E-NOTE FOR YEAR 8

TOPIC: - TRIANGLES

CONTENT: -

1 TRIANGLES

2 Types of triangles

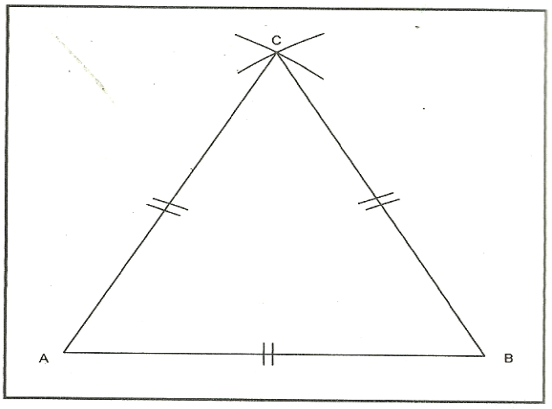
3 Construction of triangles

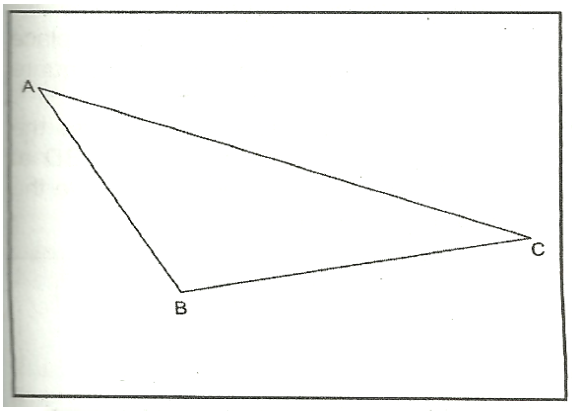
TRIANGLE

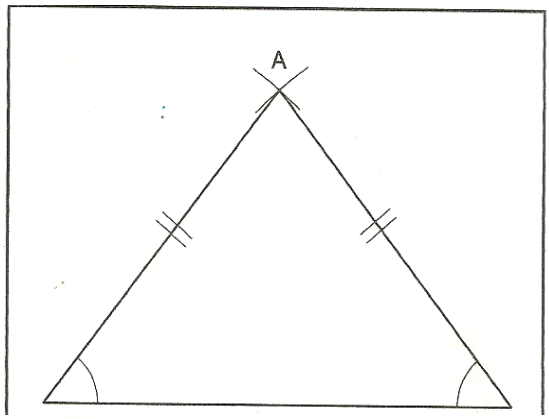
A triangle is a plane figure bounded by three straight lines and having three angles. The sum of angles in a triangle is 180^0

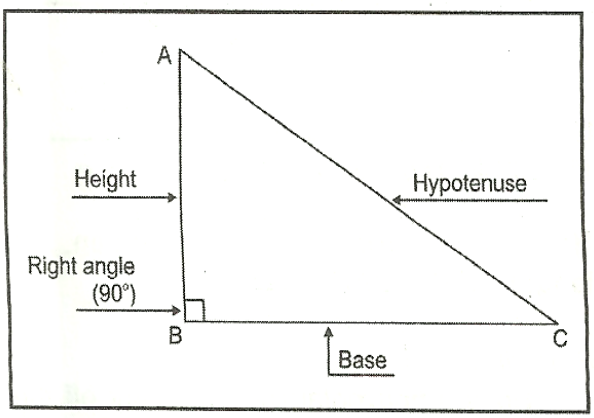
Types of triangles

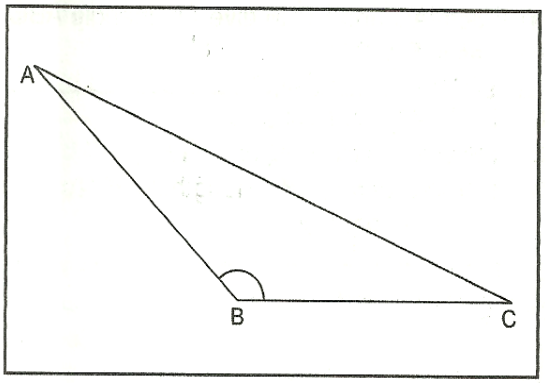
1. Scalene triangle: - This is a triangle that has none of its sides or angles equal.
2. Isosceles triangle: - This is a triangle that has two sides and two angles equal.
3. Equilateral triangle: - This is a triangle that has all the three sides and angles equal.
4. Right-angled triangle: - This is a triangle that one of its angles equal to 90^0 and the longest line facing the 90^0 is called **THE HYPOTENUSE**

