EXERCISE 14.1 PAGE NO: 14.6

1. Write down each pair of adjacent angles shown in fig. 13.

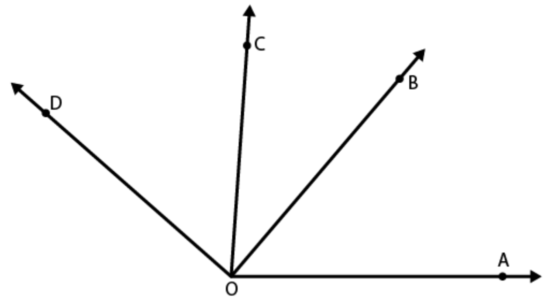


Fig 13

Solution:

The angles that have common vertex and a common arm are known as adjacent angles

Therefore the adjacent angles in given figure are:

∠DOC and ∠BOC

∠COB and ∠BOA

2. In Fig. 14, name all the pairs of adjacent angles.

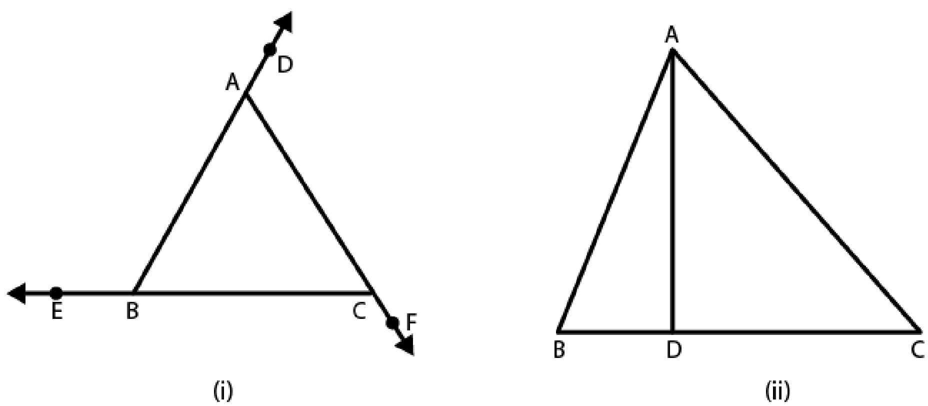


Fig 14

Solution:

The angles that have common vertex and a common arm are known as adjacent angles.

In fig (i), the adjacent angles are

∠EBA and ∠ABC

∠ACB and ∠BCF

∠BAC and ∠CAD

In fig (ii), the adjacent angles are

∠BAD and ∠DAC
∠BDA and ∠CDA

3. In fig. 15, write down
(i) Each linear pair
(ii) Each pair of vertically opposite angles.

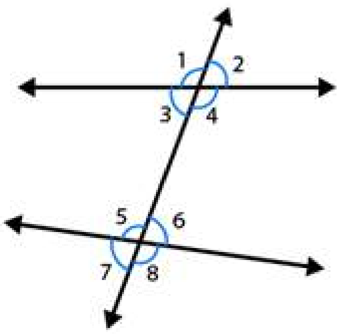


Fig 15

Solution:
(i) The two adjacent angles are said to form a linear pair of angles if their non – common arms are two opposite rays.
∠1 and ∠3
∠1 and ∠2
∠4 and ∠3
∠4 and ∠2
∠5 and ∠6
∠5 and ∠7
∠6 and ∠8
∠7 and ∠8

(ii) The two angles formed by two intersecting lines and have no common arms are called vertically opposite angles.
∠1 and ∠4
∠2 and ∠3
∠5 and ∠8
∠6 and ∠7

4. Are the angles 1 and 2 given in Fig. 16 adjacent angles?

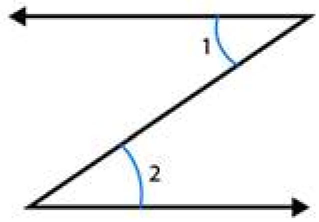


Fig 16

Solution:

No, because they don't have common vertex.

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

(i) 35^o

(ii) 72^o

(iii) 45^o

(iv) 85^o

Solution:

(i) The two angles are said to be complementary angles if the sum of those angles is 90^o

Complementary angle for given angle is

$90^o - 35^o = 55^o$

(ii) The two angles are said to be complementary angles if the sum of those angles is 90^o

Complementary angle for given angle is

$90^0 - 72^o = 18^o$

(iii) The two angles are said to be complementary angles if the sum of those angles is 90^o

Complementary angle for given angle is

$90^o - 45^o = 45^o$

(iv) The two angles are said to be complementary angles if the sum of those angles is 90^o

Complementary angle for given angle is

$90^o - 85^o = 5^o$

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

(i) 70^o

(ii) 120^o

(iii) 135^o

(iv) 90^o

Solution:

(i) The two angles are said to be supplementary angles if the sum of those angles is 180^o
Therefore supplementary angle for the given angle is
$180^o - 70^o = 110^o$

(ii) The two angles are said to be supplementary angles if the sum of those angles is 180^o
Therefore supplementary angle for the given angle is
$180^o - 120^o = 60^o$

(iii) The two angles are said to be supplementary angles if the sum of those angles is 180^o
Therefore supplementary angle for the given angle is
$180^o - 135^o = 45^o$

(iv) The two angles are said to be supplementary angles if the sum of those angles is 180^o
Therefore supplementary angle for the given angle is
$180^o - 90^o = 90^o$

7. Identify the complementary and supplementary pairs of angles from the following pairs:
(i) 25^o, 65^o
(ii) 120^o, 60^o
(iii) 63^o, 27^o
(iv) 100^o, 80^o

Solution:

(i) $25^o + 65^o = 90^o$ so, this is a complementary pair of angle.
(ii) $120^o + 60^o = 180^o$ so, this is a supplementary pair of angle.

(iii) $63^o + 27^o = 90^o$ so, this is a complementary pair of angle.

(iv) $100^o + 80^o = 180^o$ so, this is a supplementary pair of angle.

8. Can two obtuse angles be supplementary, if both of them be
(i) Obtuse?
(ii) Right?

(iii) Acute?

Solution:
(i) No, two obtuse angles cannot be supplementary
Because, the sum of two angles is greater than 90^o so their sum will be greater than 180^o

(ii) Yes, two right angles can be supplementary
Because, $90^o + 90^o = 180^o$

(iii) No, two acute angle cannot be supplementary
Because, the sum of two angles is less than 90^o so their sum will also be less than 90^o

9. Name the four pairs of supplementary angles shown in Fig.17.

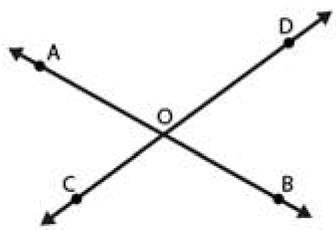


Fig 17

Solution:
The two angles are said to be supplementary angles if the sum of those angles is 180^o
The supplementary angles are
∠AOC and ∠COB
∠BOC and ∠DOB
∠BOD and ∠DOA
∠AOC and ∠DOA

10. In Fig. 18, A, B, C are collinear points and ∠DBA = ∠EBA.
(i) Name two linear pairs.
(ii) Name two pairs of supplementary angles.

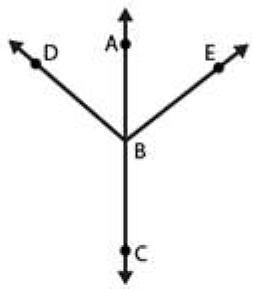


Fig 18

Solution:

(i) Two adjacent angles are said to be form a linear pair of angles, if their non-common arms are two opposite rays.

Therefore linear pairs are

∠ABD and ∠DBC

∠ABE and ∠EBC

(ii) We know that every linear pair forms supplementary angles, these angles are

∠ABD and ∠DBC

∠ABE and ∠EBC

11. If two supplementary angles have equal measure, what is the measure of each angle?

Solution:

Let p and q be the two supplementary angles that are equal

The two angles are said to be supplementary angles if the sum of those angles is 180^o

$\angle p = \angle q$

So,

$\angle p + \angle q = 180^o$

$\angle p + \angle p = 180^o$

$2\angle p = 180^o$

$\angle p = 180^o/2$

$\angle p = 90^o$

Therefore, $\angle p = \angle q = 90^o$

12. If the complement of an angle is 28^o, then find the supplement of the angle.

Solution:

Given complement of an angle is 28^o
Here, let x be the complement of the given angle 28^o
Therefore, $\angle x + 28^o = 90^o$
$\angle x = 90^o - 28^o$
$= 62^o$
So, the supplement of the angle $= 180^o - 62^o$
$= 118^o$

