# 8. Lines and Angles

## Exercise 8.1

**1. Question**

Write the complement of each of the following angles:

(i) 20° (ii) 35° (iii) 90°

(iv) 77° (v) 30°

**Answer**

(i) Given angle is $20^o$

Since the sum of an angle and its compliment is $90^o$

Therefore, its compliment will be:

$90^o – 20^o = 70^o$

(ii) Given angle is $35^o$

Since the sum of an angle and its compliment is $90^o$

Therefore, its compliment will be:

$90^o – 35^o = 55^o$

(iii) Given angle is $90^o$

Since the sum of an angle and its compliment is $90^o$

Therefore, its compliment will be:

$90^o – 90^o = 0^o$

(iv) Given angle is $77^o$

Since the sum of an angle and its compliment is $90^o$

Therefore, its compliment will be:

$90^o – 77^o = 13^o$

(v) Given angle is $30^o$

Since the sum of an angle and its compliment is $90^o$

Therefore, its compliment will be:

$90^o – 30^o = 60^o$

**2. Question**

Write the supplement of each of the following angles:

(i) 54° (ii) 132° (iii) 138°

**Answer**

(i) Given angle is $54^o$

Since the sum of an angle and its supplement is $180^o$

Therefore, its compliment will be:

$180^o – 54^o = 126^o$

(ii) Given angle is $132^o$

Since the sum of an angle and its supplement is $180^o$

Therefore, its compliment will be:

$180^o - 132^o = 48^o$

(iii) Given angle is $138^o$

Since the sum of an angle and its supplement is $180^o$

Therefore, its compliment will be:

$180^o - 138^o = 42^o$

**3. Question**

If an angle is 28° less than its complement, find its measure.

**Answer**

Angle measured will be 'x' say

Therefore, its compliment will be $(90^o - x)$

It is given that angle = Compliment – $28^o$

$x = (90^o - x) - 28^o$

$2x = 62^o$

$x = 31^o$

**4. Question**

If an angle is 30° more than one half of its complement, find the measure of the angle.

**Answer**

Let the angle be "x"

The, its complement will be $(90^o - x)$

Note: Complementary angles: When the sum of 2 angles is 90°.

It is given that angle = $30^o + \frac{1}{2}$ Complement

$x = 30^o + \frac{1}{2}(90^o - x)$

$x = 30^o + 45^o - x/2$

$x + x/2 = 30^o + 45^o$

$\frac{3x}{2} = 75^o$

$3x = 150^o$

$x = 50^0$

Thus, the angle is $50^0$

**5. Question**

Two supplementary angles are in the ratio 4 : 5. Find the angles.

**Answer**

Supplementary angles are in the ratio 4: 5

Let the angles be 4x and 5x.

It is given that they are supplementary angles

Therefore,

$4x + 5x = 180^o$

$x = 20^o$

Hence, $4x = 80^o$

$5x = 100^o$

Therefore, angles are $80^o$ and $100^o$.

**6. Question**

Two supplementary angles differ by 48°. Find the angles.

**Answer**

Given that,

Two supplementary angles are differ by $48^o$

Let, the angle measured be $x^o$

Therefore, its supplementary angle will be $(180^o – x)$

It is given that,

$(180^o – x) – x = 48^o$

$2x = 180^o – 48^o$

$x = 66^o$

Hence, $180^o – x = 114^o$

Therefore, angles are $66^o$ and $114^o$.

**7. Question**

An angle is equal to 8 times its complement. Determine its measure.

**Answer**

It is given that,

Angle = 8 times its compliment

Let x be the measured angle

Angle = 8 (Compliment)

Angle = $8 (90^o – x^o)$

$x = 720^o – 8x$

$9x = 720^o$

$x = 80^o$

**8. Question**

If the angles $(2x-10)°$ and $(x-5)°$ are complementary angles, find $x$.

**Answer**

Given that,

$(2x - 10)^o$ and $(x - 5)^o$ are compliment angles.

Let x be measured angle

Since, angles are complimentary

Therefore,

$(2x - 10)^o + (x - 5)^o = 90^0$

$3x - 15^o = 90^o$

$x = 35^o$

**9. Question**

If the complement of an angle is equal to the supplement of the thrice of it. Find the measure of the angle.

**Answer**

Let the angle measured be x

Compliment angle = $(90^o - x)$

Supplement angle = $(180^o - x)$

Given that,

Supplementary of thrice of the angle = $(180^o - 3x)$

According to question,

$(90^o - x) = (180^o - 3x)$

$2x = 90^o$

$x = 45^o$

**10. Question**

If an angle differs from its complement by 10°, find the angle.

**Answer**

Let the angle measured be x

Given that,

The angles measured will be differ by $10^o$

$x^o - (90^o - x) = 10^o$

$2x = 100^o$

$x = 50^o$

**11. Question**

If the supplement of an angle is three times its complement, find the angle.

**Answer**

Given that,

Supplement angle = 3 times its compliment angle

Let the angle measured be x

According to the question

$(180^o - x) = 3\ (90^o - x)$

$2x = 90^o$

$x = 45^o$

**12. Question**

If the supplement of an angle is two-thirds of itself. Determine the angle and its supplement.

**Answer**

Given that,

Supplement = $\frac{2}{3}$ of the angle itself

Let the angle be x

Therefore,

Supplement = $(180^o – x)$

According to the question

$(180^o – x) = \frac{2}{3} x$

$540^o - 3x = 2x$

$5x = 540^o$

$x = 108^o$

Hence, supplement = $72^o$

**Therefore, the angle will be $108^o$ and its supplement will be $72^o$.**

**13. Question**

An angle is 14° more than its complementary angle. What is its measure?

**Answer**

Given that,

An angle is 14 more than its compliment

Let the angle be x

Compliment = $(90^o – x)$

According to the question,

$x – (90^o – x) = 14$

$2x = 90^o + 14^o$

$x = 52^o$

**14. Question**

The measure of an angle is twice the measure of its supplementary angle. Find its measure.

**Answer**

Given that,

Angle measured is twice its supplement

Let the angle measured be x

Therefore,

Supplement = $(180^o – x)$

According to the question

$x^o = 2 (180^o – x)$

$3x = 360^o$

$x = 120^o$

## Exercise 8.2

**1. Question**

In Fig. 8.31, *OA* and *OB* are opposite rays:

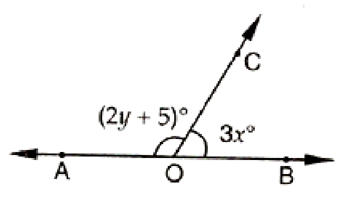



Fig. 8.31

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

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

**Answer**

(i) Given that,

$x = 25^o$

$\angle AOC + \angle BOC = 180^o$ (Linear pair)

$(2y + 5) + 3x = 180^o$

$(2y + 5) + 3 (25) = 180^o$

$2y = 100^o$

$y = 50^o$

(ii) Given that,

If $y = 35^o$

$\angle AOC + \angle BOC = 180^o$

$(2y + 5) + 3x = 180^o$

$2 (35) + 5 + 3x = 180^o$

$3x = 105^o$

$x = 35^o$

**2. Question**

In Fig. 8.32, write all pairs of adjacent angles and all the linear pairs.

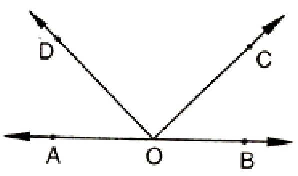



Fig. 8.32

**Answer**

Adjacent angles are:

(i) $\angle AOC, \angle COB$

(ii) $\angle AOD, \angle BOD$

(iii) $\angle AOD, \angle COD$

(iv) $\angle BOC, \angle COD$

Linear pairs are:

$\angle AOD, \angle BOD$ *and*

$\angle AOC, \angle BOC$

**3. Question**

In Fig. 8.33, find *x*. Further find $\angle BOC, \angle COD$ and $\angle AOD$.

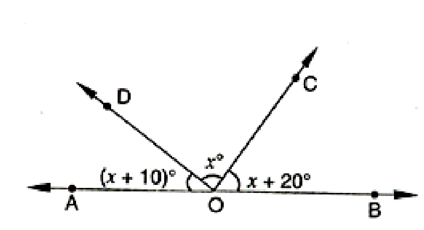


Fig. 8.33

**Answer**

$\angle AOD + \angle BOD = 180^o$ (Linear pair)

$\angle AOD + \angle COD + \angle BOC = 180^o$ (Linear pair)

Given that,

$\angle AOD = (x + 10)$

$\angle COD = x$

$\angle BOC = (x + 20)$

$(x + 10) + x + (x + 20) = 180^0$

$3x = 150^o$

x = $50^o$

Therefore,

$\angle AOD = 60^o$

$\angle COD = 50^o$

$\angle BOC = 70^o$

**4. Question**

In Fig. 8.34, rays *OA, OB, OC, OD* and *OE* have the common endpoint, O. Show, that $\angle AOB + \angle BOC + \angle COD + \angle DOE + \angle EOA$ = 360°.

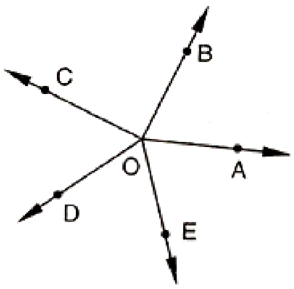


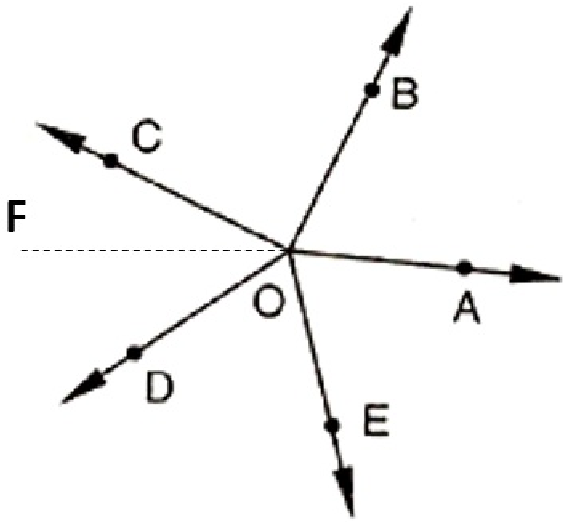
Fig. 8.34

**Answer**

Given that,

The rays OA, OB, OC, OD, and OE have the common endpoint O.

A ray of opposite to OA is drawn.




Since,

$\angle AOB$, $\angle BOF$ *are linear pair*

$\angle AOB + \angle BOF = 180^o$

$\angle AOB + \angle BOC + \angle COF = 180^o$ *(i)*

Also,

$\angle AOE + \angle EOF = 180^o$

$\angle AOE + \angle DOF + \angle DOE = 180^o$ *(ii)*

Adding (i) and (ii), we get

$\angle AOB + \angle BOC + \angle COF + \angle AOE + \angle DOF + \angle DOE = 360^o$

$\angle AOB + \angle BOC + \angle COD + \angle DOE + \angle EOA = 360^o$

Hence, proved

**5. Question**

In Fig. 8.35, $\angle AOC$ and $\angle BOC$ form a linear pair. If $a - 2b = 30°$, find $a$ and $b$.

