MATHEMATICS

Class-VI

Topic-10

UNDERSTANDING ELEMENTARY SHAPES

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CHAPTER 10 UNDERSTANDING ELEMENTARY SHAPES

TERMINOLOGIES

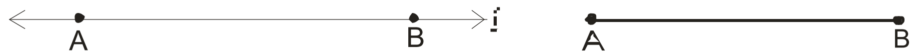
Congruent segment, magnitude of an angle, degree measure of an angle, congruent angles, perpendicular lines, perpendicular bisector, solid figures

INTRODUCTION

We have learnt about points, lines, planes, rays, angles etc. We also studies about curves and polygons. In this chapter we shall learn about the shapes of cubes, cuboids, cylinders etc. which are made by them.

10.1 LINE SEGMENT, CONGRUENT SEGMENT AND ANGLES

In the given fig. l is a line and A and B are two points on it. The portion of the line from A to B is a line segment AB.



NOTE:

(a) Two distinct points in a plane determine one and only one line segment.
(b) A line segment is completely known if its end points are given.
(c) A line segment has length but no breadth or thickness.

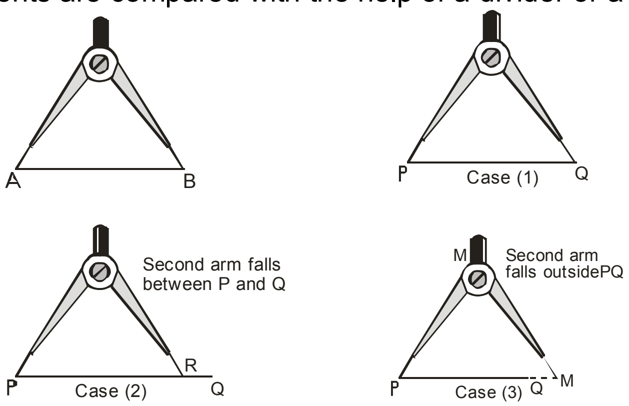
(a) Comparison Of line Segment

Comparison of two line segments means finding an order (relation) between their lengths, i.e. which of them is longer than the other.
(Comparison by observation)

The method of comparing two segments by observations is not always correct. Therefore, we need a better method.

(b) Comparison By Divider Or Compass

The line segments are compared with the help of a divider or a pair of compasses.



STEP 1.
Place the end point of one arm of the divider at A.

STEP 2.
Open the divider so that the end point of the other arm reaches the other point B.

STEP3. Lift the divider and without disturbing its opening ,place the end-point of one arm at P.

Now three cases might arise :

Case1. The second arm of the divider falls on Q.In this case , we say that the length of AB and PQ are equal i.e. AB = PQ .

Case2. The second arm falls at a point R between P and Q. In this case , we conclude that AB is shorter than PQ i.e. AB < PQ .

Case3. The second arm falls at a point M outside PQ . In this case ,we conclude that AB is longer than PQ and AB > PQ.

(c) Units For Measurement Of Line Segment

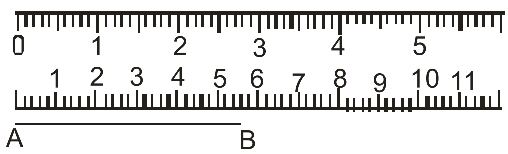
In 1962 India started adopting S.I. units and the unit of measurement of length was changed to metre.
A metre is divided into 100 equal parts, each called a centimetre. A centimetre is further subdivided into 10 equal parts, each called a millimetre.
Thus we have the following table :
10 Millimetres (mm) = 1 Centimetre (cm)
10 Centimetres(cm) = 1 Decimetre (dm)
10 Decimetres (dm) = 1 Metre (m)
or
1 metre = 10 decimetres = 100 centimetres = 1000 millimetres
Length of the segments in geometry are measured with the help of a straight edged ruler.

(d) Measurement Of Length Of A Line Segment

(i) Using a ruler **(ii)** Using a divider or a compass

(i) Using Ruler :

Suppose we have to measure the length of a given line segment AB. Take a ruler with centimetre marks and place it along the line segment AB such that the

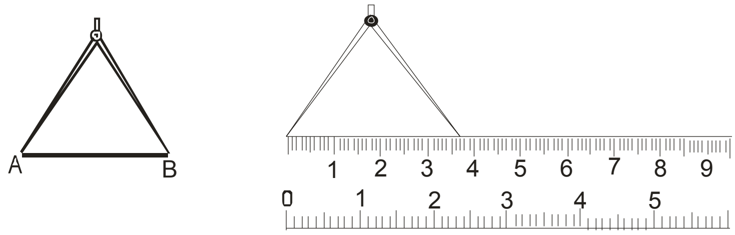


zero mark on the ruler is just at A as shown in the figure. Now read the mark on the ruler which corresponds to B. In this figure we see that the mark corresponding to B is the eighth small division after 5, i.e. AB contains 5 full centimeters and 8 millimeters. We say that the length of AB is 5.8 cm and write it as AB = 5.8 cm.

(ii) Using A Divider Or A Compass :

We open the divider such that the point of one arm is at A and the second exactly at B, i.e. the segment AB is contained in the divider. Now lift the divider carefully without disturbing its opening and place it on the ruler so that one point of the divider is at zero (0) mark. We then read the mark which corresponds to the second point of the divider.

In the adjoining figure the second point of the divider is at the seventh mark after 3, i.e. AB contains 3 complete centimetres and seven-tenths of a centimetre. We say that AB is 3 cm and 7 mm and write it as AB = 3.7 cm.



(e) Congruent Segment

Two segments are equal or congruent if they are of the same length.

Illustration 10.1

If B is the mid point of AC and C is the mid-point of BD where A, B, C and D are collinear, show that AB = CD ?

Sol. B is the mid-point of AC

$\therefore$ AB = BC ....(i)

Again C is the mid-point of BD

CD = BC ....(ii)

From (i) and (ii), we get

AB = CD

(f) Angles

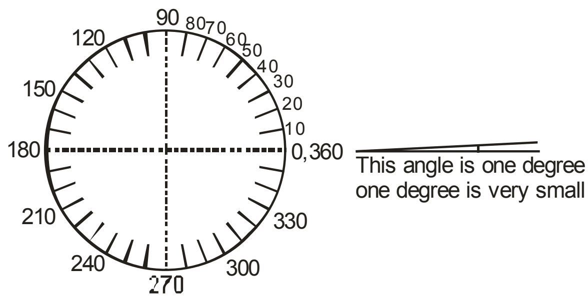
(i) Magnitude Of An Angle

Magnitude of an angle is the amount of rotation through which one of the arms must be rotated about the vertex to bring it to the position of the other arm.

(ii) Degree Measure Of An Angle :

Many centuries ago in Babylonia, it was decided to divide circles into 360 equal parts and to use one of the 360 parts, or $\frac{1}{360}$, as a unit. This unit is still used today and is called degree.

Instead of spelling out the words degree or degrees, we usually use the sign(°).



The drawing above shows a circle divided into 360 equal parts. The numerals label the marks for each of 10 arcs, beginning at 0. **The arc from 0 to1 is a 1-degree arc.** 1° is read "one degree". The arc from 0 to 10 is a 10-degree arc.

Illustration 10. 2

What is the measure of the arc from 0 to 20 ?

Sol. The measure of the arc from 0 to 20 is 20°

Illustration 10.3

What fractional part of the circle is the 90 – degree arc from 0 to 90 ?

Sol. $\frac{90}{360}$, i.e. $\frac{1}{4}$

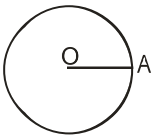
Illustration 10.4

Is a 180-degree arc, $\frac{1}{2}$ of the circle ?

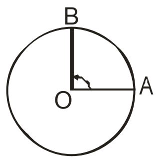
Sol. $\frac{180}{360} = \frac{1}{2}$

Yes ,180-degree arc is $\frac{1}{2}$ of the circle.

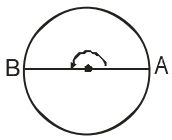
The following illustrates the number of degrees in angles of standard rotations.