13. In Fig. 19, name each linear pair and each pair of vertically opposite angles:

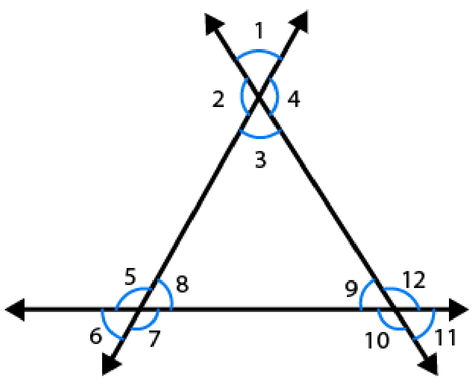


Fig 19

Solution:
Two adjacent angles are said to be linear pair of angles, if their non-common arms are two opposite rays.
Therefore linear pairs are listed below:
$\angle 1$ and $\angle 2$
$\angle 2$ and $\angle 3$
$\angle 3$ and $\angle 4$
$\angle 1$ and $\angle 4$
$\angle 5$ and $\angle 6$
$\angle 6$ and $\angle 7$
$\angle 7$ and $\angle 8$
$\angle 8$ and $\angle 5$
$\angle 9$ and $\angle 10$
$\angle 10$ and $\angle 11$
$\angle 11$ and $\angle 12$
$\angle 12$ and $\angle 9$

The two angles are said to be vertically opposite angles if the two intersecting lines have no common arms.
Therefore supplement of the angle are listed below:
∠1 and ∠3
∠4 and ∠2
∠5 and ∠7
∠6 and ∠8
∠9 and ∠11
∠10 and ∠12

14. In Fig. 20, OE is the bisector of ∠BOD. If ∠1 = 70^o, find the magnitude of ∠2, ∠3 and ∠4.

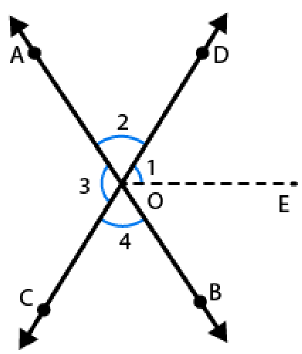


Fig 20

Solution:
Given, ∠1 = 70^o
∠3 = 2(∠1)
= 2(70^o)
∠3 = 140^o
As, OE is the angle bisector,
∠DOB = 2(∠1)
= 2(70^o)
= 140^o
∠DOB + ∠AOC + ∠COB +∠AOD = 360^o [sum of the angle of circle = 360^o] 140^o + 140^o + 2(∠COB) = 360^o
Since, ∠COB = ∠AOD
2(∠COB) = 360^o – 280^o

$2(\angle COB) = 80^o$
$\angle COB = 80^o/2$
$\angle COB = 40^o$
Therefore, $\angle COB = \angle AOD = 40^o$
The angles are, $\angle 1 = 70^o$, $\angle 2 = 40^o$, $\angle 3 = 140^o$ and $\angle 4 = 40^o$

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

Solution:
Given one of the angle of a linear pair is the right angle that is 90^o
We know that linear pair angle is 180^o
Therefore, the other angle is
$180^o – 90^o = 90^o$

16. One of the angles forming a linear pair is an obtuse angle. What kind of angle is the other?

Solution:
Given one of the angles of a linear pair is obtuse, then the other angle should be acute, because only then their sum will be 180^o.

17. One of the angles forming a linear pair is an acute angle. What kind of angle is the other?

Solution:
Given one of the Angles of a linear pair is acute, then the other angle should be obtuse, only then their sum will be 180^o.

18. Can two acute angles form a linear pair?

Solution:
No, two acute angles cannot form a linear pair because their sum is always less than 180^o.

19. If the supplement of an angle is 65^o, then find its complement.

Solution:

Let x be the required angle

So, $x + 65^o = 180^o$

$x = 180^o - 65^o$

$x = 115^o$

The two angles are said to be complementary angles if the sum of those angles is 90^o here it is more than 90^o therefore the complement of the angle cannot be determined.

20. Find the value of x in each of the following figures.

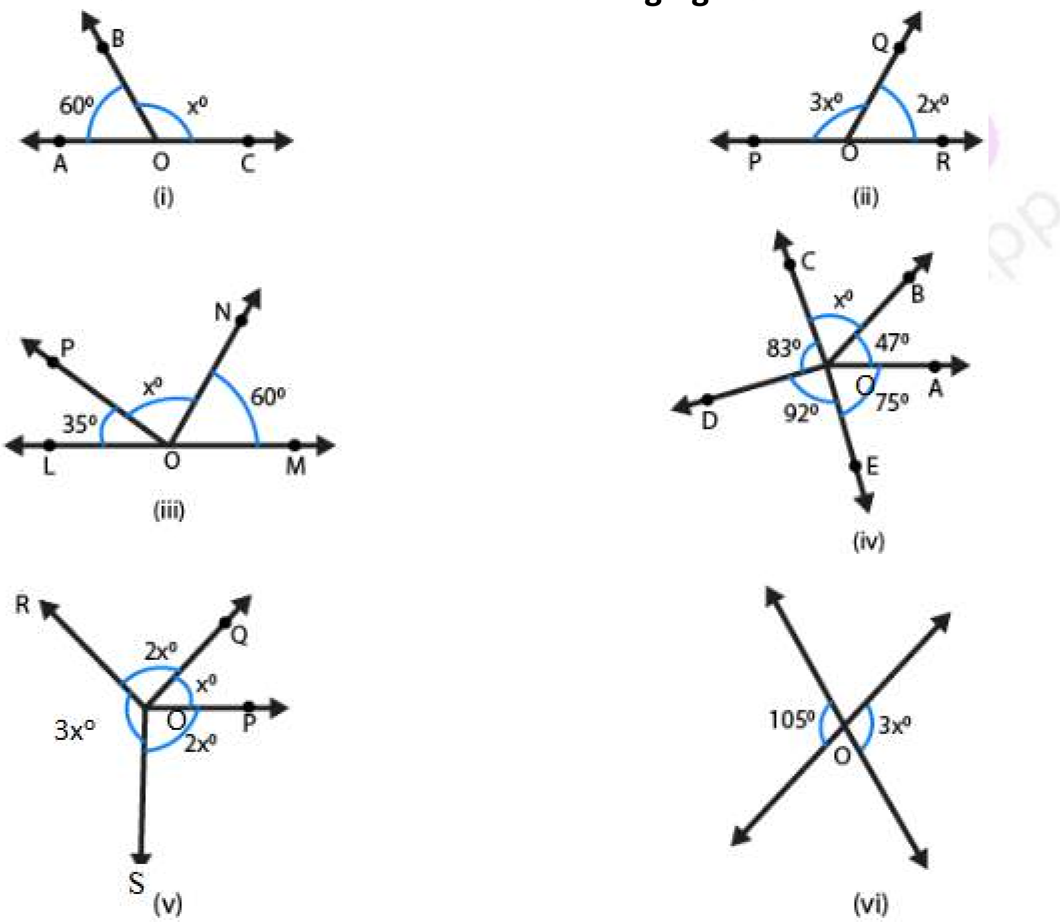


Fig 21

Solution:

(i) We know that ∠BOA + ∠BOC = 180^o

[Linear pair: The two adjacent angles are said to form a linear pair of angles if their non–common arms are two opposite rays and sum of the angle is 180^o]

$60^o + x^o = 180^o$

$x^o = 180^o - 60^o$

$x^{o} = 120^{o}$

(ii) We know that $\angle POQ + \angle QOR = 180^{o}$
[Linear pair: The two adjacent angles are said to form a linear pair of angles if their non–common arms are two opposite rays and sum of the angle is 180^{o}]
$3x^{o} + 2x^{o} = 180^{o}$
$5x^{o} = 180^{o}$
$x^{o} = 180^{o}/5$
$x^{o} = 36^{o}$

(iii) We know that $\angle LOP + \angle PON + \angle NOM = 180^{o}$
[Linear pair: The two adjacent angles are said to form a linear pair of angles if their non–common arms are two opposite rays and sum of the angle is 180^{o}]

Since, $35^{o} + x^{o} + 60^{o} = 180^{o}$
$x^{o} = 180^{o} – 35^{o} – 60^{o}$
$x^{o} = 180^{o} – 95^{o}$
$x^{o} = 85^{o}$

(iv) We know that $\angle DOC + \angle DOE + \angle EOA + \angle AOB + \angle BOC = 360^{o}$
$83^{o} + 92^{o} + 47^{o} + 75^{o} + x^{o} = 360^{o}$
$x^{o} + 297^{o} = 360^{o}$
$x^{o} = 360^{o} – 297^{o}$
$x^{o} = 63^{o}$

(v) We know that $\angle ROS + \angle ROQ + \angle QOP + \angle POS = 360^{o}$
$3x^{o} + 2x^{o} + x^{o} + 2x^{o} = 360^{o}$
$8x^{o} = 360^{o}$
$x^{o} = 360^{o}/8$
$x^{o} = 45^{o}$

(vi) Linear pair: The two adjacent angles are said to form a linear pair of angles if their non–common arms are two opposite rays and sum of the angle is 180^{o}
Therefore $3x^{o} = 105^{o}$
$x^{o} = 105^{o}/3$
$x^{o} = 35^{o}$

21. In Fig. 22, it being given that ∠1 = 65°, find all other angles.

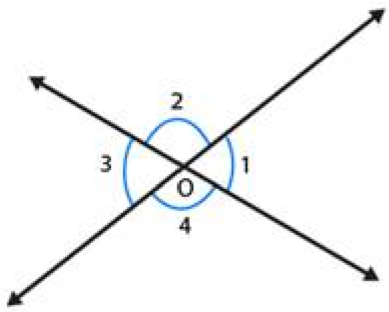


Fig 22

Solution:

Given from the figure 22, ∠1 = ∠3 are the vertically opposite angles

Therefore, ∠3 = 65°

Here, ∠1 + ∠2 = 180° are the linear pair [The two adjacent angles are said to form a linear pair of angles if their non–common arms are two opposite rays and sum of the angle is 180°]

Therefore, ∠2 = 180° – 65°

= 115°

∠2 = ∠4 are the vertically opposite angles [from the figure]

Therefore, ∠2 = ∠4 = 115°

And ∠3 = 65°

22. In Fig. 23, OA and OB are opposite rays:

(i) If x = 25°, what is the value of y?

