# MATHEMATICS

# Class-VII

## Topic-04

## LINES & ANGLES

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CHAPTER 04

# LINES & ANGLES

## TERMINOLOGIES

**Angles, Adjacent angles,Linear pair, Vertically opposite angles, Complementary angles, Supplementary angles, Parallel lines, Parallel segments, Parallel Rays, Transversal, Exterior Angles, Interior Angles, Corresponding Angles, Alternate Exterior Angles, Alternate Interior Angles.**

## INTRODUCTION

In this chapter apart from point, line, line segment, we will deal with types of angles such as complementary angles, supplementary angles, adjacent angles, linear pair angles, vertically opposite angles. Also about angles formed when transversal cut two parallel lines and their appears corresponding angles, alternate interior angles, alternate exterior angles and co-interior angles.

## 4.1 PAIRS OF ANGLES

There are some angles, which occur in pairs.

### (a) Adjacent angles

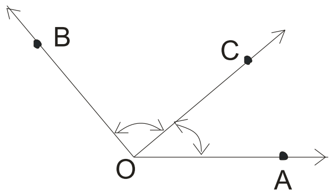
Two angles in a plane are called **adjacent angles**, if

**(i)** They have a common vertex

**(ii)** They have a common arm, and

**(iii)** Their non-common arms lie on the opposite sides of the common arm.

$\angle$AOC and $\angle$BOC have the common vertex O. Also, they have a common arms OC and their other arms OA and OB lie on the opposite sides of the common arm OC. Therefore, $\angle$AOC and $\angle$BOC are adjacent angles.

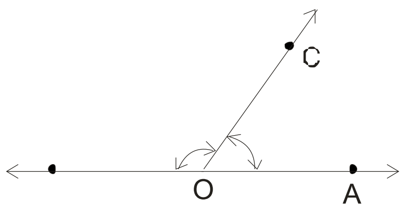


Adjacent angle

### (b) Linear pair

Two adjacent angles are said to form a linear pair of angles, if their non-common arms are two opposite rays, in fig. OA and OB are two opposite rays and $\angle$AOC and $\angle$BOC are the adjacent angles. Therefore, $\angle$AOC and $\angle$BOC form a linear pair.

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



Linear pair

## (c) Vertically opposite angles

Two angles formed by two intersecting lines having no common arm are called **vertically opposite angles**. In given fig. two lines AB and CD are intersecting at a point O. We observe that with the intersection of these lines, four angles have been formed. Angles $\angle 1$ and $\angle 3$ form a pair of vertically opposite angles; while angles $\angle 2$ and $\angle 4$ form another pair of vertically opposite angles.

Clearly, Angles $\angle 1$ and $\angle 2$ form a linear pair.

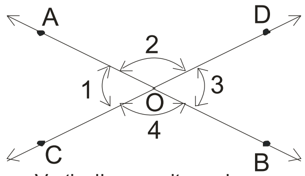
$\therefore \quad \angle 1 + \angle 2 = 180^\circ \quad \Rightarrow \angle 1 = 180^\circ - \angle 2 \qquad$ ...(i)

Also $\angle 2$ and $\angle 3$ form a linear pair.

$\therefore \quad \angle 2 + \angle 3 = 180^\circ \quad \Rightarrow \angle 3 = 180^\circ - \angle 2 \qquad$ ...(ii)

From (i) and (ii), we get $\angle 1 = \angle 3$.

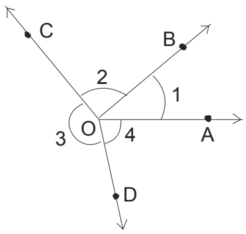
Similarly, we can prove that $\angle 2 = \angle 4$



Vertically opposite angles

## (d) Angles at a point

Angles formed by a number of rays having a common initial point are called angles at a point. In fig. rays OA, OB, OC, OD having a common initial point O, form $\angle 1$, $\angle 2$, $\angle 3$, $\angle 4$ at the point O and $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 360^\circ$.




Thus, the sum of the measures of all the angles at a point is 4 right angles or 360º.

## (e) Complementary angles

If the sum of the measures of two angles is 90º, then the angles are called **complementary angles** and each is called a complement of the other. Angles of measures 35º and 55º are complementary angles.

❖ **Remark**

**(i)** If two angles are complement of each other, then each is an acute angle except the pair (90º, 0º). But any two acute angles need not be complementary. For example, angles of measure 30º and 50º are not complement of each other.
**(ii)** Two obtuse angles cannot be complement of each other.
**(iii)** Two right angles cannot be complement of each other.

## (f) Supplementary angles

Two angles are said to be supplementary angles if the sum of their measures is 180º, and each of them is called a **supplement** of the other. Angles of measures 55º and 125º are supplementary angles.

❖ **Remark**

**(i)** Two acute angles cannot be supplement of each other.
**(ii)** Two right angles are always supplementary.
**(iii)** Two obtuse angles cannot be supplement of each other.

**Illustration 4.1**

Find the measure of an angle which is complement of itself.

**Sol.** Let the measure of the angle be $x^o$. Then, the measure of its complement is given to be $x^o$. Since, the sum of the measures of an angle and its complement is $90^o$.

$\therefore \quad x^o + x^o = 90^o$

$\Rightarrow \quad 2x^o = 90^o$

$\Rightarrow \quad x^o = 45$

Hence, the measure of the angle is $45^o$.

**Illustration 4.2**

Two supplementary angles differ by $34^o$. Find the angles.

**Sol.** Let one angle be $x^o$. Then, the other angle is $(x + 34)^o$.
Now, $x^o$ and $(x + 34)^o$ are supplementary angles.

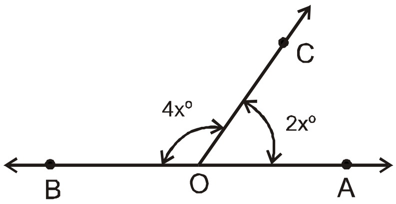
$\therefore \quad x^o + (x + 34)^o = 180^o \quad \Rightarrow \quad 2x^o + 34^o = 180^o$

$\Rightarrow \quad 2x^o = 180^o - 34^o \quad \Rightarrow \quad 2x^o = 146^o \quad \Rightarrow \quad x^o = 73^o.$

Hence, the measures of two angles are $73^o$ and $73^o + 34^o = 107^o$.

**Illustration 4.3**

In fig. $\angle AOC$ and $\angle BOC$ form a linear pair. Determine the value of x.



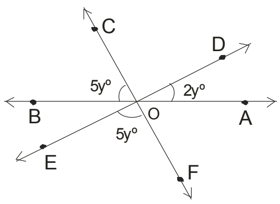

**Sol.** Since $\angle AOC + \angle BOC$ form a linear pair

$\therefore \quad \angle AOC + \angle BOC = 180^o \quad \Rightarrow \quad 4x + 2x = 180^o$

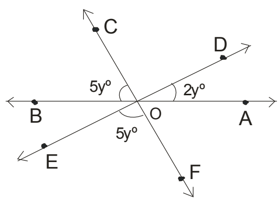
$\Rightarrow \quad 6x = 180^o \quad \Rightarrow \quad x = \dfrac{180^\circ}{6} = 30^o$

**Illustration 4.4**

In the given figure below, find the value of y.