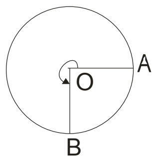
Starting position (0°)



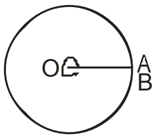
$\frac{1}{4}$ rotation (90°)



$\frac{1}{2}$ rotation (180°)



$\frac{3}{4}$ rotation (270°)



1 complete rotation (360°)

Illustration 10.5

What fraction of a revolution does the hour hand of a clock turn clockwise when it goes from

(a) 3 to 9 **(b)** 6 to 3 **(c)** 2 to 5

Sol. **(a)** Half **(b)** 3 quarters **(c)** quarter

Illustration 10.6

Where will the hour hand of a clock stop if it starts at:

(a) 12 and makes $\frac{1}{2}$ revolution, clockwise

(b) 5 and makes $\frac{1}{4}$ revolution, clockwise

(c) 7 and makes $\frac{3}{4}$ revolution, clockwise

Sol. **(a)** For 1 revolution, hour hand takes 12 hours

For $\frac{1}{2}$ revolution, hour hand takes $\frac{1}{2} \times 12$ or 6 hours.

$\therefore$ It will stop at 6.

(b) For $\frac{1}{4}$ revolution, hour hand takes $\frac{1}{4} \times 12$ or 3 hours.

$\therefore$ It will stop at 8.

(c) For $\frac{3}{4}$ revolution, hour hand takes $\frac{3}{4} \times 12$ or 9 hours.

$\therefore$ It will stop at 4.

Illustration 10.7

How many degrees are there in 2 right angles ?

Sol. $\therefore$ 1 right angle = 90º

$\therefore$ 2 right angles = 2 × 90º = 180º

(iii) Congruent Angles

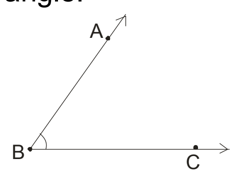
If the measure of two angles are equal, the angles are called Congruent (or equal) angles . For example, if $\angle ABC = 45^\circ$ and $\angle DEF = 45^\circ$, then $\angle ABC = \angle DEF$ i.e. $\angle ABC$ is congruent to $\angle DEF$.

(iv) Kinds Of Angles

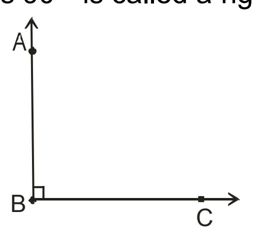
Angles are classified according to their degree measure.

(a) An angle which measures greater than 0º and less than 90º is called an **acute angle.**

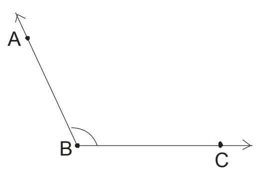
In Fig. $\angle ABC$ is an acute angle.



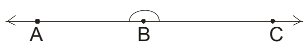
(b) An angle which measures 90º is called a right angle. In Fig. $\angle ABC$ is a right angle.



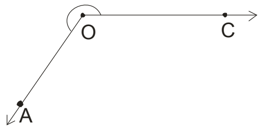
(c) An angle which measures greater than 90° and less than 180° is called an obtuse angle. In Fig. $\angle ABC$ is an obtuse angle.



(d) An angle which measures 180° is called a straight angle in figure. $\angle ABC$ is a straight angle.



(e) An angle which measures greater than 180° and less than 360° is called a reflex angle. ∠AOC is a reflex angle.

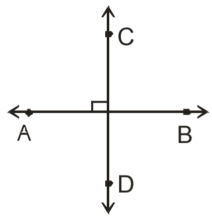


(f) An angle which measures 360° is called a complete angle. ∠AOB is a complete angle.

(g) An angle which measures 0° is called a zero angle. ∠AOB is a zero angle.

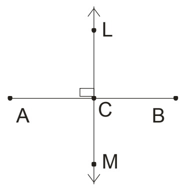
(g) Perpendicular Lines

Two lines are said to be perpendicular if the angle between them measures 90°. Line AB is perpendicular to CD , also we can say line CD is perpendicular to AB. Represented as $\overleftrightarrow{AB} \perp \overleftrightarrow{CD}$



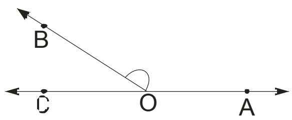
(h) Perpendicular Bisector

A line perpendicular to the given line segment as well as bisects it, is called perpendicular bisector. Line LM is perpendicular bisector of line segment AB.



Ask yourself

1. From the given figure , write an obtuse angle and an acute angle. What does their sum represent ?

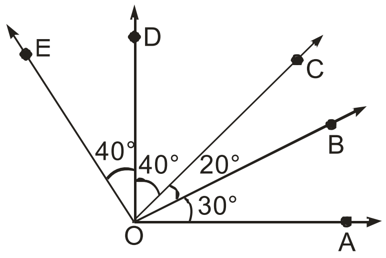


2. Find the angles between the hands of a clock at (a) 7 O'clock (b) 3:30 O'clock

3. What is the time on the clock when the hour hand moves clockwise
(a) 60º from 5 O'clock **(b)** 180º from 10 O' clock
(c) 270º from 12 O'clock

4. Through how many degrees does the minutes hand of a clock turn in :
(a) 1 minute **(b)** 8 minutes **(c)** 1 hour

5. In figure



(a) ∠AOD is a/ an _____ angle **(b)** ∠COA is a/ an _____ angle

(c) ∠AOE is a/ an _____ angle

Answers

1. ∠ AOB , ∠ BOC , ∠ AOB + ∠ BOC = 180° **2.** (a) 150° (b) 90°

3. **(a)** 7 O'clock **(b)** 4 O' clock **(c)** 9 O'clock

4. **(a)** 6° **(b)** 36° **(c)** 360°

5. **(a)** 90° **(b)** 50° **(c)** 130°

10.2 POLYGON

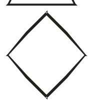
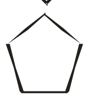
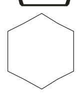
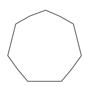
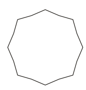
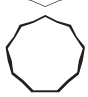
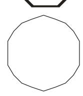
A polygon is a plane closed figure made up of lines segments.
The minimum number of sides of a polygon is 3. A polygon can have more than 3 sides.

NOTE :

Number of sides of a polygon are equal to its number of angles.

(a) Classification Of Polygon

We name the polygon according to the number of sides as follows :

No. of sides	**Name**	**Figure**
3.	Triangle	
4.	Quadrilateral	
5.	Pentagon	
6.	Hexagon	
7.	Heptagon	
8.	Octagon	
9.	Nonagon	
10.	Decagon	

Regular polygon :

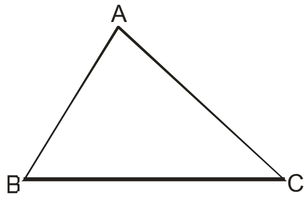
A polygon is called regular if all its sides are equal in length and all angles are equal in measure.

(b) Classification of Triangles

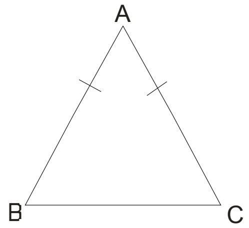
We know that a triangle is a polygon of 3 sides. It has 3 angles and 3 sides. So we classify triangles according to sides as well as according to angles.

(i) According To Sides

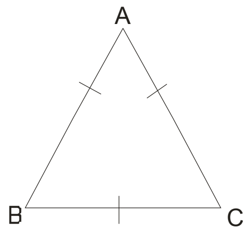
(1) Scalene Triangle : If all the sides of a triangle are unequal in length, it is called a scalene triangle.



(2) Isosceles Triangle : If two sides of a triangle are equal. It is called an isosceles triangle.

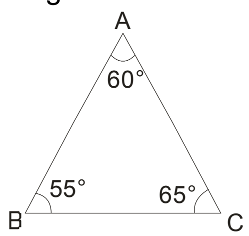


(3) Equilateral Triangle : If all the three sides of a triangle are equal, it is called equilateral triangle. AB = AC = BC, so ΔABC is an equilateral triangle.

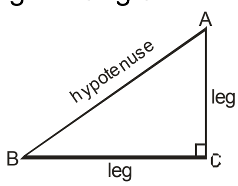


(ii) According To Angles

(1) Acute angled Triangle : A triangle whose all angles are acute is known as an acute angled triangle or simply acute triangle.