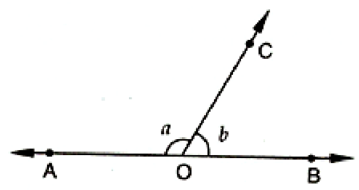


Fig. 8.35

**Answer**

Given,

If (a – 2b) = 30$^{o}$

*∠AOC = a*

*∠BOC = b*

Therefore,

a + b = 180$^{o}$ (i)

Given,

(a – 2b) = 30$^{o}$ (ii)

Now,

Subtracting (i) and (ii), we get

a + b – a + 2b = 180$^{o}$ – 30$^{o}$

b = 50$^{o}$

Hence,

(a – 2b) = 30$^{o}$

a – 2 (50) = 30$^{o}$

a = 130$^{o}$

**6. Question**

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

**Answer**

Four pairs of adjacent angles formed when two lines intersect any point. They are:

*∠AOD, ∠DOB*

*∠DOB, ∠BOC*

*∠COA, ∠AOD*

*∠BOC, ∠COA*

**7. Question**

How many pairs of adjacent angles, in all, can you name in Fig. 8.36.

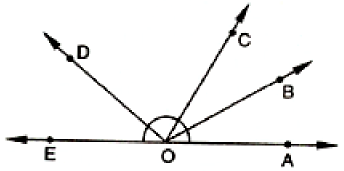


Fig. 8.36

**Answer**

Pairs of adjacent angles are:

*∠EOC, ∠DOC*

*∠EOD, ∠DOB*

*∠DOC, ∠COB*

*∠EOD, ∠DOA*

*∠DOC, ∠COA*

*∠BOC, ∠BOA*

*∠BOA, ∠BOD*

*∠BOA, ∠BOE*

*∠EOC, ∠COA*

*∠EOC, ∠COB*

Hence, ten pairs of adjacent angles.

**8. Question**

In Fig. 8.37, determine the value of *x*.

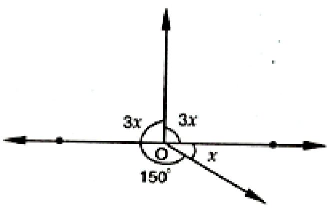



Fig. 8.37

**Answer**

Sum of all the angles around the point = $360^o$

$3x + 3x + 150^o + x = 360^o$

$7x = 360^o – 150^o$

$7x = 210^o$

$x = 30^o$

**9. Question**

In Fig. 8.38, *AOC* is a line, find *x.*

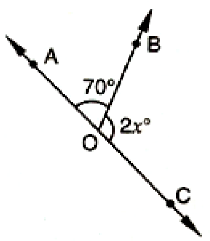



Fig. 8.38

**Answer**

*$\angle AOB + \angle BOC = 180^o$ (Linear pair)*

$70^o + 2x = 180^o$

$2x = 110^o$

$x = 55^o$

**10. Question**

In Fig. 8.39, *POS* is a line, find *x.*

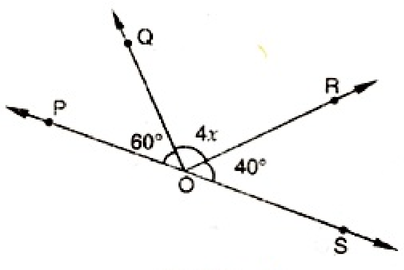



Fig. 8.39

**Answer**

*∠POQ + ∠QOS = 180^o* (Linear pair)

*∠POQ + ∠QOR + ∠SOR = 180^o*

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

$4x = 80^o$

$x = 20^o$

**11. Question**

In Fig. 8.40, *∠ACB* is a line such that *∠DCA* = 5*x* and *∠DCB* = 4*x*. Find the value of *x.*

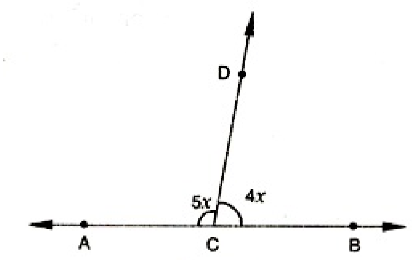



Fig. 8.40

**Answer**

*∠ACD + ∠BCD = 180^o*(Linear pair)

$5x + 4x = 180^o$

$9x = 180^o$

$x = 20^o$

**12. Question**

Given ∠POR = 3*x* and *∠QOR* = 2*x*+10, find the value of *x* for which *POQ* will be a line.

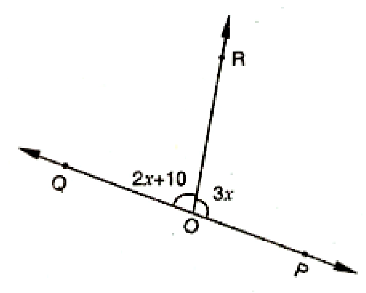



Fig. 8.41

**Answer**

$\angle QOR + \angle POR = 180^o$(Linear pair)

$2x + 10^o + 3x = 180^o$

$5x = 170^o$

$x = 34^o$

**13. Question**

In Fig. 8.42, *a* is greater than *b* by one third of a right angle. Find the values of *a* and *b*.

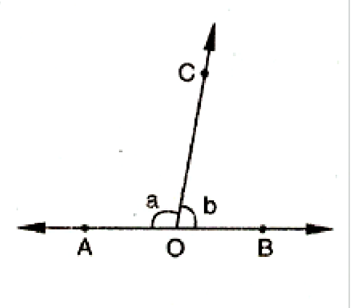



Fig. 8.42

**Answer**

$a + b = 180^o$ (Linear pair)

$a = 180^o - b$ (i)

Now, given that

$a = b + \frac{1}{3} * 90^o$

$a = b + 30^o$ (ii)

$a - b = 30^o$

Equating (i) and (ii), we get

$180^o - b = b + 30^o$

$150^o = 2b$

$b = 75^o$

Hence, $a = 180^o - b$

$= 105^o$

**14. Question**

What value of *y* would make *AOB* a line in Fig. 8.43, if $\angle AOC = 4y$ and $\angle BOC = (6y+30)$

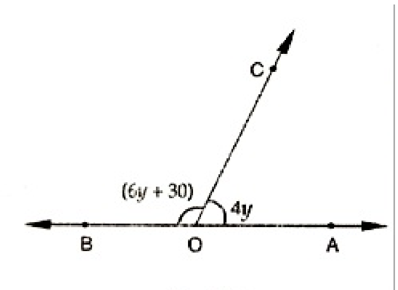



Fig. 8.43

**Answer**

$\angle AOC + \angle BOC = 180^o$

$6y + 30^o + 4y = 180^o$

$10y = 150^o$

$y = 15^o$

**15. Question**

In Fig. 8.44, $\angle AOF$ and $\angle FOG$ form a linear pair.

$\angle EOB = \angle FOC = 90°$ and $\angle DOC = \angle FOG = \angle AOB = 30°$

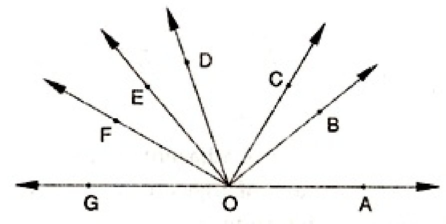



Fig. 8.44

(i) Find the measures of $\angle FOE$, $\angle COB$ and $\angle DOE$.

(ii) Name all the right angles.

(iii) Name three pairs of adjacent complementary angles.

(iv) Name three pairs of adjacent supplementary angles.

(v) Name three pairs of adjacent angles.

**Answer**

(i) Say,

$\angle FOE = x$

$\angle DOE = y$

$\angle BOC = z$

$\angle AOF + 30^o = 180^o$ $(\angle AOF + \angle FOG = 180^o)$

$\angle AOF = 150^o$

$\angle AOB + \angle BOC + \angle COD + \angle DOE + \angle EOF = 150^o$

$30^o + z + 30^o + y + x = 150^o$

$x + y + z = 90^o$(i)

Now,

$\angle FOC = 90^o$

$\angle FOE + \angle EOD + \angle DOC = 90^o$

$x + y + 30^o = 90^o$

$x + y = 60^o$ (ii)

Using (ii) in (i), we get

$x + y + z = 90^o$

$60^o + z = 90^o$

z = 30° ($\angle BOC = 30^o$)

$\angle BOE = 90^o$

$\angle BOC + \angle COD + \angle DOE = 90^o$

$30^o + 30^o + \angle DOE = 90^o$

$\angle DOE = 30^o$

Now, we have

x + y = 60°

y = 30°

$\angle FOE = 30^o$

(ii) Right angles are:

$\angle DOG, \angle COF, \angle BOF, \angle AOD$

(iii) Three pairs of adjacent complimentary angles are:

$\angle AOB, \angle BOD$

$\angle AOC, \angle COD$

$\angle BOC, \angle COE$

(iv) Three pairs of adjacent supplementary angles are:

$\angle AOB, \angle BOG$

$\angle AOC, \angle COG$

$\angle AOD, \angle DOG$

(v) Three pairs of adjacent angles are:

$\angle BOC, \angle COD$

$\angle COD, \angle DOE$

$\angle DOE, \angle EOF$

**16. Question**

In Fig. 8.45, *OP, OQ, OR* and *OS* are four rays, prove that:

$\angle POQ + \angle QOR + \angle SOR + \angle POS = 360°$

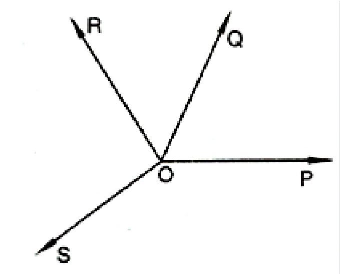


Fig. 8.45

**Answer**

Given that,

OP, OQ, OR and OS are four rays

You need to produce any of the rays OP, OQ, OR and OS backwards to a point T so that TOQ is a line.

Ray OP stands on line TOQ

$\angle TOP + \angle POQ = 180^o$ (Linear pair) (i)

Similarly,

$\angle TOS + \angle SOQ = 180^o$(ii)

$\angle TOS + \angle SOR + \angle OQR = 180^o$ (iii)

Adding (i) and (iii), we get

$\angle TOP + \angle POQ + \angle TOS + \angle SOR + \angle QOR = 360^o$

$\angle TOP + \angle TOS = \angle POS$

Therefore, $\angle POQ + \angle QOR + \angle SOR + \angle POS = 360^o$.

**17. Question**

In Fig. 8.46, ray *OS* stand on a line *POQ*. Ray *OR* and ray *OT* are angle bisectors of $\angle POS$ and $\angle$ respectively. If $\angle POS = x$, find $\angle ROT$.

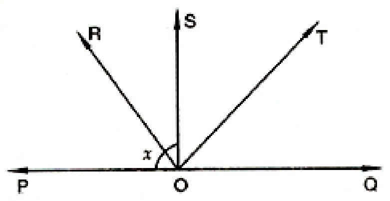


Fig. 8.46

**Answer**

Given that,

Ray OS stand on a line POQ

Ray OR and OT are angle bisector of $\angle POS$ and $\angle SOQ$ *respectively.*

$\angle POS = x$

$\angle POS + \angle QOS = 180^o$(Linear pair)

$\angle QOS = 180^o - x$

$\angle ROS = \frac{1}{2}\angle POS$ (Given)

$= \frac{1}{2}x$

$\angle ROS = \frac{x}{2}$

Similarly,

$\angle TOS = (90^o - \frac{x}{2})$

Therefore,

$\angle ROT = \angle ROS + \angle ROT$

$= \frac{x}{2} + 90^o - \frac{x}{2}$

$= 90^o$

Therefore, $\angle ROT = 90^o$

**18. Question**

In Fig. 8.47, lines *PQ* and *RS* intersect each other at point *O*. If $\angle POR : \angle ROQ = 5 : 7$, find all the angles.