**Sol.** Since $\angle COD$ and $\angle EOF$ are vertically opposite angles.



∴ $\angle COD = \angle EOF$ ⇒ $\angle COD = 5y^o$ [∵ EOF = $5y^o$ (Given)]

Now, OA and OB are opposite rays.

∴ $\angle AOD + \angle DOC + \angle COB = 180^o$ ⇒ $2y^o + 5y^o + 5y^o = 180^o$

⇒ $12y^o = 180^o$ ⇒ y =  = $15^o$

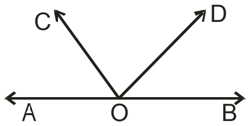
Hence, y = $15^o$.

## Ask yourself

1. Find the measure of an angle, if six times its complement is $12^o$ less than twice its supplement.

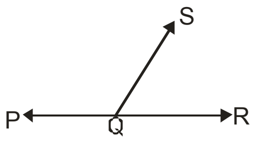
2. Among two supplementary angles , the measure of the larger angle is 36 degree more than the measure of the smaller . Find their measures.

3. In figure, find $\angle COD$ when $\angle AOC + \angle BOD = 100^0$ .




4. In angles of a linear pair are equal , then find each angle,

5. In figure PQR is a straight line and $\angle PQS : \angle SQR = 7 : 5$ . Find $\angle SQR$




**Answers**

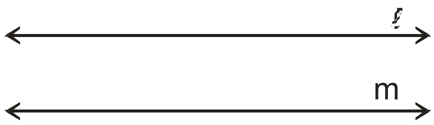
**1.** 48° **2.** 72° and 108° **3.** 80° **4.** 90°, 90° **5.** 75°

## 4.2 ANGLE MADE BY TRANSVERSAL

### (a) Parallel Lines

**Parallel Lines :** Two lines $\ell$ and m in the same plane are said to be parallel lines if they do not intersect when produced indefinitely in either direction and we write $\ell \parallel m$ which is read as $\ell$ is parallel to m.

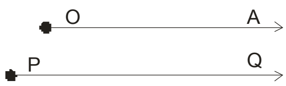
Clearly, when $\ell \parallel m$, we have $m \parallel \ell$.




### (b) Parallel Rays

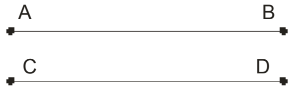
Two rays are parallel if the corresponding lines determined by them are parallel. In other words, two rays in the same plane are parallel. If they do not intersect each other even if extended indefinitely beyond their initial points.

In fig. ray OA || ray PQ.



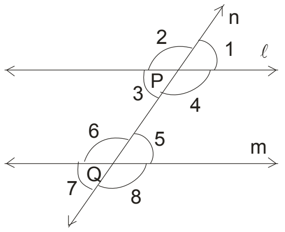
**(c) Parallel segments**

Two segments are parallel if the corresponding lines determined by them are parallel.
In other words, two segments which are in the same plane and do not intersect each other even if extended indefinitely in both directions are said to be parallel.




**(d) Angles made by a transversal with two lines**

A line which intersects two or more given lines at distinct points is called a transversal to the given lines.




**(i) Exterior angles :** The angles whose arms do not include the line segment PQ are called **exterior angles**. In fig. angles 1, 2, 7 and 8 are exterior angles.

**(ii) Interior angles :** The angles whose arms include line segment PQ are called **interior angles**. In fig. angles 3, 4, 5 and 6 are interior angles.

**(iii) Corresponding angles :** 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 fig. $\angle 1$, $\angle 5$ ; $\angle 2$, $\angle 6$ ; $\angle 3$, $\angle 7$ and $\angle 4$, $\angle 8$ are four pairs of corresponding angles.

**(iv) Alternate interior angles:** A pair of angles in which one arm of each of the angles is on opposite side of the transversal and whose other arm include the segment PQ is called a pair of alt**ernate interior angles**. In fig $\angle 3$, $\angle 5$ ; $\angle 4$ and $\angle 6$ are alternate interior angles.

**(v) Alternate exterior angles :** A pair of angles in which one arm of each of the angles is on opposite sides of the transversal and whose other arms are directed in opposite direction and do not include segment PQ is called a pair of **alternate exterior angles**. In fig. $\angle 2$, $\angle 8$ ; $\angle 1$ and $\angle 7$ are alternate exterior angles.

**NOTE:**

Lines in a plane are para!lel, if they do not intersect when produced indefinitely in either direction.

The distance between two intersecting lines is zero.

The distance between two parallel lines is the same everywhere and is equal to the perpendicular distance between them.

**(e) Angles made by transversal to two parallel lines**

**If two parallel lines are intersected by a transversal, then**

**(i)** Pairs of alternate (interior or exterior) angles are equal.
**(ii)** Pairs of corresponding angles are equal.
**(iii)** Interior angles on the same side of the transversal are supplementary.

If two non-parallel lines are intersected by transversal then none of (i), (ii) and (iii) hold true.

**If two lines are intersected by a transversal, then they are parallel if anyone of the following is true:**

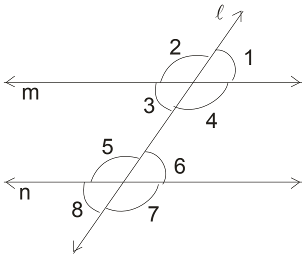
**(i)** Pair of corresponding angles are equal.

**(ii)** Pair of alternate interior angles are equal.

**(iii)** Pair of interior angles on the same side of the transversal are supplementary.

**Illustration 4.5**

In fig., m || n and $\angle 1 = 65^\circ$. Find $\angle 5$ and $\angle 8$.




**Sol.** We have,

$\angle 1 = \angle 3$ [Vertically opposite angles]

and, $\angle 3 = \angle 8$ [Corresponding angles]

$\therefore$ $\angle 1 = \angle 8$

$\Rightarrow$ $\angle 8 = 65^\circ$ [$\because \angle 1 = 65^\circ$ (given)]

Now, $\angle 5 + \angle 8 = 180^\circ$ [Linear pair]

$\Rightarrow$ $\angle 5 + 65^\circ = 180^\circ$

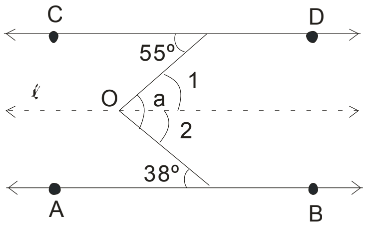
$\Rightarrow$ $\angle 5 = 180^\circ - 65^\circ = 115^\circ$

Thus, $\angle 5 = 115^\circ$ and $\angle 8 = 65^\circ$.

**Illustration 4.6**

In fig., AB || CD. Determine $\angle a$.

