EXERCISE 14.1 PAGE NO: 14.6

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

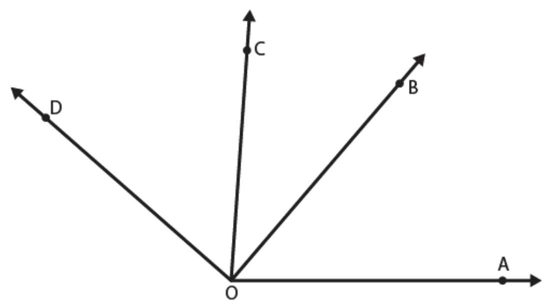


Fig 13

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.

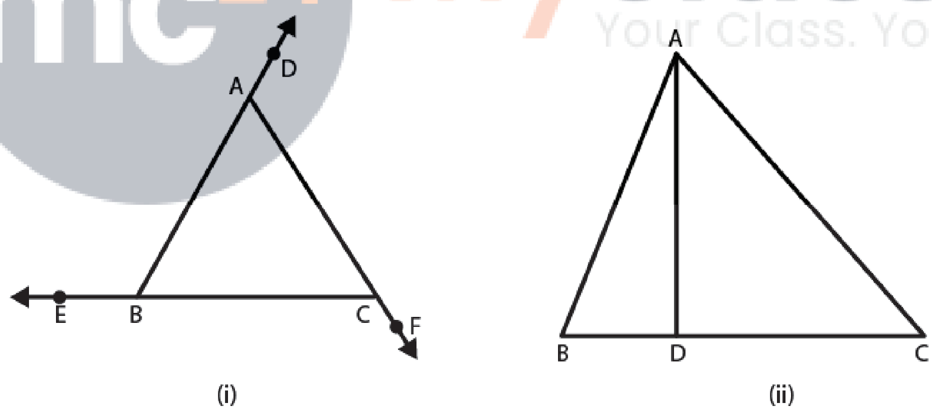


Fig 14

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.

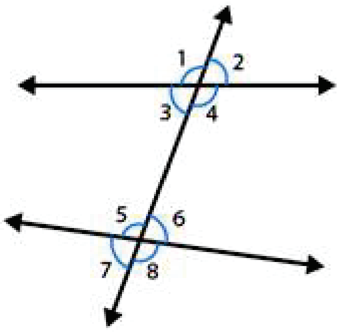


Fig 15

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?

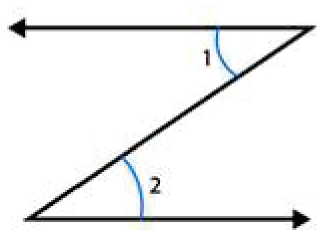


Fig 16

Solution:

No, because they don't have common vertex.

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

(i) 35°

(ii) 72°

(iii) 45°

(iv) 85°

Solution:

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

Complementary angle for given angle is

$90^\circ - 35^\circ = 55^\circ$

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

Complementary angle for given angle is

$90^0 - 72^\circ = 18^\circ$

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

Complementary angle for given angle is

$90^\circ - 45^\circ = 45^\circ$

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

Complementary angle for given angle is

$90^\circ - 85^\circ = 5^\circ$

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

(i) 70°

(ii) 120°

(iii) 135°

(iv) 90°

Solution:

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

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

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

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

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

Solution:

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

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

(iv) $100^\circ + 80^\circ = 180^\circ$ 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.

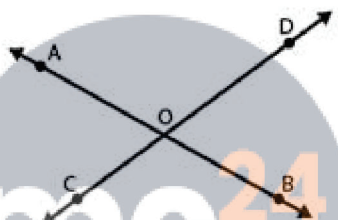


Fig 17

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.

