MATHEMATICS

Class-VI

Topic-09

BASIC GEOMETRICAL IDEAS

CHAPTER 09

BASIC GEOMETRICAL IDEAS

TERMINOLOGIES

Point, line, line segment, ray, curves, angles, open and closed figures, polygon, triangle, quadrilateral, circles.

INTRODUCTION

The part of Mathematics that deals with such objects as points , lines, planes and space is called geometry. Some of the geometrical objects are triangle , rectangle , circle , etc.
The English word Geometry has been derived from the Greek word geometron which means to measure the Earth'. Geometrical idea have developed over centuries to cater the needs in art, architecture etc. Here, we will discuss some basic concepts in geometry.

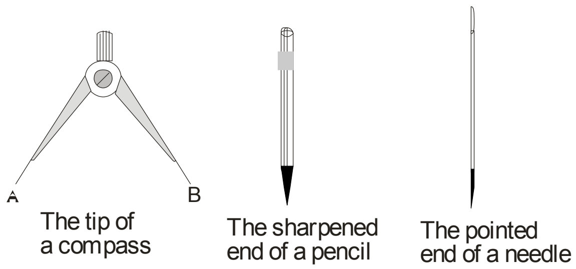
9.1 POINT, LINE, LINE SEGMENT, RAY, CURVES AND ANGLES

(a) Point

A point shows an exact location of an object. It is the basic unit of geometry. It is represented with the help of a dot. It is named by using a single capital English alphabet.

• A

This is point A
A point has no length and no breadth.

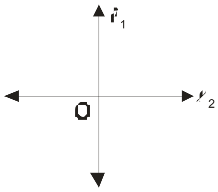


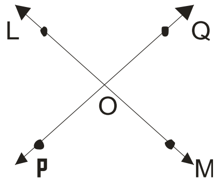
(b) Line

A line is a collection of points going endlessly in both directions along a straight path.
The symbol for a line is $\longleftrightarrow$.

The arrows show that the line goes on endlessly in both directions. A and B are two points on the line. We call it line AB and write it as $\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$. It can also be named by means of any small English letter, say l.

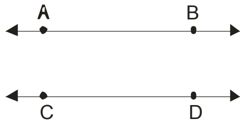
If two lines meet each other at one point then they are called intersecting lines. Two intersecting lines have one common point.





(c) Parallel Lines

If two or more lines do not meet each other however far they are extended, then they are called parallel lines.



The opposite edges of a book, table, ruler etc. are good examples of parallel lines.

(d) Line Segment

A line segment is part of a line. It has two endpoints and has a fixed length.
We name the segment by its endpoints.

The symbol for a line segment is "_____".

Points P and Q are the two endpoints of the line segment PQ as shows above. We write it as $\overline{PQ}$ or $\overline{QP}$.

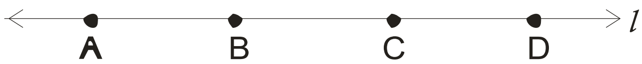
(e) Ray

You must have noticed rays of light coming out of a torch or car headlights. A ray is part of a line. It has one endpoint and goes on endlessly in one direction. The endpoint is mentioned first while naming a ray.

Ray QR is written as $\overrightarrow{QR}$. It is important to note that $\overrightarrow{RQ}$ is not a ray as Q is an end point.

(f) Collinear Points

Three or more points in a plane are said to be collinear if they all lie on the same line.
In Fig, points A, B, C and D are collinear because only one line l passes through all of them.



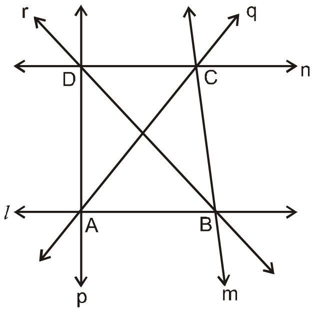
If the points do not lie on a line, they are called non-collinear points.

NOTE:

We have learnt earlier that through two given distinct points, we can always draw a line. Thus two distinct points are always collinear. But given three distinct points may or may not be collinear. So we talk of collinearity of three or more distinct points.

Illustration 9.1

In Fig. name :

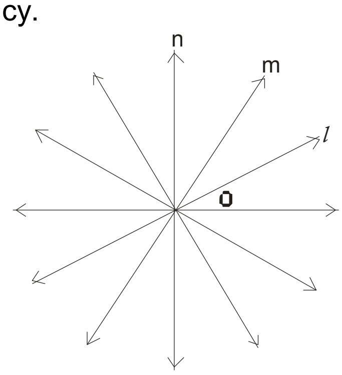


(i) Four non-collinear points.
(ii) Point of intersection of the lines l and m.
(iii) Point of intersection of the lines r and n.
(iv) Point of intersection of the lines q and n.
(v) Point of intersection of the lines p and q.
(vi) Four line segments.
(vii) Two points on the line q.

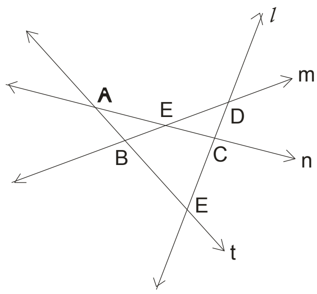
Sol. **(i)** A, B, C, D **(ii)** B **(iii)** D
(iv) C **(v)** A **(vi)** $\overline{AB}$, $\overline{BC}$, $\overline{CD}$, $\overline{AD}$ **(vii)** A, C

(g) Concurrent Lines

Three or more lines in plane are said to be concurrent if they all pass through the same point. In below Fig., the lines l, m, n, ... all pass through a common point O. Such lines are said to be concurrent lines and we say that they are concurrent at O. The point O is called the point of concurrency.



The point of concurrency of three or more lines in a plane is also called the point of intersection of these given lines.
Now look at below Fig., the lines l, m, n, t are not concurrent lines but are intersecting lines. The points A, B, C, ... are the points of intersection of the lines l, m, n, ... but none of them is a point of concurrency. In this case the point of intersection is not point of concurrency.



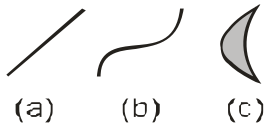
NOTE:

As collinearity is defined for three or more points, we define concurrency for three or more lines.

(h) Curves

When you draw lines on a piece of paper without lifting the pencil and without using a scale, the shapes that you get are called curves. Some examples are shown below.

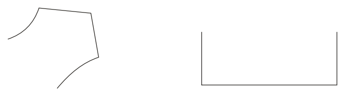
Simple curve : A curve that does not cross itself is called a simple curve. The figures shown below are simple curves.



(i) Open and Closed Figures

(i) Open Figures :

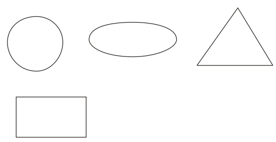
The figures that do not begin and end at the same point are called open figures.



(ii) Closed Figures :

The figures that begin and end at the same point are called closed figures. They are also called closed curves. The closed curves that do not cross themselves are called simple closed curve.

For example : triangle, circle, ellipse, rectangle, square, etc. are all closed figures.



Interior And Exterior Of closed figures :

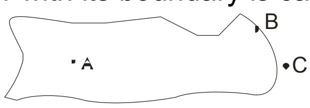
There are three parts in a closed curve.

(a) Interior (inside) of the curve.

(b) Exterior (outside) of the curve

(c) Boundary of (on) the curve.

