x = 90°

Question 3.
Find the measure of angles in each of the following figures.



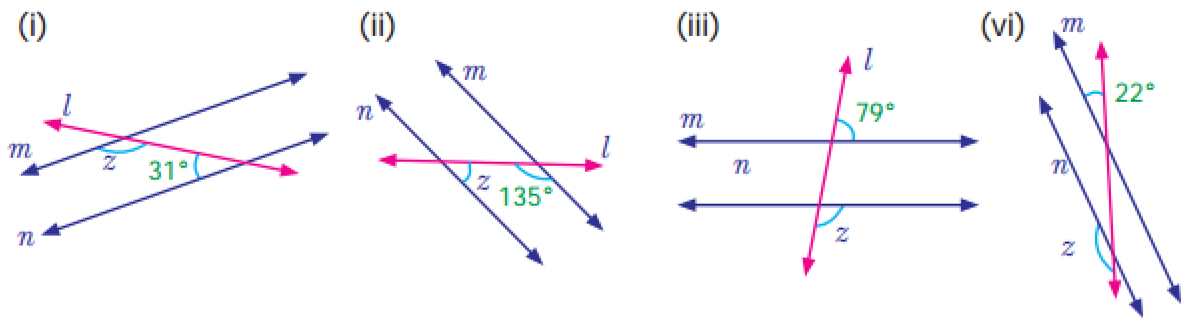
Solution:
(i) m and n are parallel lines. l is the transversal. Then alternate interior angles are equal
∴ y = 28°

(ii) m and n are parallel lines. l is the transversal. Alternate exterior angles are equal
∴ y = 58°

(iii) m and n are parallel lines. l is the transversal.
Alternate interior angles are equal
∴ y = 123°

(iv) m and n are parallel lines . l is the transversal
alternate exterior angles are equal.
∴ y = 108°

Question 4.
Find the measure of angle z in each of the following figures.



Solution:

(i) m and n are parallel lines l is the transversal

Then interior angles that lie on the same side of the transversal are supplementary

∴ z + 31° = 180°

z + 31° – 31° = 180° – 31°

z = 149°

(ii) m and n are parallel lines, l is the transversal

Interior angles that lie on the same side of the transversal are supplementary

∴ z + 135° = 180°

z + 135° – 135° = 180° – 135°

z = 45°

(iii) m and n are parallel lines l is the transversal exterior angles that lie on the same side of the transversal are supplementary.

∴ z + 79° = 80°

z + 79° – 79° = 180° – 79°

z = 101°

(iv) m and n are parallel lines and l is the transversal. Corresponding angles are equal

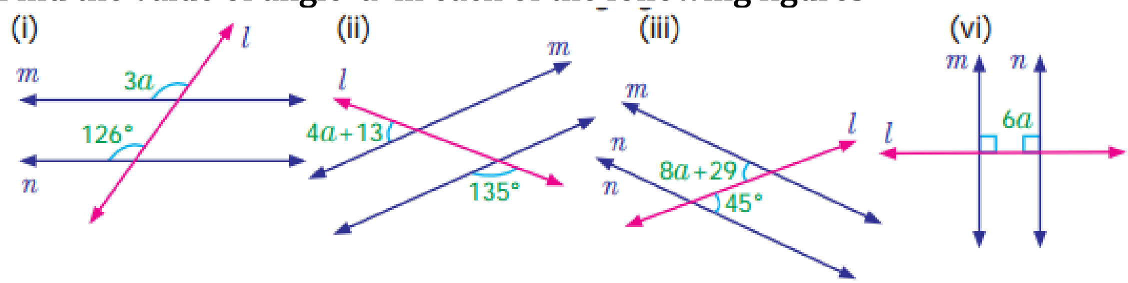
z + 22° = 180°

z + 22° – 22° = 180° – 22°

z = 158°

Question 5.

Find the value of angle 'a' in each of the following figures



Solution:

(i) m and n are parallel lines. l is the transversal

∴ Corresponding angles are equal

$$\therefore 3a = 126^\circ$$

$$a = \frac{126^\circ}{3} = 42^\circ$$

$$\boxed{a = 42^\circ}$$

(ii) m and n are parallel lines l is the transversal

Exterior angles that lie on the same side of the transversal are supplementary

∴ $(4a + 13) + 135^\circ = 180^\circ$

$4a + 13 + 135^\circ = 180^\circ$

$4a + 148^\circ = 180^\circ$

$4a + 148^\circ - 148^\circ = 180^\circ - 148^\circ$

$4a = 32^\circ$

$$a = \frac{32^\circ}{4}$$

$$\boxed{a = 8^\circ}$$

(iii) m and n are parallel lines l is the transversal

∴ Alternate interior angles are equal

$$\therefore 8a + 29^\circ = 45^\circ$$

$$8a + \cancel{29^\circ} - \cancel{29^\circ} = 45^\circ - 29^\circ$$

$$8a = 16^\circ$$

$$a = \frac{\cancel{16^\circ}^{\,2}}{\cancel{8}}$$

$$\boxed{a = 2^\circ}$$

(iv) m and n are parallel lines l is the transversal which is perpendicular to m and n

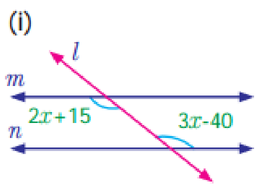
$$\therefore 6a = 90^\circ$$

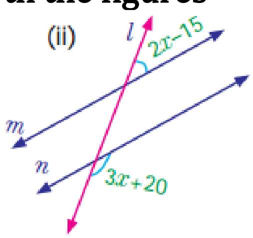
$$a = \frac{90^\circ}{6} = 15^\circ$$

$$\boxed{a = 15^\circ}$$

Question 6.