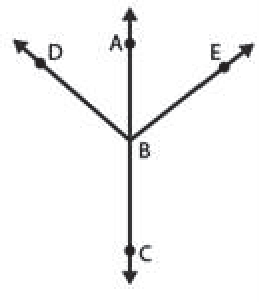


Fig 18

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

∠p = ∠q

So,

∠p + ∠q = 180^o

∠p + ∠p = 180^o

2∠p = 180^o

∠p = $180^o/2$

∠p = 90^o

Therefore, ∠p = ∠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:

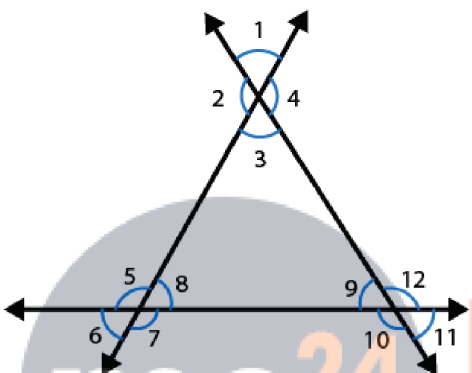


Fig 19

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:
∠1 and ∠2
∠2 and ∠3
∠3 and ∠4
∠1 and ∠4
∠5 and ∠6
∠6 and ∠7
∠7 and ∠8
∠8 and ∠5
∠9 and ∠10
∠10 and ∠11
∠11 and ∠12
∠12 and ∠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°, find the magnitude of ∠2, ∠3 and ∠4.

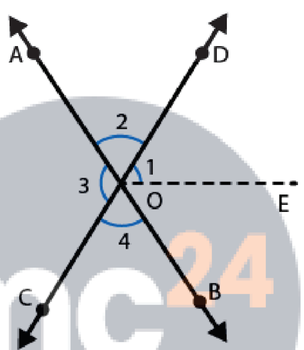


Fig 20

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

$2(\angle COB) = 80^o$
$\angle COB = 80^o/2$
$\angle COB = 40^o$
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, $x + 65^\circ = 180^\circ$