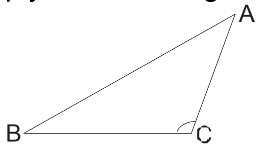


(2) Right angled Triangle : A triangle whose one of the angles is a right angle is called a right angled triangle or simply a right triangle.



The side opposite to the right angle is called the hypotenuse and the other two sides are called the legs of the triangle.

(3) Obtuse angled Triangle : A triangle whose one of the angles is obtuse angle is called an obtuse angled triangle or simply obtuse triangle.



(iii) Relation between Sides and Angles of a Triangle:

(a) The angles of a scalene triangle are unequal.

(b) In an isosceles triangle, two angles are equal.

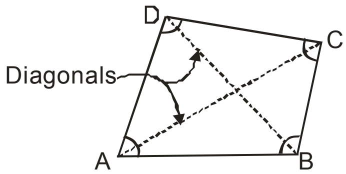
(c) All the angles of an equilateral triangle are equal.

(d) If two angles of a triangle are equal then the sides opposite to them are also equal.

(e) A right angled triangle with two sides equal is called an isosceles right angled triangle.

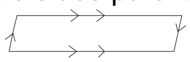
(c) Classification Of quadrilateral

We know that a quadrilateral is a polygon of 4 sides. In other words, a quadrilateral is a closed plane figure with four sides. A quadrilateral is named by taking its vertices in order either clockwise or anticlockwise direction. ABCD is a quadrilateral. The line segments AC and BD are its diagonals.

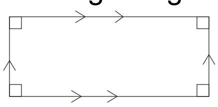


The classification of six types of quadrilaterals is summarised as below :

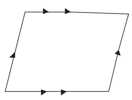
(i) Parallelogram: 2 pair of opposite sides parallel



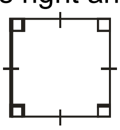
(ii) Rectangle: Parallelogram with all angles right angles



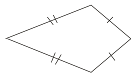
(iii) Rhombus : Parallelogram with all 4 sides equals



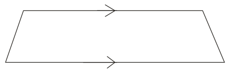
(iv) Square : Rhombus with all angles right angles



(v) Kite : 2 pair of adjacent sides equal



(vi) Trapezium :1 pair of opposite sides parallel



Ask yourself

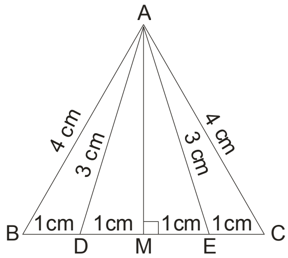
1. Classify the triangles the measures of whose sides are given below as scalene , isosceles or equilateral:

(a) 6 cm , 8cm , 10cm **(b)** 5.8cm , 7cm , 5.8cm
(c) 6.9cm , 8.3cm , 9.2cm **(d)** 4.5cm , 4.5cm , 4.5cm

2. Classify the triangles whose angles have measure as under as acute , obtuse or right.

(a) 58º , 83º , 39º **(b)** 65º , 95º , 20º
(c) 46º , 90º , 44º **(d)** 56º , 48º , 76º

3. Study the figure given below and answer the following questions :

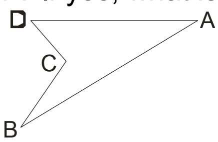


(a) Name the equilateral triangles. **(b)** Name the isosceles triangles.
(c) Name the acute triangles. **(d)** Name the right triangles

4. Name the types of the following triangles :

(a) Triangle with sides 6cm , 4cm , and 5cm
(b) ΔABC with $\angle B = 120^\circ$
(c) ΔPQR with PQ = QR = RP = 5cm
(d) ΔDEF with DE = EF = 4cm and DF = 6cm
(e) A triangle with all angles equal.

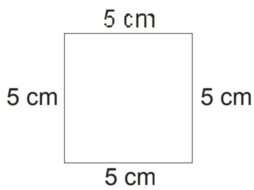
5. Is ABCD of given figure a polygon ? If yes, what is the special name for it ?

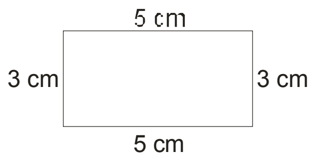


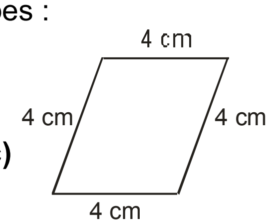
6. Fill in the blanks:

(a) A polygon is a simple closed figure formed by more than ______
(b) A polygon formed by four line segments is called a ________
(c) A quadrilateral has _____ sides and ________ angles.

7. Classify the following quadrilaterals on the basis of their shapes :

(a) 

(b) 

(c) 

8. The angles of a quadrilateral are in the ratio 1:2:3:4. Find the measures of each of the four angles

Answers

1.	**(a)** Scalene	**(b)** Isosceles	**(c)** Scalene	**(d)** Equilateral
2.	**(a)** Acute	**(b)** Obtuse	**(c)** Right	**(d)** Acute

3. **(a)** ∆ BAC **(b)** ∆ DAE , ∆ BAC **(c)** ∆ ADE , ∆ BAC
(d) ∆ AMB , ∆ AMD , ∆ AME , ∆ AMC

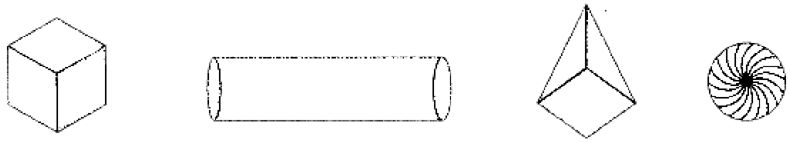
4. **(a)** Scalene **(b)** Obtuse **(c)** Equilateral **(d)** Isosceles
(e) Equilateral

5. Yes, Concave Polygon **6.** **(a)** Two line segment **(b)** Quadrilateral **(c)** 4 , 4

7. **(a)** Square **(b)** Rectangle **(c)** Rhombus **8.** 18° , 36° , 54° , 72°

10.3 SOLID FIGURES

A Closed figure which lies in more than one plane is called a **space figure** or a **solid figure.**
The figures such as cube, cuboid, cylinder, pyramid, etc., which have three dimensions, namely length, breadth and height are called solid figures or 3-dimensional figures.



Solid figures (Three dimensional figures)

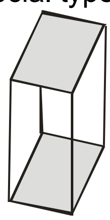
(a) Faces , Edges And Vertices Of Solid Figures

- The surface of a solid is called its face.
- An edge is a line segment that is the inter-section of two faces.
- A corner or vertex in a solid shape is the point where the faces meet.

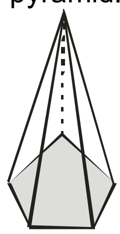
(b) Types Of Solid

There are mainly three types of solid :

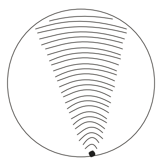
(i) Prism : A solid whose base and top are identical polygons and side faces are rectangles, is called a **prism**. In a square prism whose base and top are congruent squares. Cuboid, cube etc. are all special types of prisms.



(ii) Pyramid : A solid whose base is any polygon and side faces are triangles, is called a **pyramid**. Figure shows a pentagonal pyramid.



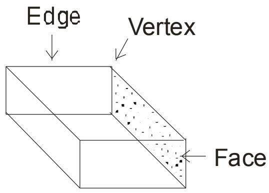
(iii) Sphere : Sphere is a solid whose every point is equidistant from a fixed point. Figure shows the sphere.



NOTE

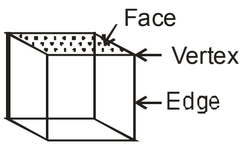
- All the side faces of a pyramid (triangular, rectangular, squares, pentagonal etc.) are triangular.
- A pyramid is named according to the shape of its non-triangular face. If all the faces are triangular, then it is called a triangular pyramid or tetrahedron.

(iv) Cuboid : A cuboid has



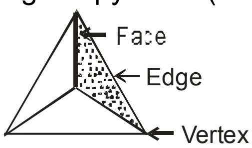
(1) 6 rectangular faces **(2)** 12 edges **(3)** 8 vertices.