Find the value of the angle x in both the figures





Solution:

(i) m and n are parallel lines. l is the transversal

∴ Alternate interior angles are equal

$$
\begin{aligned}
\therefore \quad 2x + 15 &= 3x - 40 \\
2x + 15 - 15 &= 3x - 40 - 15 \\
2x + 55 &= 3x - \cancel{55} + \cancel{55} \\
2x + 55 &= 3x \\
2x + 55 - 2x &= 3x - 2x \\
55 &= x
\end{aligned}
$$

$$\boxed{x = 55^\circ}$$

(ii) m and n are parallel lines. l is the transversal

Exterior angles on the same side of the transversal are supplementary

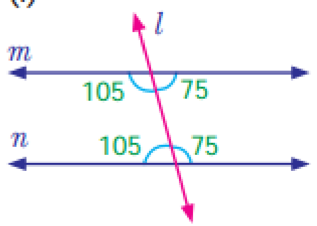
$$
\begin{aligned}
\therefore (2x - 15) + (3x + 20) &= 180^\circ \\
2x - 15 + 3x + 20 &= 180^\circ \\
5x + 5 &= 180^\circ \\
5x + \cancel{5} - \cancel{5} &= 180 - 5 \\
5x &= 175^\circ \\
x &= \frac{175}{5} \\
&= 35^\circ
\end{aligned}
$$

$$\boxed{x = 35^\circ}$$

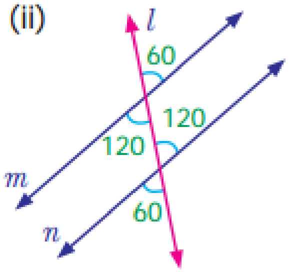
Question 7.

Anbu has marked the angles as shown below in (i) and (ii). Check whether both of them are correct. Give reasons

(i)



(ii)



Solution:

(i) m and n are parallel lines. l is the transversal.

Interior angles on the same side of the transversal are supplementary. But here it is 75 + 75 ≠ 180°

105 + 105 ≠ 180°

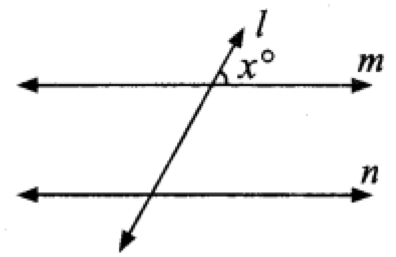
∴ Angles marked are not correct

(ii) m and n are parallel lines. l is the transversal.
Corresponding angles must be equal. So here the marking is wrong.

Question 8.
Mention two real life situations where we use parallel lines.
Solution:
Two angles of a wall in a building Cross rods in a window.

Question 9.
Two parallel lines are intersected by a transversal. What is the minimum number of angles you need to know to find the remaining angles. Give reasons.

Solution:



When two parallel lines are intersected by a transversal, we need a minimum of a single angle to find the remaining angle.
Using the concept of linear pair of angles, we can final one more angle.
By the concepts of corresponding angles, alternate interior angles and alternate , exterior angles we could find all other angles.

Objective Type Questions

Question 10.
A line which intersects two or more lines in different points is known as
(i) parallel lines
(ii) transversal
(iii) non-parallel lines
(iv) Intersecting lines

Solution:
(ii) Transversal

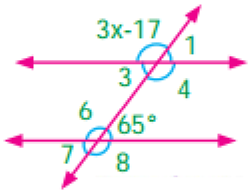
Question 11.
In the given figure angles a and b are
(i) alternate exterior angles
(ii) corresponding angles
(iii) Alternate interior angles
(iv) Vertically opposite angles

Solution:
(i) alternate exterior angles

Question 12.
Which of the following statement is ALWAYS TRUE when parallel lines are cut by a transversal
(i) corresponding angles supplementary
(ii) alternate interior angles supplementary
(iii) alternate exterior angles supplementary
(iv) interior angles on the same side of the transversal are supplementary

Solution:
(iv) Interior angles on the same side of the transversal are supplementary.

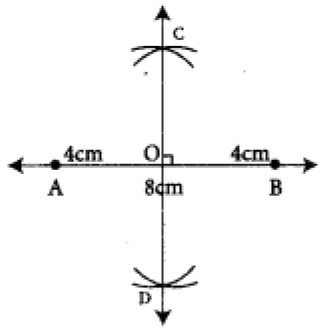
Question 13.
In the diagram what is the value of angle x?
(i) 43°
(ii) 44°
(iii) 132°
(iv) 134°

Hint:


Ex 5.3

Question 1.
Draw a line segment of given length and construct a perpendicular bisector to each line segment using scale and compass
(a) 8 cm
(b) 7 cm
(c) 5.6 cm
(d) 10.4 cm
(e) 58 cm

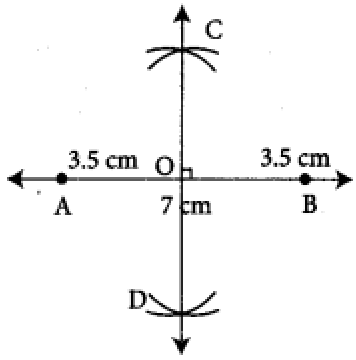
Solution:
(a) 8 cm
Construction :



Step 1: Drawn a line. Marked two points A and B on it so that AB = 8 cm
Step 2: Using compass with A as centre and radius more than half of the length of AB, drawn two arcs of the same length one above AB and one below AB
Step 3: With the same radius and B as centre drawn two arcs to cut the arcs drawn in step 2. Marked the points of intersection of the arcs as C and D.
step 4: Joined C and D, CD intersect AB. Marked the point of intersection as 'O'.
CD is the required perpendicular bisector of AB.

$AO = OB = \frac{8}{2} = 4 \text{ cm} ; \angle AOC = 90°$

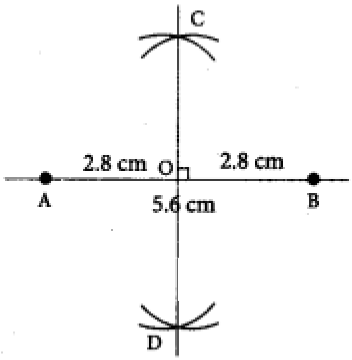
(b) 7 cm
Construction :



step 1: Drawn a line and marked points A and B on it so that AB = 7 cm.
step 2: Using compass with A as centre and radius more than half of the length of AB drawn two arcs of same length one above AB and one below AB.
step 3: With the same radius and B as centre drawn two arcs to cut the already drawn arcs in step 2. Marked the intersection of the arcs as C and D
step 4: Joined C and D, CD is the required perpendicular bisector of AB.