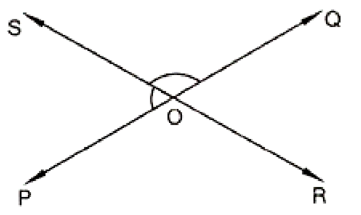


Fig. 8.47

**Answer**

Given,

$\angle POR$ *and* $\angle ROP$ is linear pair

$\angle POR + \angle ROP = 180^o$

Given that,

$\angle POR = \angle ROQ = 5: 7$

Therefore,

$\angle POR = \frac{5}{12} \times 180^o = 75^o$

Similarly,

$\angle ROQ = 125^o$

Now,

$\angle POS = \angle ROQ = 125^o$(Vertically opposite angles)

*Therefore,*

$\angle SOQ = \angle POR = 75^o$(Vertically opposite angles)

**19. Question**

In Fig. 8.48, *POQ* is a line. Ray *OR* is perpendicular to line *PQ. OS* is another ray lying between rays *OP* and *OR.* Prove that $\angle ROS = \frac{1}{2}$ ($\angle QOS - \angle POS.$)

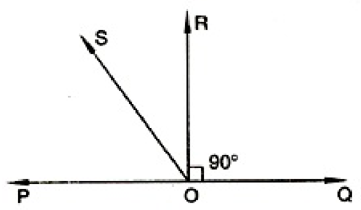


Fig. 8.48

**Answer**

OR perpendicular to PQ

Therefore,

$\angle POR = 90^o$

$\angle POS + \angle SOR = 90^o$ [Therefore, $\angle POR = \angle POS + \angle SOR$]

$\angle ROS = 90^o - \angle POS$ (i)

$\angle QOR = 90^o$ (Therefore, OR perpendicular to PQ)

$\angle QOS - \angle ROS = 90^o$

$\angle ROS = \angle QOS - 90^o$(ii)

By adding (i) and (ii), we get

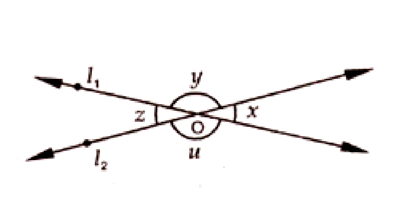
$2\angle ROS = \angle QOS - \angle POS$

$\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$

## Exercise 8.3

### 1. Question

In Fig 8.56, 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*.




### Answer

Given that,

$x = 45^o$

y =?

z =?

u =?

$z = x = 45^o$ (Vertically opposite angle)

$z + u = 180^o$ (Linear pair)

$45^o = 180^o - u$

$u = 135^o$

$x + y = 180^o$ (Linear pair)

$45^o = 180^o - y$

$y = 135^o$

Therefore, $x = 45^o$, $y = 135^o$, $u = 135^o$ and $z = 45^o$.

### 2. Question

In Fig. 8.57, three coplanar lines intersect at a point *O*, forming angles as shown in the figure, Find the values of *x, y, z* and *u*.

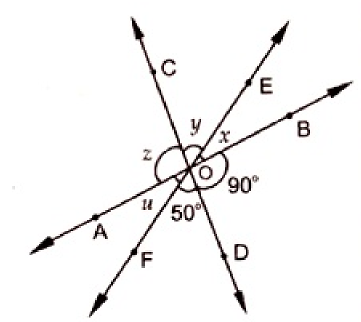



Fig. 8.57

### Answer

Since,

Vertically opposite angles are equal

So,

$\angle BOD = z = 90^o$

$\angle DOF = y = 50^o$

Now,

$x + y + z = 180^o$ (Linear pair)

$x + 90^o + 50^o = 180^0$

$x = 40^o$

**3. Question**

In Fig. 8.58, find the values of *x, y* and *z*.

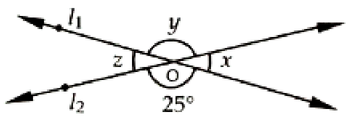



Fig. 8.58

**Answer**

From the given figure,

$\angle y = 25^o$(Vertically opposite angle)

$(x + y) = 180^o$ (Linear pair)

$x + 25^o = 180^o$

$x = 155^o$

Also,

$z = x = 155^o$ (Vertically opposite angle)

$y = 25^o$

**4. Question**

In Fig. 8.59, find the value of *x*.

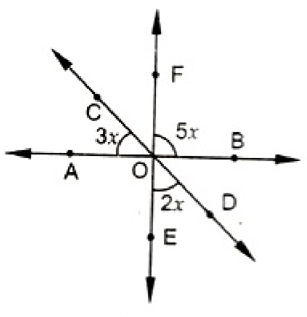



Fig. 8.59

**Answer**

$\angle AOE = \angle BOF = 5x$ (Vertically opposite angle)

By Linear pair,

$\angle COA + \angle AOE + \angle EOD = 180^o$

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

$x = 18^o$

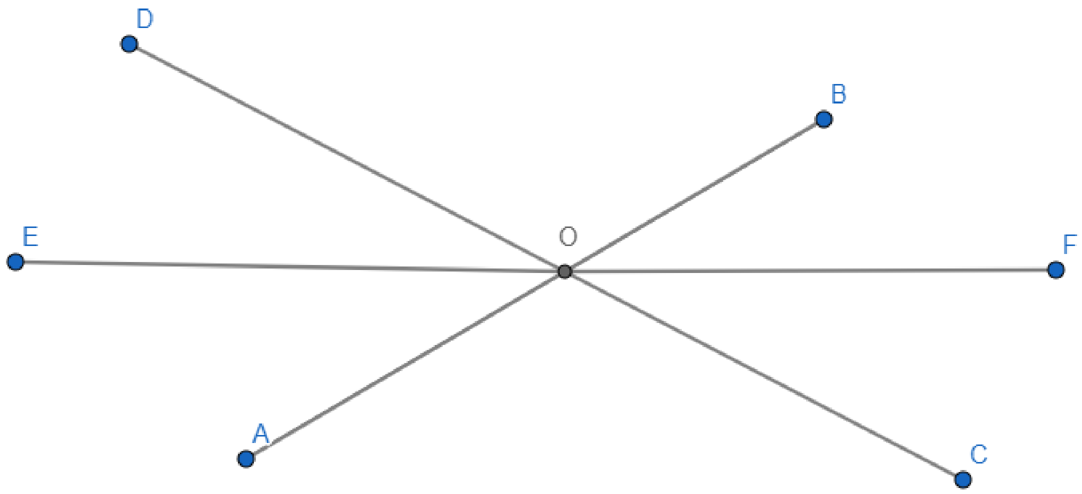
**5. Question**

Prove that the bisectors of a pair of vertically opposite angles are in the same straight line.

**Answer**

Given that,

Lines AOB and COD intersect at point O such that,




Construction: Construct a line EF which passes through O.

$\angle AOC = \angle BOD$

Also,

OF is the bisector of $\angle AOC$ and OE is the bisector of $\angle BOD$

To prove: EOF is a straight line.

$\angle AOD = \angle BOC = 2x$ (Vertically opposite angle) (i)

As OE and OF are bisectors.So $\angle AOE = \angle BOF = x$

$\angle AOD + \angle BOD = 180°$ *(linear pair)*

$\angle AOE + \angle EOD + \angle DOB = 180°$

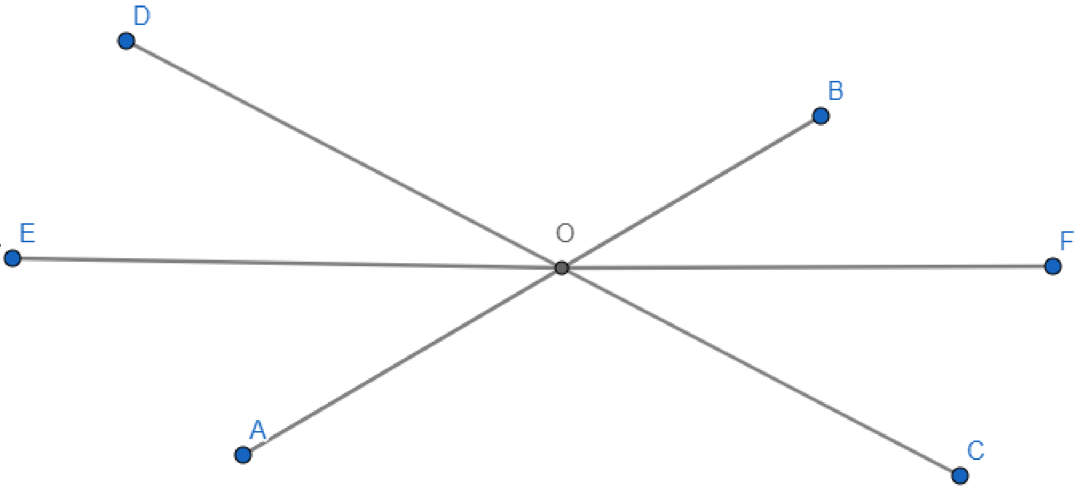
From (1)

$\angle BOF + \angle EOD + \angle DOB = 180°$∠EOF = $180^o$EF is a straight line.

**6. Question**

If two straight lines intersect each other, prove that the ray opposite to the bisector of one of the angles thus formed bisects the vertically opposite angle.

**Answer**

Given that, 


AB and CD intersect at O

OF bisects $\angle COB$

To prove: $\angle AOF = \angle DOF$

Proof: OF bisects $\angle COB$ *[given]*

(Vertically opposite angle)

$\angle BOE = \angle AOF = x$ (i)

$\angle COE = \angle DOF = x$ (ii)

From (i) and (ii), we get

$\angle AOF = \angle DOF = x$

Hence, proved

**7. Question**

If one of the four angles formed by two intersecting lines is a right angle, then show that each of the four angles is a right angle.

**Answer**

Given that,

AB and CD are two lines intersecting at O

To prove: $\angle BOC = 90^o$

$\angle AOC = 90^o$

$\angle AOD = 90^o$

$\angle BOD = 90^o$

Proof: Given that,

$\angle BOC = 90^o$

$\angle BOC = \angle AOD = 90^o$(Vertically opposite angle)

$\angle AOC + \angle BOC = 180^o$(Linear pair)

$\angle AOC + 90^o = 180^o$

$\angle AOC = 90^o$

$\angle AOC = \angle BOD = 90^o$(Vertically opposite angles)

Therefore,

$\angle AOC = \angle BOC = \angle BOD = \angle AOD = 90^o$

Hence, proved

**8. Question**

In Fig. 8.60, ray *AB* and *CD* intersect at *O*.

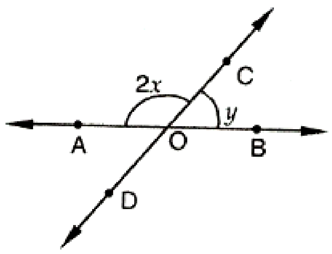



Fig. 8.60

(i) Determine *y* when $x = 60°$

(ii) Determine *x* when $y = 40^o$

**Answer**

(i) Given that,

$x = 60^o$

y =?

$\angle AOC + \angle DOC = 180^o$(Linear pair)

$2x + y = 180^o$

$120^o + y = 180^0$

$y = 60^o$

(ii) Given that,

$y = 40^o$

x =?

$\angle AOC + \angle BOC = 180^o$ (Linear pair)

$2x + y = 180^o$

$2x = 140^o$

$x = 70^o$

**9. Question**

In Fig. 8.61, lines *AB, CD* and *EF* intersect at *O*. Find the measures of $\angle AOC$, $\angle COF$, $\angle DOE$ and $\angle BOF$.