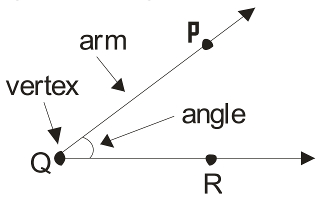
The interior of a curve together with its boundary is called its region.



A lies in the interior of the curve, B on its boundary and C lies in its exterior.

(j) Angle

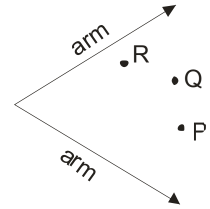
An angle is formed when two rays meet at a common point called a vertex. Each of these rays is called an arm of the angle. An angle is represented by the symbol $\angle$.



In figure $\overrightarrow{QR}$ and $\overrightarrow{QP}$ meet at the vertex Q to form an angle PQR. We write it as ∠PQR or ∠RQP or ∠Q. An angle can also be formed by the intersection of line segment.

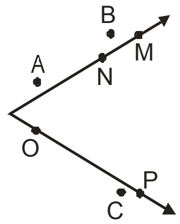
(i) Interior Of An Angle :

The space within the arms of an angle, produced indefinitely, is called the interior of the angle. In figure points P,Q and R are said to lie in the interior of the angle.



(ii) Exterior Of An Angle :

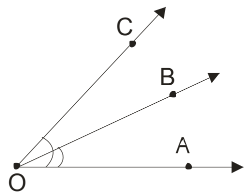
The space outside the arms of an angle, produced indefinitely, is called the exterior of the angle. Point A , B, and C lie in the exterior of the angle shown in Figure.



M, N, O and P are points on the angle and are, therefore, part of the angle.

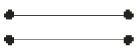
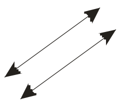
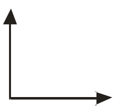
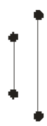
(iii) Adjacent Angles :

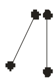
Two angles which have a common arm, a common vertex, and lie on either side of the common arm are called adjacent angles. In Fig. ∠AOB and ∠BOC are adjacent angles as they have a common arm $\overrightarrow{OB}$, a common vertex O and both the angles AOB and BOC are on either side of the common arm $\overrightarrow{OB}$. Both the angles are distinct angles and no part of ∠AOB is a part of ∠BOC and vice versa.



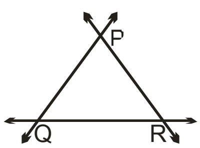
Ask yourself

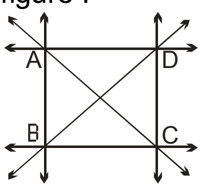
1. Which of the following are parallel line segments or lines ?

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

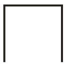
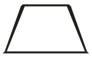
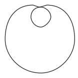
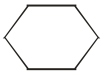
(E) 

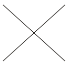
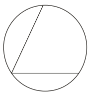
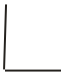
2. Write the names of the lines in the following figure :



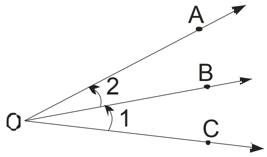


3. Identify each figure below as an open figure or a closed figure.

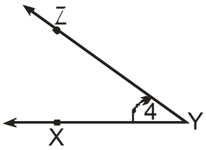
(A)  (B)  (C)  (D)  (E)  (F) 

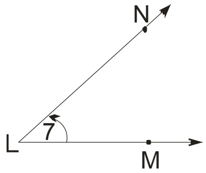
(G)  (H)  (I) 

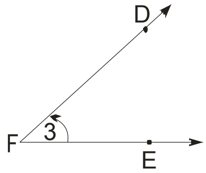
4. Name the angles in the figure

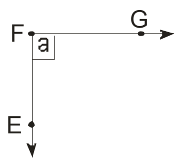


5. Name each of the following angles in three different ways

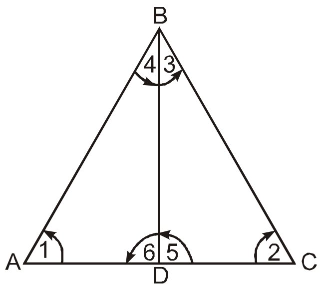
(A) 

(B) 

(C) 

(D) 

6. In the given figure , match the angle indicated by a number by their three letter name.



(i)	∠1	**(a)**	∠DBA
(ii)	∠2	**(b)**	∠CBD
(iii)	∠3	**(c)**	∠ADB
(iv)	∠4	**(d)**	∠DCB
(v)	∠5	**(e)**	∠BAD
(vi)	∠6	**(f)**	∠BDC

Answers

1. (A) , (B) , (D)

2. $\overline{PQ}$, $\overline{QR}$, $\overline{PR}$; $\overline{AD}$, $\overline{DC}$, $\overline{CB}$, $\overline{BA}$, $\overline{AC}$, $\overline{BD}$

3. (A) Open (B) Closed (C) Closed (D) Open (E) Closed
(F) Closed (G) Open (H) Closed (I) Open

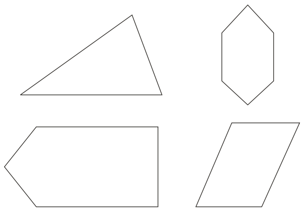
4. ∠ AOB , ∠ BOC , ∠ AOC

5. (A) ∠ ZYX , ∠ XYZ , ∠ Y (B) ∠ NLM , ∠ MLN , ∠ L
(C) ∠ DFE , ∠ EFD , ∠ F (D) ∠ EFG , ∠ GFE , ∠ F

6. (i) (e) , (ii) (d) , (iii) (b) , (iv) (a) , (v) (f) (vi) (c)

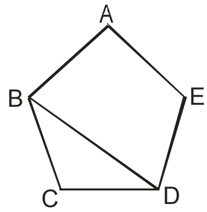
9.2 POLYGON

Polygon is a closed figure made by joining three or more line segments (not curves), where each line segments intersects exactly two other line segments. For example, triangle, quadrilateral, pentagon, etc., are all examples of polygon.



If all sides of a polygon are equal and all angles are also equal , then it is called a **regular polygon**.

Sides, vertices, and diagonals.
Consider the given figure. This is a polygon.



(a) The line segment forming a polygon are called its side. In the given polygon $\overline{AB}, \overline{BC}, \overline{CD}, \overline{DE}, \overline{EA}$ are sides.

(b) Any two sides with a common end point are called adjacent sides.

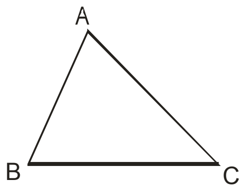
(c) The meeting point of a pair of sides is called vertex. Side $\overline{AB}$ and $\overline{BC}$ meet at B, so B is a vertex of the polygon ABCDE. Similarly, A, C, D, and E are the other vertices.

(d) The end points of the same side are called adjacent vertices. Vertices A and B are adjacent vertices but A and C are not.

(e) The line joining two non-adjacent vertices of a polygon is called a diagonal. Since A and C are non-adjacent vertices, so $\overline{AC}$ is a diagonal.

(a) Triangle

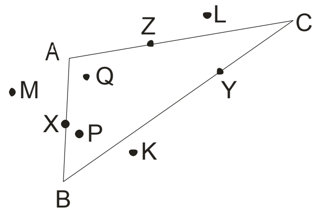
A triangle is a closed figure made of three line segments. In figure, line segments $\overline{AB}, \overline{BC}$, and $\overline{CA}$ form a closed figure. The figure given below is a triangle and is denoted by ΔABC. This triangle can also be named as ΔABC, ΔBCA, ΔCAB, ΔCBA, ΔBAC, or ΔACB.