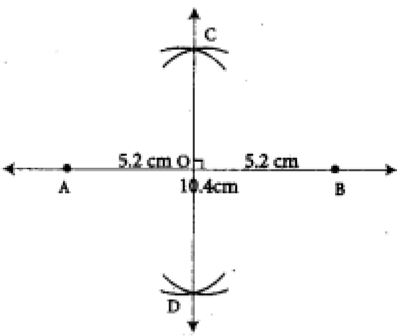
$AO = OB = \frac{7}{2} = 3.5\text{cm} ; \angle AOC = 90°$

(c) 5.6 cm.
Construction :



Step 1: Drawn a line and marked two points A and B on it so that AB = 5.6cm
Step 2: Using compass with A as centre and radius more than half of the length of AB, drawn two arcs of the same length, one above AB and one below AB
Step 3: With the same radius and B as centre drawn two arcs to cut the arcs drawn in step 2 and marked the points of intersection of the arcs as C and D
Step 4: Joined C and D. CD intersects AB. Marked the point of intersection as 'O'CD is the required perpendicular bisector of AB.
Now $\angle AOC = 90°$ AO = BO = 2.8 cm

(d) 10.4 cm
Construction :

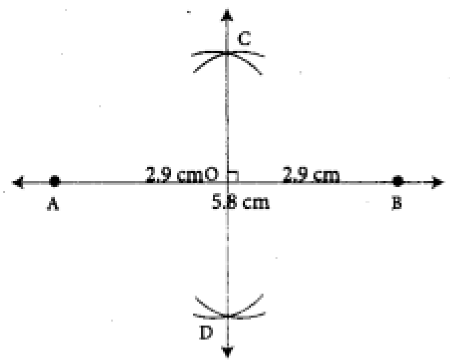


Step 1: Drawn a line and marked two points A and B on it so that AB = 10.4 cm.
Step 2: Using compass with A as centre and radius more than half of the length of AB, drawn two arcs of same length one above AB and one below AB.
Step 3: With the same radius and B as centre drawn two arcs to cut the arcs drawn in step 2 and marked the points of intersection of the arcs as C and D.
Step 4: Joined C and D. CD intersects AB. Marked the points of intersection as O. CD is the required perpendicular bisector.
Now $\angle AOC = 90°$; AO = BO = 5.2 cm

(e) 58 mm

$$58\text{mm} = 58 \times \frac{1}{10}\ \text{cm} = 5.8\ \text{cm}$$

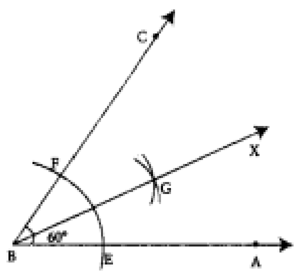
Construction :



Step 1: Drawn a line. Marked two points A and B on it so that
AB = 5.8 cm = 58 mm.
Step 2: Using compass with A as centre and radius more than half of the length of AB, drawn two arcs of the same length one above AB and one below AB.
Step 3: With the same radius and B as centre drawn two arcs to cut the arcs of drawn in step 2. Marked the points of intersection of the arcs as C and D.
Step 4: Joined C and D. CD intersects AB. Marked the point of intersection as O.
CD is the required perpendicular bisector. ∠AOC = 90°
AO = BO = 2.9 cm

Ex 5.4

Question 1.
Construct the following angles using protractor and draw a bisector to each of the angle using ruler and compass.
(a) 60°
(b) 100°
(c) 90°
(d) 48°
(e) 110°.
Solution:
(a) 60°
Construction:

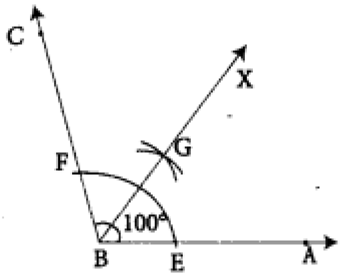


Step 1: Drawn the given angle ∠ABC with the measure 60° using protractor.
Step 2: With B as centre and convenient radius, drawn an arc to cut BA and BC. Marked the points of intersection as E on BA and F on BC.
Step 3: With the same radius and E as centre drawn an arc in the interior of

∠ABC and another arc of same measure with centre at F to cut the previous arc.
Step 4: Marked the point of intersection as G. Drawn a ray BX through G. BG is the required bisector of the given ∠ABC

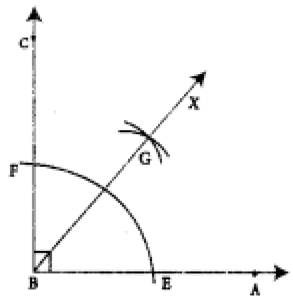
Now $\angle ABG = \angle CBG = 30°$

(b) 100°



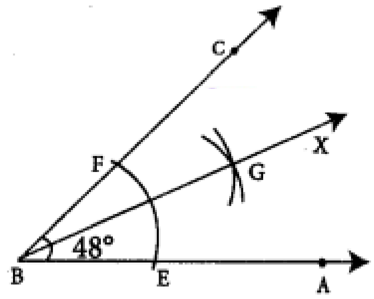
Construction :
Step 1: Drawn the given angle ∠ABC with the measure 100° c using protractor.
Step 2: With B as centre and convenient radius, drawn an arc to cut BA and BC. Marked the points of intersection as E on BA and F on BC.
Step 3: With the same radius and E as centre drawn an arc in the interior of ∠ABC and another arc of the same measure with centre at F to cut the previous arc.
Step 4: Marked the point of intersection at G. Drawn a ray BX through G.
BG is the required bisector of angle ∠ABC
∠ABG = ∠GBC = 50°