(ii) If y = 35°, what is the value of x?

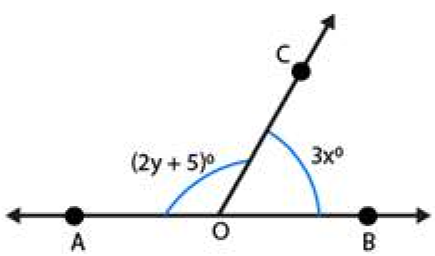


Fig 23

Solution:

(i) ∠AOC + ∠BOC = 180° [The two adjacent angles are said to form a linear pair of angles if their non–common arms are two opposite rays and sum of the angle is 180°]

$2y + 5^0 + 3x = 180^o$

$3x + 2y = 175^o$
Given If $x = 25^o$, then
$3(25^o) + 2y = 175^o$
$75^o + 2y = 175^o$
$2y = 175^o – 75^o$
$2y = 100^o$
$y = 100^o/2$
$y = 50^o$

(ii) $\angle AOC + \angle BOC = 180^o$ [The two adjacent angles are said to form a linear pair of angles if their non–common arms are two opposite rays and sum of the angle is 180^o]
$2y + 5 + 3x = 180^o$
$3x + 2y = 175^o$
Given If $y = 35^o$, then
$3x + 2(35^o) = 175^o$
$3x + 70^o = 175^o$
$3x = 175^0 – 70^o$
$3x = 105^o$
$x = 105^o/3$
$x = 35^o$

23. In Fig. 24, write all pairs of adjacent angles and all the liner pairs.

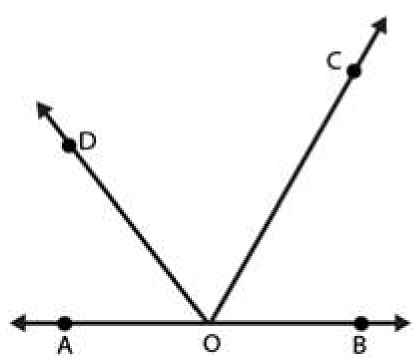


Fig 24

Solution:
Pairs of adjacent angles are:
$\angle DOA$ and $\angle DOC$
$\angle BOC$ and $\angle COD$
$\angle AOD$ and $\angle BOD$

∠AOC and ∠BOC
Linear pairs: [The two adjacent angles are said to form a linear pair of angles if their non–common arms are two opposite rays and sum of the angle is 180^o]
∠AOD and ∠BOD
∠AOC and ∠BOC

24. In Fig. 25, find ∠x. Further find ∠BOC, ∠COD and ∠AOD.

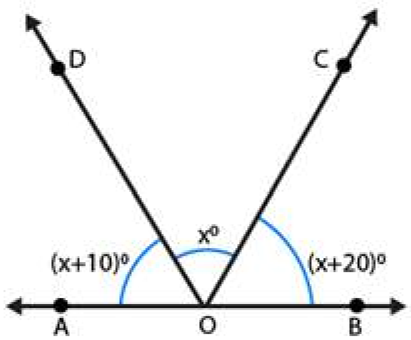


Fig 25

Solution:
$(x + 10)^o + x^o + (x + 20)^o = 180^o$[linear pair]
On rearranging we get
$3x^o + 30^o = 180^o$
$3x^o = 180^o – 30^o$
$3x^o = 150^o$
$x^o = 150^o/3$
$x^o = 50^o$
Also given that
$∠BOC = (x + 20)^o$
$= (50 + 20)^o$
$= 70^o$
$∠COD = 50^o$
$∠AOD = (x + 10)^o$
$= (50 + 10)^o$
$= 60^o$

25. How many pairs of adjacent angles are formed when two lines intersect in a point?

Solution:
If the two lines intersect at a point, then four adjacent pairs are formed and those are

linear.

26. How many pairs of adjacent angles, in all, can you name in Fig. 26?

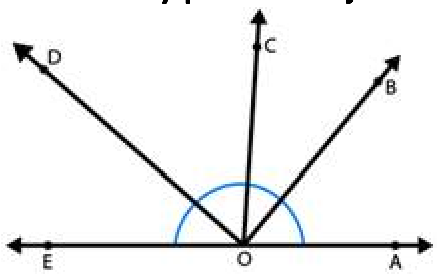


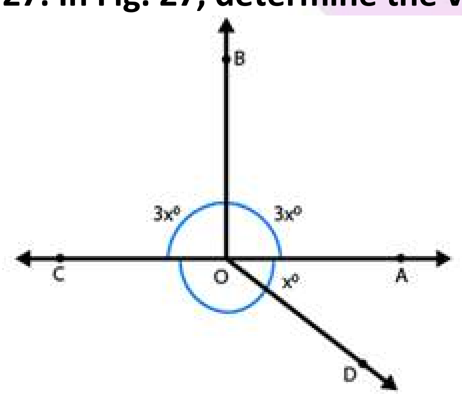
Fig 26

Solution:

There are 10 adjacent pairs formed in the given figure, they are

∠EOD and ∠DOC
∠COD and ∠BOC
∠COB and ∠BOA
∠AOB and ∠BOD
∠BOC and ∠COE
∠COD and ∠COA
∠DOE and ∠DOB
∠EOD and ∠DOA
∠EOC and ∠AOC
∠AOB and ∠BOE

27. In Fig. 27, determine the value of x.



Solution:

From the figure we can write as ∠COB + ∠AOB = 180^{o} [linear pair]

$3x^{o} + 3x^{o} = 180^{o}$

$6x^o = 180^o$
$x^o = 180^o/6$
$x^o = 30^o$

28. In Fig.28, AOC is a line, find x.

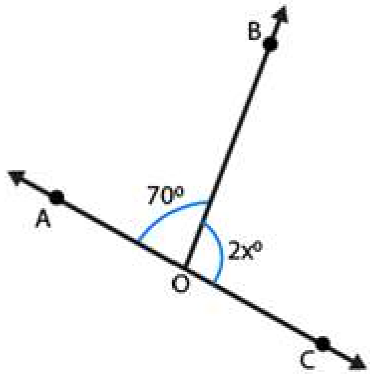


Fig 28

Solution:
From the figure we can write as
$\angle AOB + \angle BOC = 180^o$ [linear pair]
Linear pair
$2x + 70^o = 180^o$
$2x = 180^o - 70^o$
$2x = 110^o$
$x = 110^o/2$
$x = 55^o$

29. In Fig. 29, POS is a line, find x.

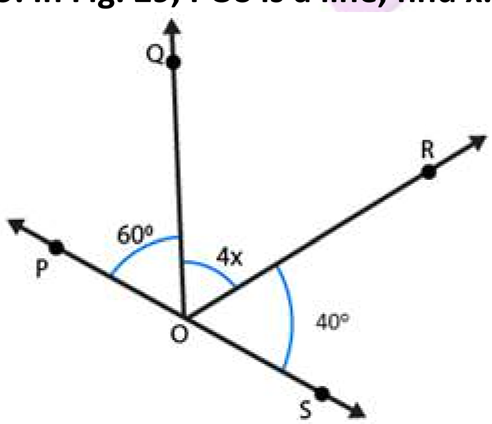


Fig 29

Solution:

From the figure we can write as angles of a straight line,

$\angle QOP + \angle QOR + \angle ROS = 180^o$

$60^o + 4x + 40^o = 180^o$

On rearranging we get, $100^o + 4x = 180^o$

$4x = 180^o – 100^o$

$4x = 80^o$

$x = 80^o/4$

$x = 20^o$

30. In Fig. 30, lines l_1 and l_2 intersect at O, forming angles as shown in the figure. If $x = 45^o$, find the values of y, z and u.