The line segments forming a triangle are the three sides of the triangle. In the above figure $\overline{AB}$, $\overline{BC}$, and $\overline{CA}$ are the three sides of the triangle.
The point where any two of the three line segments of triangle intersect is called the vertex of the triangle. A triangle has three vertices. In the given figure, A, B and C are the three vertices.

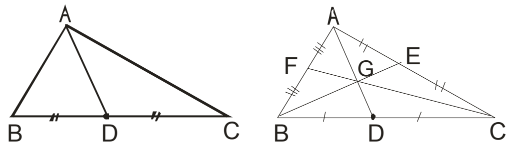
When two line segments intersect, they form an angle at that point. In the above triangle $\overline{AB}$ and $\overline{BC}$ intersect at B and form an angle at that vertex. This angle at B is read as $\angle B$ or $\angle ABC$ or $\angle CBA$. Thus a triangle has three angles, ΔABC has three angles namely $\angle A$, $\angle B$, and $\angle C$.

Look at ΔABC in figure below points P and Q are in the interior of ΔABC. The region within the boundary of ΔABC is called interior region of the triangle.



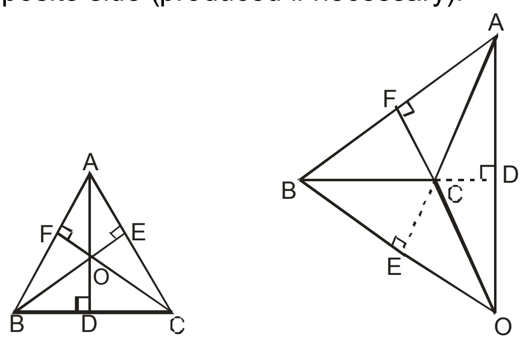
Note that ΔABC only refers to the boundary of the figure and not its interior. Points X, Y, and Z are on the boundary of the ΔABC and hence they are on ΔABC. The interior region along with the boundary is known as the triangular region. Points K, L, and M are on the exterior of ΔABC.

(i) Medians Of A Triangle : A line segment joining a vertex to the mid-point of the side opposite to the vertex is called a median of the triangle.



Thus , in the above figure, D is the mid-point of BC and AD is a median. Obviously, every triangle has three medians, one from each vertex.
The point G where all the median of triangle intersects is known as Centroid.

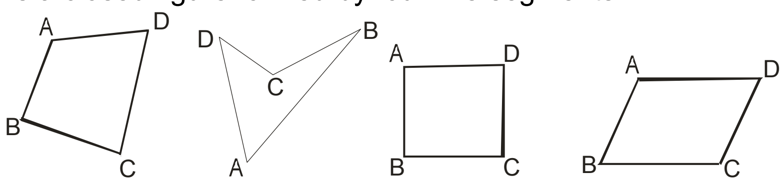
(ii) Altitudes Of A Triangle : An altitude of a triangle is the perpendicular drawn from a vertex to the opposite side (produced if necessary).



Clearly, every triangle has three altitudes, one from each vertex.
If we take BC as the base, then AD is called the height of the triangle.
The point O where all the altitudes of a triangle meets is known as Orthocentre.

(b) Quadrilateral

A quadrilateral is a closed figure formed by four line segments.

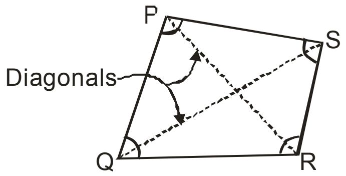


All the shapes shown above are quadrilaterals as they are all bounded by four line segments.

A quadrilateral has four sides, four vertices, and four angles. In the above figure $\overline{AB}$, $\overline{BC}$, $\overline{CD}$ and $\overline{DA}$ constitute the sides, and $\angle A$, $\angle B$, $\angle C$ and $\angle D$ are the four angles. These quadrilaterals are read as quadrilateral ABCD.

Elements of a Quadrilateral

(i) Adjacent Sides : In the quadrilateral PQRS there are four sides, namely $\overline{PQ}$, $\overline{QR}$, $\overline{RS}$ and $\overline{SP}$.



The two sides of a quadrilateral having a common endpoint are called adjacent sides. Thus, sides $\overline{PQ}$ and $\overline{QR}$ are adjacent sides having the common endpoint Q. Sides $\overline{QR}$ and $\overline{RS}$ are also adjacent sides having the common endpoint R. Similarly, and are adjacent sides, and $\overline{SP}$ and $\overline{PQ}$ are also adjacent sides.

(ii) Opposite Sides : The sides $\overline{PQ}$ and $\overline{RS}$ are called opposite sides. Similarly, $\overline{QR}$ and $\overline{SP}$ are also opposite sides. They have no common end point.

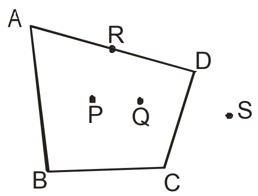
(iii) Adjacent Angles : Two angles of a quadrilateral which have a common arm are called adjacent angles.

Therefore $\angle P$ and $\angle Q$ are adjacent angles as they have a common arm $\overline{PQ}$. Similarly, $\angle Q$ and $\angle R$; $\angle R$ and $\angle S$; $\angle S$ and $\angle P$ are also adjacent angles.

(iv) Opposite Angles: $\angle P$ and $\angle R$ are opposite angles as they have no common arm. Similarly, $\angle Q$ and $\angle S$ are also opposite angles.

(v) Diagonals : The line segments joining the opposite vertices are called the diagonals of the quadrilateral. $\overline{QS}$ and $\overline{PR}$ are the two diagonals of the quadrilateral PQRS.

(vi) Interior And Exterior Of Quadrilateral : The region inside the quadrilateral ABCD is called its interior and that outside is called the exterior. In the given figure, four points P,Q,R, and S are marked. P and Q are said to be in the interior of the quadrilateral ABCD, R is on the quadrilateral ABCD, while S is in the exterior of the quadrilateral ABCD.

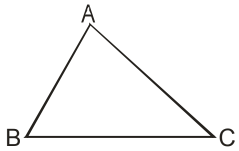


The interior of the quadrilateral ABCD along with the quadrilateral ABCD is called the quadrilateral region of ABCD, i.e., P,Q, and R are points in the quadrilateral region of the quadrilateral ABCD.

A quadrilateral has four angles and the sum of all four angles of a quadrilateral is 360°.

Ask yourself

1. In the adjoining figure, name :

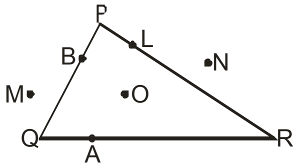


(i) the side opposite to ∠C   **(ii)** the angle opposite to BC.

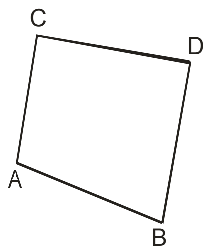
(iii) the vertex opposite to AC.   **(iv)** the side opposite to vertex A.

2. **(a)** Name the points which are in the triangular region PQR. Which of these lie on the ΔPQR?

(b) Which points lie in the exterior of ΔPQR ?