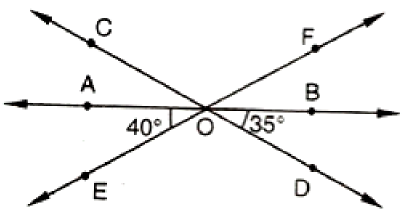



Fig. 8.61

**Answer**

$\angle AOE + \angle EOB = 180^o$(Linear pair)

$\angle AOE + \angle DOE + \angle BOD = 180^o$

$\angle DOE = 105^o$

$\angle DOE = \angle COF = 105^o$(Vertically opposite angle)

$\angle AOE + \angle AOF = 180^o$(Linear pair)

$40^o + \angle AOC + 105^o = 180^o$

$\angle AOC = 35^o$

Also,

$\angle BOF = \angle AOE = 40^o$(Vertically opposite angle)

**10. Question**

*AB, CD* and *EF* are three concurrent lines passing through the point *O* such that *OF* bisects $\angle BOD$. If $\angle BOF$ = 35°, find $\angle BOC$ and $\angle AOD$.

**Answer**

OF bisects $\angle BOD$

$\angle BOF = 35^o$

$\angle BOC =?$

$\angle AOD =?$

$\angle BOD = \angle BOF = 70^o$(Therefore, OF bisects $\angle BOD$)

$\angle BOD = \angle AOC = 70^o$(Vertically opposite angle)

$\angle BOC + \angle AOC = 180^o$

$\angle BOC + 70^o = 180^o$

$\angle BOC = 110^o$

$\angle AOD = \angle BOC = 110^o$(Vertically opposite angle)

**11. Question**

In Fig. 8.62, lines *AB* and *CD* intersect at *O*. If $\angle AOC + \angle BOE$ = 70° and $\angle BOD$ = 40° find $\angle BOE$ and reflex $\angle COE$.

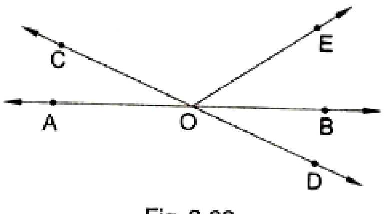



Fig. 8.62

**Answer**

Given that,

$\angle AOC + \angle BOE = 70^o$

And,

$\angle BOD = 40^o$

$\angle BOF = ?$

$\angle BOD = \angle AOC = 40^o$ (Vertically opposite angle)

Given,

$\angle AOC + \angle BOE = 70^o$

$40^o + \angle BOE = 70^o$

$\angle BOE = 70^o - 40^o$

$= 30^o$

$\angle AOC$ *and* $\angle BOC$ are linear pair angle

$\angle AOC + \angle COE + \angle BOE = 180^o$

$\angle COE = 180^o - 30^o - 40^o$

$= 110^o$

Therefore,

$\angle COE = 360^o - 110^o$

$= 250^o$

**12. Question**

Which of the following statements are true (T) and which are false (F)?

(i) Angles forming a linear pair are supplementary.

(ii) If two adjacent angles are equal, then each angle measures 90°.

(iii) Angles forming a linear pair can both be acute angles.

(iv) If angles forming a linear pair are equal, then each of these angles is of measure 90°.

**Answer**

(i) True: Since, the angles form a sum of $180^o$.

(ii) False: Since, the two angles unless are on the line are necessarily equal to $90^o$.

(iii) False: Since, acute are less than $90^o$ and hence two acute angles cannot give a sum of $180^o$

(iv) True: Since, sum of angles of linear pair is $180^o$ hence, if both the angles are equal they would measure $90^o$.

**13. Question**

Fill in the blanks so as to make the following statements true:

(i) If one angle of a linear pair is acute, then its other angle will be ………..

(ii) A ray stands on a line, then the sum of the two adjacent angles so formed is …………

(iii) If the sum of two adjacent angles is 180°, then the …………arms of the two angles are opposites rays.

**Answer**

(i) Obtuse angle

(ii) $180^o$

(iii) Uncommon

## Exercise 8.4

**1. Question**

In Fig 8.105, *AB, CD* and ∠1 and ∠2 are in the ratio 3 : 2. Determine all angles from 1 to 8.

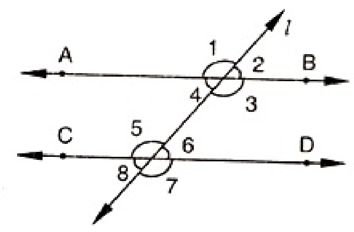



Fig. 8.105

**Answer**

Let, $\angle 1 = 3x$

$\angle 2 = 2x$

$\angle 1 + \angle 2 = 180^o$(Linear pair)

$3x + 2x = 180^o$

$5x = 180^o$

$x = 36^o$

Therefore,

$\angle 1 = 3x = 108^o$

$\angle 2 = 2x = 72^o$

Vertically opposite angles are equal, so:

$\angle 1 = \angle 3 = 108^o$

$\angle 2 = \angle 4 = 72^o$

$\angle 5 = \angle 7 = 108^o$

$\angle 6 = \angle 8 = 72^o$

Corresponding angles:

$\angle 1 = \angle 5 = 108^o$

$\angle 2 = \angle 6 = 72^o$

**2. Question**

In Fig 8.106, *l, m* and *n* are parallel lines intersected by transversal *p* at *X, Y* and and *Z* respectively. Find ∠1, ∠2 and∠3.

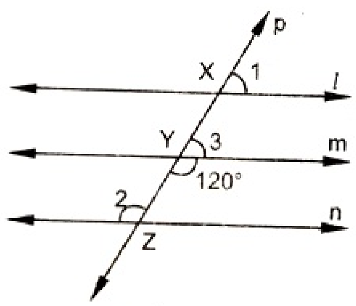



Fig. 8.106

**Answer**

From the given figure,

$\angle 3 + \angle myz = 180^o$(Linear pair)

$\angle 3 = 60^o$

Now,

Line l ∥ m

$\angle 1 = \angle 3$ (Corresponding angles)

$\angle 1 = 60^o$

Now, m ∥ n

$\angle 2 = 120^o$(Alternate interior angle)

Therefore,

$\angle 1 = \angle 3 = 60^o$

$\angle 2 = 120^o$

**3. Question**

In Fig 8.107, $AB \parallel CD \parallel EF$ and $GH \parallel KL$. Find $\angle HKL$.

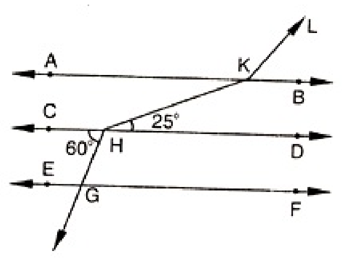
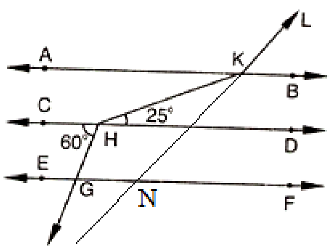



Fig. 8.107

**Answer**

Produce LK to meet GF at N




Now,

$\angle HGN = \angle CHG = 60^o$(Alternate angle)

$\angle HGN = \angle KNF = 60^o$(Corresponding angles)

Therefore,

$\angle KNG = 120^o$

$\angle GNK = \angle AKL = 120^o$(Corresponding angle)

$\angle AKH = \angle KHD = 25^o$(Alternate angles)

Therefore,

$\angle HKL = \angle AKH + \angle AKL$

$= 25^o + 120^o$

$= 145^o$

**4. Question**

In Fig 8.108, show that *AB|| EF.*

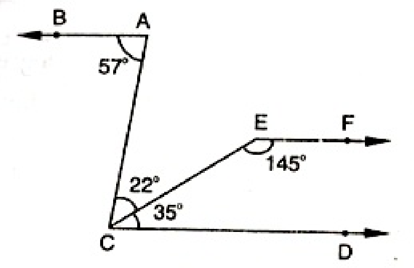



Fig. 8.108

**Answer**

Produce EF to intersect AC at K

Now,

$\angle DCE + \angle CEF = 35^o + 145^o$

$= 180^o$

*Therefore, EF ∥ CD* (Since, sum of co-interior angles is 180$^o$) (i)

*Now,*

$\angle BAC = \angle ACD = 57^o$

*BA ∥ CD (Therefore, alternate angles are equal) (ii)*

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

*AB ∥ EF (Lines parallel to the same line are parallel to each other)*

*Hence, proved*

**5. Question**

In Fig 8.109, if *AB //CD* and *CD//EF*, find *∠ACE.*

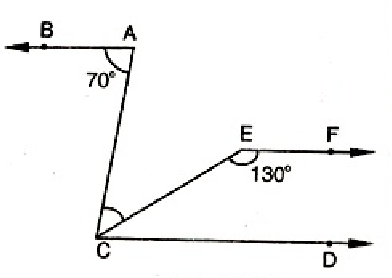



Fig. 8.109

**Answer**

Since,

EF ∥ CD

Therefore,

$\angle EFC + \angle LEC = 180^o$(Co. interior angles)

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

$= 50^o$

Also, BA ∥ CD

$\angle BAC = \angle ACD = 70^o$(Alternate angles)

But, $\angle ACE + \angle ECD = 70^o$

$\angle ACE = 70^o - 50^o$

$= 20^o$

**6. Question**

In Fig 8.110, *PQ*||*AB* and *PR*||*BC*. If $\angle QPR = 102°$, determine $\angle ABC$. Give reasons.

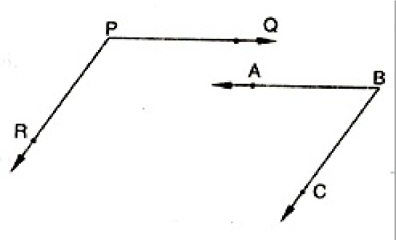



Fig. 8.110

**Answer**

AB is produced to meet PR at K

Since, PQ ∥ AB

$\angle QPR = \angle BKR = 102^o$ (Corresponding angles)

Since, PR ∥ BC

Therefore,

$\angle RKB + \angle CBK = 180^o$ *(Co. interior angles)*

$\angle CKB = 180^o - 102^o$

$= 78^o$

**7. Question**

In Fig 8.111, state which lines are parallel and why?

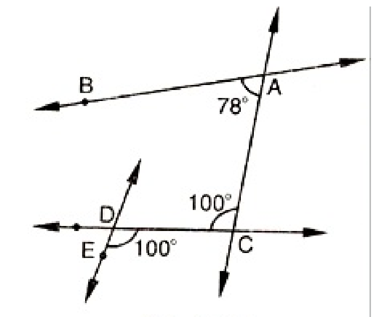



Fig. 8.111

**Answer**

$\angle EOC = \angle DOK = 100^o$(Vertically opposite angle)

$\angle DOK = \angle ACO = 100^o$(Vertically opposite angle)

Here two lines, EK and CA cut by a third line L and the corresponding angles to it are equal.

Therefore,

EK ∥ AC

**8. Question**

In Fig 8.112, if *l*||*m*, *n*||*p* and $\angle 1 = 85°$, find $\angle 2$.