**Sol.** Through O draw a line $\ell$ parallel to both AB and CD.




Clearly, $\angle a = \angle 1 + \angle 2$ ...(i)

Now, $\angle 1 = 55^\circ$ [Alternate $\angle$s]

and, $\angle 2 = 38^\circ$ [Alternate $\angle$s]

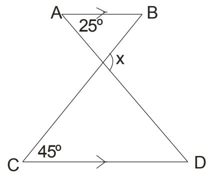
$\therefore$ $\angle a = 55^\circ + 38^\circ$ [Using (i)]

$\Rightarrow$ $\angle a = 93^\circ$

Thus, $\angle a = 93^\circ$.

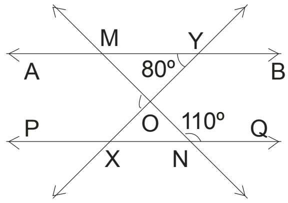
## Ask yourself

**1.** Given AB II CD find the value of x in below

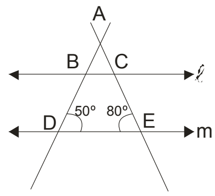



**2.** AB and CD are two parallel lines. PQ cuts AB and CD at E and F respectively. EL is the bisector of ∠FEB. If ∠LEB = 35°, then find ∠CFQ

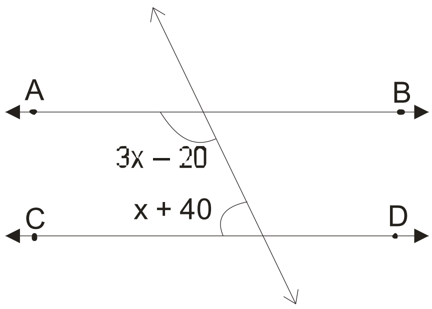
**3.** As shown in figure, line AB || line PQ, m∠ONQ = 110°, m∠MYO = 80°. Find m∠MOX.




**4.** In figure $\ell$||m, find ∠BAC, ∠ABC




**5.** In figure AB||CD find the value of x




**Answers**

**1.** 70° **2.** 110° **3.** 150° **4.** 50°, 50° **5.** 40°

## Add your knowledge

**Sexagesimal system :** In this system a **right angle** is divided into **90** equal parts called **degrees**. Each **degree** is divided into **60** equal parts called **minutes** and each **minute** is divided into **60** equal parts called **seconds**.

Thus, **1 right angle** = **90 degrees** ( **90º**)

**1º** = **60 minutes** (**60'**)

**1'** = **60 seconds** (**60"**)

This section is useful to solve questions such as:

**1.** Find the complement of each of the following angles.

36⁰ 40'

**Sol.**

$$\left.\begin{array}{r} 90°.00' \\ -36°.40' \\ \hline ? \end{array}\right\} \quad \begin{array}{r} 89°.60' \\ -36°.40' \\ \hline 53°20' \end{array}$$

$\therefore$ 53°20' **Ans.**

**2.** Write the supplementary angles of the following angles.

54⁰ 28'

**Sol.**

$$\left.\begin{array}{r} 180°00' \\ -\ 54°28' \\ \hline ? \end{array}\right\} \rightarrow \begin{array}{r} 179°60' \\ -\ 54°28' \\ \hline 125°32' \end{array}$$

$\therefore$ 125°32' **Ans.**

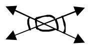
## Concept Map

# LINES AND ANGLES

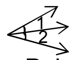
### Lines
- Parallel lines
- Intersecting lines

### Types of Angles
- Acute $0° < \theta < 90°$
- Right $\theta = 90°$
- Obtuse $90° < \theta < 180°$
- Straight $\theta = 180°$
- Complete $\theta = 360°$

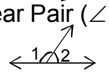
### Pairs of Angles
- Complementary Angle $\theta_1 + \theta_2 = 90°$
- Supplementary Angle $\theta_1 + \theta_2 = 180°$
- Vertically Opposite Angle



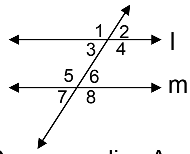
- Adjacent Angle ($\angle 1$, $\angle 2$)




- Linear Pair ($\angle 1$, $\angle 2$)




### Angle made by Transversal




- Corresponding Angle (1,5), (3,7), (2,6), (4,8)
- Alternative Int. Angle (3,6), (4,5)
- Co interior Angle (3,5), (4,6)

If l || m then

(i) $\angle 1 = \angle 5$, $\angle 3 = \angle 7$, $\angle 2 = \angle 6$, $\angle 4 = \angle 8$ (Corresponding angles are equal)

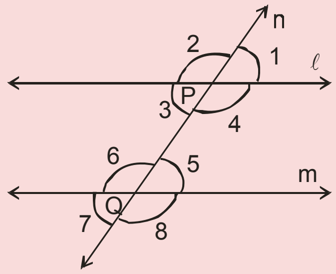
(ii) $\angle 3 = \angle 6$, $\angle 4 = \angle 5$ (Alternate interior angles are equal)

(iii) $\angle 3 + \angle 5 = 180°$, $\angle 4 + \angle 6 = 180°$ (Sum of co-interior angle is 180°)

## Summary

1. An angle is formed when two lines or rays or line segments meet or intersect.
2. Two angles in a plane are called **adjacent angles**, if
   **(i)** They have a common vertex
   **(ii)** They have a common arm, and
   **(iii)** Their non-common arms lie on the opposite sides of the common arm.

3. A linear pair is a pair of adjacent angles whose non comon sides are opposite rays.
4. Two angles formed by two intersecting lines having no common arm are called **vertically opposite angles**.
5. When two line intersect , the vertically opposite angles so formed are equal.
6. If the sum of the measures of two angles is 90º, then the angles are called **complementary angles**.
7. Two angles are said to be supplementary angles if the sum of their measures is 180º, and each of them is called a **supplement** of the other.
8. Two lines $\ell$ and m in the same plane are said to be parallel lines if they do not intersect when produced indefinitely in either direction and we write $\ell$ || m which is read as $\ell$ is parallel to m.
9. When two lines are intersected by a transversal , eight angles are formed . These angles can be classified as 4 interior angles, 4 exterior angles, 4 pairs of corresponding angles, 2 pairs of alternate interior angles, 2 pairs of alternate exterior angles and two pairs of interior angles on the same side of the transversal.




   **(i)** **Exterior angles (** In fig. $\angle 1$, $\angle 2$, $\angle 7$ and $\angle 8$ )
   **(ii)** **Interior angles** (In fig. $\angle 3$, $\angle 4$, $\angle 5$ and $\angle 6$ )
   **(iii)** **Corresponding angles** (In fig. $\angle 1$, $\angle 5$ ; $\angle 2$, $\angle 6$ ; $\angle 3$, $\angle 7$ and $\angle 4$, $\angle 8$ )
   **(iv)** **Alternate interior angles**(In fig $\angle 3$, $\angle 5$ ; $\angle 4$ and $\angle 6$ )
   **(v)** **Alternate exterior angles (** In fig. $\angle 2$, $\angle 8$ ; $\angle 1$ and $\angle 7$ )

10. If two parallel lines are intersected by a transversal, then
   **(i)** Pairs of alternate (interior or exterior) angles are equal.
   **(ii)** Pairs of corresponding angles are equal.
   **(iii)** Interior angles on the same side of the transversal are supplementary.