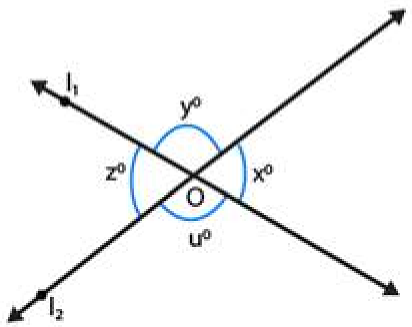


Fig 30

Solution:

Given that, $\angle x = 45^o$

From the figure we can write as

$\angle x = \angle z = 45^o$

Also from the figure, we have

$\angle y = \angle u$

From the property of linear pair we can write as

$\angle x + \angle y + \angle z + \angle u = 360^o$

$45^o + 45^o + \angle y + \angle u = 360^o$

$90^o + \angle y + \angle u = 360^o$

$\angle y + \angle u = 360^o – 90^o$

$\angle y + \angle u = 270^o$ (vertically opposite angles $\angle y = \angle u$)

$2\angle y = 270^o$

$\angle y = 135^o$

Therefore, $\angle y = \angle u = 135^o$

So, ∠x = 45°, ∠y = 135°, ∠z = 45° and ∠u = 135°

31. In Fig. 31, three coplanar lines intersect at a point O, forming angles as shown in the figure. Find the values of x, y, z and u

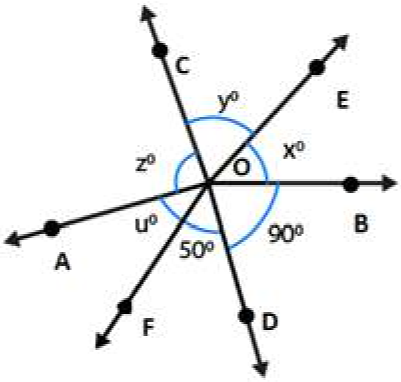


Fig 31

Solution:

Given that, ∠x + ∠y + ∠z+ ∠u + 50° + 90° = 360°

Linear pair, ∠x + 50° + 90° = 180°

∠x + 140° = 180°

On rearranging we get

∠x = 180° – 140°

∠x = 40°

From the figure we can write as

∠x = ∠u = 40° are vertically opposite angles

∠z = 90° is a vertically opposite angle

∠y = 50° is a vertically opposite angle

Therefore, ∠x = 40°, ∠y = 50°, ∠z = 90° and ∠u = 40°

32. In Fig. 32, find the values of x, y and z.

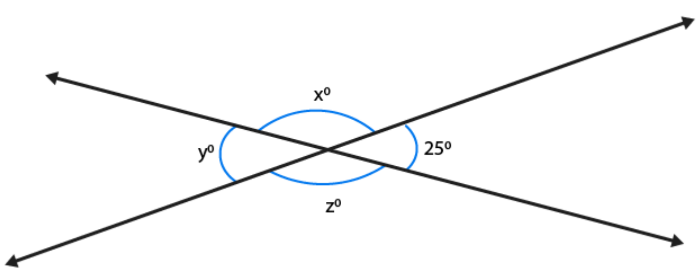


Fig 32

Solution:

$\angle y = 25^o$ vertically opposite angle
From the figure we can write as
$\angle x = \angle z$ are vertically opposite angles
$\angle x + \angle y + \angle z + 25^o = 360^o$
$\angle x + \angle z + 25^o + 25^o = 360^o$
On rearranging we get,
$\angle x + \angle z + 50^o = 360^o$
$\angle x + \angle z = 360^o – 50^o$ [$\angle x = \angle z$]
$2\angle x = 310^o$
$\angle x = 155^o$
And, $\angle x = \angle z = 155^o$
Therefore, $\angle x = 155^o$, $\angle y = 25^o$ and $\angle z = 155^o$

EXERCISE 14.2 PAGE NO: 14.20

1. In Fig. 58, line n is a transversal to line l and m. Identify the following:
(i) Alternate and corresponding angles in Fig. 58 (i)
(ii) Angles alternate to ∠d and ∠g and angles corresponding to ∠f and ∠h in Fig. 58 (ii)
(iii) Angle alternate to ∠PQR, angle corresponding to ∠RQF and angle alternate to ∠PQE in Fig. 58 (iii)
(iv) Pairs of interior and exterior angles on the same side of the transversal in Fig. 58 (ii)

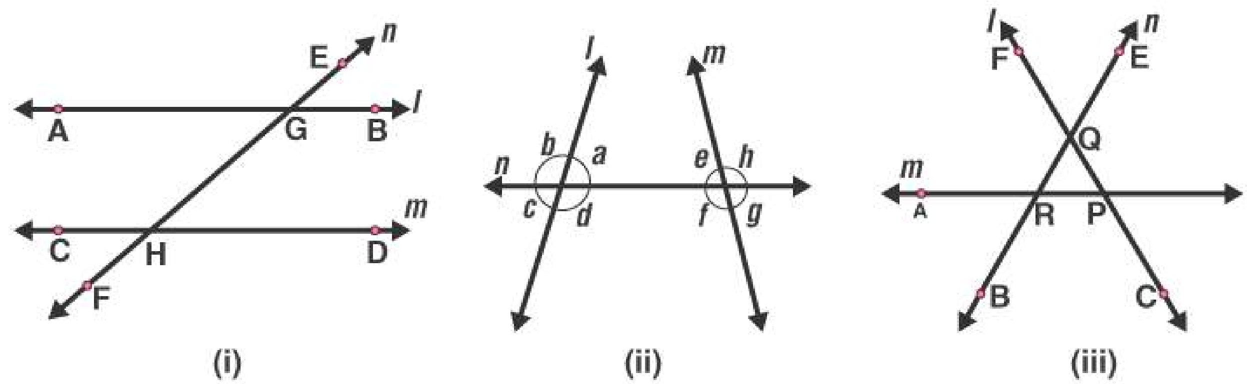


Fig.58

Solution:
(i) A pair of angles in which one arm of both the angles is on the same side of the transversal and their other arms are directed in the same sense is called a pair of corresponding angles.
In Figure (i) Corresponding angles are
∠EGB and ∠GHD
∠HGB and ∠FHD
∠EGA and ∠GHC
∠AGH and ∠CHF
A pair of angles in which one arm of each of the angle is on opposite sides of the transversal and whose other arms include the one segment is called a pair of alternate angles.
The alternate angles are:
∠EGB and ∠CHF

∠HGB and ∠CHG
∠EGA and ∠FHD
∠AGH and ∠GHD

(ii) In Figure (ii)
The alternate angle to ∠d is ∠e.
The alternate angle to ∠g is ∠b.
The corresponding angle to ∠f is ∠c.
The corresponding angle to ∠h is ∠a.

(iii) In Figure (iii)
Angle alternate to ∠PQR is ∠QRA.
Angle corresponding to ∠RQF is ∠ARB.
Angle alternate to ∠POE is ∠ARB.

(iv) In Figure (ii)
Pair of interior angles are
∠a is ∠e.
∠d is ∠f.
Pair of exterior angles are
∠b is ∠h.
∠c is ∠g.

2. In Fig. 59, AB and CD are parallel lines intersected by a transversal PQ at L and M respectively, If ∠CMQ = 60°, find all other angles in the figure.

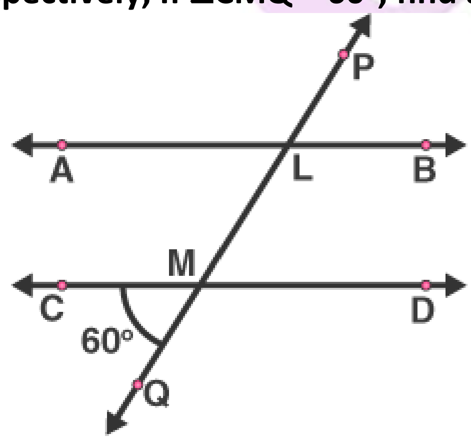


Fig. 59

Solution:

A pair of angles in which one arm of both the angles is on the same side of the transversal and their other arms are directed in the same sense is called a pair of corresponding angles.

Therefore corresponding angles are

$\angle ALM = \angle CMQ = 60^o$ [given]

Vertically opposite angles are

$\angle LMD = \angle CMQ = 60^o$ [given]

Vertically opposite angles are

$\angle ALM = \angle PLB = 60^o$

Here, $\angle CMQ + \angle QMD = 180^o$ are the linear pair

On rearranging we get

$\angle QMD = 180^o - 60^o$

$= 120^o$

Corresponding angles are

$\angle QMD = \angle MLB = 120^o$

Vertically opposite angles

$\angle QMD = \angle CML = 120^o$

Vertically opposite angles

$\angle MLB = \angle ALP = 120^o$

3. In Fig. 60, AB and CD are parallel lines intersected by a transversal by a transversal PQ at L and M respectively. If $\angle LMD = 35^o$ find $\angle ALM$ and $\angle PLA$.