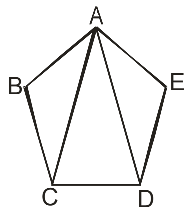
3. Name the angles in given figure :



4. How many pairs of adjacent sides are there in a

(a) Triangle   **(b)** Quadrilateral   **(c)** Pentagon

5. Name all the line segments and vertices?



Answers

1. **(i)** AB   **(ii)** ∠A   **(iii)** B   **(iv)** BC

2. **(a)** O ; B , L , A   **(b)** M , N

3. ∠A , ∠B , ∠C , ∠D

4. **(a)** 3   **(b)** 4   **(c)** 5

5. Line segments = AB , BC , CD , DE , AE , AC , AD

Vertices = A , B , C , D , E

9.3 CIRCLES

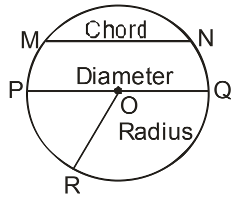
A circle is a simple closed curve all of whose points are at the same distance from a given point O in the same plane . The given point O is called the centre of the circle.

Parts of a Circle

A line segment joining the centre of a circle to any point on the circle is called a radius of that circle.

A line segment joining any two points on a circle is called a **chord** of that circle.

A chord that passes through the centre of a circle is called a **diameter** of that circle.



NOTE:

(i) A diameter is the longest chord of a circle.

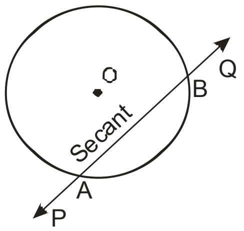
(ii) The diameter is twice the radius i.e. PQ = 2OR

(iii) The distance around a circle is called the **circumference**.

A Few More Definitions

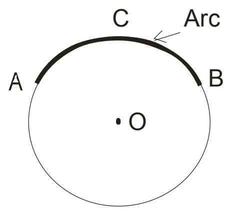
(a) Secant :

A line which intersects or meets the circle at two distinct points is called a secant.



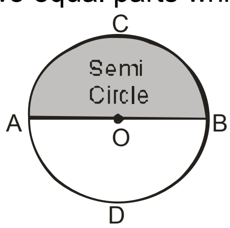
(b) Arc

A part (continuous) of a circle is called an arc.



(c) Semi-Circle

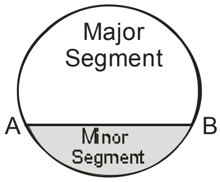
A diameter divides a circle into two equal parts which are called semi-circles.



(d) Segment

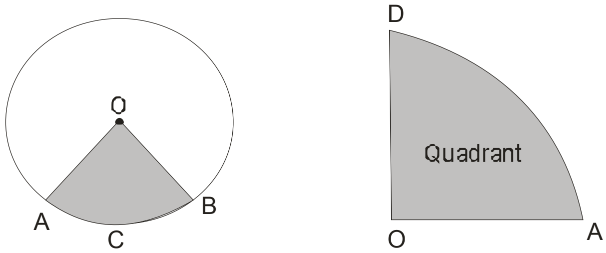
A chord AB of a circle divides the area enclosed by it into two parts which are called segments.

The smaller part is called a **minor** segment and the larger part a **major** segment. The chord also divides the circumference of the circle into two parts. The smaller part is called a **minor arc** because it is less than a semicircle and the larger part a **major arc** because it is greater than a semi-circle.



(e) Sector And Quadrant

The part of a circle enclosed by any two radii of the circle is called a sector of the circle.



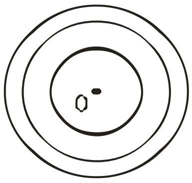
(i) (ii)

In figure (i) OACB is a sector.

If the two radii are at right angles to each other the sector is called a **quadrant**. A quadrant is thus $\frac{1}{4}$th of a circle. In figure (ii) AOD is a quadrant.

(f) Concentric Circles

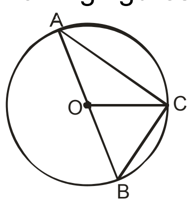
Two or more circles drawn with the same centre are called concentric circles.



Ask yourself

1. What is the shape of full moon

2. Use circle O at the right to name following figures :

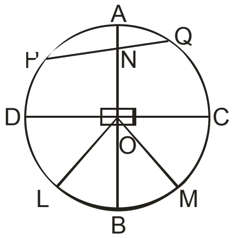


(a) three radii **(b)** three chords **(c)** a diameter

3. Which of the following statements is true ?

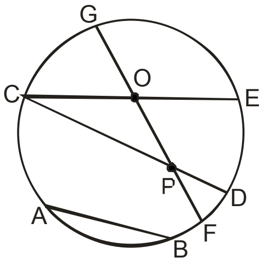
(i) All diameters are chords **(ii)** Some radii are chords.

4. Refer to the figure , O is the centre of a circle shown in the figure drawn below. Fill up the blanks in the following :



(a) COA , AOD , DOB , BOC are four ______ of the circle.
(b) PAQNP is a minor________ of the circle.
(c) LOM is a _______ of the circle.

5. From figure :



(a) Identify the centre **(b)** Identify the radii
(c) Identify the diameters **(d)** Chord

Answers:

1. Circle **2.** **(a)** OA,OB,OC **(b)** AC,BC,AB **(c)** AB

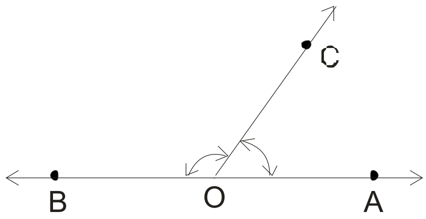
3. **(i)** True **(ii)** False **4.** **(a)** Quadrants **(b)** Segment **(c)** Sector

5. **(a)** O **(b)** OG,OE,OC,OF **(c)** CE,GF **(d)** AB,CD,CE,GF

Add your knowledge

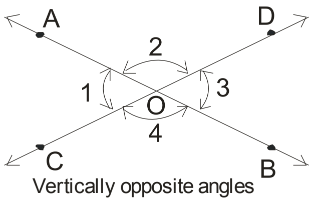
Linear Pair : Two adjacent angles are said to form a linear pair of angles, if their non-common arms are two opposite rays, in fig. OA and OB are two opposite rays and $\angle AOC$ and $\angle BOC$ are the adjacent angles. Therefore, $\angle AOC$ and $\angle BOC$ form a linear pair.

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



Linear pair

Vertically Opposite Angles : Two angles formed by two intersecting lines having no common arm are called **vertically opposite angles**