(v) Cube (Square prism) : A cube has



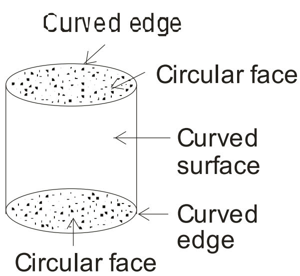
(1) 6 square faces **(2)** 12 edges **(3)** 8 vertices

(vi) Triangular Pyramid : A triangular pyramid (Tetrahedron) shown in fig. has :



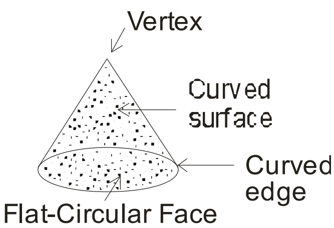
(1) 4 faces **(2)** 6 edges **(3)** 4 vertices

(vii) Cylinder : A cylinder has

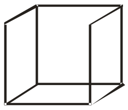
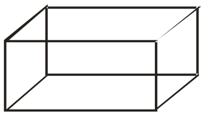
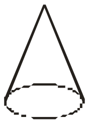
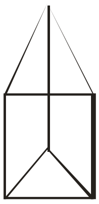
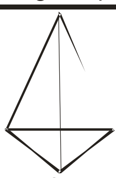
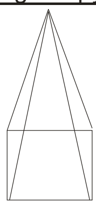
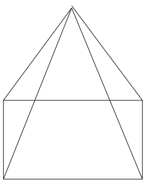


(1) no vertex **(2)** two circular faces
(3) one curved face **(4)** two curved edges

(viii) Cone : A cone has



❖ Following table provides the details of the number of faces, edges and vertices of some solids.

Solid	No. of faces	No. of vertices	No. of edges
 Cube	6	8	12
 Cuboid	6	8	12
 Cylinder	3	—	2
 Cone	2	1	1
 Sphere	1	—	—
 Triangular prism	5	6	9
 Triangular pyramid	4	4	6
 Square pyramid	5	5	8
 Rectangular pyramid	5	5	8

Ask yourself

1. Identify the shapes of
   (a) Geometry box (b) Brick
   (c) Match box (d) Road roller

2. Write number of faces, vertex and edges of the three dimensional shapes mentioned here.
   (a) Cylinder (b) Cone (c) Triangular Prism
   (d) Triangular Pyramid (e) Square Pyramid
   (f) Cube (g) Cuboid

3. Give two examples each of
   (a) Cylinder (b) Cone (c) Cuboid (d) Cube

4. Which solid figure has 6 faces that are the same size and shape ?

5. (a) What is the shape of a round marble ?
   (b) What is the shape of a basket- ball?

Answers

1. **(a)** Cuboid **(b)** Cuboid **(c)** Cuboid **(d)** Cylinder

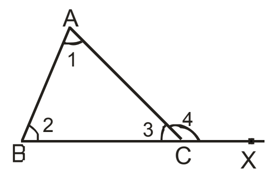
2. **(a)** 3 , 0 , 2 **(b)** 2 , 1 , 1 **(c)** 5 , 6 , 9 **(d)** 4 , 4 , 6
   (e) 5 , 5 , 8 **(f)** 6 , 8 , 12 **(g)** 6 , 8 , 12

4. Cube

5. **(a)** Cylinder **(b)** Sphere

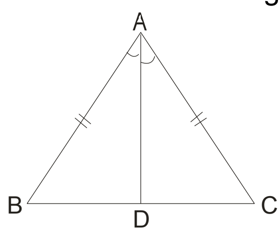
Add your knowledge

(a) If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the interior opposite angles.



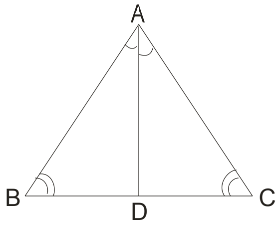
$\angle ACX = \angle BAC + \angle ABC$

(b) Angles opposite to equal sides of an isosceles triangle are equal.



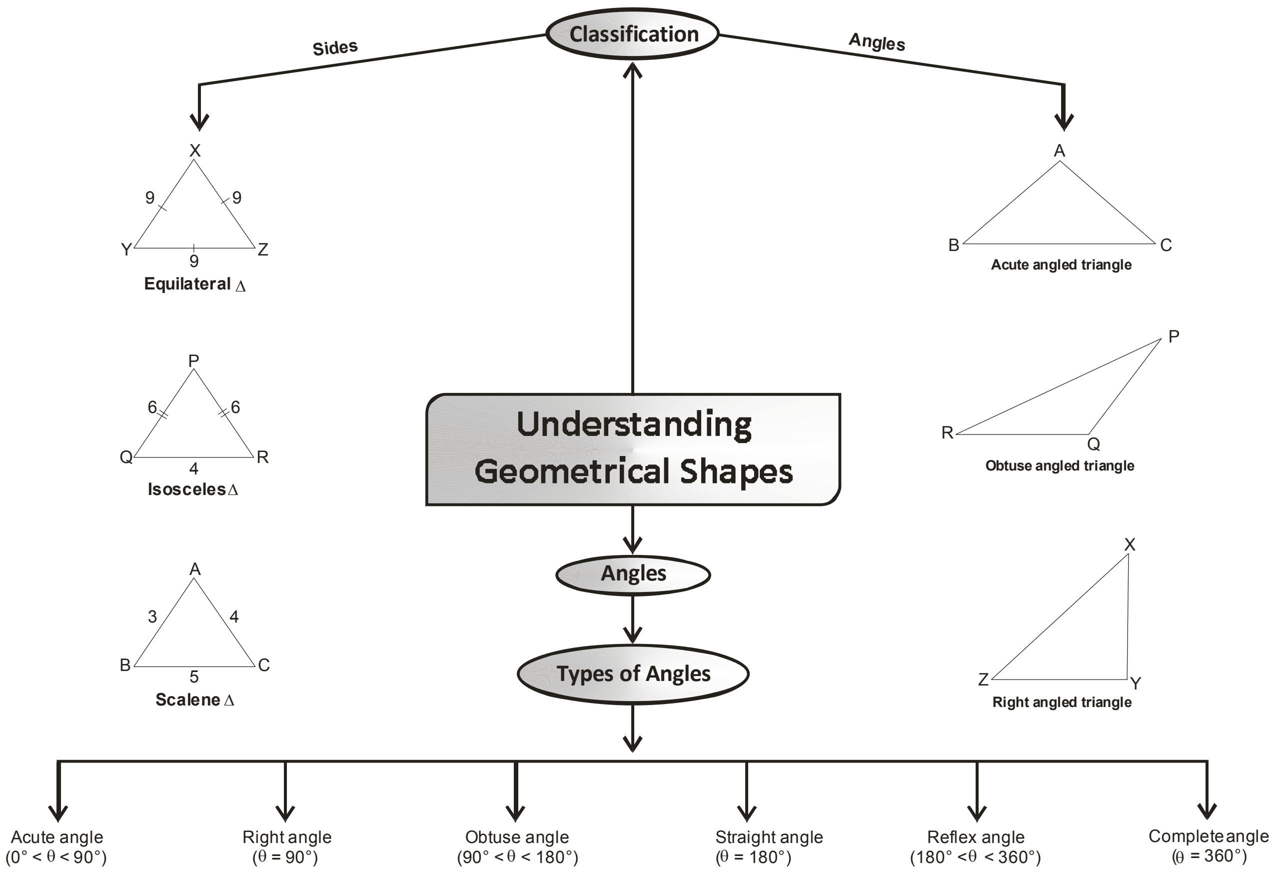
If, AB = AC. **Then** ,$\angle B = \angle C$.