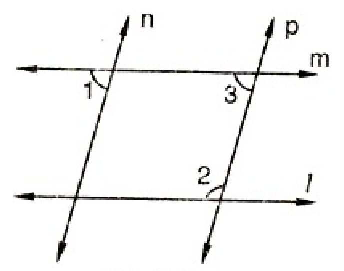


Fig. 8.112

**Answer**

Corresponding angles are equal so,

$\angle 1 = \angle 3 = 85^o$

By using co-interior angle property,

$\angle 2 + \angle 3 = 180^o$

$\angle 2 + 85^o = 180^o$

$\angle 2 = 95^o$

**9. Question**

If two straight lines are perpendicular to the same line, prove that they are parallel to each other.

**Answer**

Given m and l perpendicular to t

$\angle 1 = \angle 2 = 90^o$

Since,

l and m are two lines and t is transversal and the corresponding angles are equal.

Therefore,

l ‖ m

Hence, proved

**10. Question**

Prove that the two arms of an angle are perpendicular to the two arms of another angle, then the angles are either equal or supplementary.

**Answer**


Consider the angles,

$\angle AOB$ and $\angle ACB$

Given that,

OA perpendicular AO and OB perpendicular BO

To prove: $\angle AOB = \angle ACB$ or,

$\angle AOB + \angle ACB = 180^o$

Proof: In a quadrilateral

$\angle A + \angle O + \angle B + \angle C = 360^o$(Sum of angles of a quadrilateral)

$180^o + \angle O + \angle C = 360^o$

$\angle O + \angle C = 180^o$

Hence, $\angle AOB + \angle AOC = 180^o$ *(i)*

Also,

$\angle B + \angle ACB = 180^o$

$\angle ACB = 180^o - 90^o$

$\angle ACB = 90^o$ *(ii)*

From (i) and (ii), we get

$\angle ACB = \angle AOB = 90^o$

Hence, the angles are equal as well as supplementary.

**11. Question**

In Fig 8.113, lines *AB* and *CD* are parallel and *P* is any point as shown in the figure. Show that $\angle ABP + \angle CDP = \angle DPB$.

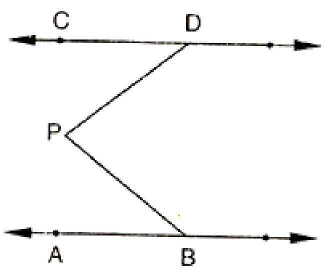


Fig. 8.113

**Answer**

Given that,

AB ∥ CD

Let, EF be the parallel line to AB and CD which passes through P.

It can be seen from the figure that alternate angles are equal

$\angle ABP = \angle BPF$

$\angle CDP = \angle DPF$

$\angle ABP + \angle CDP = \angle BPF + \angle DPF$

$\angle ABP + \angle CDP = \angle DPB$

Hence, proved

**12. Question**

In Fig 8.114, $AB || CD$ and P is any point shown in the figure. Prove that:

$\angle ABP + \angle BPD + \angle CDP = 360°$

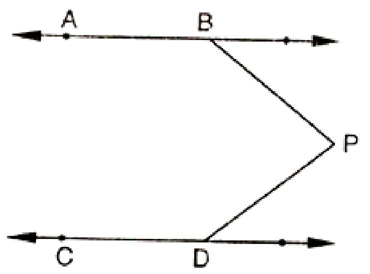


Fig. 8.114

**Answer**

AB is parallel to CD, P is any point

To prove: $\angle ABP + \angle BPD + \angle CDP = 360^o$

Construction: Draw EF ∥ AB passing through F

Proof: Since,

AB ∥ EF and AB ∥ CD

Therefore,

EF ∥ CD (Lines parallel to the same line are parallel to each other)

$\angle ABP + \angle EPB = 180^o$(Sum of co interior angles is 180°, AB ∥ EF and BP is transversal)

$\angle EPD + \angle COP = 180^o$ (Sum of co. interior angles is 180°, EF ∥ CD and DP is transversal) (i)

$\angle EPD + \angle CDP = 180^o$(Sum of co. interior angles is 180°, EF ∥ CD and DP is the transversal) (ii)

Adding (i) and (ii), we get

$\angle ABP + \angle EPB + \angle EPD + \angle CDP = 360^o$

$\angle ABP + \angle EPD + \angle COP = 360^o$

**13. Question**

Two unequal angles of a parallelogram are in the ratio 2 : 3. Find all its angles in degrees.

**Answer**

Let, $\angle A = 2x$ and

$\angle B = 3x$

*Now,*

$\angle AHB = 180^o$ *(Co. interior angles are supplementary)*

$2x + 3x = 180^o$

$5x = 180^o$

$x = 36^o$

$\angle A = 2x = 72^o$

$\angle B = 3x = 108^o$

Now,

$\angle A = \angle C = 72^o$(Opposite sides angles of a parallelogram are equal)

$\angle B = \angle D = 108^o$(Opposite sides angles of a parallelogram are equal)

**14. Question**

If each of the two lines is perpendicular to the same line, what kind of lines are they to each other?

**Answer**

Let AB and CD be perpendicular to MN

$\angle ABD = 90^o$(AB perpendicular to MN) (i)

$\angle CON = 90^o$ (CD perpendicular to MN) (ii)

Now,

$\angle ABD = \angle CON = 90^o$

Since, AB ∥ CP

Therefore, corresponding angles are equal.

**15. Question**

In Fig 8.115, ∠1=60° and ∠2= $\left(\frac{2}{3}\right)^{rd}$ if a right angle. Prove that $l \| m$.

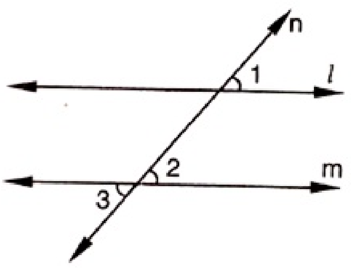



Fig. 8.115

**Answer**

Given,

$\angle 1 = 60^o$

$\angle 2 = \frac{2}{3}$ of right angle

To prove: l ∥ m

Proof: $\angle 1 = 60^o$

$\angle 2 = \frac{2}{3} * 90^o = 60^o$

Since, $\angle 1 = \angle 2 = 60^o$

Therefore, l ∥ m as pair of corresponding angles are equal.

**16. Question**

In Fig 8.116, if $l // m // n$ and ∠1 = 60°, find ∠2

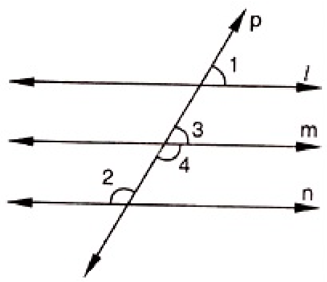



Fig. 8.116

**Answer**

Since,

l ∥ m and P is transversal

Therefore,

Given that,

l ∥ m ∥ n

$\angle 1 = 60^o$

$\angle 1 = \angle 3 = 60^o$(Corresponding angles)

Now,

$\angle 3 + \angle 4 = 180^o$(Linear pair)

$60^o + \angle 4 = 180^o$

$\angle 4 = 120^o$

Also,

m ∥ n and P is the transversal

Therefore,

$\angle 4 = \angle 2 = 120^o$(Alternate interior angles)

**17. Question**

Prove that the straight lines perpendicular to the same straight line are parallel to one another.

**Answer**

Let AB and CD perpendicular to the line MN

$\angle ABD = 90^o$(Since, AB perpendicular MN) (i)

$\angle CON = 90^o$(Since, CD perpendicular MN) (ii)

Now,

$\angle ABD = \angle CON = 90^o$

Therefore,

AB ∥ CD (Since, corresponding angles are equal)

**18. Question**

The opposite sides of a quadrilateral are parallel. If one angle of the quadrilateral is 60° find the other angles.

**Answer**

AB ∥ CD and AD is transversal

AD ∥ BC

Therefore,

$\angle A + \angle D = 180^o$(Co. interior angles are supplementary)

$60^o + \angle D = 180^o$

$\angle D = 120^o$

Now,

AD ∥ BC and AB is transversal

$\angle A + \angle B = 180^o$(Co. interior angles are supplementary)

$60^o + \angle B = 180^o$

$\angle B = 120^o$

Hence,

$\angle A = \angle C = 60^o$

$\angle B = \angle D = 120^o$

**19. Question**

Two lines *AB* and *CD* intersect at *O*. If $\angle AOC + \angle COB + \angle BOD = 270°$, find the measures of $\angle AOC$, $\angle COB$, $\angle BOD$ and $\angle DOA$.

**Answer**

$\angle AOC + \angle COB + \angle BOP = 270^o$

To find: $\angle AOC, \angle COB, \angle BOD$ and $\angle BOA$

Here, $\angle AOC + \angle COB + \angle BOD + \angle AOD = 360^o$(Complete angle)

$270^o + \angle AOD = 360^o$

$\angle AOD = 360^o - 270^o$

$= 90^o$

Now,

$\angle AOD + \angle BOD = 180^o$(Linear pair)

$90^o + \angle BOD = 180^o$

Therefore,

$\angle BOD = 90^o$

$\angle AOD = \angle BOC = 90^o$(Vertically opposite angle)

$\angle BOD = \angle AOC = 90^o$(Vertically opposite angle)

**20. Question**

In Fig 8.117, *p* is a transversal to lines *m* and *n*, $\angle 2 = 120°$ and $\angle 5 = 60°$. Prove that $m || n$.

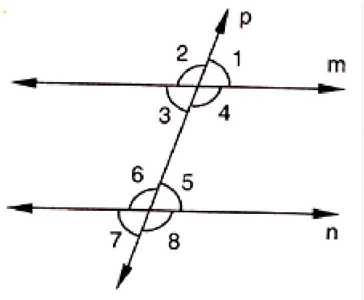


Fig. 8.117

**Answer**

Given that,

$\angle 2 = 120^o$

$\angle 5 = 60^o$

To prove: $\angle 2 + \angle 1 = 180^o$(Linear pair)

$120^o + \angle 1 = 180^o$

$\angle 1 = 180^o - 120^o$

$= 60^o$

Since,

$\angle 1 = \angle 5 = 60^o$

Therefore,

m ∥ n (As pair of corresponding angles are equal)

**21. Question**

In Fig 8.118, transversal *l* intersects two lines *m* and *n*, ∠4= 110° and ∠7 = 65°. Is *m*||*n*?

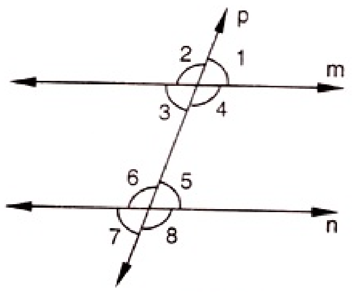



Fig. 8.118

**Answer**

Given,

$\angle 4 = 110^o$,

$\angle 7 = 65^o$

To find: m ∥ n

Here,

$\angle 7 = \angle 5 = 65^o$(Vertically opposite angle)

Now,

$\angle 4 + \angle 5 = 110^o + 65^o$

$= 175^o$

Therefore, m is parallel to n as the pair of co interior angles is not supplementary.

**22. Question**

Which pair of lines in fig 8.119 are parallel? Given reasons

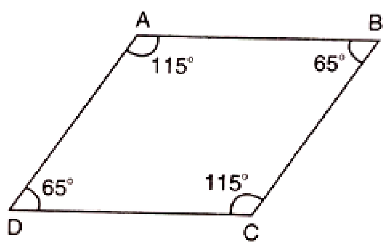



Fig. 8.119

**Answer**

$\angle A + \angle B = 115^o + 65^o$

$= 180^o$

Therefore,

AB ∥ BC, as sum of co interior angles are supplementary.

$\angle B + \angle C = 65^o + 115^o$

$= 180^o$

Therefore,

AB ∥ CD, as sum of co interior angles are supplementary.