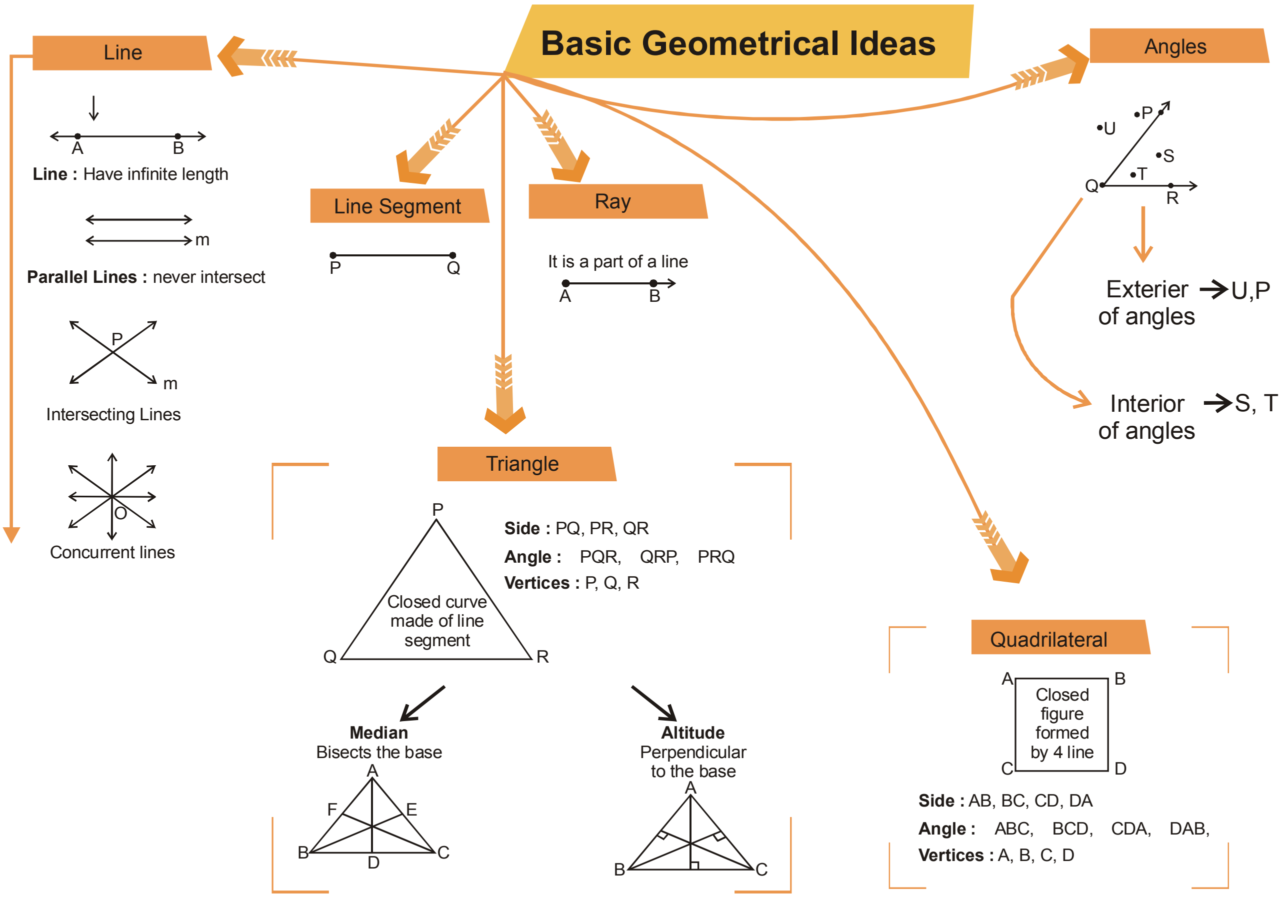


Vertically opposite angles

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.

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.

Concept Map


Basic Geometrical Ideas
Line
A B
Line : Have infinite length
m
Parallel Lines : never intersect
P
m
Intersecting Lines
O
Concurrent lines
Line Segment
P Q
Ray
It is a part of a line
A B
Angles
U
P
S
T
Q
R
Exterier of angles → U,P
Interior of angles → S, T
Triangle
P
Q R
Closed curve made of line segment
Side : PQ, PR, QR
Angle : PQR, QRP, PRQ
Vertices : P, Q, R
Median
Bisects the base
A
F E
B D C
Altitude
Perpendicular to the base
A
B C
Quadrilateral
A B
C D
Closed figure formed by 4 line
Side : AB, BC, CD, DA
Angle : ABC, BCD, CDA, DAB,
Vertices : A, B, C, D

Summary

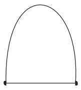
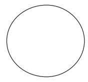
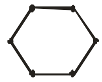
1. A point is a mark of position , having no length , no breadth and no thickness.
2. A line is a straight path that can be extended in both the directions.
3. Line segment has two end points.
4. Infinite number of lines can be drawn from a given point.
5. A ray has only one initial point.
6. All the lines passing through one point are called concurrent lines.
7. The lines that do not intersect in plane on extending in both the directions are called parallel lines.
8. Two rays with the same initial point form an angle.
9. Curves are either open or closed
10. A polygon is a closed curve made up of line segments only.
11. A triangle is a closed figure made of three line segments.
12. A line segment joining a vertex to the mid-point of the side opposite to the vertex is called a median of the triangle.
13. An altitude of a triangle is the perpendicular drawn from a vertex to the opposite side.
14. A quadrilateral is a polygon having four sides.
15. A circle is the collection of all those points in a plane which are equidistant from a fixed point. The fixed point is called the centre of the circle.
16. Diameter is a chord which passes through the centre of the circle.
17. Any part of a circle is called an arc.
18. A diameter divides a circle into two equal parts which are called semi-circles.
19. A chord AB of a circle divides the area enclosed by it into two parts which are called segments.
20. The part of a circle enclosed by any two radii of the circle is called a sector of the circle.

EXERCISE 01

SECTION -A (FIXED RESPONSE TYPE)

MULTIPLE CHOICE QUESTIONS

1. Which of the following figures is made of line segments only ?

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

2. An exact location in space is called a

(A) ray (B) point (C) line segment (D) plane

3. Which of the following has no end points ?

(A) $\overleftrightarrow{AB}$ (B) $\overline{CD}$ (C) $\overrightarrow{BC}$ (D) $\overline{EF}$

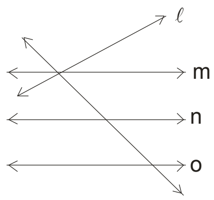
4. What is three or more lines called if they pass through a common point ?

(A) parallel lines (B) intersecting lines (C) concurrent (D) none of these

5. How many end points does a ray has ?

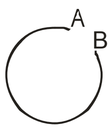
(A) one (B) two (C) three (D) zero

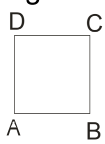
6. Name the parallel lines -

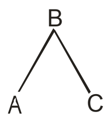


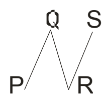
(A) m||n||O (B) m||n||p (C) ℓ ||m||n (D) ℓ ||P

7. Choose closed curve among these :

(A) 

(B) 

(C) 

(D) 

8. If ∠ABC = 60º, then which angle is 60º

(A) ∠B (B) ∠A (C) ∠C (D) None

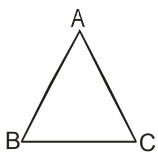
9. Which of the following is another name for ∠ABC?

(A) ∠A (B) ∠CBA (C) ∠ACB (D) ∠CAB

10. Number of lines passing through five points such that no three of them are collinear is

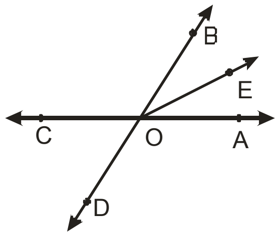
(A) 10 (B) 5 (C) 20 (D) 8

11. What is the wrong representation of ∠A



(A) ∠ABC (B) ∠A (C) m(∠A) (D) ∠BAC

12. Which of the following rays are the arms of ∠BOA?



(A) OB, OE (B) OE, OA (C) OB, OA (D) OC, OA

13. A quadrilateral has
(A) 2 diagonals, 3 angles (B) 4 diagonals, 4 angles
(C) 2 diagonals, 4 angles (D) 4 diagonals, 4 sides.