(c) 90°
Construction :



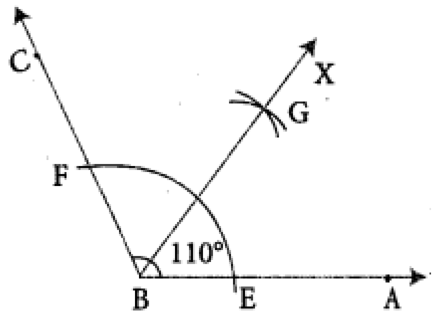
Step 1: Drawn the given angle ∠ABC with the measure 90° using protractor.
Step 2: With B as center and convenient radius, drawn an arc to cut BA and BC. Marked the points of intersection as E on BA and F on BC.
Step 3: With the same radius and E as center drawn an arc in the interior of ∠ABC and another arc of same measure with center at F to cut the previous arc.
Step 4: Mark the point of interaction as G. Drawn a ray BX through G. BG is the required bisector of the given angle ∠ABC
∠ABG = ∠GBC = 45°

(d) 48°



Construction :
Step 1: Drawn the given angle ∠ABC with the measure 48° using protractor.
Step 2: With B as center and convenient radius, drawn an arc to cut BA and to cut BA and BC. Marked the points of intersection as E on BA and F on BC.
Step 3: With the same radius and E as center drawn an arc in the interior of ∠ABC and another arc of the same measure with center at F to cut the previous arc.
Step 4: Marked the point of intersection as G. Drawn a ray BX through G. BG is the required bisector of the given angle ∠ABC
Now ∠ABC = ∠GBC = 24°

(e) 110°
Construction:

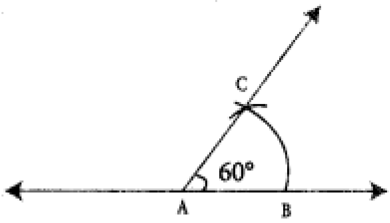


Step 1: Drawn the given angle ∠ABC with the measure 110° using protractor.
Step 2: With B as center and convenient radius, drawn an arc to cut BA and BC. Marked points of intersection as E on BA and F BC.
Step 3: With the same radius and E as center, drawn an arc in the interior of ∠ABC and another arc of same measure with center at F to cut the previous arc.
Step 4: Mark the point of intersection as G. Drawn a ray BX through G. BG is the
required bisector of the given angle ∠ABC
∠ABG = ∠GBC = 55°

Ex 5.5

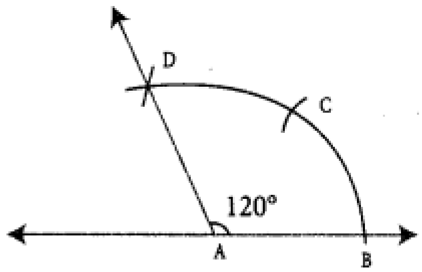
Question 1.
Construct the following angles using ruler and compass only.
(i) 60°
(ii) 120°
(iii) 30°
(iv) 90°
(v) 45°
(vi) 150°
(vii) 135°

Solution:
(i) 60°
Construction :
Step 1: Drawn a line and marked a point 'A' on it.
Step 2: With A as center drawn an arc of convenient radius to meet the line at a point B.



Step 3: With the same radius and B as center drawn an arc to cut the previous arc at C.
Step 4: Joined AC. The ∠ABC is the required angle with the measure 60°.

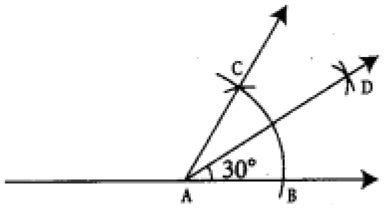
(ii) 120°
Construction :



We know that there are two 60° angles in 120°.
∴ We can construct two 60° angles consecutively construct 120°
Step 1: Drawn a line and marked a point 'A' on it.
Step 2: With 'A' as center, drawn an arc of convenient radius to the line at a point B.
Step 3: With the same radius and B as center, drawn an arc to cut the previous arc at C.
Step 4: With the same radius and C as center, drawn an arc to cut the arc drawn in step 2 at D.

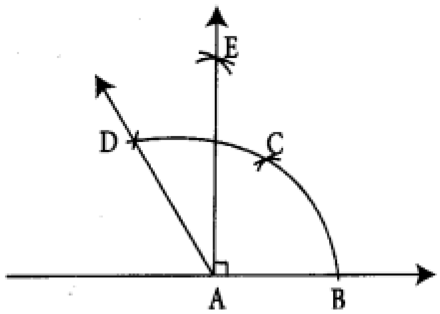
Step 5: Joined AD. Then ∠BAD is the required angle with measure 120°.

(iii) 30°
Constructions :



Since 30° is half of 60°, we can construct 30° by bisecting the angle 60°.
Step 1: Drawn a line and marked a point A on it.
Step 2: With A as center drawn an arc of convenient radius to the line to meet at a point B.
Step 3: With the same radius and B as center drawn an arc to cut the previous arc at C.
Step 4: Joined AC to get ∠BAC = 60°
Step 5: With B as center drawn an arc of convenient radius in the interior of ∠BAC
Step 6: With the same radius and C as center drawn an arc to cut the previous arc at D.
Step 7: Joined AD.
∴ ∠BAD is the required angle of measure 30°.