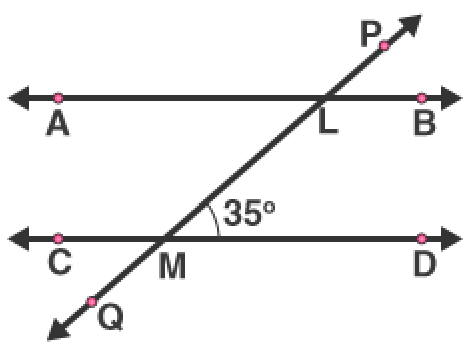


Fig. 60

Solution:

Given that, $\angle LMD = 35^o$

From the figure we can write

$\angle LMD$ and $\angle LMC$ is a linear pair

$\angle LMD + \angle LMC = 180^o$ [sum of angles in linear pair = 180^o]

On rearranging, we get
∠LMC = $180^o – 35^o$
= 145^o
So, ∠LMC = ∠PLA = 145^o
And, ∠LMC = ∠MLB = 145^o
∠MLB and ∠ALM is a linear pair
∠MLB + ∠ALM = 180^o [sum of angles in linear pair = 180^o]
∠ALM = $180^o – 145^o$
∠ALM = 35^0
Therefore, ∠ALM = 35^o, ∠PLA = 145^o.

4. The line n is transversal to line l and m in Fig. 61. Identify the angle alternate to ∠13, angle corresponding to ∠15, and angle alternate to ∠15.

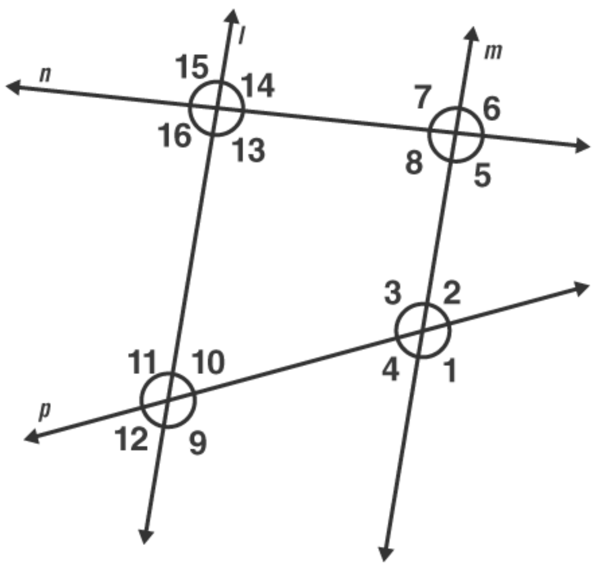


Fig.61

Solution:
Given that, l ‖ m
From the figure the angle alternate to ∠13 is ∠7
From the figure the angle corresponding to ∠15 is ∠7 [A pair of angles in which one arm of both the angles is on the same side of the transversal and their other arms are directed in the same sense is called a pair of corresponding angles.]
Again from the figure angle alternate to ∠15 is ∠5

5. In Fig. 62, line l ‖ m and n is transversal. If ∠1 = 40°, find all the angles and check

that all corresponding angles and alternate angles are equal.

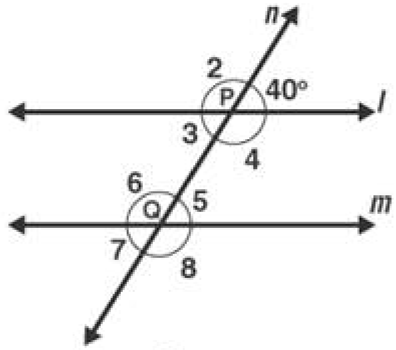


Fig. 62

Solution:

Given that, ∠1 = 40°

∠1 and ∠2 is a linear pair [from the figure]

∠1 + ∠2 = 180°

∠2 = 180° – 40°

∠2 = 140°

Again from the figure we can say that

∠2 and ∠6 is a corresponding angle pair

So, ∠6 = 140°

∠6 and ∠5 is a linear pair [from the figure]

∠6 + ∠5 = 180°

∠5 = 180° – 140°

∠5 = 40°

From the figure we can write as

∠3 and ∠5 are alternate interior angles

So, ∠5 = ∠3 = 40°

∠3 and ∠4 is a linear pair

∠3 + ∠4 = 180°

∠4 = 180° – 40°

∠4 = 140°

Now, ∠4 and ∠6 are a pair of interior angles

So, ∠4 = ∠6 = 140°

∠3 and ∠7 are a pair of corresponding angles

So, ∠3 = ∠7 = 40°

Therefore, ∠7 = 40°

∠4 and ∠8 are a pair of corresponding angles

So, ∠4 = ∠8 = 140°

Therefore, $\angle 8 = 140^o$
Therefore, $\angle 1 = 40^o$, $\angle 2 = 140^o$, $\angle 3 = 40^o$, $\angle 4 = 140^o$, $\angle 5 = 40^o$, $\angle 6 = 140^o$, $\angle 7 = 40^o$ and $\angle 8 = 140^o$

6. In Fig.63, line l ∥ m and a transversal n cuts them P and Q respectively. If ∠1 = 75°, find all other angles.

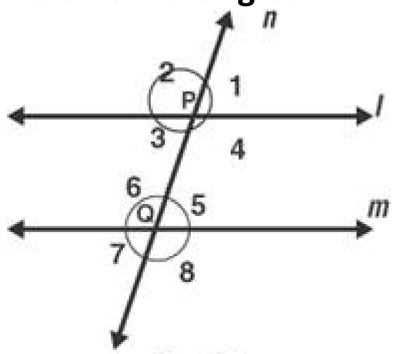


Fig. 63

Solution:
Given that, l ∥ m and $\angle 1 = 75^o$
$\angle 1 = \angle 3$ are vertically opposite angles
We know that, from the figure
$\angle 1 + \angle 2 = 180^o$ is a linear pair
$\angle 2 = 180^o - 75^o$
$\angle 2 = 105^o$
Here, $\angle 1 = \angle 5 = 75^o$ are corresponding angles
$\angle 5 = \angle 7 = 75^o$ are vertically opposite angles.
$\angle 2 = \angle 6 = 105^o$ are corresponding angles
$\angle 6 = \angle 8 = 105^o$ are vertically opposite angles
$\angle 2 = \angle 4 = 105^o$ are vertically opposite angles
So, $\angle 1 = 75^o$, $\angle 2 = 105^o$, $\angle 3 = 75^o$, $\angle 4 = 105^o$, $\angle 5 = 75^o$, $\angle 6 = 105^o$, $\angle 7 = 75^o$ and $\angle 8 = 105^o$

7. In Fig. 64, AB ∥ CD and a transversal PQ cuts at L and M respectively. If ∠QMD = 100°, find all the other angles.

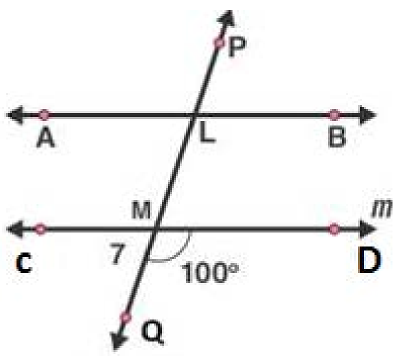


Fig. 64

Solution:

Given that, AB ∥ CD and ∠QMD = 100°

We know that, from the figure ∠QMD + ∠QMC = 180° is a linear pair,

∠QMC = 180° – ∠QMD

∠QMC = 180° – 100°

∠QMC = 80°

Corresponding angles are

∠DMQ = ∠BLM = 100°

∠CMQ = ∠ALM = 80°

Vertically Opposite angles are

∠DMQ = ∠CML = 100°

∠BLM = ∠PLA = 100°

∠CMQ = ∠DML = 80°

∠ALM = ∠PLB = 80°

8. In Fig. 65, l ∥ m and p ∥ q. Find the values of x, y, z, t.

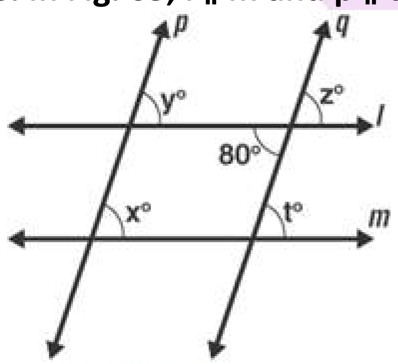


Fig. 65

Solution:

Given that one of the angle is 80°

$\angle z$ and 80^o are vertically opposite angles
Therefore $\angle z = 80^o$
$\angle z$ and $\angle t$ are corresponding angles
$\angle z = \angle t$
Therefore, $\angle t = 80^o$
$\angle z$ and $\angle y$ are corresponding angles
$\angle z = \angle y$
Therefore, $\angle y = 80^o$
$\angle x$ and $\angle y$ are corresponding angles
$\angle y = \angle x$
Therefore, $\angle x = 80^o$