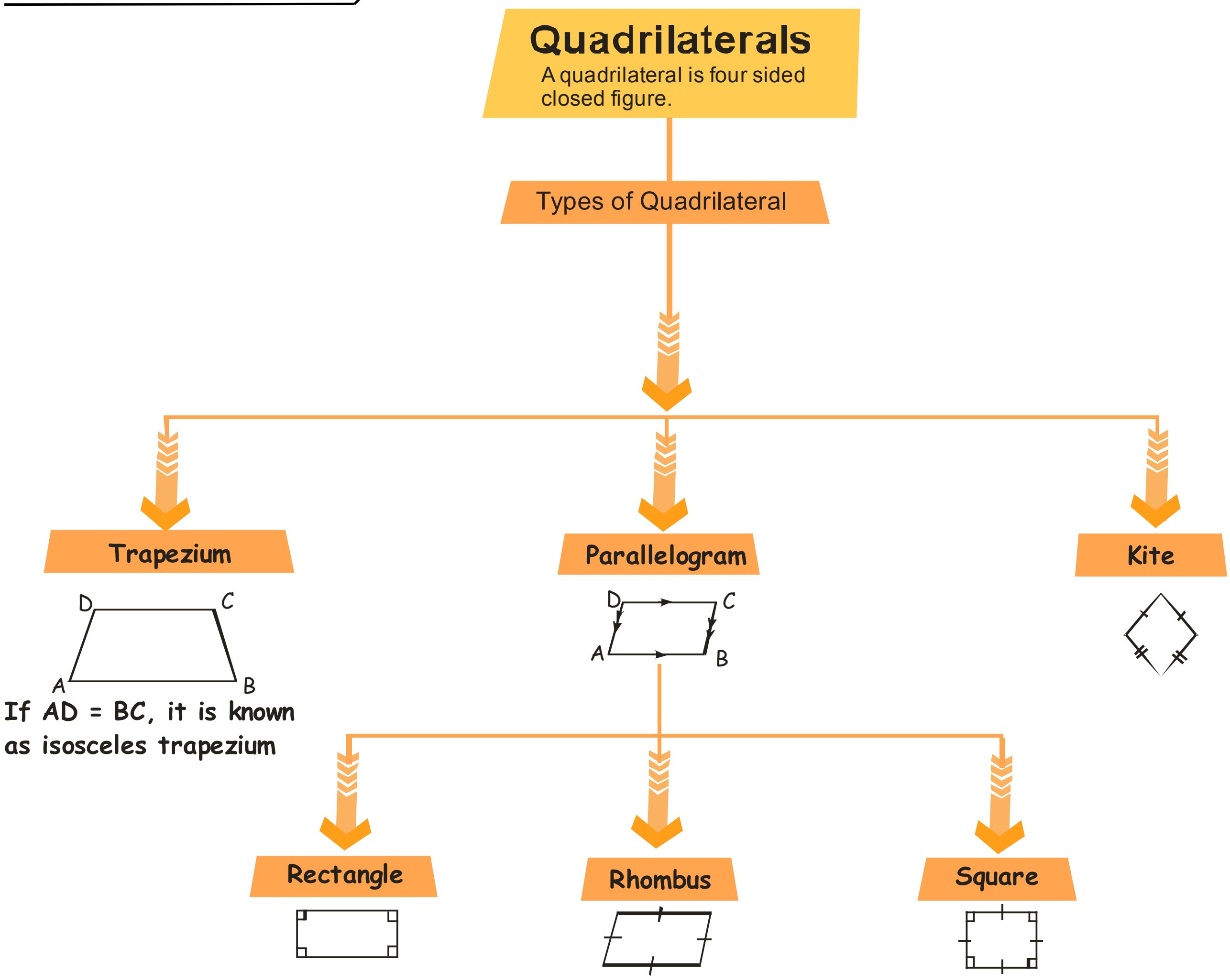
(c) If two angles of a triangle are equal, then sides opposite to them are also equal.



If, $\angle B = \angle C$. **Then**, AB = AC.

Concept Map




Quadrilaterals
A quadrilateral is four sided closed figure.
Types of Quadrilateral
Trapezium
D
C
A
B
If AD = BC, it is known as isosceles trapezium
Parallelogram
D
C
A
B
Kite
Rectangle
Rhombus
Square

Summary

1. The minute hand describes an angle of 360° in one complete round.

2. Different kinds of angles are :
   - **(a)** Zero angle **(b)** Acute angle **(c)** Right angle **(d)** Obtuse angle
   - **(e)** Straight angle **(f)** Reflex angle **(g)** Complete angle

3. Different kinds of triangles are :

   According to sides:

   (a) Scalene **(b)** Isosceles **(c)** Equilateral

   According to angles :

   (a) Acute angled **(b)** Obtuse angled **(c)** Right angled

4. Two lines are said to be perpendicular if the angle between them measure 90°

5. Different kinds of quadrilaterals are :
   - **(a)** Trapezium **(b)** Parallelogram **(c)** Rectangle
   - **(d)** Rhombus **(e)** Square **(f)** Kite

6. A polygon is a plane closed figure made up of line segments.

7. A polygon is called regular if all its sides are equal in length and all angles are equal in measure.

8. A closed figure which lies in more than one plane is called a **space figure** or a **solid figure.**

9. Cube , cuboid , sphere , cylinder , cone , pyramid , prism are all solids.

10. The surface of a solid is called its face.

11. An edge is a line segment that is the inter-section of two faces.

12. A corner or vertex in a solid shape is the point where the faces meet.

EXERCISE 01

SECTION -A (FIXED RESPONSE TYPE)

MULTIPLE CHOICE QUESTIONS

1. The angle between two opposite rays is
(A) right (B) obtuse (C) acute (D) straight

2. Which of the following is an obtuse angle?
(A) 92º (B) 181º (C) 195º (D) 83º

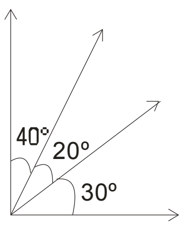
3. Which of the following letter of the alphabet is made up of only two lines which are perpendicular to each other?
(A) H (B) T (C) F (D) I

4. When two lines intersect and the angle between them is a right angle, then the lines are said to be
(A) coincident. (B) parallel.
(C) perpendicular. (D) perpendicular bisector.

5. An acute angle is formed between the hands of a clock at
(A) 9 O' clock (B) 4 O' clock (C) 11 O' clock (D) 6 O' clock

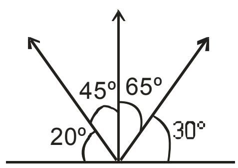
6. Measures of the two angles between hour and minute hands of a clock at 9 O' clock are
(A) 60º, 360º (B) 270º, 90º (C) 75º, 285º (D) 30º, 330º

7. The number of angles



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

8. The number of obtuse angles



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

9. If you are facing east and turn clock wise through 270º ,which direction would you face ?
(A) South (B) West (C) East (D) North

10. Through how many degree does the hour hand of a clock turn in 5 minutes ?
(A) $\frac{1}{2}^{\circ}$ (B) $3\frac{1}{2}^{\circ}$ (C) 5º (D) $2\frac{1}{2}^{\circ}$

11. In a triangle if the length of all the sides are different, then it is called a/an
(A) scalene triangle. (B) isosceles triangle.
(C) equilateral triangle. (D) right angled triangle.

12. Which quadrilateral is not a parallelogram?
(A) Rectangle (B) Trapezium (C) Square (D) Rhombus

13. Which of the following is a regular polygon ?
(A) Isosceles triangle (B) Rectangle
(C) Square (D) Scalene triangle

14. A figure is said to be regular, if its sides are equal in length and angles are equal in measure. Can you identify the regular quadrilateral ?
(A) Parallelogram (B) Rhombus (C) Square (D) Rectangle

15. Which of the following is NOT true?
(A) All rhombuses are parallelograms. (B) Some trapeziums are rectangles.
(C) All squares are rectangles. (D) Some rhombuses are squares.

16. Which solid does not have any square faces ?
(A) Cube (B) Cuboid (C) Cone (D) Square pyramid

17. Cricket ball is an example of a
(A) Cube (B) Cylinder (C) Cone (D) Sphere

18. Which solid has the greatest number of faces ?
(A) Cone (B) Cylinder (C) Triangular Prism (D) Cube

19. A cuboid has
(A) length only. (B) length and breadth only.
(C) length, breadth and height. (D) thickness only.

20. A square pyramid has
(A) 2 faces and 6 edges. (B) 4 faces and 6 edges.
(C) 5 faces and 8 edges. (D) 5 faces and 10 edges.