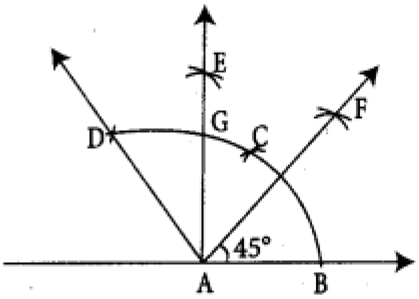
(iv) 90°
Construction :



Step 1: Drawn a line and marked a point 'A' on it.
Step 2: With 'A' as center, drawn an arc of convenient radius to the line at a point B.
Step 3: With the same radius and B as center drawn an arc to cut the previous arc at 'C'.
Step 4: With the same radius and C as center, drawn an arc to cut the arc drawn in step 2 at D.
Step 5: Joined AD. ∠BAD = 120°.
Step 6: With C as center, drawn an arc of convenient radius in the interior of

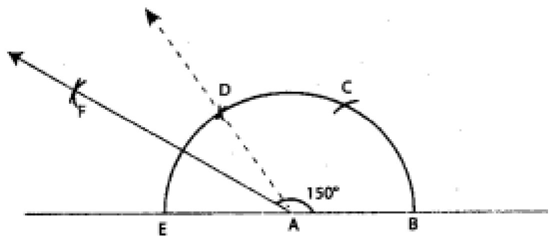
∠CAD.
Step 7: With the same radius and D as center, drawn an arc to cut the arc at E.
Step 8: Joined AF ∠BAE = 90°.

(v) 45°
Construction :
Step 1: Drawn a line and marked a point A on it



Step 2: With A as center, drawn an arc of convenient radius to the line at a point B.
Step 3: With the same radius and B as center drawn an arc to cut the previous arc at C.
Step 4: With the same radius and C as center, drawn an arc to cut the arc drawn in step 2 at D.
Step 5: Joined AD. ∠BAD = 120°.
Step 6: With G as center and any convenient radius drawn an arc in the interior of ∠GAB
Step 7: With the same radius and B as center drawn an arc to cut the arc at F.
Step 8: Joined AF. ∠BAF = 45°

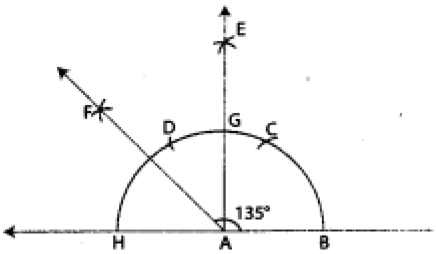
(vi) 150°
Construction :



Since 150° = 60° + 60° + 30°; we construct as follows
Step 1: Drawn a line and marked a point A on it.
Step 2: With 'A' as center, drawn a full arc of convenient radius to the line at a point B and at E the other end.
Step 3: With the same radius and B as center, drawn an arc to cut the previous arc at C.
Step 4: With the same radius and C as center drawn an arc to cut the already drawn arc at D.
Step 5: With D as center, drawn an arc of convenient radius in the interior of

∠DAE
Step 6: With E as center and with the same radius drawn an arc to cut the previous arc at F.
Step 7: Joined AF, ∠FAB = 150°.

(vii) 135°
Construction :



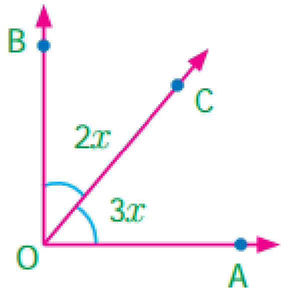
Step 1: Drawn a line and marked a point A on it.
Step 2: With 'A' as center, drawn an arc of convenient radius to the line at a point B.
Step 3: With the same radius and B as center drawn an arc to cut the previous arc at C.
Step 4: With the same radius and C as center, drawn an arc to cut the arc at D.
Step 5: With C and D as centers drawn arcs of convenient (same) radius in the interior of ∠CAD. Marked the point of intersection as E.
Step 6: Joined AE, through G. ∠BAE = 90°.
Step 7: Drawn angle bisector to ∠GAH through F.
Now ∠BAF = 135°.

Ex 5.6

Miscellaneous Practice Problems

Question 1.
Find the value of x if ∠AOB is a right angle.

Solution:
Given that ∠AOB = 90°

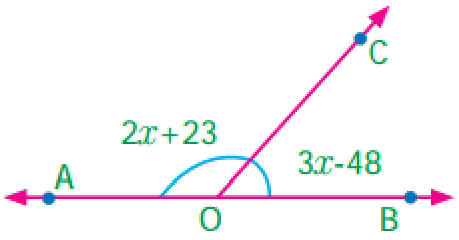


∠AOB = ∠AOC + ∠COB = 90° (Adjacent angles)

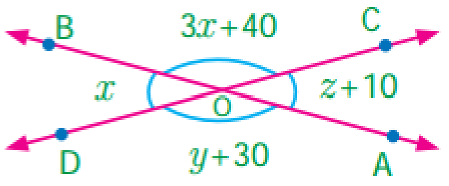
$3x + 2x = 90°$
$5x = 90°$
$$x = \frac{90°}{5}$$
$$= 18°$$
$$\boxed{x = 18°}$$

Question 2.
In the given figure, find the value of x.

Solution:
Since ∠BOC and ∠AOC are linear pair, their sum = 180°
$2x + 23 + 3x – 48 = 180°$
$5x – 25 = 180°$
$5x – 25 + 25 = 180° + 25$
$$x = \frac{205°}{5}$$
$$\boxed{x = 41°}$$



Question 3.
Find the value of x, y and z.

Solution:


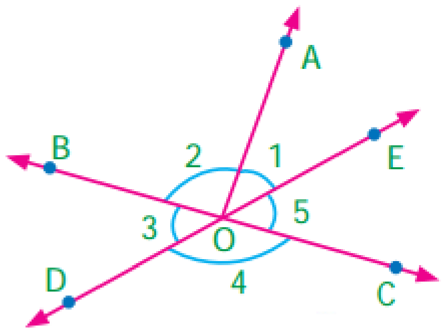
∠DOB and ∠BOC are linear pair
∴ ∠DOB + ∠BOC = 180°
$x + 3x + 40 = 180°$
$4x + 40 = 180°$
$4x + 40 – 40 = 180° – 40°$
$4x = 140°$

$$x = \frac{140°}{4}$$
$$x = 35°$$
Also ∠BOD and ∠AOC are vertically opposite angles.
∴ ∠BOD = ∠AOC
x = z + 10
35° = z + 10
z + 10 – 10 = 35 – 10
z = 25°
Again ∠AOD and ∠AOC are linear pair.
∴ ∠AOD + ∠AOC = 180°
y + 30 + z + 10 = 180°
y + 30 + 25 + 10 = 180°
y + 65 = 180°
y + 65 – 65 = 180° – 65
y = 115°
∴ x = 35°,
y = 115°,
z = 25°

Question 4.
Two angles are in the ratio 11 : 25. If they are linear pair, find the angles.