9. In Fig. 66, line l ∥ m, $\angle 1 = 120^o$ and $\angle 2 = 100^o$, find out $\angle 3$ and $\angle 4$.

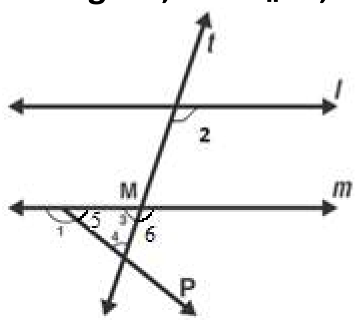


Fig. 66

Solution:
Given that, $\angle 1 = 120^o$ and $\angle 2 = 100^o$
From the figure $\angle 1$ and $\angle 5$ is a linear pair
$\angle 1 + \angle 5 = 180^o$
$\angle 5 = 180^o - 120^o$
$\angle 5 = 60^o$
Therefore, $\angle 5 = 60^o$
$\angle 2$ and $\angle 6$ are corresponding angles
$\angle 2 = \angle 6 = 100^o$
Therefore, $\angle 6 = 100^o$
$\angle 6$ and $\angle 3$ is a linear pair
$\angle 6 + \angle 3 = 180^o$
$\angle 3 = 180^o - 100^o$
$\angle 3 = 80^o$
Therefore, $\angle 3 = 80^o$

By, angles of sum property

$\angle 3 + \angle 5 + \angle 4 = 180^\circ$

$\angle 4 = 180^\circ - 80^\circ - 60^\circ$

$\angle 4 = 40^\circ$

Therefore, $\angle 4 = 40^\circ$

10. In Fig. 67, l ∥ m. Find the values of a, b, c, d. Give reasons.

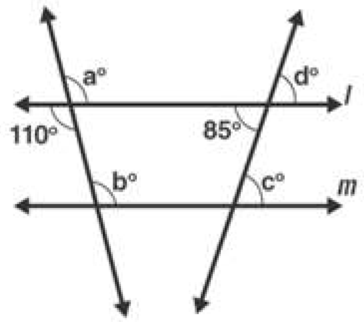


Fig. 67

Solution:

Given l ∥ m

From the figure vertically opposite angles,

$\angle a = 110^\circ$

Corresponding angles, $\angle a = \angle b$

Therefore, $\angle b = 110^\circ$

Vertically opposite angle,

$\angle d = 85^\circ$

Corresponding angles, $\angle d = \angle c$

Therefore, $\angle c = 85^\circ$

Hence, $\angle a = 110^\circ$, $\angle b = 110^\circ$, $\angle c = 85^\circ$, $\angle d = 85^\circ$

11. In Fig. 68, AB ∥ CD and ∠1 and ∠2 are in the ratio of 3: 2. Determine all angles from 1 to 8.

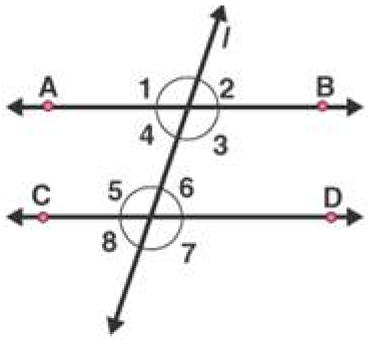


Fig. 68

Solution:

Given ∠1 and ∠2 are in the ratio 3: 2
Let us take the angles as 3x, 2x
∠1 and ∠2 are linear pair [from the figure]
$3x + 2x = 180^o$
$5x = 180^o$
$x = 180^o/5$
$x = 36^o$
Therefore, ∠1 = 3x = 3(36) = 108^o
∠2 = 2x = 2(36) = 72^o
∠1 and ∠5 are corresponding angles
Therefore ∠1 = ∠5
Hence, ∠5 = 108^o
∠2 and ∠6 are corresponding angles
So ∠2 = ∠6
Therefore, ∠6 = 72^o
∠4 and ∠6 are alternate pair of angles
∠4 = ∠6 = 72^o
Therefore, ∠4 = 72^o
∠3 and ∠5 are alternate pair of angles
∠3 = ∠5 = 108^o
Therefore, ∠3 = 108^o
∠2 and ∠8 are alternate exterior of angles
∠2 = ∠8 = 72^o
Therefore, ∠8 = 72^o
∠1 and ∠7 are alternate exterior of angles

$\angle 1 = \angle 7 = 108^o$
Therefore, $\angle 7 = 108^o$
Hence, $\angle 1 = 108^o$, $\angle 2 = 72^o$, $\angle 3 = 108^o$, $\angle 4 = 72^o$, $\angle 5 = 108^o$, $\angle 6 = 72^o$, $\angle 7 = 108^o$, $\angle 8 = 72^o$

12. In Fig. 69, l, m and n are parallel lines intersected by transversal p at X, Y and Z respectively. Find ∠1, ∠2 and ∠3.

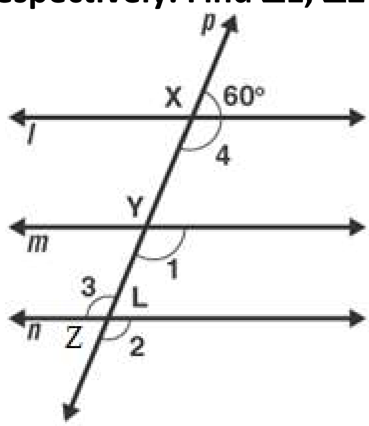


Fig. 69

Solution:
Given l, m and n are parallel lines intersected by transversal p at X, Y and Z
Therefore linear pair,
$\angle 4 + 60^o = 180^o$
$\angle 4 = 180^o - 60^o$
$\angle 4 = 120^o$
From the figure,
$\angle 4$ and $\angle 1$ are corresponding angles
$\angle 4 = \angle 1$
Therefore, $\angle 1 = 120^o$
$\angle 1$ and $\angle 2$ are corresponding angles
$\angle 2 = \angle 1$
Therefore, $\angle 2 = 120^o$
$\angle 2$ and $\angle 3$ are vertically opposite angles
$\angle 2 = \angle 3$
Therefore, $\angle 3 = 120^0$

13. In Fig. 70, if l ∥ m ∥ n and $\angle 1 = 60^o$, find ∠2

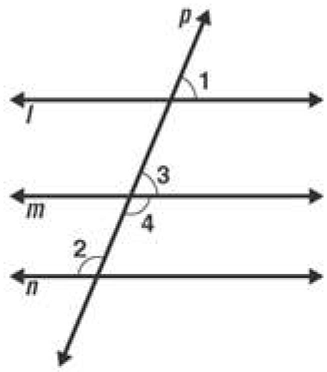


Fig. 70

Solution:

Given that l ∥ m ∥ n

From the figure Corresponding angles are

$\angle 1 = \angle 3$

$\angle 1 = 60^{\circ}$

Therefore, $\angle 3 = 60^{\circ}$

$\angle 3$ and $\angle 4$ are linear pair

$\angle 3 + \angle 4 = 180^{\circ}$

$\angle 4 = 180^{\circ} - 60^{\circ}$

$\angle 4 = 120^{\circ}$

$\angle 2$ and $\angle 4$ are alternate interior angles

$\angle 4 = \angle 2$

Therefore, $\angle 2 = 120^{\circ}$

14. In Fig. 71, if AB ∥ CD and CD ∥ EF, find ∠ACE

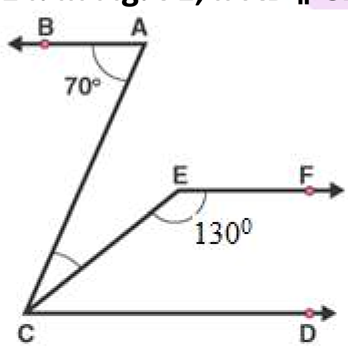


Fig. 71

Solution:

Given that, AB ∥ CD and CD ∥ EF

Sum of the interior angles,

$\angle CEF + \angle ECD = 180^o$
$130^o + \angle ECD = 180^o$
$\angle ECD = 180^o - 130^o$
$\angle ECD = 50^o$
We know that alternate angles are equal
$\angle BAC = \angle ACD$
$\angle BAC = \angle ECD + \angle ACE$
$\angle ACE = 70^o - 50^o$
$\angle ACE = 20^o$
Therefore, $\angle ACE = 20^o$

15. In Fig. 72, if l ∥ m, n ∥ p and $\angle 1 = 85^o$, find $\angle 2$.

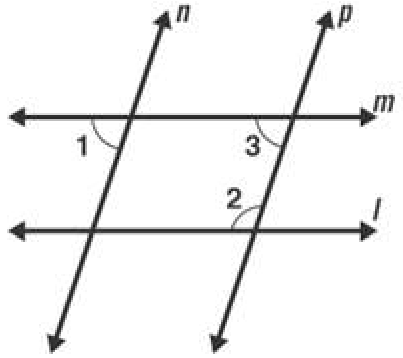


Fig. 72

Solution:
Given that, $\angle 1 = 85^o$
$\angle 1$ and $\angle 3$ are corresponding angles
So, $\angle 1 = \angle 3$
$\angle 3 = 85^o$
Sum of the interior angles is 180^o
$\angle 3 + \angle 2 = 180^o$
$\angle 2 = 180^o - 85^o$
$\angle 2 = 95^o$

16. In Fig. 73, a transversal n cuts two lines l and m. If $\angle 1 = 70^o$ and $\angle 7 = 80^o$, is l ∥ m?

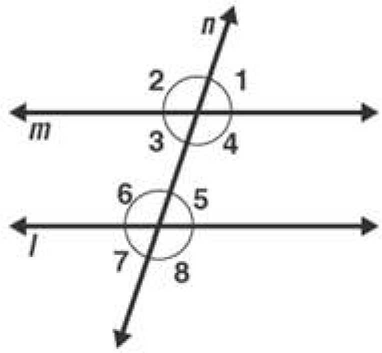


Fig. 73

Solution:

Given $\angle 1 = 70^o$ and $\angle 7 = 80^o$

We know that if the alternate exterior angles of the two lines are equal, then the lines are parallel.