11. If a transversal cuts two lines such that any one of the following condition is true.
   **(i)** Pairs of alternate (interior or exterior) angles are equal.
   **(ii)** Pairs of corresponding angles are equal.
   **(iii)** Interior angles on the same side of the transversal are supplementary.
   then the lines are parallel.

# EXERCISE 01

## SECTION -A (FIXED RESPONSE TYPE)

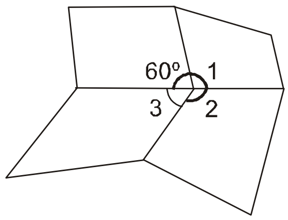
## MULTIPLE CHOICE QUESTIONS

**1.** Two parallel lines have :
(A) a common point (B) two common point
(C) no common point (D) infinite common points

**2.** Which one of the following statements is not false :
(A) If two angles forming a linear pair, then each of these angles is of measure $90^{0.}$
(B) Angles forming a linear pair can both be acute angles.
(C) One of the angles forming a linear pair can be obtuse angle.
(D) Bisectors of the adjacent angles form a right angle.

**3.** Linear pair angles are also
(A) Complementary angles (B) Supplementary angles
(C) Equal angles (D) None of these

**4.** In the given figure, the sum of $\angle 1$, $\angle 2$, and $\angle 3$ is :



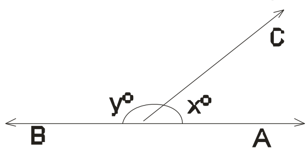

(A) 360º (B) 270º (C) 120º (D) 300º

**5.** An angle is $14^0$ more than its complementary angle then angle is :
(A) $38^0$ (B) $52^0$ (C) $50^0$ (D) None of these

**6.** Two complementary angles differ by 16º find the angles.
(A) 53º , 37º (B) 56º , 40º (C) 62º , 28º (D) 59º, 31º

**7.** If the supplement of an angle is three times its complement, then angle is :
(A) $40^0$ (B) $35^0$ (C) $50^0$ (D) $45^0$

**8.** In the given figure, x is greater then one fifth of a right angle then :



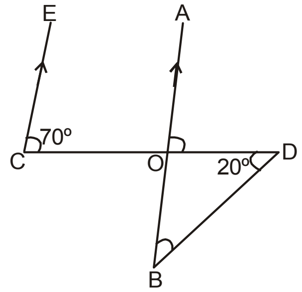

(A) y > 162º (B) y ≥162º (C) y ≤ 162º (D) y < 162º

**9.** Which one of the following is not correct :
(A) If two lines are intersected by a transversal, then alternate angles are equal.
(B) If two lines are intersected by a transversal then sum of the interior angles on the same side of transversal is $180^{0.}$
(C) If two lines intersected by a transversal then corresponding angles are equal.
(D) All of these.

**10.** The co-interior angles are supplementary than lines are

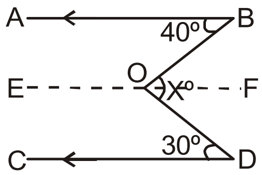
(A) Parallel (B) Intersecting (C) Perpendicular (D) None of these

**11.** In the given figure, if EC || AB ∠ECD =70º and ∠BDO = 20º, then ∠OBD is :



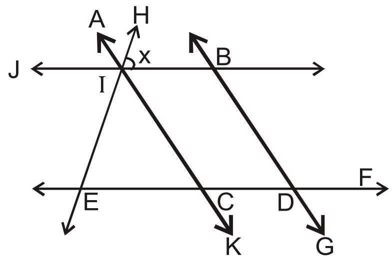

(A) 20º (B) 50º (C) 60º (D) 70º

**12.** In the given figure, AB || CD, ∠ABO = 40º and ∠CDO = 30º. If ∠DOB = xº, then the value of x is



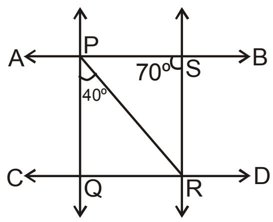

(A) 35º (B) 110º (C) 70º (D) 140º

**13.** In the given Figure, IB || CD and AC || BD. If ∠EIC = 40º, ∠FDG = 55º, ∠HIB = xº, then the value of x is:



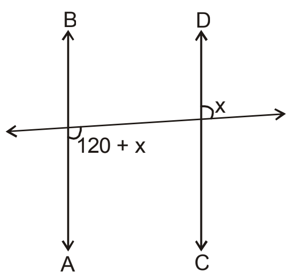

(A) 95º (B) 85º (C) 165º (D) 50º

**14.** In the given Figure, AB || CD and PQ || SR. Then, ∠SPR is :



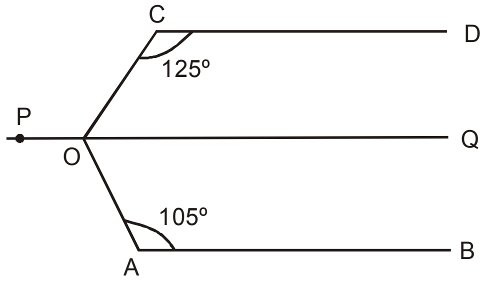

(A) 55º (B) 60º (C) 70º (D) 40º

**15.** In the given figure, AB || CD. The value of x is :



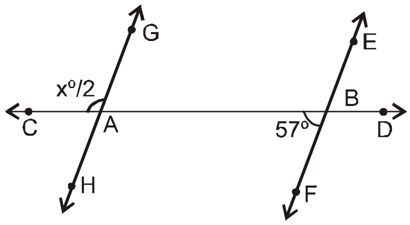

(A) 20º (B) 30º (C) 45º (D) 60º

**16.** AB || CD || PQ and O is a point between AB and CD such that ∠BAO = 105º and ∠OCD = 125º, find the measure of ∠AOC.



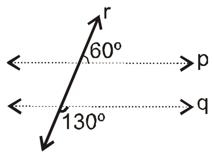
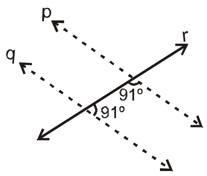
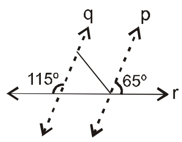
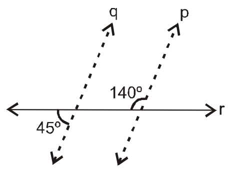

(A) 50º (B) 105º (C) 125º (D) 130º

**17.** EF is parallel to GH, then find the value of 'x'.

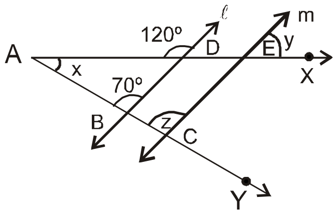



(A) 57º (B) 123º (C) 246º (D) 61.5º

**18.** Observe the diagram carefully and decide in which option, the pair of dotted lines is parallel.

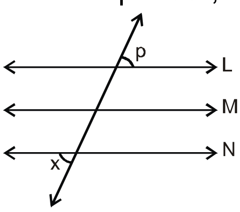
(A)  (B)  (C)  (D) 