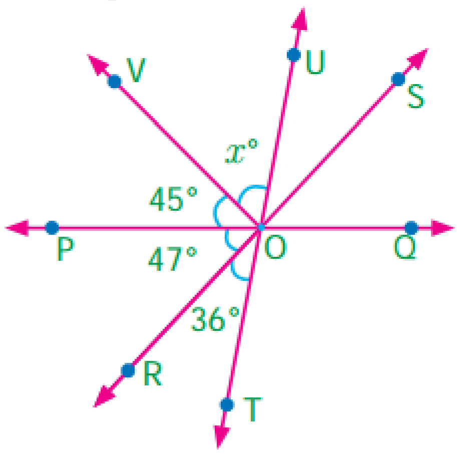
Solution:
Given two angles are in the ratio 11 : 25.
Let the angles be 11x and 25x.
They are also linear pair
∴ 11x + 25x = 180°.
$$36x = 180°$$
$$x = \frac{180°}{36}$$
$$x = 5°$$
∴ The angles 11x = 11 × 5° = 55° and 25x = 25 × 5 = 125°.
∴ The angles are 55° and 125°.

Question 5.
Using the figure, answer the following questions and justify your answer.
(i) Is ∠1 adjacent to ∠2?
(ii) Is ∠AOB adjacent to ∠BOE?
(iii) Does ∠BOC and ∠BOD form a linear pair?
(iv) Are the angles ∠COD and ∠BOD supplementary.
(v) Is ∠3 vertically opposite to ∠1 ?



Solution:
(i) Yes, ∠1 is adjacent to ∠2.
Because they both have the common vertex 'O' and the common arm OA . Also their interiors do not overlap.
(ii) No, ∠AOB and ∠BOB are not adjacent angles because they have overlapping interiors.
(iii) No, ∠BOC and ∠BOD does not form a linear pair.
Because ∠BOC itself a straight angle, so the sum of ∠BOC and ∠BOD exceed 180°.
(iv) Yes, the angles ∠COD and ∠BOD are supplementary ∠COD + ∠BOD = 180°, [∵ linear pair of angles]
∴ ∠COD and ∠BOD are supplementary.
(v) No. ∠3 and ∠1 are not formed by intersecting lines. So they are not vertically opposite angles.

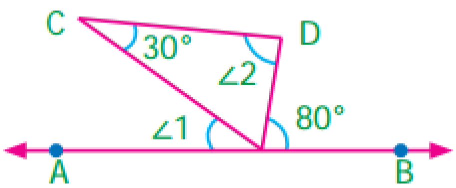
Question 6.
In the figure POQ, ROS and TOU are straight lines. Find the x°.



Solution:
Given TOU is a straight line.
∴ The sum of all angles formed at a point on a straight line is 180°
∠TOR + ∠ROP + ∠POV + ∠VOU = 180°.

$36° + 47° + 45° + x° = 180°$.
$128° + x° = 180°$
$128° + x° - 128° = 180° - 128°$
$x = 52°$

Question 7.
In the figure AB is parallel to DC. Find the value of ∠1 and ∠2. Justify your answer.



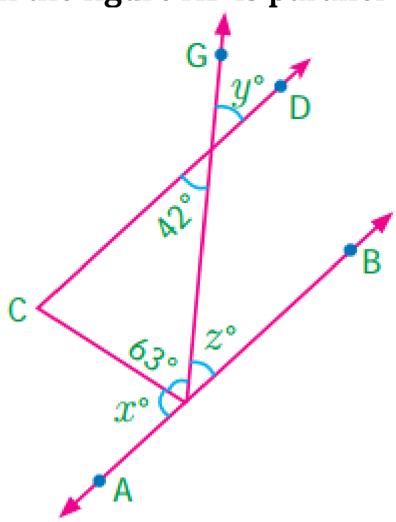
Solution:
Given AB || DC
AB and CD are parallel lines Taking CE as transversal we have.
$\angle 1 = 30°$, [∵ alternate interior angles]
Taking DE as transversal
$\angle 2 = 80°$.[∵ alternate interior angles]
$\angle 1 = 30°$ and $\angle 2 = 80°$
Justification:
CDE is a triangle

∠AEC + ~~∠CED~~ + ∠DEB = ~~∠DEC~~ + ∠ECD + ∠CDE

$\angle 1 + 80° = 30° + \angle 2$

$\therefore 30° + 80° = 30° + 80°$.

Question 8.
In the figure AB is parallel to CD. Find x, y and z.

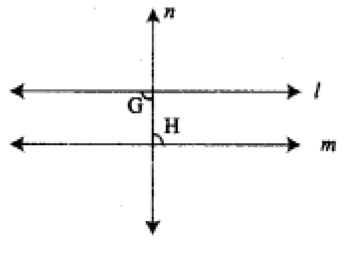


Solution:
Given AB || CD
∴ Z = 42 (∵ Alternate interior angles)
Also y = 42° [vertically opposite angles]
Also x° + 63° + z° = 180°
x° + 63° + 42° = 180°
x° + 105° = 180°
x°+ 105° – 105° = 180° – 105°
x° = 75°
∴ x = 75°;
y = 42°;
z = 42°

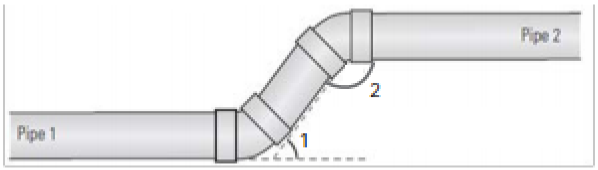
Question 9.
Draw two parallel lines and a transversal. Mark two alternate interior angles G and H. If they are supplementary, what is the measure of each angle?