**23. Question**

If, *l, m, n* are three lines such that $l \| m$ and $n \perp l$, prove that $n \perp m$.

**Answer**

Given that,

l ∥ m and n perpendicular to m

Since, l ∥ m and n intersects them at G and H respectively

Therefore,

$\angle 1 = \angle 2$ (Corresponding angles)

But, $\angle 1 = 90^o$ as n is perpendicular to l

Therefore, $\angle 2 = 90^o$

Hence, n is perpendicular to m.

**24. Question**

In Fig 8.120, arms *BA* and *BC* of $\angle ABC$ are respectively parallel to arms *ED* and EF of $\angle DEF$. Prove that $\angle ABC = \angle DEF$.

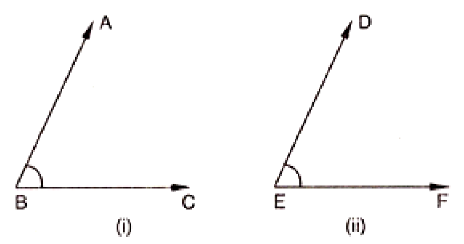


Fig. 8.120

**Answer**

Given that,

AB ∥ DE and EC ∥ EF

To prove: $\angle ABC = \angle DEF$

Construction: Produce BC to X such that it intersects DE at M

Proof: Since, AB ∥ DE and BX is the transversal

Therefore,

$\angle ABC = \angle DMX$ (Corresponding angles) (i)

Also,

BX ∥ EF and DE is transversal

Therefore,

$\angle DMX = \angle DEF$ (Corresponding angles) (ii)

From (i) and (ii), we get

$\angle ABC = \angle DEF$

Hence, proved

**25. Question**

In Fig 8.121, arms *BA* and *BC* of $\angle ABC$ are respectively parallel to arms *ED* and *EF* of $\angle DEF$. Prove that $\angle ABC + \angle DEF = 180°$

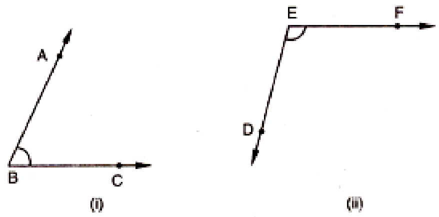



Fig. 8.121

**Answer**

Given that,

AB ∥ DE and BC ∥ EF

To prove: $\angle ABC + \angle DEF = 180^o$

Construction: Produce BC to intersect DE at M

Proof: Since, AB ∥ EM and BL is the transversal

$\angle ABC = \angle EML$ (Corresponding angles) (i)

Also,

EF ∥ ML and EM is the transversal

By the property co interior angles are supplementary

$\angle DEF + \angle EML = 180^o$(ii)

From (i) and (ii), we have

$\angle DEF + \angle ABC = 180^o$

Hence, proved

**26. Question**

Which of the following statements are true (T) and which are false (F)? Give reasons.

(i) If two lines are intersected by a transversal, then corresponding angles are equal.

(ii) If two parallel lines are intersected by a transversal, then alternate interior angles are equal.

(iii) Two lines perpendicular to the same line are perpendicular to each other.

(iv) Two lines parallel to the same line are parallel to each other.

(v) If two parallel lines are intersected by a transversal, then the interior angles on the same side of the transversal are equal.

**Answer**

(i) False: The corresponding angles can only be equal if the two lines that are intersected by the transversal are parallel in nature.

(ii) True: Since, if two parallel lines are intersected by a transversal, then alternate interior angles are equal.

(iii) False: Two lines perpendicular to the same line are parallel to each other.

(iv) True: Since, two lines parallel to the same line are parallel to each other.

(v) False: If two parallel lines are intersected by a transversal, then the interior angles on the same side of the transversal sums up to $180^{o}$.

**27. Question**

Fill in the blanks in each of the following to make the statement true:

(i) If two parallel lines are intersected by a transversal, then each pair of corresponding angles are .....

(ii) If two parallel lines are intersected by a transversal, then interior angles on the same side of the transversal are ..........

(iii) Two lines perpendicular to the same line are ........ to each other.

(iv) Two lines parallel to the same line are ..... to each other.

(v) If a transversal intersects a pair of lines in such away that a pair of alternate angles are equal, then the lines are ............

(vi) If a transversal intersects a pair of lines in such away that the sum of interior angles on the same side of transversal is 180°, then the lines are ......

**Answer**

(i) Equal

(ii) Supplementary

(iii) Parallel

(iv) Parallel

(v) Parallel

(vi) Parallel

## CCE - Formative Assessment

**1. Question**

Define complementary angles.

**Answer**

Two Angles are Complementary when they add up to 90 degrees (a right angle). They don't have to be next to each other, just so long as the total is 90 degrees. Examples: 60° and 30° are complementary angles.

**2. Question**

Define supplementary angles.

**Answer**

Two Angles are Supplementary when they add up to 180 degrees. They don't have to be next to each other, just so long as the total is 180 degrees. Examples: 60° and 120° are supplementary angles.

**3. Question**

Define adjacent angles.

**Answer**

Two angles are Adjacent when they have a common side and a common vertex (corner point) and don't overlap. Angle ABC is adjacent to angle CBD. Because: they have a common side (line CB) they have a common vertex (point B).

**4. Question**

The complement of an acute angle is ..........

**Answer**

The complement of an acute angle is an acute angle. Since complementary angles add to 90 degrees, the only angles that add to 90 are acute angles.

**5. Question**

The supplement of an acute angle is ……….

**Answer**

Supplement is defined as the other angle that adds up to 180 degrees. So therefore if you have an acute angle you know by definition that the angle is less than 90 degrees. In order for both of them to be supplementary (add up to 180 degrees) the other angle must be greater than 90 degrees. Angles that are greater than 90 degrees are obtuse angles. So an obtuse angle is the supplement of an acute angle.

**6. Question**

The supplement of a right angle is ……….

**Answer**

It is also a right angle

Supplement = $180^{o}$ - angle = $180^{o} – 90^{o}$

= $90^{o}$ = Right angle

**7. Question**

Write the complement of an angle of measure $x°$.

**Answer**

Compliments are the angle that adds up to give 90°.

Hence, compliment of x° = 90° - x°

**8. Question**

Write the supplement of an angle of measure $2y°$.

**Answer**

Supplementary angles' measures have a sum of $180^{o}$

Hence, supplementary angles of 2y° = 180 - 2y°

**9. Question**

If a wheel has six spokes equally spaced, then find the measure of the angle between two adjacent spokes.

**Answer**

Total measure of angles of the wheel = 360°

6 spokes = 360°

1 spoke = 60°

So, measure of the angle between 2 adjacent spokes = 2 x 60° = 120°

**10. Question**

An angle is equal to its supplement. Determine its measure.

**Answer**

Supplementary angles are pairs of angles whose measures add up to 180 degrees.

Hence, let one angle be x. Since they are equal, therefore the other angle is also equal to x.

So, x + x = 180°

$2x = 180°$

$x = 180/2$

Therefore, $x = 90°$

So, the angle which is its supplement is 90°.

**11. Question**

An angle is equal to five times its complement. Determine its measure.

**Answer**

Let the complement be x then the number = 5x

Now, according to question

$x + 5x = 90°$

$6x = 90°$

$x = \frac{90}{6}$

$x = 30°$

Hence, measure of the angle is 30°.

**12. Question**

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

**Answer**

When two lines intersect each other then four adjacent pairs of angles are formed. Hence, there are four basic pairs of adjacent angles formed.

**1. Question**

One angle is equal to three times its supplement. The measure of the angle is

A. 130°

B. 135°

C. 90°

D. 120°

**Answer**

Let the required angle be x

Supplement = $180^o – x$

According to question,

$x = 3 (180^o – x)$

$x = 540^o – 3x$

$x = 135^o$

**2. Question**

Two complementary angles are such that two times the measure of one is equal to three times the measure of the other. The measure of the smaller angle is

A. 45°

B. 30°

C. 36°

D. None of these

**Answer**

Let x and ($90^o$ – x) be two complimentary angles

According to question,

$2x = 3(90^o - x)$

$2x = 270^o - 3x$

$x = 54^o$

The angles are:

$54^o$ and $90^o - 54^o = 36^o$

Thus, smallest angle is $36^o$

**3. Question**

Two straight lines *AB* and *CD* intersect one another at the point *O*. If $\angle AOC + \angle COB + \angle BOD = 274°$, then $\angle AOD =$

A. 86°

B. 90°

C. 94°

D. 137°

**Answer**

Given,

$\angle AOC + \angle COB + \angle BOD = 274^o$ (i)

$\angle AOD + \angle AOC + \angle COB + \angle BOD = 360^o$ (Angles at a point)

$\angle AOD + 274^o = 360^o$

$\angle AOD = 86^o$

**4. Question**

Two straight lines *AB* and *CD* cut each other at *O*. If $\angle BOD = 63°$, the $\angle BOC =$

A. 63°

B. 117°

C. 17°

D. 153°

**Answer**

$\angle BOD + \angle BOC = 180^o$ (Linear pair)

$63^o + \angle BOC = 180^o$

$\angle BOC = 117^o$

**5. Question**

Consider the following statements:

When two straight lines intersect:

(i) 0Adjacent angles are complementary

(ii) Adjacent angles are supplementary.

(iii) Opposite angles are equal.

(iv) Opposite angles are supplementary.

Of these statements

A. (i) and (iii) are correct

B. (ii) and (iii) are correct

C. (i) and (iv) are correct

D. (ii) and (iv) are correct

**Answer**

When two straight lines intersect them,

Adjacent angles are supplementary and opposite angles are equal.

**6. Question**

Given $\angle POR = 3x$ and $\angle QOR = 2x + 10°$. If $\angle POQ$ is a straight line, then the value of $x$ is

A. 30°

B. 34°

C. 36°

D. None of these

**Answer**

Given,

POQ is a straight line

$\angle POQ + \angle QOR = 180^{o}$ (Linear pair)

$3x + 2x + 10^{o} = 180^{o}$

$5x = 170^{o}$

$x = 34^{o}$

**7. Question**

In Fig. 8.122, $AOB$ is a straight line. If $\angle AOC + \angle BOD = 85°$, then $\angle COD =$

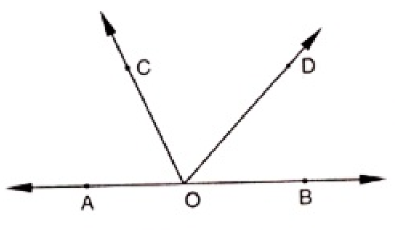



Fig. 8.122

A. 85°

B. 90°

C. 95°

D. 100°

**Answer**

Given,

AOB = Straight line

∠AOC + ∠BOD = $85^o$

∠AOC + ∠COD + ∠BOD = $180^o$ (Linear pair)

$85^o$ + ∠COD = $180^o$

∠COD = $95^o$

**8. Question**

In Fig. 8.123, the value of *y* is

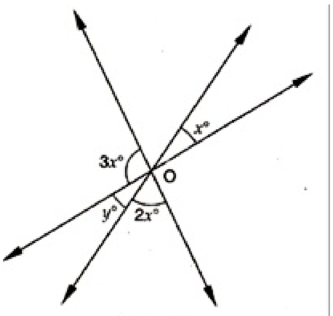


Fig. 8.123

A. 20°

B. 30°

C. 45°

D. 60°

**Answer**

3x + y + 2x = $180^o$ (Linear pair)