**19.** In the figure, $\ell$ parallel to m and AX and AY are transversals. Then the value of the angle (x + y – z) is :



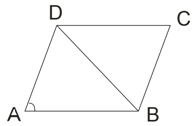

(A) 110º (B) 80º (C) 40° (D) 30º

**20.** In the below figure L || M, M || N and ∠p = 65º, the value of ∠x is =




(A) 65º (B) 115º (C) 25º (D) 45º

**21.** Diagonal DB of a rhombus ABCD is equal to one of its sides.The values of ∠A is :




(A) 30º (B) 60º (C) 120º (D) 90º

## FILL IN THE BLANKS

**1.** A Line segment has ______ end points.

**2.** A ray has _____ end point.

**3.** A figure formed by two rays having the same initial point is called an ________

**4.** If the sum of the measures of two angles is 90º, then the angles are called _______

**5.** Three or more points which lie on the same line are called _________

**6.** Three or more lines in a plane passing through the same point are called _______

**7.** The distance between two parallel lines remains ________ everywhere.

**8.** A line which intersect two or more lines at distinct point is called a _______

## TRUE / FALSE

**1.** The distance between two parallel lines is not always same.

**2.** Complementary angle of 45º is 45º.

**3.** Two obtuse angles cannot be complement of each other.

**4.** If two lines in a plane do not intersect then lines are parallel.

**5.** If two parallel lines are intersected by transversal then sum of cointerior angle is 180º

**6.** If two parallel lines are intersected by transversal then alternate interior angle are equal.

## MATCH THE COLUMN

**1.**

| | Column – A | | Column–B |
|---|---|---|---|
| (A) | Complement of 53° | (p) | Linear pair |
| (B) | Supplement of 87° | (q) | 360° |
| (C) | Two adjacent supplementry angles | (r) | 93° |
| (D) | Sum of the measure of all angles at a point | (s) | 72° |
| (E) | Angle which is 2/3 of its supplement | (t) | 37° |

## SECTION -B (FREE RESPONSE TYPE)

### VERY SHORT ANSWER TYPE

**1.** If (2x – 10) and (x – 5) are complementary angles, find x.

**2.** If (3x + 40º) and (x – 20º) are supplementary angles, find x.

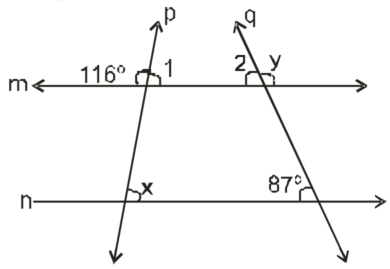
**3.** Two supplementary angles are in ratio 3 : 7. Find the angles.

**4.** Two complementary angles are in ratio 2 : 3. find the angles.

**5.** X lies in the interior of $\angle$BAC. If $\angle$BAC = 70$^0$ and $\angle$BAX = 42$^0$ then $\angle$XAC = ?

**6.** The sum of an angle and half of its complement is 75º, find the angle.

**7.** In the figure, m || n and p and q are transversal. Find the values of x and y.



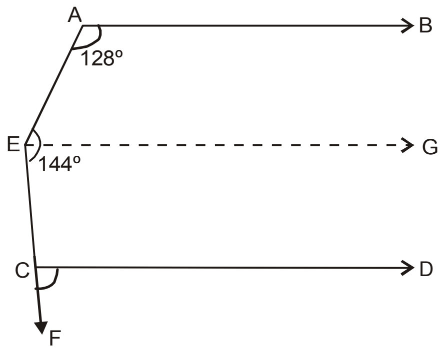

**8.** The co- interior angles given between 2 parallel lines are 2x – 35º and x + 5º. Find 5x – 30º according to question

### SHORT ANSWER TYPE

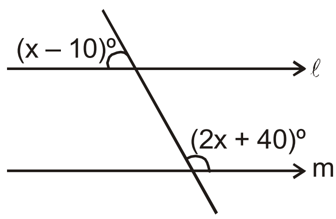
**9.** If (3x +20)º and (2x + 25)º are supplementary angles then find the value of x.

**10.** If one angle of triangle is equal to the sum of the other two then prove that it is right triangle

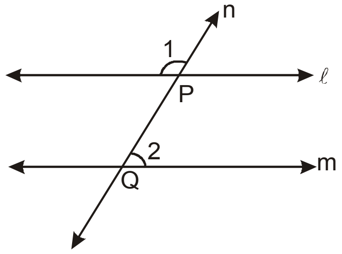
**11.** In the given figure, AB || CD, $\angle$A = 128º, $\angle$E = 144º. Then find the $\angle$FCD.



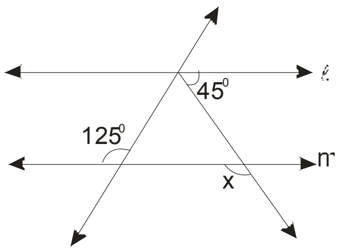

**12.** For what value of x will line $\ell$ be parallel to line m ?



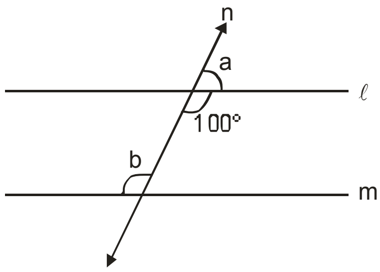
**13.** In figure $\ell \parallel m$ and n is the transversal cutting $\ell$ and m at P and Q respectively. If $\angle 1 = 3x$ and $\angle 2 = x$, find the value of x.



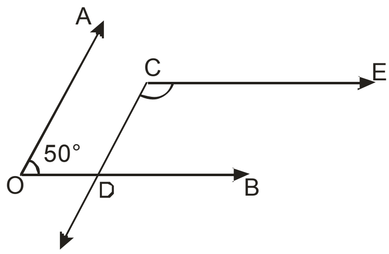

**14.** In figure, if $\ell \parallel m$, find x.




**15.** In figure, $\ell \| m$ find the $2a + 3b$



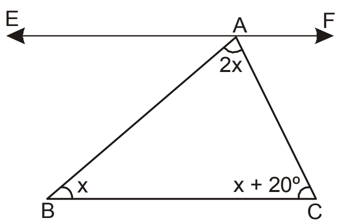

**16.** In figure, if AO || CD, BO || CE and $\angle AOB = 50°$. Find $\angle ECD$.



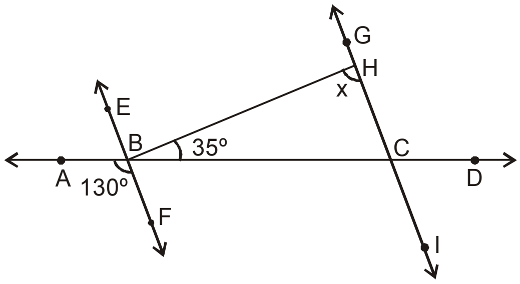

## LONG ANSWER TYPE

**17.** The supplement of an angle is one third of itself. Determine the angle and its supplement.

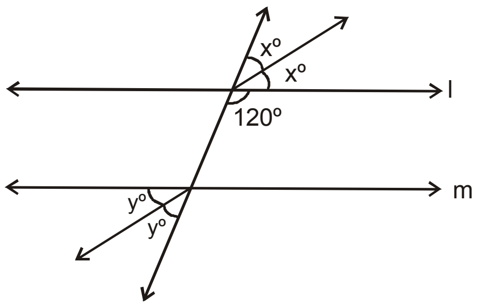
**18.** In figure, EF is a line through A and parallel to the side BC of triangle ABC. Find the value of x and use that to find $\angle EAB$ and $\angle FAC$.