14. A quadrilateral is a simple closed figure formed by ___________ line segments.
(A) 3 (B) 4 (C) 2 (D) 5

15. Two angles of a quadrilateral having a common side are called :
(A) opposite angles (B) equal angles (C) adjacent angles (D) none of these

16. The point where a pair of adjacent sides of a polygon meets is called :
(A) diagonal (B) adjacent angles (C) vertex (D) none of these

17. Which of the following is not a pair of adjacent angles of quadrilateral ABCD ?
(A) ∠A, ∠B (B) ∠C, ∠D (C) ∠B, ∠D (D) ∠D, ∠A

18. The complete distance around a circle is called the
(A) Sector (B) Quadrant (C) Circumference (D) Segment

19. One-fourth part of a circle is known as a
(A) semi-circle (B) major segment (C) sector (D) quadrant

20. The longest chord of a circle is equal to its.
(A) radius (B) diameter (C) circumference (D) secant

21. An arc is a continuous part of the ________of the circle.
(A) diameter (B) major segment (C) circumference (D) chord

22. The centre of the circle always lies in the interior of the
(A) minor segment (B) semi-circle (C) major segment (D) minor arc

23. The radius of a circle is 3 cm. Its diameter is
(A) 1.5 cm (B) 9 cm (C) 4.5 cm (D) 6 cm

24. The end points of a diameter of a circle divide the circle into two parts, each of which is known as
(A) segment (B) sector (C) semi-circle (D) quadrant

25. Diameter =
(A) 2 × radius (B) 2 (C) radius (D) 1/2 × radius

FILL IN THE BLANKS

1. A line segment has a _____ length
2. A ray has _________ end points'
3. A line has ______ end points'
4. A ray has no ______ length
5. A line _________ be drawn on a paper.
6. The standard unit of measuring an angle is _____
7. Two lines lying in a plane are _________ if they are not parallel to each other.
8. A triangle has ________ sides ______ angles and ________ vertices.
9. The vertices of a triangle are called ___
10. The line segment forming a polygon is called_____
11. Line joining the opposite vertices of a polygon is called a ____
12. A diameter of a circle is a chord that ____ the centre.
13. If we join any two points on a circle by a line segment, we obtain a _________ of a circle.
14. The figure bounded by an arc and the two radii joining the end points of the arc with the centre is called a ______ of the circle.
15. Half of circle is known as ________
16. A line which intersect or meets the circle at two distinct points is called ____

TRUE / FALSE

1. Only one ray can be drawn with a given initial point.
2. Two planes intersect in a line.
3. A line is longer than a line segment
4. Two different lines can be drawn passing through two given points
5. If two lines intersect at a point P, then P is called the point of intersection of the two lines.
6. The maximum number of points of intersection of three lines is three.
7. In a triangle ABC, sides are AB , BC and CA
8. In a triangle ABC, angles are $\angle A$, $\angle B$ and $\angle D$
9. In a quadrilateral PQRS, $\angle P$ and $\angle R$ are a pair of adjacent angles.
10. In a quadrilateral ABCD, $\angle B$ and $\angle C$ are a pair of opposite angles.

11. The interior of a triangle, and the triangle itself make the triangular region.

12. All diameters are chords

13. The line segments joining the centre of the circle and any point on the circle are all equal.

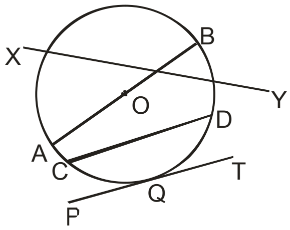
14. A segment is a figure enclosed by a chord and the corresponding arc of the circle.

15. The distance of a point which is in the interior of a circle from the centre, is less than its radius.

16. Two concentric circle have two distinct centres.

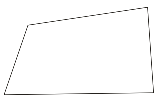
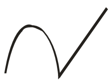
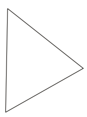
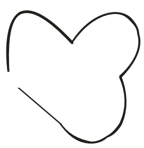
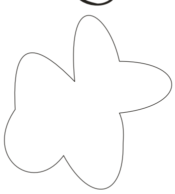
MATCH THE COLUMN

1. **COLUMN – I** **COLUMN – II**



COLUMN – I		COLUMN – II	
(A)	AB	(p)	Point of cutting
(B)	PT	(q)	Tangent
(C)	CD	(r)	Radius
(D)	XY	(s)	Chord
(E)	O	(t)	Centre
(F)	AO	(u)	Diameter
(G)	Q	(v)	Secant

2. **COLUMN – I** **COLUMN – II**

COLUMN – I		COLUMN – II	
(A)		(p)	Triangle
(B)		(q)	Curve
(C)		(r)	Closed figure
(D)		(s)	Quadrilateral
(E)		(t)	Open figure

SECTION -B (FREE RESPONSE TYPE)

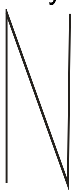
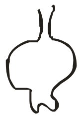
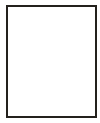
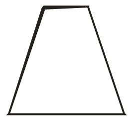
VERY SHORT ANSWER TYPE

1. The minimum number of points of intersection of three lines is ?

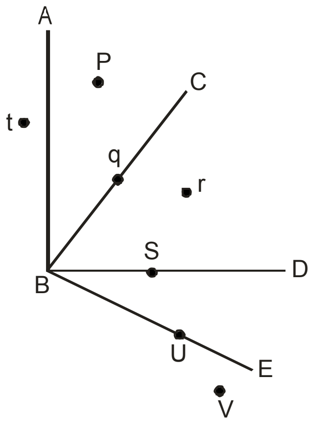
2. The maximum number of point of intersection of three lines is ?

3. Name three examples of angles from your daily life.

4. Classify the following as open or closed :

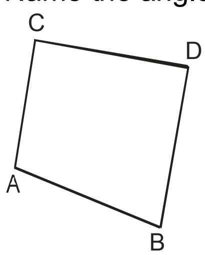
(a)  **(b)**  **(c)**  **(d)**  **(e)** 

5. Name the points lie in

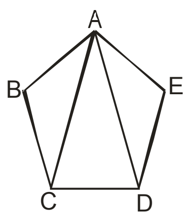


(a) In the interior of ∠DBC **(b)** In the exterior of ∠ABD
(c) In the interior of ∠DBE

6. Name the angles in given figure :



7. Name all the line segments and vertices?



8. Define the following:
(a) chord **(b)** semi-circle **(c)** tangent

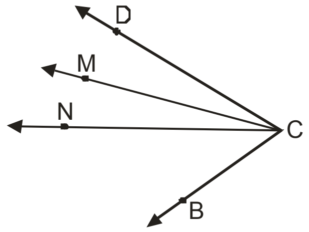
9. What shape are the wheels of the scooter ?

SHORT ANSWER TYPE

10. Define each of the following
(a) closed figure **(b)** open figures

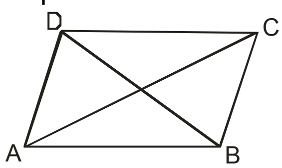
11. How many lines can be drawn to pass through
(a) a given point **(b)** two given points **(c)** three given points

12. Name the six angles in the diagram above that have C as a vertex.



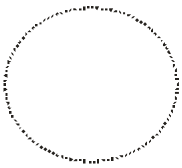
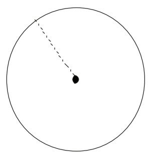
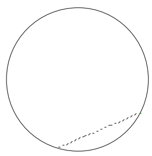
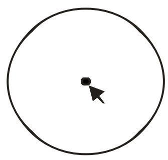
13. How many pairs of adjacent sides are there in a
(a) Triangle **(b)** Quadrilateral **(c)** Pentagon

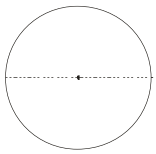
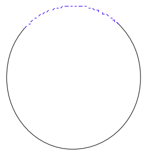
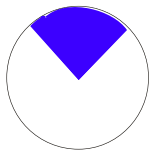
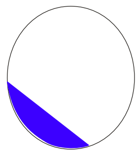
14. In the adjacent figure, a quadrilateral has been shown.