21. The surface of a solid is called :
(A) edge. (B) face. (C) vertex. (D) corner.

22. If a solid shape is completely bounded by plane faces. The least number of faces it may have is
(A) 4 (B) 5 (C) 6 (D) 3

FILL IN THE BLANKS

1. A line segment can be measured by an instrument called _______

2. We are facing North and we turn to east, the angle formed is ________

3. One complete revolution is a _______ angle.

4. When the sum of the measures of two angles is that of a right angle, then each one of them is ________

5. When the sum of the measure of two angles is that of a straight angle one of them should be obtuse or_____

6. What is the angle between the hands of the clock at 6 O'clock

7. The sum of the angles of a triangle is _______

8. Each angle of an equilateral triangle measures _______

9. If two angles of a triangle are 40º and 60º , then the third angle is _______

10. The sum of the angles of a Quadrilateral is _______

11. In a quadrilateral, number of sides are _______

12. A triangular pyramid has a triangular has its base. It has ______ faces, ______ edges, _______ vertices

13. A triangular prism has ______ faces, ______ edges, _______ vertices.

14. A square pyramid has a square has its base. It has ______ faces, ______ edges, _______ vertices.

15. A cone has ____ edges & _____ faces

16. A sphere has ___ edge.

TRUE / FALSE

1. If two angles are acute , their measures must be equal.

2. If an angle measures 45º , it is acute .

3. If one angle is acute and a second is obtuse , the measure of the second is larger than that of the first .

4. The angle between the directions north and south is a right angle .

5. If an angle measures twice that of an acute angle, it must be obtuse .

6. If the sides of a triangle are 4cm , 5cm and 7cm , then it is a isosceles triangle.

7. If the sides of a triangle are 3cm , 4cm and 5cm , then it is a right angled triangle.

8. There are 3 diagonals in a quadrilateral .

9. Each face of a cuboid has 4 edges.

10. A cone has two circular faces

11. A triangular pyramid has 8 edges.

12. Sphere is a solid figure with no edge and no vertex.

13. A brick has the shape of a cube

MATCH THE COLUMN

1. **Column – I** | **Column – II**

Column – I		Column – II	
(A)	Triangular Pyramid	(p)	8 vertex
(B)	Cylinder	(q)	1 vertex
(C)	Cone	(r)	No edge
(D)	Cube	(s)	2 edges
(E)	Sphere	(t)	4 faces

2.

Column – I		Column – II	
(A)	90°	(p)	Obtuse angle
(B)	45°	(q)	Complete angle
(C)	120°	(r)	Reflex angle
(D)	360°	(s)	Right angle
(E)	180°	(t)	Acute angle
(F)	270°	(u)	Straight angle

SECTION -B (FREE RESPONSE TYPE)

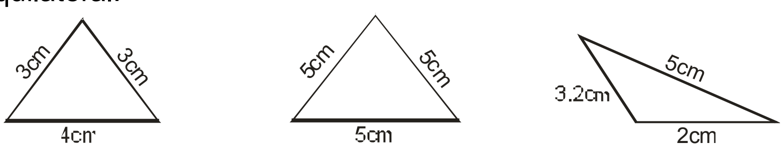
VERY SHORT ANSWER TYPE

1. Classify the angles whose magnitudes are given below :
(i) 122° **(ii)** 17° **(iii)** 89.9°
(iv) 257° **(v)** 360°

2. John turns right three times. How many degrees does he turn through?

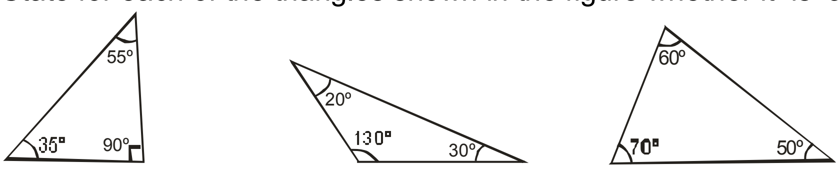
3. A boat is sailing N–E. A later it is formed sailing South. Through what angle has it turned ?

4. State for each of the triangles shown in the figure whether it is scalene ,isosceles or equilateral.



(i) **(ii)** **(iii)**

5. State for each of the triangles shown in the figure whether it is acute, right or obtuse:



(i) **(ii)** **(iii)**

6. **(a)** What is the shape of a round marble ?
(b) What is the shape of a basket- ball?

7. Define a face

SHORT ANSWER TYPE

8. How many degrees are there in :

(i) One right angle ? **(ii)** Two right angles ?

(iii) Three right angles ? **(iv)** $\frac{2}{3}$ right angle ?

9. The angles of a triangle are in the ratio 3:5:7 . Find the measure of these angles.

10. State the properties of rhombus

11. Two sides of a parallelogram are in the ratio 4:3 . If its perimeter is 56cm , find the lengths of its sides.

12. Can a triangle have

(i) two right angles? **(ii)** two obtuse angles?

(iii) two acute angles? **(iv)** each angle more than 60^o **?**

(iv) each angle equal to 60^o ?

13. Name each of the following parallelograms

(i) The diagonals are equal and the adjacent sides are unequal.

(ii) The diagonals are equal and the adjacent sides are equal.

(iii) The diagonals are unequal and the adjacent sides are equal.

14. Define :

(a) Face **(b)** Edge **(c)** Vertex

15. Give two basic differences between a prism & a pyramid.

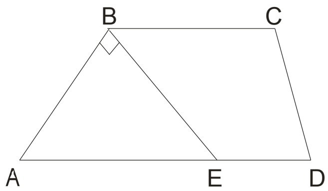
LONG ANSWER TYPE

16. Through how many degrees does the minute hand of a clock turn in :

(i) 8 minutes **(ii)** $\frac{3}{4}$ hour **(iii)** $1\frac{1}{2}$ hours

17. If BD = 2 BA + AD and LM =3 LP - PM , find which one is greater BD or LM ?
Given that BA = 3 cm , AD = 2.5 cm, LP = 4 cm and PM = 1.5 cm.

18. In the figure name the following angles :



(a) an acute angle at B **(b)** an acute angle at E

(c) a straight angle

19. Give reasons for:

(a) A square can be thought of as a special rectangle.

(b) A rectangle can be thought of as a special parallelogram.

(c) A square can be thought of as a special rhombus.

(d) Squares, rectangles, parallelograms are all quadrilaterals.

(e) Square is also a parallelogram.

20. The angles of a quadrilateral are in the ratio 3:4:5:6. Find the all angles of quadrilateral.

21. If one angle of a triangle is equal to the sum of other two, show that the triangle is a right angled triangle.

22. Find the number of edges, vertices and faces in a rectangular pyramid.

23. Draw the three views of a brick.

EXERCISE 02

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

MULTIPLE CHOICE QUESTIONS

1. If the bicycle wheel has 48 spokes, then the angle between a pair of two consecutive spokes is

(A) $5\frac{1}{2}$ (B) $7\frac{1}{2}$ (C) $\frac{2}{11}$ (D) $\frac{2}{15}$

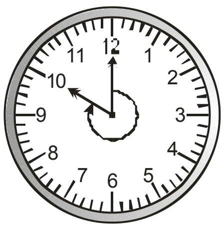
2. If the sum of two angle is equal to an obtuse angle, then which of the following is not possible?

(A) One obtuse angle and one acute angle. (B) One reflex angle and one acute angle.
(C) Two obtuse angles. (D) Two right angles.

3. The minute hand when it moves 330° from 11 O'clock, is now at ________

(A) 9 (B) 11 (C) 12 (D) 10

4. Which angle is shown by the hands of the clock in the given figure ?

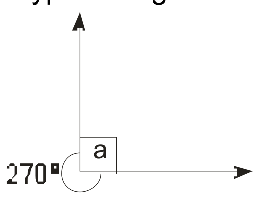


(A) acute (B)right (C) obtuse (D) reflex

5. John turns right three times. How many degrees does he turn through ?

(A) 90° (B) 45° (C) 180° (D) 270°

6. In the figure , calculate $\angle$a. What type of angle is it ?



(A) right (B) acute (C) obtuse (D) reflex

7. The angle between two opposite rays is

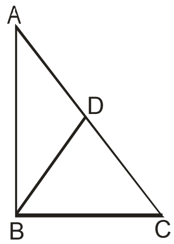
(A) right (B)obtuse (C) acute (D) straight

8. Which of the following statement is false ?
(A) Using protractor, angle of any measure between 0° and 180° can be drawn
(B) A line has two end points
(C) An angle whose measure is greater than 90° is an obtuse of measure 0°.
(D) Two coinciding rays with a common end point form an angle of measure 0°.