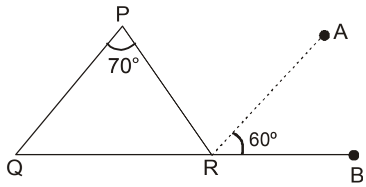
**19.** In the given fig. $\overleftrightarrow{EF} \parallel \overleftrightarrow{GI}$. Find the value of x.



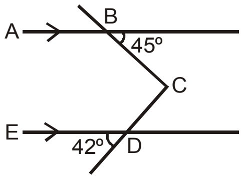

**20.** In the given fig. l || m. Find measure of x and y.




**21.** In the given fig. QP|| RA. $\angle$ QPR = 70° and $\angle$ ARB = 60°, find $\angle$ PRQ.




**22.** In the given figure AB || ED ; then find the value of $\angle$ABC + $\angle$BCD + $\angle$CDE




## EXERCISE 02

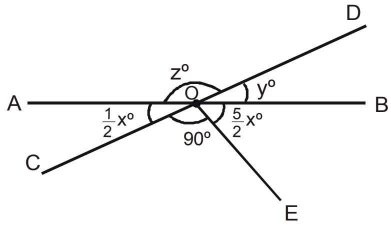
### SECTION -A (COMPETITIVE EXAMINATION QUESTION)

### MULTIPLE CHOICE QUESTIONS

**1.** Find the measure of an angle, if six times its complement is 12° less than twice its supplement.
(A) 48° (B) 30° (C) 87° (D) 49°

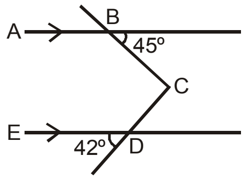
**2.** The complementary and supplementary angles of an angle are in the ratio 2 : 5 respectively. Find the measure of that angle.
(A) 60° (B) 30° (C) 90° (D) 45°

**3.** In the given figure, if AB and CD are straight lines and $\angle COE = 90°$, then the value of the angles x, y and z are :



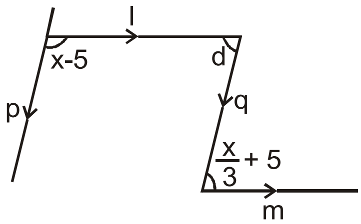

(A) 16°, 50°, 130° (B) 18°, 45°, 135° (C) 20°, 40°, 140° (D) 30°, 15°, 165°

**4.** In the given figure AB || ED ; then the value of $\angle ABC + \angle BCD + \angle CDE$ is :



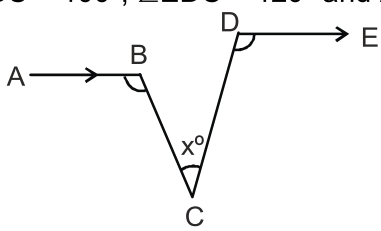

(A) 180° (B) 273° (C) 360° (D) 110°

**5.** In the given figure lines p and q are parallel. Find value of x so that lines l and m be parallel.



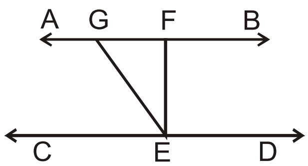

(A) 45° (B) 100° (C) 135° (D) 60°

**6.** In the adjoining figure, $\angle ABC = 100°$, $\angle EDC = 120°$ and AB || DE. Then, find $\angle BCD$ .



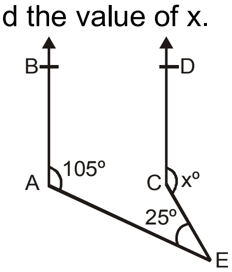

(A) 40° (B) 100° (C) 75° (D) 60°

**7.** In given figure if AB || CD, EF $\perp$ CD and $\angle GED = 126^0$, then $\angle AGE$ is :



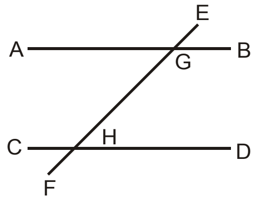

(A) 126° (B) 132° (C)146° (D) None of these

**8.** In the given figure, AB || CD. Find the value of x.



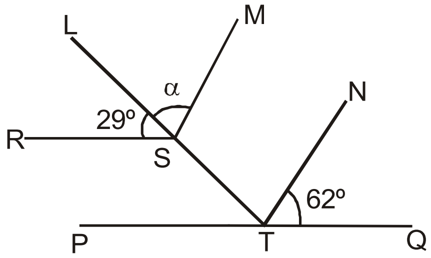

(A) 126° (B) 132° (C)146° (D) None of these

**9.** Given that AB || CD. False statement from the following is :



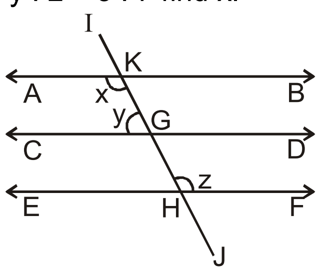

(A) $\angle AGH + \angle DHF = \angle EGB + \angle GHC$ (B) $\angle AGE + \angle GHC = \angle AGH + \angle GHD$
(C) $\angle AGE + \angle CHF = \angle EGB + \angle DHF$ (D) $\angle AGH + \angle GHC = \angle EGB + \angle DHF$