Name :(i) Its diagonals **(ii)** two pairs of opposite sides.
(iii) two pairs of opposite angles. **(iv)** two pairs of adjacent sides.
(v) two pairs of adjacent angles.

15. Name the doted / shaded part.

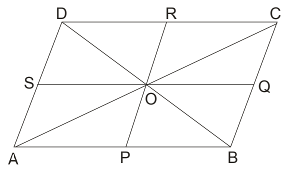
(a)  **(b)**  **(c)**  **(d)** 

(e)  **(f)**  **(g)**  **(h)** 

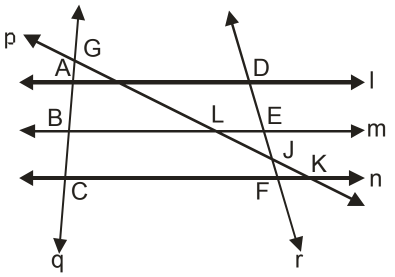
16. Two points A and B are given. How many circles can be drawn
(a) passing through both the points ?
(b) with A as centre and AB as radius ?

LONG ANSWER TYPE

17. In Fig. name the lines which are concurrent at the point
(a) A **(b)** O **(c)** B
Name also the sets of collinear points.



18. Write :



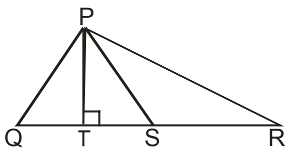
(i) All pairs of parallel lines.
(ii) All pairs of intersecting lines.
(iii) Lines whose point of intersection is L.

19. Take three noncollinear points A, B and C on a page of your notebook. Join AB , BC and CA. What figure do you get ?
Name :

(i) the side opposite to $\angle C$
(ii) the angle opposite to the side BC
(iii) the vertex opposite to the side CA
(iv) the side opposite to the veretx B

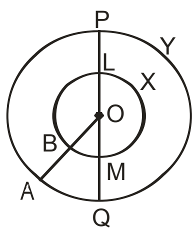
20. In a quadrilateral , define each of the following :
(a) Sides
(b) Vertices
(c) Angle
(d) Diagonals
(e) Adjacent sides
(f) Adjacent angles
(f) Opposite angles
(g) Opposite sides

21. In the given triangle, S is mid point of QR :



(i) The side opposite to vertex P, in ΔPQR.
(ii) The altitude from vertex P, in ΔPQR.
(iii) The angle opposite to side PQ, in ΔPQT.
(iv) The vertex opposite to side PR in ΔPQR.
(v) The median from vertex P, in ΔPQR.

22. O is the centre of the two circles in the figure drawn below. Fill up the blanks in the following :



(i) __________are radii of the inner circle.

(ii) OA, OQ, OP are the___________ of the _____circle.

(iii) LM is a __________ of the __________ circle.

(iv) PQ is a _______ of the _______circle.

(v) The two circles are called ___________ circles.

(vi) LXM is a _________of the _________circle.

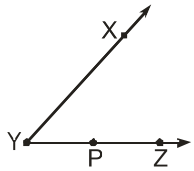
(vii) POA is a _________ of the ________circle.

EXERCISE 02

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

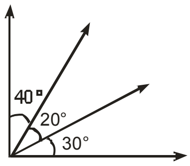
MULTIPLE CHOICE QUESTIONS

1. In given figure $\angle XYZ$ cannot be written as



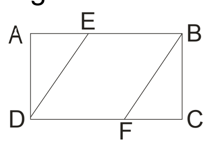
(A) $\angle Y$ (B) $\angle ZXY$ (C) $\angle ZYX$ (D) $\angle XYP$

2. The number of angles in given figure is



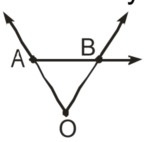
(A) 3 (B) 4 (C) 5 (D)6

3. Which of the following pair of line segments are not parallel , as shown in the figure ?



(A) AD, BC (B) AE, FC (C) DE , BF (D) AB , BC

4. Which of the following does not represent a ray in the given figure ?

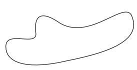
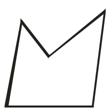
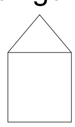
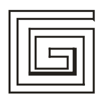


(A) OA (B) OB (C) BA (D) AB

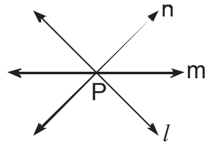
5. The end points of a diameter of a circle divide the circle into two parts, each of which is known as

(A) segment (B) sector (C) semi-circle (D) quadrant

6. Tell, which of the following is not a simple closed figure

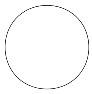
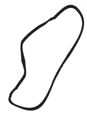
(A)  (B)  (C)  (D) 

7. In the given figure , lines l , m and n have been drawn passing through P. Can we draw more lines through P . If yes, how many ?



(A) None (B) One (C) Five (D) Infinite

8. Which of the following figures has linear boundaries ?

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

9. Set of points extending infinitely in all directions on the same flat surface

(A) line (B) plane (C) line segment (D) point

10. A line segment $\overline{AB}$ = 4.6 cm. Another $\overline{CD}$ = 3.8 cm. Then measure of the line segment whose length is equal to the difference of $\overline{AB}$ and $\overline{CD}$.

(A) 1.8 cm (B) 2.8 cm (C) 0.8 cm (D) 8.4 cm

11. Number of line segments possible with three collinear points is

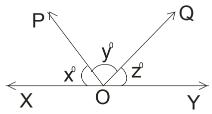
(A) 1 (B) 2 (C) 3 (D) infinite

12. Number of arcs made by a chord on a circle

(A) 3 (B) 2 (C) one (D) none

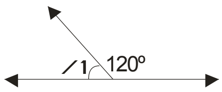
SECTION -B (TECHIE STUFF)

13. In figure, x : y : z = 5 : 4 : 6. If XOY is a straight line the values of x is



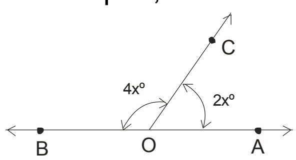
(A) 42° (B) 48° (C) 72° (D) 60°

14. In the given figure, the measure of angle $\angle 1$ is



(A) 90° (B) 60° (C) 120° (D) 30°

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



(A) 30° (B) 60° (C) 40° (D) 50°

16. An angle is 14^0 more than its complementary angle, then the angle is

(A) 38° (B) 14° (C) 50° (D) 52°

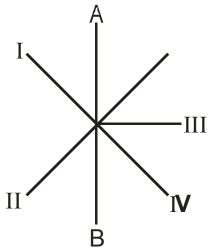
17. If the supplement of an angle is three times its complement, then the angle is

(A) 45° (B) 135° (C) 180° (D) 60°

EXERCISE 03

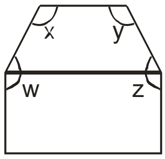
(PREVIOUS YEAR EXAMINATION QUESTIONS)