Here, $\angle 1$ and $\angle 7$ are alternate exterior angles, but they are not equal

$\angle 1 \neq \angle 7$

17. In Fig. 74, a transversal n cuts two lines l and m such that $\angle 2 = 65^o$ and $\angle 8 = 65^o$. Are the lines parallel?

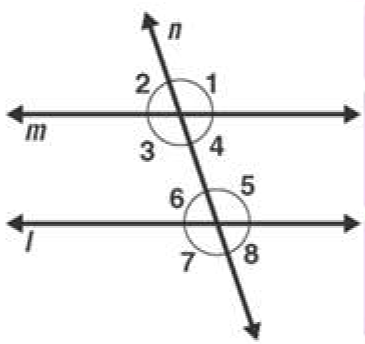


Fig. 74

Solution:

From the figure $\angle 2 = \angle 4$ are vertically opposite angles,

$\angle 2 = \angle 4 = 65^o$

$\angle 8 = \angle 6 = 65^o$

Therefore, $\angle 4 = \angle 6$

Hence, l || m

18. In Fig. 75, Show that AB ∥ EF.

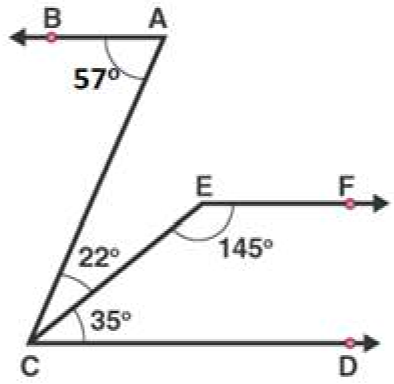


Fig. 75

Solution:

We know that,

∠ACD = ∠ACE + ∠ECD

∠ACD = 22° + 35°

∠ACD = 57° = ∠BAC

Thus, lines BA and CD are intersected by the line AC such that, ∠ACD = ∠BAC

So, the alternate angles are equal

Therefore, AB ∥ CD ……1

Now,

∠ECD + ∠CEF = 35° + 145° = 180°

This, shows that sum of the angles of the interior angles on the same side of the transversal CE is 180°

So, they are supplementary angles

Therefore, EF ∥ CD …….2

From equation 1 and 2

We conclude that, AB ∥ EF

19. In Fig. 76, AB ∥ CD. Find the values of x, y, z.

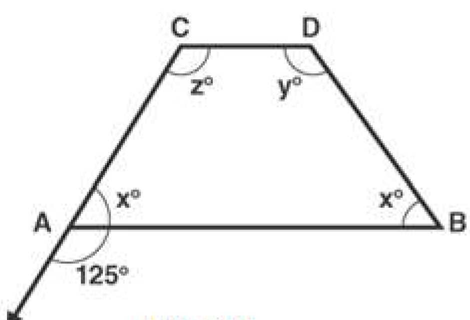


Fig. 76

Solution:

Given that AB ∥ CD

Linear pair,

$\angle x + 125^\circ = 180^\circ$

$\angle x = 180^\circ - 125^\circ$

$\angle x = 55^\circ$

Corresponding angles

$\angle z = 125^\circ$

Adjacent interior angles

$\angle x + \angle z = 180^\circ$

$\angle x + 125^\circ = 180^\circ$

$\angle x = 180^\circ - 125^\circ$

$\angle x = 55^\circ$

Adjacent interior angles

$\angle x + \angle y = 180^\circ$

$\angle y + 55^\circ = 180^\circ$

$\angle y = 180^\circ - 55^\circ$

$\angle y = 125^\circ$

20. In Fig. 77, find out ∠PXR, if PQ ∥ RS.

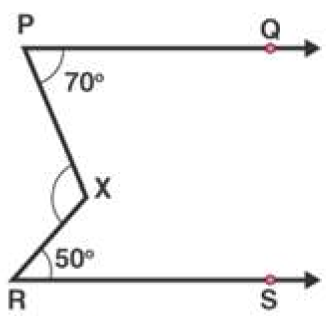


Fig. 77

Solution:

Given PQ ∥ RS

We need to find ∠PXR

$\angle XRS = 50^\circ$

$\angle XPQ = 70^\circ$

Given, that PQ ∥ RS

$\angle PXR = \angle XRS + \angle XPQ$

$\angle PXR = 50^\circ + 70^\circ$

$\angle PXR = 120^\circ$

Therefore, $\angle PXR = 120^o$

21. In Figure, we have
(i) $\angle MLY = 2\angle LMQ$
(ii) $\angle XLM = (2x - 10)^o$ and $\angle LMQ = (x + 30)^o$, find x.
(iii) $\angle XLM = \angle PML$, find $\angle ALY$
(iv) $\angle ALY = (2x - 15)^o$, $\angle LMQ = (x + 40)^o$, find x.

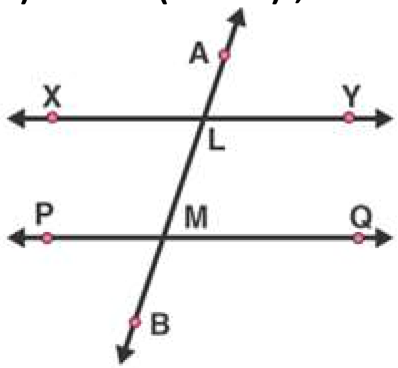


Fig. 78

Solution:

(i) $\angle MLY$ and $\angle LMQ$ are interior angles
$\angle MLY + \angle LMQ = 180^o$
$2\angle LMQ + \angle LMQ = 180^o$
$3\angle LMQ = 180^o$
$\angle LMQ = 180^o/3$
$\angle LMQ = 60^o$

(ii) $\angle XLM = (2x - 10)^o$ and $\angle LMQ = (x + 30)^o$, find x.
$\angle XLM = (2x - 10)^o$ and $\angle LMQ = (x + 30)^o$
$\angle XLM$ and $\angle LMQ$ are alternate interior angles
$\angle XLM = \angle LMQ$
$(2x - 10)^o = (x + 30)^o$
$2x – x = 30^o + 10^o$
$x = 40^o$
Therefore, $x = 40°$

(iii) $\angle XLM = \angle PML$, find $\angle ALY$
$\angle XLM = \angle PML$

Sum of interior angles is 180 degrees
$\angle XLM + \angle PML = 180^o$
$\angle XLM + \angle XLM = 180^o$
$2\angle XLM = 180^o$
$\angle XLM = 180^o/2$
$\angle XLM = 90^o$
$\angle XLM$ and $\angle ALY$ are vertically opposite angles
Therefore, $\angle ALY = 90^o$

(iv) $\angle ALY = (2x - 15)^o$, $\angle LMQ = (x + 40)^o$, find x.
$\angle ALY$ and $\angle LMQ$ are corresponding angles
$\angle ALY = \angle LMQ$
$(2x - 15)^o = (x + 40)^o$
$2x - x = 40^o + 15^o$
$x = 55^o$
Therefore, $x = 55^o$

22. In Fig. 79, DE ∥ BC. Find the values of x and y.

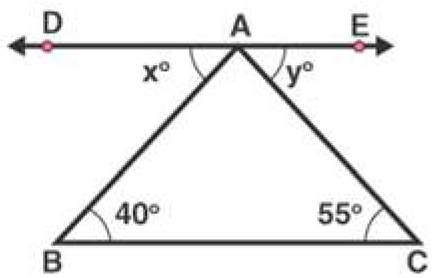


Fig. 79

Solution:
We know that,
ABC, DAB are alternate interior angles
$\angle ABC = \angle DAB$
So, $x = 40^o$
And ACB, EAC are alternate interior angles
$\angle ACB = \angle EAC$
So, $y = 55^o$