5x + y = $180^o$ (i)

From figure,

y = x (Vertically opposite angles)

Using it in (i), we get

5x + x = $180^o$

6x = $180^o$

x = $30^o$

Thus,

Y = x = $30^o$

**9. Question**

In Fig. 8.124, if $\frac{x}{y}$ = 5 and $\frac{z}{x}$ = 4, then the value of *x* is

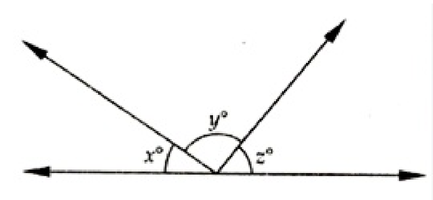


Fig. 8.124

A. 8° B. 18°

C. 12°

D. 15°

**Answer**

Given,

$\frac{y}{x} = 5$

y = 5x

And,

$\frac{z}{x} = 4$

z = 4x

From figure,

$x + y + z = 180^o$ (Linear pair)

$x + 5x + 4x = 80^o$

$10x = 180^o$

$x = 18^o$

**10. Question**

In Fig. 8.125, the value of *x* is

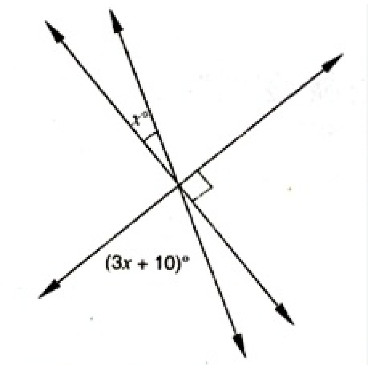



Fig. 8.125

A. 12

B. 15

C. 20

D. 30

**Answer**

Let,

AB, CD and EF intersect at O

∠COB = ∠AOD (Vertically opposite angle)

∠AOD = 3x + 10 (i)

∠AOE + ∠AOD + ∠DOF = $180^o$ (Linear pair)

$x + 3x + 10^o + 90^o = 180^o$

$4x + 100^o = 180^o$

$4x = 80^o$

$x = 20^o$

**11. Question**

In Fig. 8.126, which of the following statements must be true?

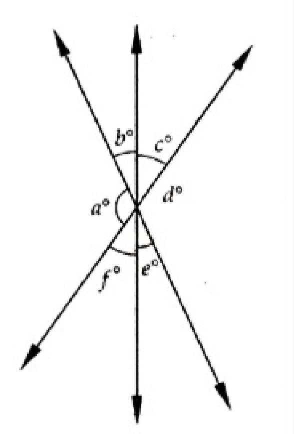


Fig. 8.126

(i) $a + b = d + c$

(ii) $a + c + e = 180°$

(iii) $b + f = c + e$

A. (i) only

B. (ii) only

C. (iii) only

D. (ii) and (iii) only

**Answer**

Let AB, CD and EF intersect at O

∠AOD = ∠COB (Vertically opposite angle)

b = e (i)

∠EOC = ∠DOF (Vertically opposite angle)

f = c (ii)

Adding (i) and (ii), we get

b + f = c + e (iii)

Now,

$\angle ADE + \angle EOC + \angle COB = 180^o$

$a + f + e = 180^o$

$a + c + e = 180^o$ [From (ii)]

**12. Question**

If two interior angles on the same side of a transversal intersecting two parallel lines are in the ratio 2:3, then the measure of the larger angle is

A. 54°

B. 120°

C. 108°

D. 136°

**Answer**

Let,

l and m be two parallel lines and transversal p cuts them

∠1: ∠2 = 2: 3 (Interior angles on same side)

Let,

∠1 = 2k

∠2 = 3k

∠1 + ∠2 = 180$^{o}$ (Interior angle)

2k + 3k = 180$^{o}$

k = 36$^{o}$

So, ∠1 = 2k = 72$^{o}$

∠2 = 3k = 108$^{o}$

Hence, larger angle is 108$^{o}$

**13. Question**

In Fig. 8.127, $AB||CD||EF$ and $GH||KL$. The measure of $\angle HKL$ is

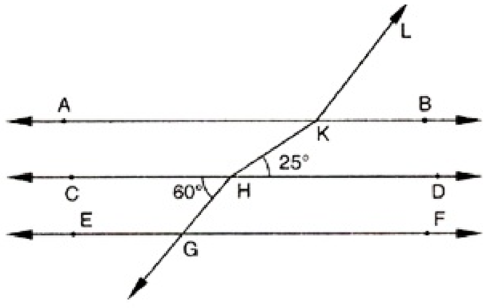



Fig. 8.127

A. 85°

B. 135°

C. 145°

D. 215°

**Answer**

Given,

AB ∥ CD ∥ EF and GH ∥ KL

Produce HG to M and KL to N

∠MHD and ∠CHG = 60$^{o}$ (Vertically opposite angle)

Since,

MG ∥ NL and transversal cuts them

So,

∠MHD + ∠1 = 180$^{o}$ (Interior angles)

60$^{o}$ + ∠1 = 180$^{o}$

∠1 = 120$^{o}$

∠3 = ∠HKD = $25^o$ (Alternate angles) (i)

∠1 = ∠MKL = $120^o$ (Corresponding angles) (ii)

Now,

∠HKL = ∠3 + ∠MKL

= $25^o$ + $120^o$

= $145^o$

**14. Question**

In Fig. 8.128, if *AB*//*CD*, then the value of *x* is

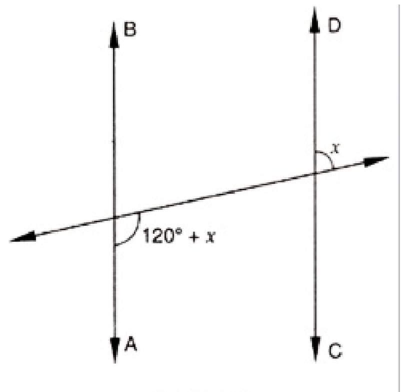


Fig. 8.128

A. 20°

B. 30°

C. 45°

D. 60°

**Answer**

Given that,

AB ∥ CD and transversal cuts them

Let,

∠1 = $120^o$ + x and

∠2 = x

∠1 = ∠3 (Alternate angles)

∠3 = $120^o$ + x (i)

∠2 + ∠3 = $180^o$ (Linear pair)

x + $120^o$ + x = $180^o$

2x = $60^o$

x = $30^o$

**15. Question**

*AB* and *CD* are two parallel lines. *PQ* cuts *AB* and *CD* at *E* and *F* respectively. *EL* is the bisector of ∠*FEB.* If ∠*LEB* =35°, then ∠*CFQ* will be

A. 55°

B. 70°

C. 110°

D. 130°

**Answer**

Given that,

AB ∥ CD and PQ cuts them

EL is bisector of ∠FEB

$\angle LEB = \angle FEL = 35^{o}$

∠FEB = ∠LEB + ∠FEL

$= 35^{o} + 35^{o}$

$= 70^{o}$

$\angle FEB = \angle EFC = 70^{o}$ (Alternate angles)

$\angle EFC + \angle CFQ = 180^{o}$ (Linear pair)

$70^{o} + \angle CFQ = 180^{o}$

$\angle CFQ = 110^{o}$

**16. Question**

Two lines $AB$ and $CD$ intersect at $O$. If $\angle AOC + \angle COB + \angle BOD = 270°$, then $\angle AOC =$

A. 70°

B. 80°

C. 90°

D. 180°

**Answer**

Given that,

AB and CD intersect at O

$\angle AOC + \angle COB + \angle BOD = 270°$ (i)

$\angle COB + \angle BOD = 180^{o}$ (Linear pair) (ii)

Using (ii) in (i), we get

$\angle AOC + 180^{o} = 270^{o}$

$\angle AOC = 90^{o}$

**17. Question**

In Fig. 8.129, $PQ ++ RS$, $\angle AEF = 95°$, $\angle BHS = 110°$ and $\angle ABC = x°$. Then the value of $x$ is,

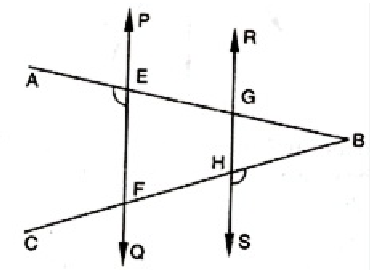



Fig. 8.129

A. 15°

B. 25°

C. 70°

D. 35°

**Answer**

Given that,

PQ ∥ RS

∠AEF = $95^o$

∠BHS = $110^o$

∠ABC = $x^o$

∠AEF = ∠AGH = $95^o$ (Corresponding angles)

∠AGH + ∠HGB = $180^o$ (Linear pair)

$95^o$ + ∠HGB = $180^o$

∠HGB = $85^o$

∠BHS + ∠BHG = $180^o$ (Linear pair)

$110^o$ + ∠BHG = $180^o$

∠BHG = $70^o$

In △BHG,

∠BHG + ∠HGB + ∠GBH = $180^o$

$70^o$ + $95^o$ + ∠GBH = $180^o$

∠GBH = $25^o$

Thus,

∠ABC = ∠GBH = $25^o$

**18. Question**

In Fig. 8.130, if $l_1 || l_2$, what is the value of $x$?

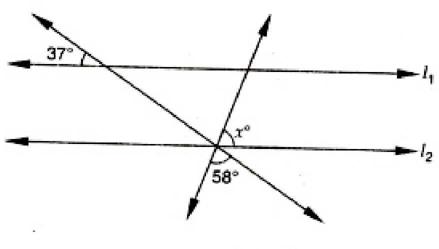



Fig. 8.130

A. 90°

B. 85°

C. 75°

D. 70°

**Answer**

Given that,

$l_1 \parallel l_2$

Let transversal P and Q cuts them

∠1 = 37°

∠4 = 58°

∠5 = x°

∠1 = ∠2 = 37° (Corresponding angles) (i)

∠2 = ∠3 (Vertically opposite angle)

∠3 = 37°

∠3 + ∠4 + ∠5 = 180° (Linear pair)

37° + 58° + x = 180°

x = 85°

**19. Question**

In Fig. 8.131, if $l_1 \parallel l_2$, what is $x + y$ in terms of $w$ and $z$?

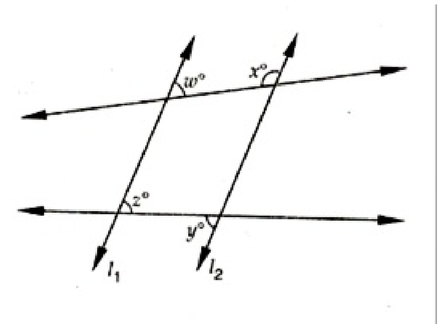


Fig. 8.131

A. 180 – $w + z$

B. 180 + $w - z$

C. 180 – $w - z$

D. 180 + $w + z$

**Answer**

Given that,

$l_1 \parallel l_2$

Let m and n be two transversal cutting them

∠w + ∠x = 180° (Consecutive interior angle)

x = 180° – w (i)

z = y (Alternate angles) (ii)

From (i) and (ii), we get

x + y = 180° – w + z

**20. Question**

In Fig. 8.132, if $l_1 \parallel l_2$, what is the value of $y$?