$x = 180^\circ – 65^\circ$

$x = 115^\circ$

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

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

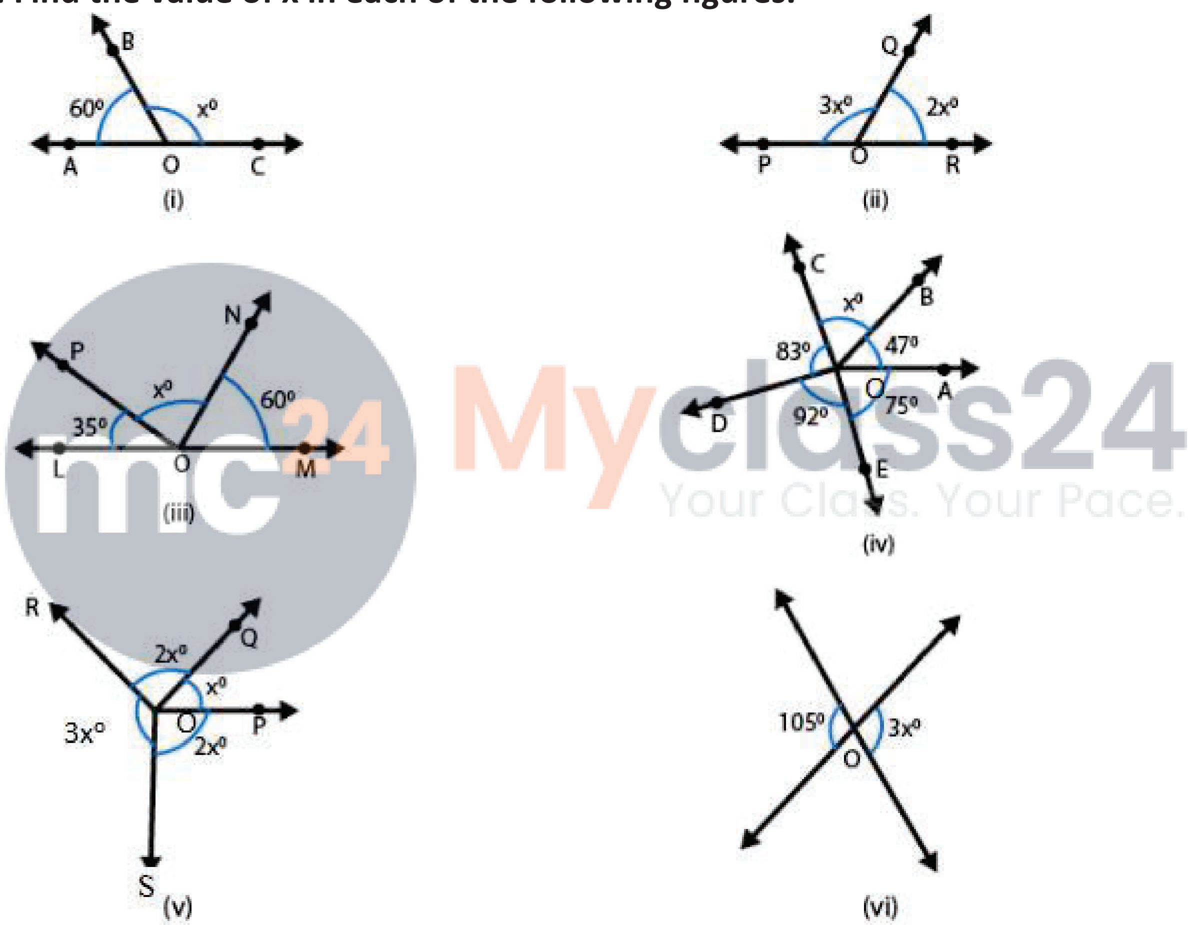


Fig 21

Solution:

(i) We know that $\angle BOA + \angle BOC = 180^\circ$

[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°]

$60^\circ + x^\circ = 180^\circ$

$x^\circ = 180^\circ – 60^\circ$

$x^o = 120^o$

(ii) We know that ∠POQ + ∠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 ∠LOP + ∠PON + ∠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 ∠DOC + ∠DOE + ∠EOA + ∠AOB+ ∠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 ∠ROS + ∠ROQ + ∠QOP + ∠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.

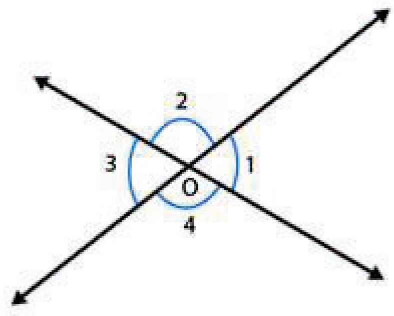


Fig 22

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?

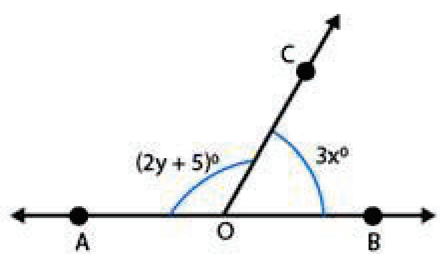


Fig 23

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) ∠AOC + ∠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.

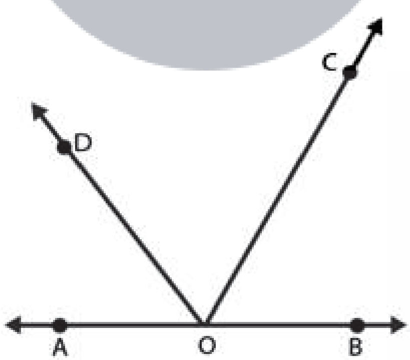


Fig 24

Solution:
Pairs of adjacent angles are:
∠DOA and ∠DOC
∠BOC and ∠COD
∠AOD and ∠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.

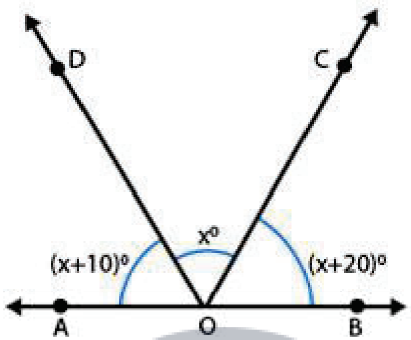


Fig 25

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?

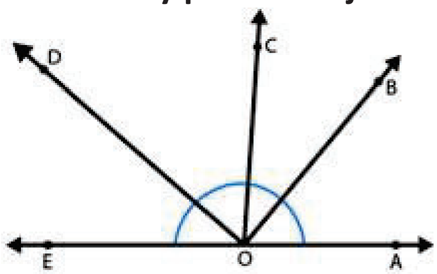


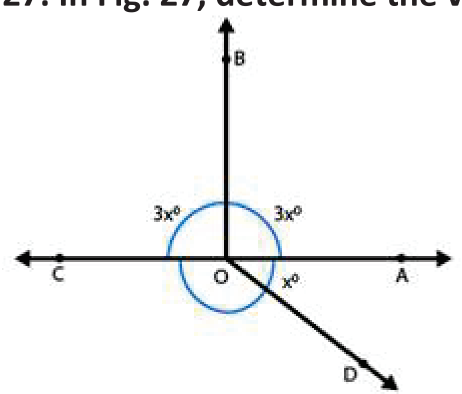
Fig 26

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° [linear pair]