1. Which of the following lines is perpendicular to line AB? **[NSTSE 2010]**



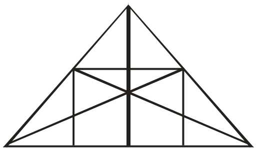
(A) IV (B) III (C) II (D) I

2. The figure below is made up of a trapezium and a rectangle. Find the sum of $\angle w + \angle x + \angle y + \angle z$. **[NSTSE 2010]**



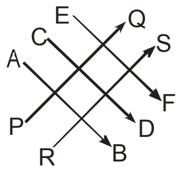
(A)360° (B)450° (C) 540° (D) 720°

3. The number of straight lines in the given figure are: **[NSTSE 2010]**



(A)9 (B) 10 (C)14 (D)32

4. Which of the lines in the given fig are parallel to line PQ? **[NSTSE 2011]**



(A) AB (B) CD (C) EF (D) RS

5. PQRS is straight line. PQ = 2cm and PS = 40 cm. If PR : RS = 7 : 3, then QR in cms is : **[NSTSE 2011]**

(A) 12 (B) 10 (C) 26 (D) 28

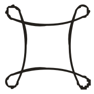
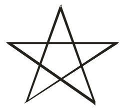
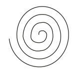
6. Count the number of line segments. **(IMO 2011)**

(A) 8 (B) 12 (C) 10 (D) 13

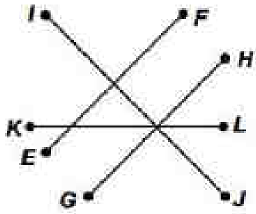
7. The centre of the circle always lie in the interior of a **[NSTSE 2012]**

(A) semi-circle (B) minor segment
(C) major segment (D) minor arc

8. Which of the following is a simple closed figure ? **[NSTSE 2012]**

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

9. Raghav drew the line segments shown here on a piece of paper. Which of the following pairs of line segments appears to be perpendicular? **(IMO 2012)**

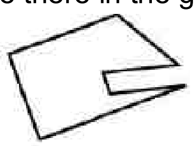


(A) $\overline{GH}$ and $\overline{KL}$ (B) $\overline{GH}$ and $\overline{IJ}$ (C) $\overline{EF}$ and $\overline{KL}$ (D) $\overline{EF}$ and $\overline{GH}$

10. By joining any two points on the circumference of a circle, we obtain a ____________ **(IMO 2012)**

(A) Diameter (B) Chord (C) Radius (D) Circumference

11. How many pairs of parallel lines are there in the given figure? **(IMO 2012)**



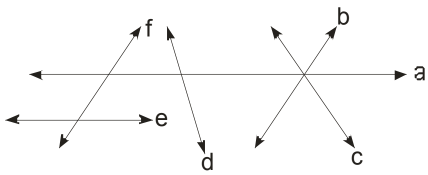
(A) 2 (B) 4 (C) 3 (D) 5

12. Fill in the blank: **(IMO 2013)**

A_________ of a circle is a region in the interior of the circle enclosed by an arc and a chord.

(A) Sector (B) Radius (C) Segment (D) Area

13. Which of the following lines is a transversal ? **[NSTSE 2014]**



(A) Line b (B) Line f (C) Line a (D) Line d

14. P, Q, R and S are four collinear points. If PQ > RS , which of the following must be true ? **[NSTSE 2014]**

I.	PQ > QR
II.	PR > QS
III.	PR > RS

(A) II only (B)I only (C) II and III only (D) III only

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	16	17	18	19	20
Ans.	D	B	A	C	A	A	B	A	B	A	A	C	C	B	C	C	D	C	D	B
Ques.	21	22	23	24	25															
Ans.	C	C	D	C	A															

FILL IN THE BLANKS

1. fixed **2.** one **3.** no **4.** fixed

5. can **6.** degree **7.** Intersecting **8.** 3,3,3

9. Points **10.** Sides **11.** Diagonal **12.** passes through

13. chord **14.** sector **15.** Semi-circle **16.** Secant

TRUE / FALSE

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

5. True **6.** True **7.** True **8.** False

9. False **10.** False **11.** True **12.** False

13. True **14.** True **15.** True **16.** False

MATCH THE COLUMN

1. (A) - u, (B)- q , (C)-s , (D)-v , (E)-t , (F)-r , (G)-p

2. (A) - s , (B) - q , (C) - p , (D)-t , (E)- r

SECTION -B (FREE RESPONSE TYPE)

VERY SHORT ANSWER TYPE

1. 0 **2.** 3 **3.** edges of table , scissor, legs of chair

4. Open figure : (a) and (c), Close figure : (b), (d) and (e)

5. **(a)** r **(b)** u,v **(c)** no point

6. $\angle A$, $\angle B$, $\angle C$, $\angle D$

7. Line Segments - AB , AE, ED,DC,CB,AC,AD
Vertices - A,B,C,D,E

9. circle

SHORT ANSWER TYPE

11. **(a)** infinite **(b)** one only **(c)** three

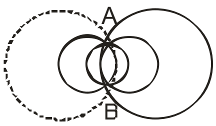
12. Angles which have C as vertex are ∠DCM, ∠MCN, ∠NCB, ∠DCN, ∠MCB, ∠DCB

13. **(a)** 3 **(b)** 4 **(c)** 5

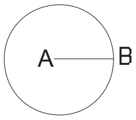
14. **(i)** AC, BD **(ii)** (AB, CD) ; (AD,BC)
(iii) (∠A , ∠C) ; (∠B , ∠D) **(iv)** (AB, BC) ; (BC,CD)
(v) (∠A,∠B) ; (∠B , ∠C)

15. **(a)** Circumference **(b)** Radius **(c)** Chord
(d) Center **(e)** Diameter **(f)** Arc
(g) Sector **(h)** Segment

16. **(a)** Many circles can be drawn both ponts A and B.



(b) Only one circle can be drawn with center A and AB as radius.



LONG ANSWER TYPE

17. **(a)** lines which are concurrent at A are DA, CA, AB
(b) At O are BD, AC, RP, SQ
(c) At B are DB, CB, AB

18. Figure from one
(i) (l,m) (m,n) (l,n)
(ii) (l,r) (m, r) (n,r) (l,q) (m,q) (n,q) (p,l) (p,m) (p,n),(p,q) ,(p,r)
(iii) (m,p)

19. **(i)** AB **(ii)** ∠A **(iii)** B **(iv)** AC

20. In a quadrilateral , define each of the following :
(a) Sides **(b)** Vertices **(c)** Angle
(d) Diagonals **(e)** Adjacent sides **(f)** Adjacent angles
(f) Opposite angles **(g)** Opposite sides

21. **(i)** The side opposite to vertex P in ΔPQR is QR
(ii) The altitude from vertex P, in ΔPQR is PT
(iii) The angle oppotite to side PQ, in ΔPQT is ∠PTQ
(iv) The vertex opposite to side PR in ΔPQR is Q
(v) The median from vertex P in ΔPQR is PS

22. **(i)** OB, OM, OL **(ii)** radii, outer **(iii)** diameter, inner
(iv) diameter, outer **(v)** concentric **(vi)** semicircle, inner
(vii) sector, outer

EXERCISE 02

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

MULTIPLE CHOICE QUESTIONS

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

EXERCISE 03

(PREVIOUS YEAR EXAMINATION QUESTIONS)

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ans.	B	C	A	D	C	C	C	A	B	B	C	C	B	C