Solution:
l and m are parallel lines and n is the transversal.
∠G and ∠H are alternate interior angles.
∠G = ∠H …… (1)
Given ∠G and ∠G are Suplementary

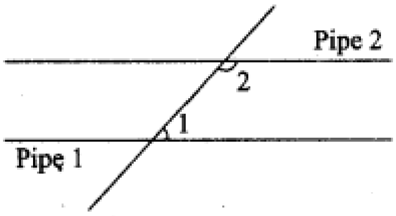
ie
$$\angle G + \angle H = 180^\circ$$
$$\angle H + \angle H = 180^\circ \text{ (from (1))}$$
$$2\angle H = 180^\circ$$
$$\angle H = \frac{180^\circ}{2}$$
$$\angle H = 90^\circ$$
$$\boxed{\angle G = \angle H = 90^\circ}$$



Question 10.
A plumber must install pipe 2 parallel to pipe 1. He knows that ∠1 is 53. What is the measure of ∠2?



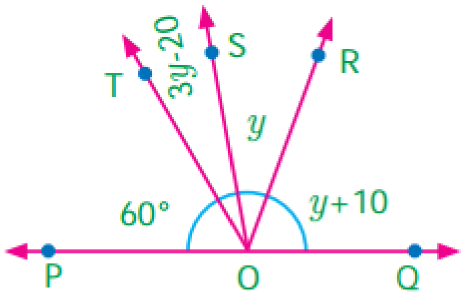
Solution:
Given ∠1 = 53°



Clearly ∠1 and ∠2 are interior angles on the same side of the transversal and so they are supplementary.
∠1 + ∠2 = 180°
53° + ∠2 = 180°
53° + ∠2 – 53° = 180° – 53°
∠2 = 127°

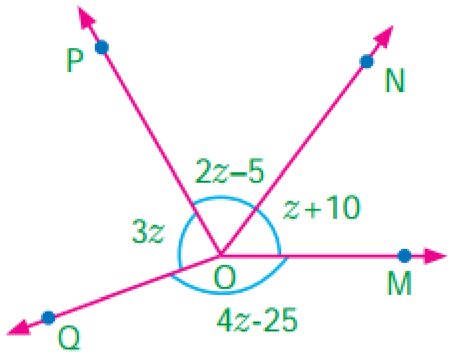
Challenge Problems

Question 11.
Find the value of y.



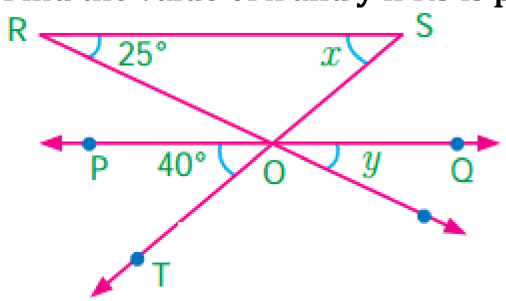
Solution:
Cleary POQ is a straight line"
Sum of all angles formed at a point on a straight line is 180°
∴ ∠POT + ∠TOS + ∠SOR + ∠ROQ = 180°
60° + (3y – 20°) + y° + (y + 10°) = 180°
60° + 3y – 20° + y° + y° + 10° = 180°
5y + 50° = 180°
5y + 50° – 50° = 180° – 50
5y = 130°
y=130∘5
y = 26°

Question 12.
Find the value of z.



Solution:
The sum of angles at a point is 360°.
∴ ∠QOP + ∠PON + ∠NOM + ∠MOQ = 360°
3z + (2z – 5) + (z + 10) + (4z – 25) = 360°
3z + 2z + z + 4z — 5 +10 — 25 = 360°
10z – 20° = 360°
10z – 20° + 20 = 360°+ 2
10z = 380°
z=380∘10
z = 38°

Question 13.
Find the value of x and y if RS is parallel to PQ.

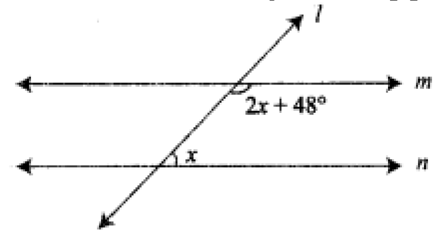


Solution:
Given RS || PQ
Considering the transversal RU, we have y = 25° (corresponding angles)
Considering ST as transversal

Question 14.
Two parallel lines are cut by a transversal. For each pair of interior angles on the same side of the transversal, if one angle exceeds the twice of the other angle by 48°. Find the angles.

Solution:

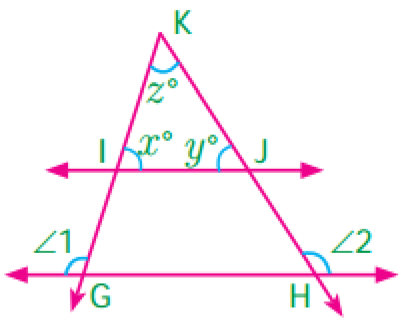
Let the two parallel lines be m and n and l be the transversal
Let one of the interior angles on the same side of the transversal be x°
Then the other will be 2x + 48.
We know that they are supplementary.



$$\therefore x + (2x + 48°) = 180°$$
$$x + 2x + 48° = 180°$$
$$3x + 48° = 180°$$
$$3x + 48° - 48° = 180° - 48°$$
$$3x = 132°$$
$$x = \frac{132°}{3}$$
$$x = 44°$$
$\therefore$ One angle is $x = 44°$
Other angle is $2x + 48 = 2(44) + 48°$
$= 88° + 48 = 136°$
$\therefore$ The angles are 44° and 136°

Question 15.
In the figure, the lines GH and IJ are parallel. If ∠1 = 108° and ∠2 = 123°, find the value of x, y and z.