9. Which of the following statement(s) is/are false ?
(A) Each diagonal of a quadrilateral divides it into two triangles
(B) Each side of a quadrilateral is less than the sum of the remaining three sides
(C) A quadrilateral can atmost have three obtuse angles.
(D) A quadrilateral has found diagonals.

10. Which of the following statement(s) is/are true ?
(A) A parallelogram in which two adjacent angles are equal is a rectangle.
(B) A quadrilateral in which both pairs of opposite angles are equal is parallelogram.
(C) In a parallelogram the number of acute angles is zero (or) two.
(D) All the above

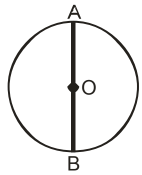
11. In figure DB = BC and AD = BD = DC the number of is acute triangles in figure



(A) 1 (B) 2 (C) 3 (D) 4

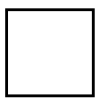
12. In figure ∠BAC = 90º and AD⊥ BC the number of right triangle in figure is
(A) 1 (B) 2 (C) 3 (D) 4

13. In the given figure , a circle is divided into two halves by the line AB. what will be the magnitude of angle AOB in each part ?

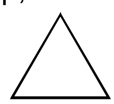


(A) 90° (B) 45° (C) 180° (D) 270°

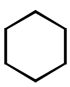
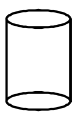
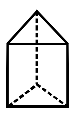
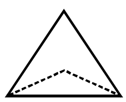
14. A solid object when seen from one side, looks like this.



The same solid, when viewed from top, looks like this.

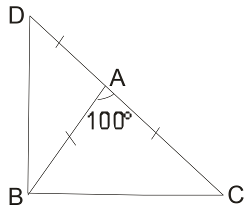


Which of these shapes could it be ?

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

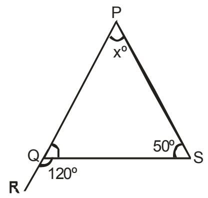
SECTION -B (TECHIE STUFF)

15. In given figure, find DBC.



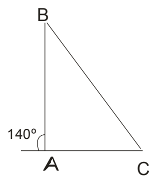
(A) 70° (B) 50° (C) 90° (D) 80°

16. Find the measure of x° in the given figure



(A) 70° (B) 50° (C) 60° (D) 120°

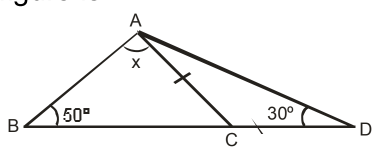
17. In the following diagram ∠B : ∠C = 3 : 4 find ∠B



(A) 30° (B) 40° (C) 60° (D) 70°

18. An exterior angle of a triangle is 100^0 and one of the interior opposite angles is 35^0, the other two angles of the triangle is
(A) 60°, 80° (B) 80°, 100° (C) 65°, 80° (D) 65°, 45°

19. The value of x in the given figure is

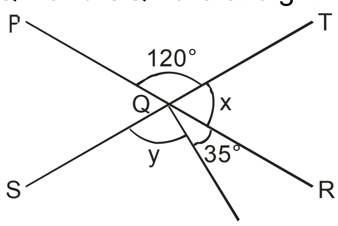


(A) 70° (B) 80° (C) 50° (D) 30°

EXERCISE 03

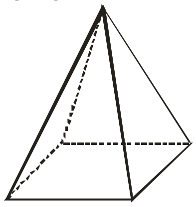
(PREVIOUS YEAR EXAMINATION QUESTIONS)

1. In the figure above, PQR and SQT are straight lines. The value of x + y is: **[NSTSE - 2009]**



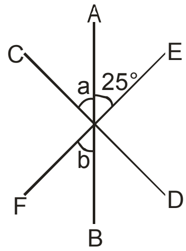
(A) 120° (B) 145° (C) 150° (D) 160°

2. How many edges does the following figure has? **[NSTSE - 2009]**



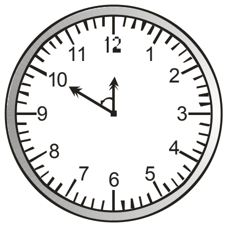
(A) 12 (B) 8 (C)6 (D)4

3. In the figure above, AB, CD and EF are straight lines. The ratio of ∠a to ∠ b is 8 : 5. What is the value of ∠a ? **[NSTSE-2010]**



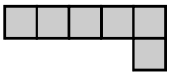
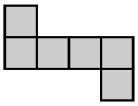
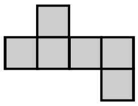
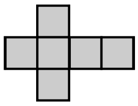
(A) 25° (B) 35° (C) 40° (D) 45°

4. In the above figure, the angle formed between the hour and minute hands is**[NSTSE-2010]**

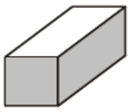


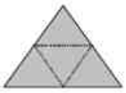
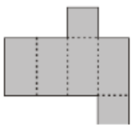
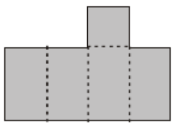
(A) acute angle (B) obtuse angle (C) right angle (D) straight angle

5. Which of the following is not a net of a cube? **[NSTSE-2010]**

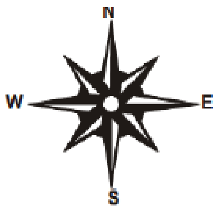
(A)  (B)  (C)  (D) 

6. Which net will make this figure? **[IMO-2010]**



(A)  (B)  (C)  (D) None of these

7. A truck departs from a distribution center. From there, it goes 2 blocks east, 3 blocks south and 3 blocks north. How far and in which direction must the truck go to get back to the distribution center? **[IMO-2010]**

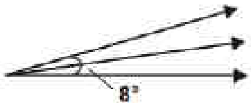


(A) 4 blocks west (B) 4 blocks east (C) 2 blocks west (D) 2 blocks east

8. Rahul put his timepiece on the table in such a way that at 6:00 P.M. the hour hand points to North. In which direction will the minute hand point at 9:15? **[IMO-2010]**

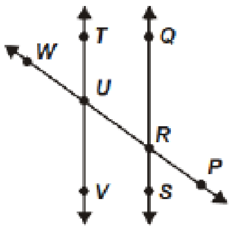
(A) South-East (B) South (C) North (D) West

9. Sneha bisects an angle to form two new angles. If the original angle had a measure of 8°, what is the measure of each new angle? **[IMO-2010]**



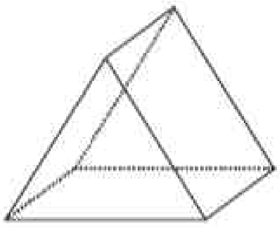
(A) 8° (B) 20° (C) 4° (D) 16°

10. QS and TV are parallel lines.
Which angles are supplementary angles? **[IMO-2010]**



(A) VUW and QRP
(B) VUW and SRU
(C) VUW and VUR
(D) VUW and TUR

11. Which of the following statements about the 3-dimensional figure appears to be true? **[IMO-2010]**

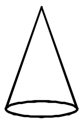
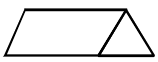
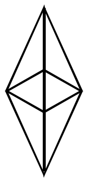
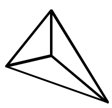


(A) It has no congruent faces.
(B) It has 3 congruent rectangular faces.
(C) It has 6 congruent faces.
(D) It has 3 congruent triangular faces.