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

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

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

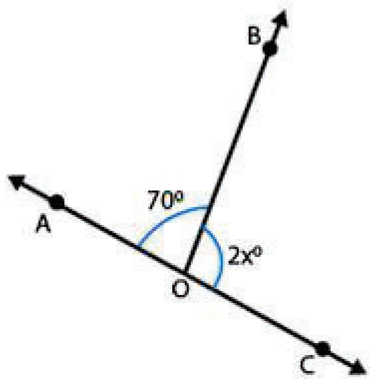


Fig 28

Solution:
From the figure we can write as
∠AOB + ∠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.

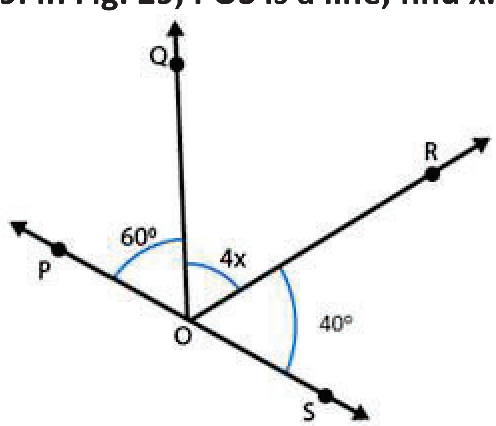


Fig 29

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°, find the values of y, z and u.

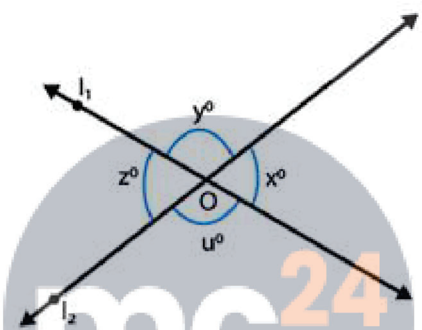


Fig 30

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, $\angle x = 45^o$, $\angle y = 135^o$, $\angle z = 45^o$ and $\angle u = 135^o$

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

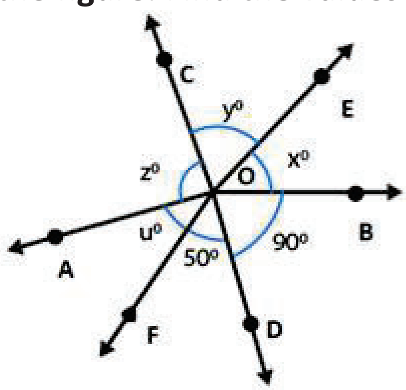


Fig 31

Solution:

Given that, $\angle x + \angle y + \angle z + \angle u + 50^o + 90^o = 360^o$

Linear pair, $\angle x + 50^o + 90^o = 180^o$

$\angle x + 140^o = 180^o$

On rearranging we get

$\angle x = 180^o - 140^o$

$\angle x = 40^o$

From the figure we can write as

$\angle x = \angle u = 40^o$ are vertically opposite angles

$\angle z = 90^o$ is a vertically opposite angle

$\angle y = 50^o$ is a vertically opposite angle

Therefore, $\angle x = 40^o$, $\angle y = 50^o$, $\angle z = 90^o$ and $\angle u = 40^o$

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

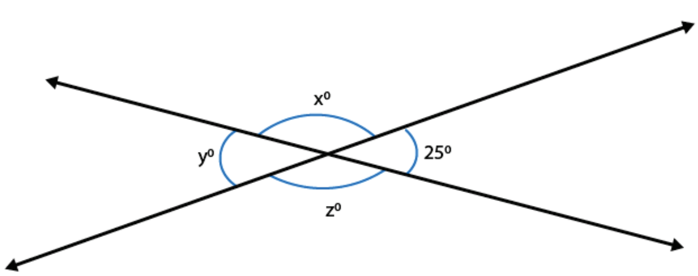


Fig 32

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 $\angle z = 155^o$