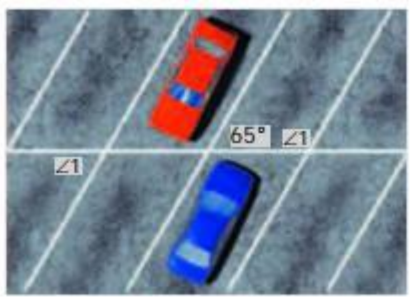
Solution:
Given GH || IZ
∠1 = 108°
∠2 = 123°
∠1 + ∠KGH = 180 [linear pair]
108° + ∠KGH = 180°



108° + ∠KGH – 108° = 180° – 108°

∠KGH = 72°
∠KGH = x° (corresponding angles if KG is a transversal)
∴ x° = 72°
Similarly
∠2 + ∠GHK = 180° (∵ linear pair)
123° + ∠GHK = 180°
123° + ∠GHK – 123° = 180° – 123°
∠GHK = 57°
Again ∠GHK = y° (corresponding angles if KH is a transversal)
y = 57°
x° +y° + z° = 180° (sum of three angles of a triangle is 180°)
72° + 57° + z° = 180°
129° + z° = 180°
129° + z° – 129° = 180° – 129°
z = 51°
x = 72°,
y = 57°,
z = 51°

Question 16.
In the parking lot shown, the lines that mark the width of each space are parallel. If
∠1 = (2x – 3y)°; ∠2 = (x + 39)° find x° and y°.



Solution:
From the picture
∠2 + 65° = 180° [Sum of interior angles on the same side of a transversal]
x + 39° + 65° = 180°
x + 104° = 180°
x + 104° – 104° = 180° – 104°
x = 76°
Also from the picture
∠1 = 65° [alternate exterior angles]
2x – 3y = 65°
2 (76) – 3y = 65°
152° – 3y = 65°

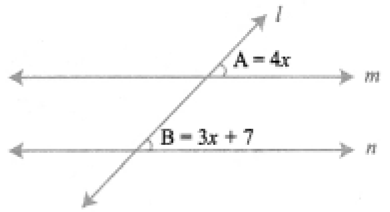
$152° – 3y – 152° = 65 – 152°$
$-3y = -87$

$$y = \frac{-87}{-3}$$

$$\boxed{y = 29°} = \boxed{x = 76°; y = 29°}$$

Question 17.
Draw two parallel lines and a transversal. Mark two corresponding angles A and B. If ∠A = 4x, and ∠B = 3x + 7, find the value of x. Explain.

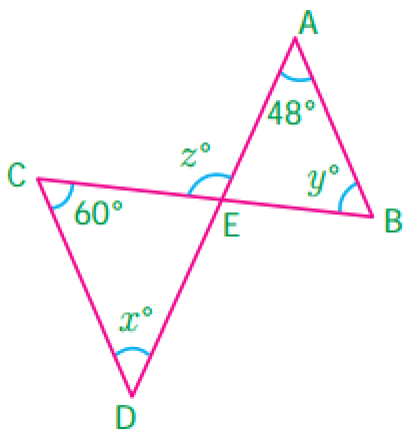
Solution:
Let m and n are two parallel lines and l is the transversal.
A and B are corresponding angles.
We know that corresponding angles are equals,



$$\therefore 4x = 3x + 7$$
$$4x - 3x = \cancel{3x} + 7 - \cancel{3x}$$
$$x = 7°$$
$$\therefore \angle A = 4 \times 7 = 28° \text{ and } \angle B = 3\ (7) + 7$$
$$= 21 + 7 = 28$$

Question 18.
In the figure AB in parallel to CD. Find x°, y° and z°.

Solution:



Given AB||CD
Then AD and BC are transversals.
x = 48°, alternate interior angles; AD is transversal y = 60°, alternate interior

angles; BC is transversal

$\angle AEB + 48° + y° = 180°$, (sum of angles of a triangle is 180°)

$$\angle AEB + 48° + 60° = 180°$$
$$\angle AEB + 108° = 180°$$
$$\angle AEB + 108° - 108° = 180° - 108°$$
$$\angle AEB = 72°$$
$$\therefore \angle AEB + z° = 180° \text{ [linear pair]}$$
$$72° + z° = 180°$$
$$\cancel{72°} + z° - \cancel{72°} = 180° - 72°$$
$$z° = 108°$$
$$\boxed{x = 48°; y = 60°; z = 108°}$$

Question 19.

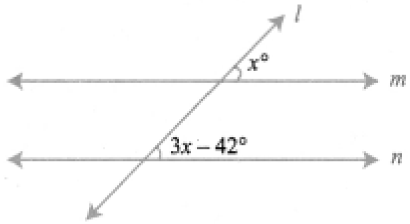
Two parallel lines are cut by transversal. If one angle of a pair of corresponding angles can be represented by 42° less than three times the other. Find the corresponding angles.

Solution:

We know that the corresponding angles are equal.

Let one of the corresponding angles be x.

Then the other will be 3x – 42°.



$$\therefore 3x - 42° = x°$$
$$3x - \cancel{42°} + \cancel{42°} = x° + 42°$$
$$3x° = x + 42°$$
$$3x° - x° = \cancel{x} + 42 - \cancel{x}$$
$$2x = 42°$$
$$x = \frac{42}{2}$$
$$x = 21°$$

$\therefore$ The corresponding angles are 21° each

Question 20.

In the given figure, ∠8 = 107°, what is these sum of the angles ∠2 and ∠4.

Solution:

Given $\angle 8 = 107°$

$\angle 2 = 107°$

[$\because$ $\angle 8$ and $\angle 2$ are alternate exterior angles, $\because$ $\angle 8 = \angle 2$]

$$\angle 4 = \angle 2 \text{ (vertically opposite angles)}$$

$$\therefore \quad \angle 4 = 107°$$

$$\therefore \quad \angle 2 + \angle 4 = 107° + 107°$$

$$= 214°$$

$$\boxed{\angle 2 + \angle 4 = 214°}$$