**10.** In the figure shown PQ || RS and SM || TN. Then measure of angle $\alpha$ is :



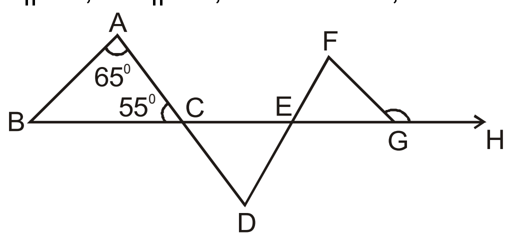

(A) 58° (B) 118° (C) 89° (D) 91°

**11.** In figure, if AB || CD || EF and y : z = 3 : 7 find x.




(A) 40° (B) 120° (C) 126° (D) 150°

**12.** In the given figure if AB || DF, AD || FG, $\angle BAC = 65°$, $\angle ACB = 55°$. Find $\angle FGH$.




(A) 125° (B) 100° (C) 120° (D) 110°

## SECTION -B (TECHIE STUFF)

**13.** Complement of an angle 36° 40' is :
(A) 54° (B) 54° 20' (C) 53° 20' (D) None of these

**14.** Write the supplement of $58^0$ 29'
(A) $31^0$ 31' (B) $121^0$ 27' (C) $120^0$ 30' (D) $121^0$ 31'

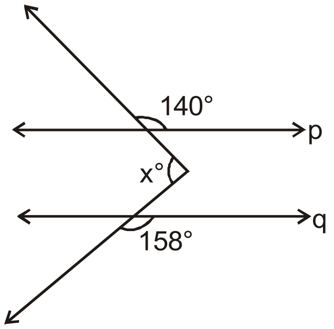
# EXERCISE 03

## (PREVIOUS YEAR EXAMINATION QUESTIONS)

**1.** The complementary angle of 14 is **[NSTSE 2009]**

(A) 90 (B) 76 (C) 41 (D) 86

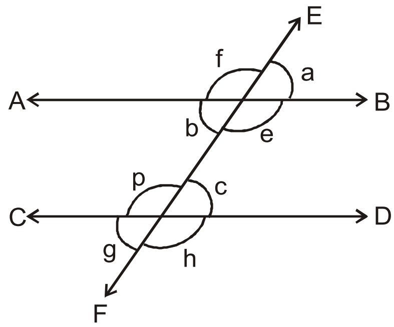
**2.** Assume p || q in the figure shown. Then x equals **[NSTSE 2009]**




(A) 18° (B) 22°

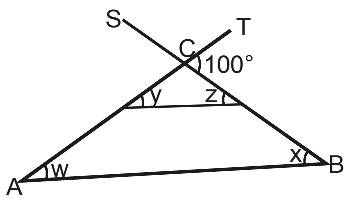
(C) 62° (D) can not be determine

**3.** AB and CD are two straight lines parallel to each other and a straight line EF intersects them as shown in the given figure. If ∠b = ∠c, then **[NSTSE 2010]**



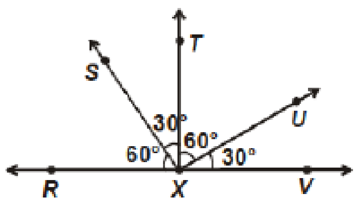

(A) ∠a = ∠h (B) ∠a = ∠c (C)∠g = ∠e (D) ∠g = ∠f

**4.** In the figure below, ACT and BCS are straight lines. Find the value of ∠w + ∠x + ∠y + ∠z **[NSTSE 2010]**




(A) 180° (B) 200° (C) 280° (D) 360°

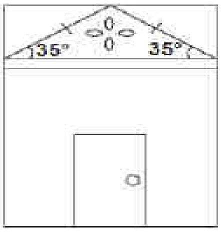
**5.** Which two angles is the given figures are NOT complementary? **[IMO-2010]**




(A) ∠RXS and ∠TXU (B) ∠SXT and ∠TXU

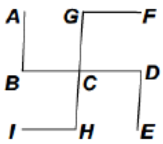
(C) ∠RXS and ∠SXT (D) ∠ TXV and ∠UXV

**6.** Mr. Raghav installed a triangular piece of stained glass above his front door. Which of the following best describes the triangle with the given measures? **[IMO-2010]**



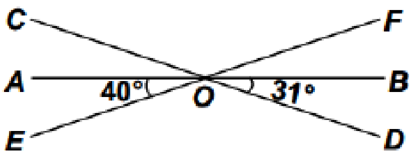

(A) Acute equilateral triangle (B) Obtuse isosceles triangle
(C) Right scalene triangle (D) Right isosceles triangle

**7.** In the given figure, AB||GH||DE and GF||BD||HI, ∠FGC = 80º. Find the value of ∠ CHI. **[IMO-2011]**



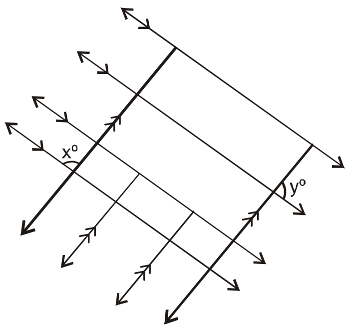

(A) 80º (B) 120º (C) 100º (D) 160º

**8.** In the given figure, find the value of ∠BOC. **[IMO-2011]**



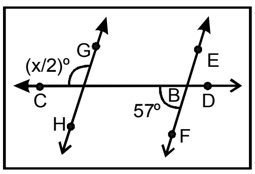

(A) 101º (B) 149º (C) 71º (D) 140º

**9.** In the adjoining figure, parallel lines are shown with similar markings. Find ∠x , if ∠x = 5 ∠y. **[NSTSE 2012]**



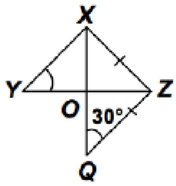

(A) 30º (B) 60º (C)150º (D) 170º

**10.** If EF is parallel to GH, then find the value of 'x'. **[NSTSE 2012]**



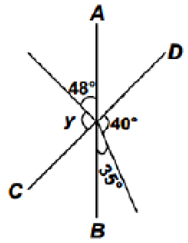

(A) 57º (B) 123º (C) 246º (D) 61.5º

**11.** In the given figure, XYZ is an equilateral triangle and XZQ is an isosceles triangle. Find $\angle QZO$. **[IMO-2012]**



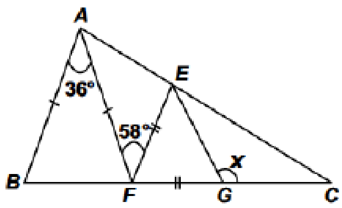

(A) 30° (B) 60° (C) 45° (D) 50°

**12.** In the given figure, AB and CD are straight lines. Find $\angle y$. **[IMO-2012]**



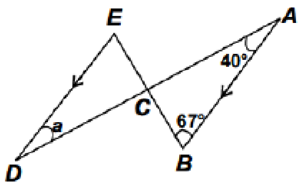

(A) 97° (B) 27° (C) 77° (D) 55°

**13.** In the given figure, find $\angle x$. **[IMO-2012]**



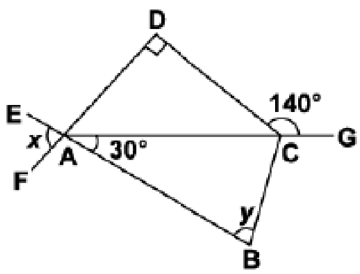

(A) 120° (B) 110° (C) 115° (D) 125°

**14.** In the given figure AB || DE. Find a. **[IMO-2012]**



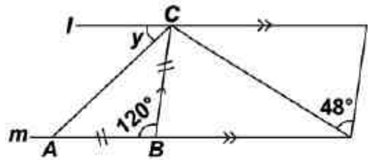

(A) 67º (B) 113º (C) 40º (D) 140º

**15.** In the figure (not drawn to scale), ACD is a right-angled triangle, ABC is an isosceles triangle with AB = AC, ACG, EAB and FAD are straight lines. Find the value of x and y respectively. **[IMO-2012]**