12. Which relationship between units of time is correct? **[IMO-2010]**

(A) One hour is $\frac{1}{365}$ of one year
(B) One hour is $\frac{1}{365}$ of one hour
(C) On second is $\frac{1}{60}$ of one minute
(D) One minute is $\frac{1}{60}$ of one second

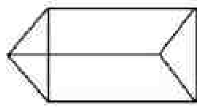
13. Which of the following have maximum number of triangular faces? **[NSTSE-2011]**

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

14. How many right angles are there in 3 complete turns? **[IMO-2011]**

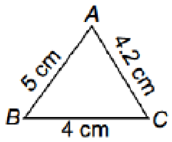
(A) 16 (B) 12 (C) 8 (D) 4

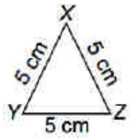
15. The number of edges in the given figure is__________ **[IMO-2011]**

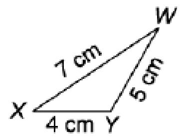


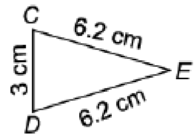
(A) 8 (B) 9 (C) 10 (D) 11

16. Which of the following is an ISOSCELES triangle ? **[IMO-2011]**

(A) 

(B) 

(C) 

(D) 

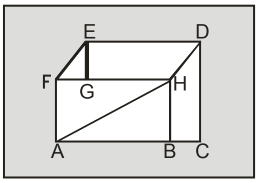
17. A figure is said to be regular, if its sides are equal in length and angles are equal in measure. Can you identify the regular quadrilateral ? **[NSTSE-2012]**

(A) Parallelogram (B) Rhombus (C) Square (D) Rectangle

18. Find the number of right angles through which the hour hand of a clock turns when it goes from 10 to 4 ? **[NSTSE-2012]**

(A) 1 (B) 2 (C) 3 (D) 4

19. Which of the following pairs of line segment shown in the figure is not parallel ? **[NSTSE-2012]**

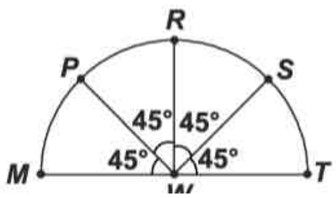


(A) ED and FH (B) AF and BH (C) EF and DH (D) EF and AH

20. Which of the following three-dimensional shapes has 1 rectangular face and 4 triangular faces? **[IMO-2012]**

(A) Rectangular pyramid (B) Triangular pyramid
(C) Rectangular prism (D) Triangular prism

21. The given diagram is in the shape of a semi-circle. Which of the following options shows a right angle? **[IMO-2012]**



(A) ∠PWT (B) ∠PWM (C) ∠MWT (D) ∠PWS

22. Which of the following statements is INCORRECT? **[IMO-2012]**

(A) Each angle of a rectangle is a right angle.

(B) A straight angle is $\frac{1}{2}$ of a revolution.

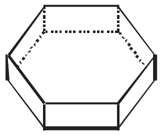
(C) A reflex angle is larger than an acute angle

(D) The perpendicular bisector of a line segment is a perpendicular to the line segment that divides it into two parts.

23. Rohan travelled 25 km North and Amit travelled 89 km South from the same point. Find the distance between the final destinations of the two. **[IMO-2012]**

(A) 114 km (B) 64 km (C) 84 km (D) -114 km

24. How many faces does the given solid have ? **[NSTSE-2013]**



(A) 6 (B) 7 (C) 8 (D) 9

25. Select the INCORRECT match. **[IMO-2013]**

(A) One pair of parallel side – Trapezium
(B) Parallelogram with 4 right angles – Rectangle
(C) Parallelogram with 4 sides of equal length - Rhombus
(D) A rhombus with 4 right angles - Kite

26. Find P, Q, R and S respectively. **[IMO-2013]**

A square pyramid has P base,
Faces : Q
Edges : R
Corners : S

(A) Square. 4, 10, 5 (B) Rectangle. 5, 10, 5
(C) Square. 5, 8, 5 (D) Rectangle. 6, 10, 5

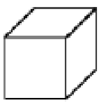
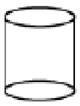
27. Which of the following statements is incorrect? **[IMO-2014]**

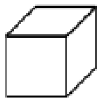
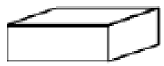
(A) Two parallel line segments will always intersect.
(B) All equilateral triangles are isosceles.
(C) Measure of straight angle is twice that of right angle.
(D) The diameter of a circle is double of its radius.

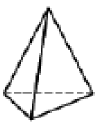
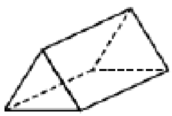
28. Which of the following figures satisfy the given conditions ? **[IMO-2014]**

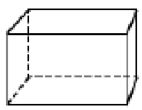
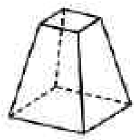
Fig. (i) Faces : 4
Edges : 6
Vertices : 4

Fig. (ii) Faces : 5
Edges : 9
Vertices : 6

(A) (i)  (ii) 

(B) (i)  (ii) 

(C) (i)  (ii) 

(D) (i)  (ii) 

29. Fill in the blanks.

Any drawing (straight or non-straight) done without lifting the pencil may be a P. A Q is the one that does not cross itself. A curve is said to be R, if its ends are joined. A S is a simple closed curve made up of line segments. **[IMO-2014]**

	P	Q	R	S
(A)	Curve	Open	curve	Closed Line
(B)	Line	Curve	Open	Line
(C)	Curve	Simple curve	Closed	Polygon
(D)	Curve	Closed curve	Open	Circles

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	A	B	C	C	B	D	D	D	D	A	B	C	C	B	C	D	D	C	C
Ques.	21	22																		
Ans.	B	A																		

FILL IN THE BLANKS

1. scale **2.** right angle **3.** complete **4.** acute
5. right - angle **6.** 180° **7.** 180° **8.** 60° **9.** 80°
10. 360° **11.** 4 **12.** 4, 6, 4 **13.** 5, 9, 6 **14.** 5, 8, 5
15. 1, 2 **16.** No

TRUE / FALSE

1. False **2.** True **3.** True **4.** False **5.** False
6. False **7.** True **8.** False **9.** True **10.** False
11. False **12.** True **13.** False

MATCH THE COLUMN

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

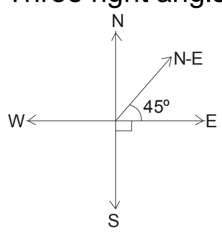
SECTION -B (FREE RESPONSE TYPE)

VERY SHORT ANSWER TYPE

1. **(i)** obtuse **(ii)** acute **(iii)** acute
(iv) Reflex **(v)** Complete

2. Three right angles = 3 × 90° = 270°

3.



Angle turned by boat is 90° + 45° = 135°

4. **(i)** Isosceles Triangle **(ii)** Equilateral Triangle **(iii)** Scalene trianlge

5. **(i)** Right angle triangle **(ii)** Obtuse angle triangle **(iii)** Acute angle trianlge

6. **(a)** Sphere **(b)** Sphere

7. Each side of a 3-dimensional shapes is a flat surface ,called a face.

SHORT ANSWER TYPE

8. **(i)** 90° **(ii)** 180° **(iii)** 270° **(iv)** 60°

9. 36° , 60° , 84° **11.** 16cm, 12cm

12. **(i)** no **(ii)** no **(iii)** yes **(iv)** no **(v)** yes

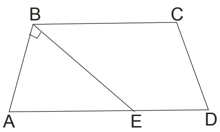
13. **(i)** rectangle **(ii)** square **(iii)** rhombus

15. Prism is a polyhedron in which the base & top are regular polygons; whereas a pyramid is a polyhedron in which the base is a polygon. 2) In a prism the lateral surfaces are parallelograms; whereas in a pyramid, the lateral surfaces are triangles.

LONG ANSWER TYPE

16. **(i)** 48° **(ii)** 270° **(iii)** 540° **17.** LM > BD

18.



(a) acute angle at B is ∠EBC **(b)** acute angle at E is ∠BEA

(c) Straight angle is ∠AED

19. **(a)** All the properties of a rectangle are there in a square.
(b) All the properties of a parallelogram are there in a rectangle.
(c) All the properties of a parallelogram are there in a square.
(d) All four sided closed plane figures are known as quadrilateral.
(e) All the properties of a parallelogram are there in a square.

20. 60° ,80°, 100° , 120° **21.** (**Hint :** $\angle A = \angle B + \angle C \Rightarrow \angle A + \angle A = \angle A + \angle B + \angle C = 180°$)

22. There are 8 edges, 5 faces and 5 vertices in a rectangular pyramid.

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	18	19
Ans.	B	D	D	D	C	A	D	B	D	D	B	C	C	C	C	A	C	C	A

EXERCISE 03

(PREVIOUS YEAR EXAMINATION QUESTIONS)

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	B	B	C	A	A	B	C	D	C	C	B	C	C	B	B	D	C	B	D	A
Ques.	21	22	23	24	25	26	27	28	29											
Ans.	D	D	A	C	D	C	A	C	C											