23. In Fig. 80, line AC ∥ line DE and $\angle ABD = 32^o$, Find out the angles x and y if $\angle E = 122^o$.

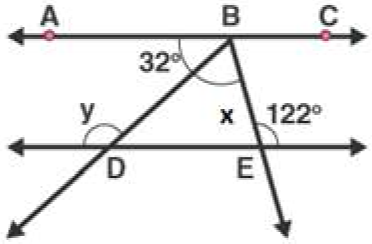


Fig. 80

Solution:

Given line AC ∥ line DE and ∠ABD = 32°

∠BDE = ∠ABD = 32° – Alternate interior angles

∠BDE + y = 180°– linear pair

32° + y = 180°

y = 180° – 32°

y = 148°

∠ABE = ∠E = 122° – Alternate interior angles

∠ABD + ∠DBE = 122°

32° + x = 122°

x = 122° – 32°

x = 90°

24. In Fig. 81, side BC of ΔABC has been produced to D and CE ∥ BA. If ∠ABC = 65°, ∠BAC = 55°, find ∠ACE, ∠ECD, ∠ACD.

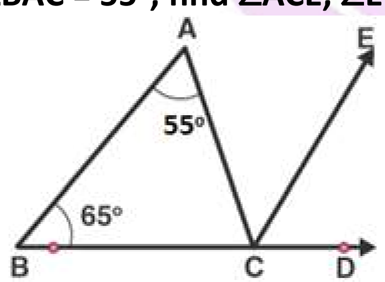


Fig. 81

Solution:

Given ∠ABC = 65°, ∠BAC = 55°

Corresponding angles,

∠ABC = ∠ECD = 65°

Alternate interior angles,

∠BAC = ∠ACE = 55^o
Now, ∠ACD = ∠ACE + ∠ECD
∠ACD = $55^o + 65^o$
= 120^o

25. In Fig. 82, line CA ⊥ AB ∥ line CR and line PR ∥ line BD. Find ∠x, ∠y, ∠z.

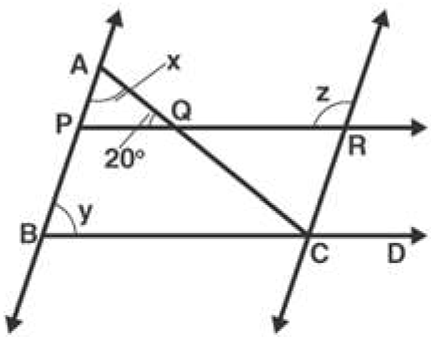


Fig. 82

Solution:
Given that, CA ⊥ AB
∠CAB = 90^o
∠AQP = 20^o
By, angle of sum property
In ΔABC
∠CAB + ∠AQP + ∠APQ = 180^o
∠APQ = $180^o - 90^o - 20^o$
∠APQ = 70^o
y and ∠APQ are corresponding angles
y = ∠APQ = 70^o
∠APQ and ∠z are interior angles
∠APQ + ∠z = 180^o
∠z = $180^o - 70^o$
∠z = 110^o

26. In Fig. 83, PQ ∥ RS. Find the value of x.

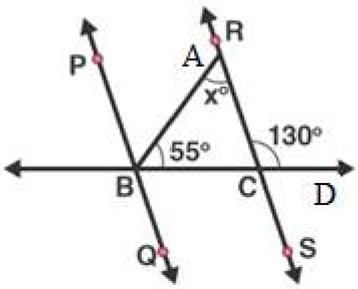


Fig. 83

Solution:

Given, linear pair,

$\angle RCD + \angle RCB = 180^o$

$\angle RCB = 180^o - 130^o$

$= 50^o$

In ΔABC,

$\angle BAC + \angle ABC + \angle BCA = 180^o$

By, angle sum property

$\angle BAC = 180^o - 55^o - 50^o$

$\angle BAC = 75^o$

27. In Fig. 84, AB ∥ CD and AE ∥ CF, $\angle FCG = 90^o$ and $\angle BAC = 120^o$. Find the value of x, y and z.

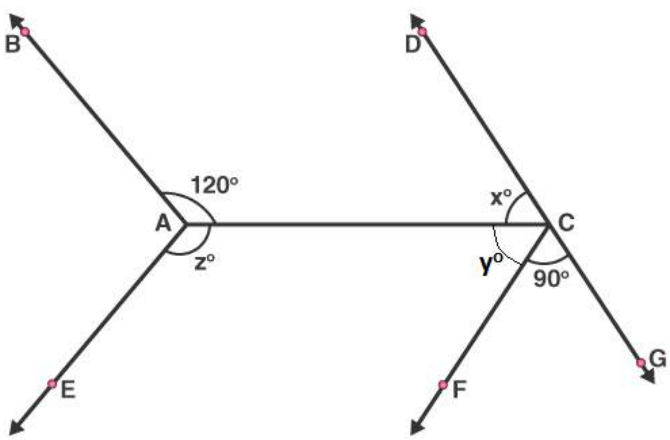


Fig. 84

Solution:

Alternate interior angle

$\angle BAC = \angle ACG = 120^o$

$\angle ACF + \angle FCG = 120^\circ$
So, $\angle ACF = 120^\circ - 90^\circ$
$= 30^\circ$
Linear pair,
$\angle DCA + \angle ACG = 180^\circ$
$\angle x = 180^\circ - 120^\circ$
$= 60^\circ$
$\angle BAC + \angle BAE + \angle EAC = 360^\circ$
$\angle CAE = 360^\circ - 120^\circ - (60^\circ + 30^\circ)$
$= 150^\circ$

28. In Fig. 85, AB ∥ CD and AC ∥ BD. Find the values of x, y, z.

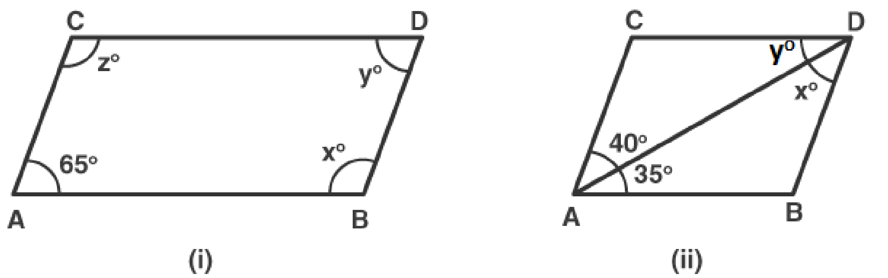


Fig. 85

Solution:
(i) Since, AC ∥ BD and CD ∥ AB, ABCD is a parallelogram
Adjacent angles of parallelogram,
$\angle CAB + \angle ACD = 180^\circ$
$\angle ACD = 180^\circ - 65^\circ$
$= 115^\circ$
Opposite angles of parallelogram,
$\angle CAB = \angle CDB = 65^\circ$
$\angle ACD = \angle DBA = 115^\circ$

(ii) Here,
AC ∥ BD and CD ∥ AB
Alternate interior angles,
$\angle CAD = x = 40^\circ$
$\angle DAB = y = 35^\circ$

29. In Fig. 86, state which lines are parallel and why?

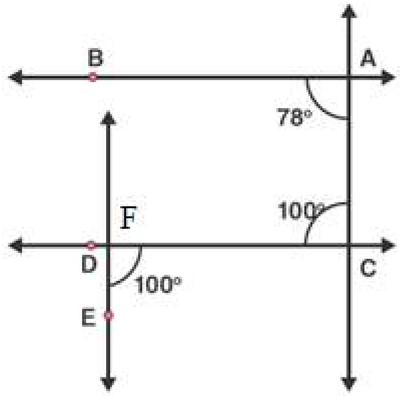


Fig. 86

Solution:

Let, F be the point of intersection of the line CD and the line passing through point E.

Here, ∠ACD and ∠CDE are alternate and equal angles.

So, ∠ACD = ∠CDE = 100°

Therefore, AC ∥ EF

30. In Fig. 87, the corresponding arms of ∠ABC and ∠DEF are parallel. If ∠ABC = 75°, find ∠DEF.

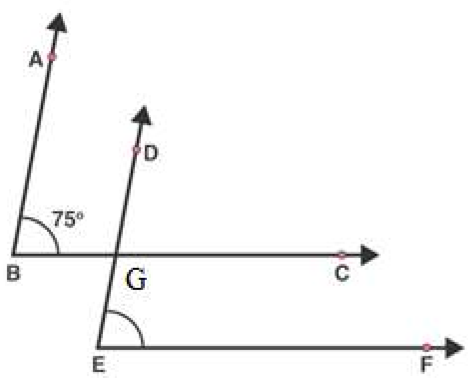


Fig. 87

Solution:

Let, G be the point of intersection of the lines BC and DE

Since, AB ∥ DE and BC ∥ EF

The corresponding angles are,

∠ABC = ∠DGC = ∠DEF = 75°