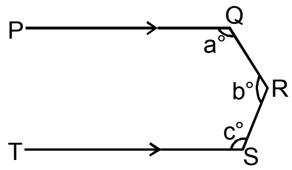

(A) 70°, 85° (B) 80°, 75° (C) 70°, 80° (D) 75°, 85°

**16.** In the given figure l II m and AB = BC, find the value of y. **[IMO-2012]**



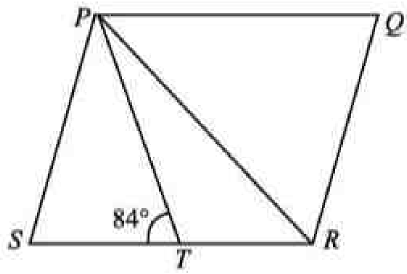

(A) 45° (B) 48° (C) 20° (D) 30°

**17.** In the given figure, PQ and TS are parallel. Identify the value of a° + b° + c°. **[NSTSE 2013]**



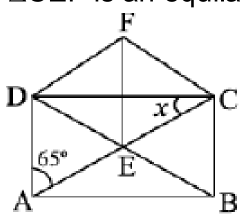

(A) 360º (B) 123º (C) 246º (D) 61.5º

**18.** In the given figure. PQ ||RS, PS || QR and RPT is $\frac{1}{4}$ as much as PTS. What is the value of RPQ ? **[IMO-2013]**



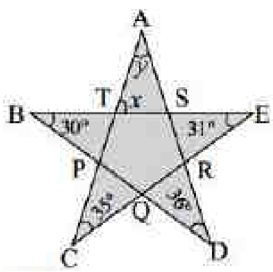

(A) 84° (B) 63° (C) 42° (D) 52°

**19.** In the figure ABCD is a rectangle ΔCEF is an equilateral triangle. Find x. **[IMO-2013]**



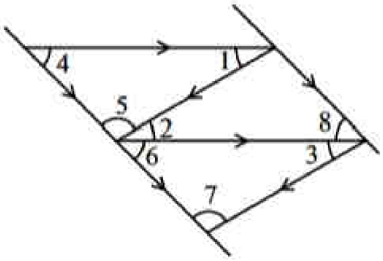

(A) 25º (B) 30º (C) 20º (D) 50º

**20.** Find the angles x and y respectively in the given figure. **[IMO 2014]**



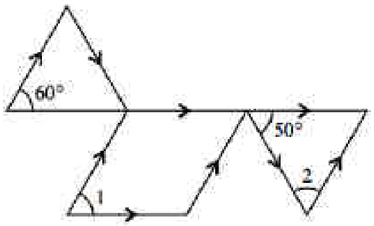

(A) 66° and 84° (B) 60° and 40° (C) 66° and 48° (D) 60° and 48°

**21.** Which of the following options is INCORRECT? **[IMO-2014]**




(A) $\angle 1 = \angle 3$ (B) $\angle 1 + \angle 4 + \angle 5 = 180°$ (C) $\angle 8 = \angle 6$ (D) $\angle 1 + \angle 3 = 180°$

**22.** Find the value of $\angle 1 + \angle 2$ **[IMO-2014]**



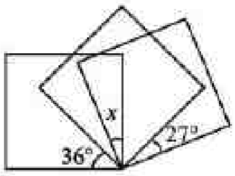

(A) 150º (B) 60º (C) 130º (D) 110º

**23.** Fill in the blanks. **[IMO-2014]**

P is perfectly straight and extends forever in both directions. Q is a perfectly flat surface that extends forever in all directions. R is the part of a line between two points.

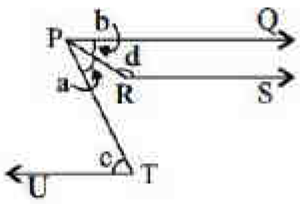
| | P | Q | R |
|---|---|---|---|
| (A) | Line | Plane | Ray |
| (B) | Line | Plane | Segment |
| (C) | Line | Ray | Plane |
| (D) | Ray | Segment | Plane |

**24.** The given figure shows three identical squares. Find x. **[IMO-2014]**




(A) 30° (B) 27° (C) 36° (D) 16°

**25.** In the given figure, PQ, RS and UT are parallel lines. If c = 75º and a = (2/5) c, find b + d/2. **[IMO-2014]**

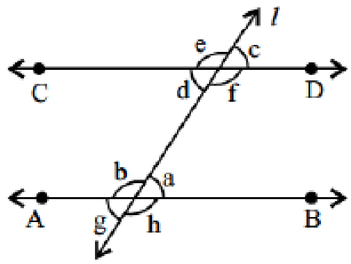



(A) 92° (B) 115° (C) 112.5° (D) 135.5

**26.** Study the given statements. **[IMO-2014]**

**Statement-I :** e and h are supplementary angles.

**Statement-II :** c and g are equal angles.




(A) Both statement-I and statement-II are true.

(B) Statement-I is true and statement-II is false.

(C) Statement-I is false and statement-II is true.

(D) Both statement-I and statement-II are false.

# ANSWER KEY

## EXERCISE 01

### SECTION -A (FIXED RESPONSE TYPE)

### MULTIPLE CHOICE QUESTIONS

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | C | C | B | D | B | A | D | D | D | A | B | C | B | C | B |
| Ques. | 16 | 17 | 18 | 19 | 20 | 21 | | | | | | | | | |
| Ans. | D | C | C | C | A | B | | | | | | | | | |

### FILL IN THE BLANKS

**1.** 2 **2.** One **3.** Angle **4.** Complementary

**5.** Collinear **6.** Concurrent **7.** Same **8.** Transversal

### TRUE / FALSE

**1.** False **2.** True **3.** True **4.** True **5.** True

**6.** True

### MATCH THE COLUMN

**1.** (A) → (t), (B) → (r), (C) → (p), (D) → (q), (E) → (s)

### SECTION -B (FREE RESPONSE TYPE)

### VERY SHORT ANSWER TYPE

**1.** 35° **2.** 40° **3.** 54° and 126° **4.** 36° and 54°

**5.** 45° **6.** 60° **7.** 64°, 93° **8.** 130°

### SHORT ANSWER TYPE

**9.** 27° **10.** Right triangle. **11.** 92° **12.** 50°

**13.** 45° **14.** 135° **15.** 460° **16.** 130°

### LONG ANSWER TYPE

**17.** 135°, 45° **18.** 40° **19.** 95° **20.** 30°

**21.** 50° **22.** 360°

# EXERCISE 02

## SECTION -A (COMPETITIVE EXAMINATION QUESTION)

### MULTIPLE CHOICE QUESTIONS

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | A | B | D | C | C | A | A | D | B | C | C | A |

## SECTION -B (TECHIE STUFF)

| Ques. | 13 | 14 |
|---|---|---|
| Ans. | C | D |

# EXERCISE 03

## (PREVIOUS YEAR EXAMINATION QUESTIONS)

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | B | C | B | B | A | B | A | B | C | C | B | B | C | C | B |
| Ques. | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | | | |
| Ans. | D | A | B | A | C | D | C | B | B | C | C | | | | |