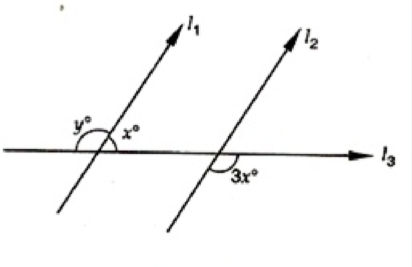



Fig. 8.132

A. 100

B. 120

C. 135

D. 150

**Answer**

Given that,

$l_1 \parallel l$ �$_2$ and $l_3$ is transversal

∠1 = 3x (Vertically opposite angle)

y = ∠1 (Corresponding angle)

y = 3x (i)

y + x = 180$^o$ (Linear pair)

3x + x = 180$^o$ [From (i)]

4x = 180$^o$

x = 45$^o$

Therefore,

y = 3x = 3 * 45$^o$

= 135$^o$

**21. Question**

In Fig. 8.133, if $l_1 \parallel l_2$ and $l_3 \parallel l_4$, what is *y* in the terms of *x*?

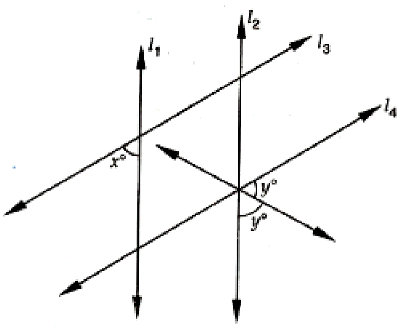



Fig. 8.133

A. 90 + *x*

B. 90 + 2*x*

C. 90 - $\frac{x}{2}$

D. 90 – 2*x*

**Answer**

Given that,

$l_1 \parallel l_2$ and $l_3 \parallel l_4$

Let,

$\angle 1 = x$

$\angle 2 = y$

$\angle 3 = y$

$\angle 1 = \angle 4$ (Alternate angle)

$\angle 4 = x$

$\angle 5 = \angle 2$ (Vertically opposite angle)

$\angle 6 = \angle 3$ (Vertically opposite angle)

$\angle 5 = \angle 6 = y$

Now,

$\angle 4 + \angle 5 + \angle 6 = 180^o$ (Consecutive interior angle)

$y = 90^o - \frac{x}{2}$

**22. Question**

In Fig. 8.134, if *l* || *m*, what is the value of *x*?

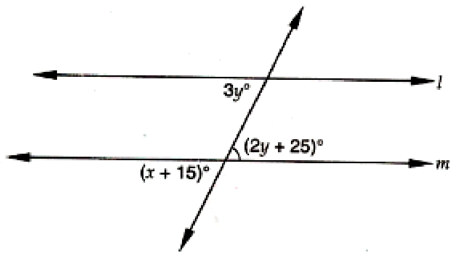



Fig. 8.134

A. 60

B. 50

C. 45

D. 30

**Answer**

Given that,

$l \parallel m$

Let,

$\angle 1 = 3y$

$\angle 2 = 2y + 25^o$

$\angle 3 = x + 15^o$

$\angle 1 = \angle 2$ (Alternate angle)

$3y = 2y + 25^o$

$y = 25^o$

∠2 = ∠3 (Vertically opposite angle)

x + 15$^o$ = 2 (25$^o$) + 25$^o$

x = 60$^o$

**23. Question**

In Fig. 8.135, if line segment *AB* is parallel to the line segment *CD*, what is the value of *y*?

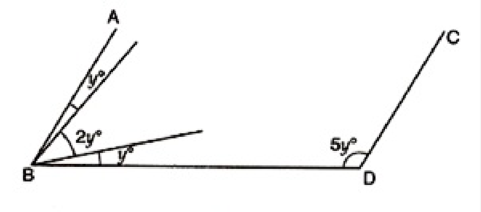



Fig. 8.135

A. 12

B. 15

C. 18

D. 20

**Answer**

Since, AB ∥ CD

And, BD cuts them

y + 2y + y + 5y = 180$^o$ (Consecutive interior angle)

9y = 180$^o$

y = 20$^o$

**24. Question**

In Fig. 8.136, if *CP* || *DQ*, then the measure of *x* is

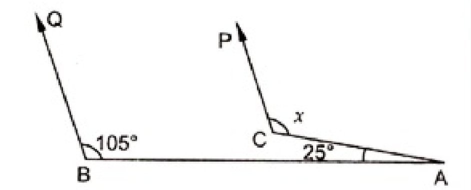



Fig. 8.136

A. 130°

B. 105°

C. 175°

D. 125°

**Answer**

Given that,

CP ∥ BQ

Produce CP to E

So, PE ∥ BQ and AB cuts them

∠QBE = ∠CBA = 105$^o$ (Corresponding angles)

In $\Delta ECA$

∠CEA + ∠ECA + ∠EAC = $180^o$

$105^o$ + ∠ECA + $25^o$ = $180^o$

∠ECA = $50^o$

∠PCA + ∠ECA = $180^o$ (Linear pair)

x + $50^o$ = $180^o$

x = $130^o$

**25. Question**

In Fig. 8.137, if *AB*|| *HF* and *DE*||*FG*, then the measure of ∠*FDE* is

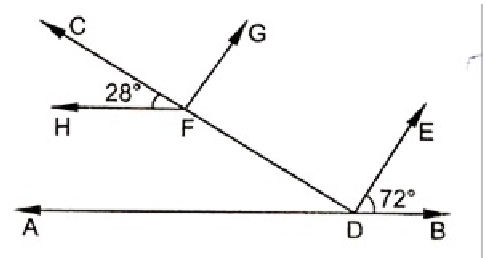



Fig. 8.137

A. 108°

B. 80°

C. 100°

D. 90°

**Answer**

Given that,

AB ∥ HF and CD cuts them

∠HFC = ∠FDA (Corresponding angle)

∠FDA = $28^o$

∠FDA + ∠FDE + ∠EDB = $180^o$ (Linear pair)

$28^o$ + ∠FDE + $72^o$ = $180^o$

∠FDE = $80^o$

**26. Question**

In Fig. 8.138, if lines *l* and *m* are parallel, then *x* =

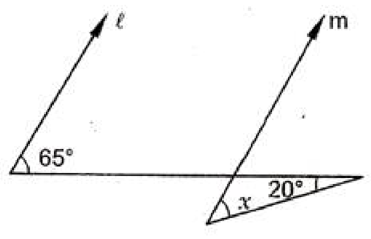



Fig. 8.138

A. 20°

B. 45°

C. 65°

D. 85°

**Answer**

l ∥ m

Let transversal be n and ∠1 = $65^{o}$

∠2 = $20^{o}$

∠3 = x

Since,

l ∥ m and n cuts them so,

∠1 + ∠4 = $180^{o}$ (Co. interior angle)

$65^{o}$ + ∠4 = $180^{o}$

∠4 = $115^{o}$ (i)

∠4 = ∠5 = $115^{o}$ (Vertically opposite angle)

∠2 + ∠5 + ∠3 = $180^{o}$

$20^{o}$ + $115^{0}$ + x = $180^{o}$

x = $45^{o}$

**27. Question**

In Fig. 8.139, if $AB||CD$, then $x =$

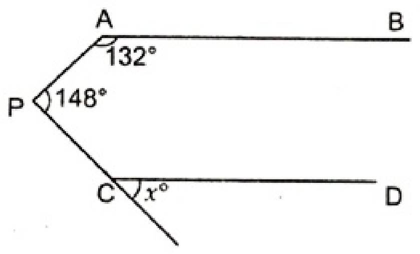


Fig. 8.139

A. 100°

B. 105°

C. 110°

D. 115°

**Answer**

Given that,

AB ∥ CD

Produce P to Q so that PQ ∥ AB ∥ CD

∠BAP + ∠APQ = $180^{o}$ (Interior angle)

$132^{o}$ + ∠APQ = $180^{o}$

∠APQ = $48^{o}$ (i)

∠APC = ∠APQ + ∠QPC

$148^o = 48^o + \angle QPC$ [From (i)]

$\angle QPC = 100^o$

$\angle QPC + \angle PCD = 180^o$ (Interior angles)

$100^o + \angle PCD = 180^o$

$\angle PCD = 80^o$

$\angle PCD + x = 180^o$ (Linear pair)

$80^o + x = 180^o$

$x = 100^o$

**28. Question**

In Fig. 8.140, if lines *l* and *m* are parallel lines, then *x* =

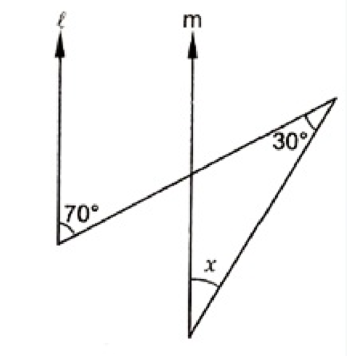


Fig. 8.140

A. 70°

B. 100°

C. 40°

D. 30°

**Answer**

Given that,

l ∥ m

Let, l ∥ m and transversal cuts them and

$\angle 1 = 70^o$

$\angle 3 = 20^o$

$\angle 4 = 30^o$

$\angle 1 + \angle 2 = 180^o$ (Interior angle)

$\angle 2 = 110^o$ (i)

$\angle 2 = \angle 5$ (Vertically opposite angle)

$\angle 5 = 110^o$ (ii)

$\angle 5 + \angle 3 + \angle 4 = 180^o$ (Sum of angles of a triangle is $180^o$)

$110^o + x + 30^o = 180^o$

$x = 40^o$

**29. Question**

In Fig. 8.141, if $l \parallel m$, then $x =$

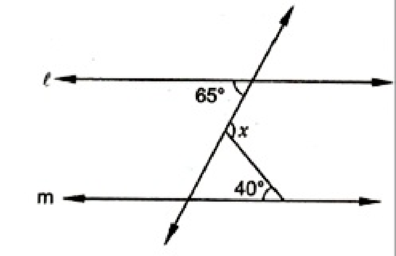



Fig. 8.141

A. 105°

B. 65°

C. 40°

D. 25°

**Answer**

Given that,

l ∥ m and n cuts them

Let,

$\angle 1 = 65^o$

$\angle 2 = x$

$\angle 3 = 40^o$

$\angle 1 = \angle 4 = 65^o$ (Alternate angle) (i)

$\angle 3 + \angle 4 + \angle 5 = 180^o$ (Angle sum property)

$40^o + 65^o + \angle 5 = 180^o$

$\angle 5 = 75^o$

Now,

$\angle 2 + \angle 5 = 180^o$ (Linear pair)

$x + 75^o = 180^o$

$x = 105^o$

**30. Question**

In Fig. 8.142, if lines $l$ and $m$ are parallel, then the value of $x$ is

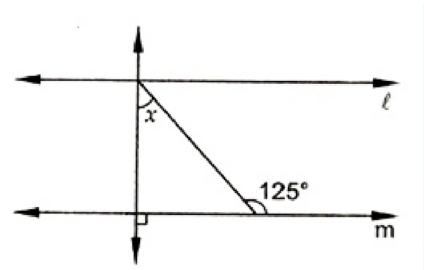



Fig. 8.142

A. 35°

B. 55°

C. 65°

D. 75°

**Answer**

Given that,

l ∥ m and n cuts them

Let,

∠1 = x

∠2 = $90^{o}$

∠3 = $125^{o}$

∠3 + ∠5 = $180^{o}$ (Linear pair)

$125^{o}$ + ∠5 = $180^{o}$

∠5 = $55^{o}$ (i)

∠4 = $90^{o}$ (ii)

Now,

∠1 + ∠4 + ∠5 = $180^{o}$ (Angle sum property)

x + $90^{o}$ + $55^{o}$ = $180^{o}$

x = $35^{o}$