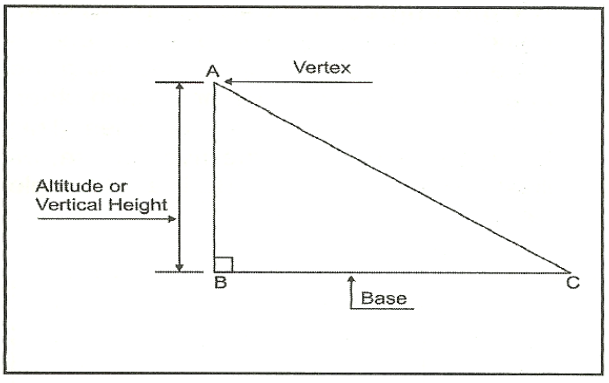


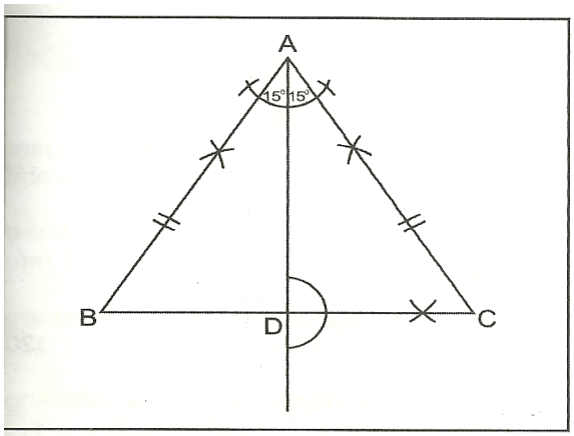


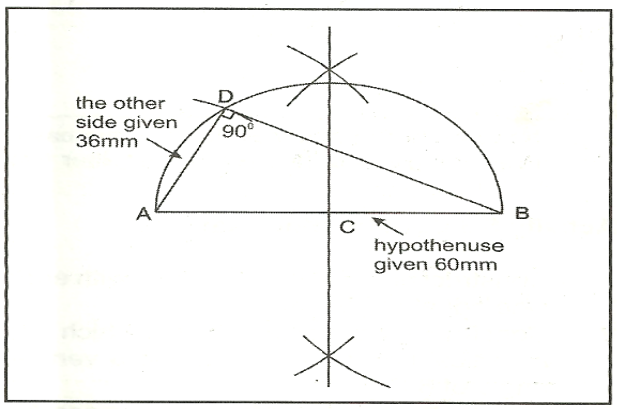












EVALUATION: -

1. What is a triangle?
2. List the types of triangles and describe them.

To a triangle given the three sides.

Procedure

1. Draw the horizontal line and mark off the base of the triangle AB.
2. With center A and a radius equal to the length of a side of the triangle, strike an arc
3. With center B and a radius equal to the other side strike another arc to cut the previous one at C.
4. Join CA and CB to obtain the triangle ABC.

EVALUATION; -

1. Construct triangle ABC such that AB is 8cm BC 7cm and AC is 6cm

To construct a triangle given two sides and the included angle.

1. Draw a horizontal line and mark off one of the given sides AB
2. At A, construct the given included angle BAC with the aid of a protractor
3. With center A and radius equal to the other given side of the triangle cut AC at D.
4. Join DB to complete the required triangle ABD

Evaluation: -

1. Construct triangle ABC such that line AB is 5cm, <ABC is 60^0 and line BC is 7cm

To construct an equilateral triangle using compasses

1. Draw a horizontal line and mark off base AB equal to the given side.
2. With centers A and B and a radius equal to the given side, strike arcs to intersect at C.
3. Join CA and CB to obtain the required equilateral triangle.

EVALUATION:

1. Construct an equilateral triangle whose sides are 6cm long.

Reading Assignment

Read about Construction of triangles

REFERENCE MATERIALS

- EVANS-BASIC TECHNOLOGY BOOK 2, page
- NERDC-BASIC TECHNOLOGY, BOOK 2, page 46- 51

WEEKEND ASSIGNMENT

1. Which of the following triangles has all its sides equal (a) Equilateral (b) Scalene (c) Isosceles (d) Right-angled
2. Which of the following triangles has none of its side equal (a) Equilateral (b) Scalene (c) Isosceles (d) Right-angled
3. Which of the following triangles has all two sides equal (a) Equilateral (b) Scalene (c) Isosceles (d) Right-angled
4. What is the center rule formula used to construct a polygon as well as dividing a circle into equal parts (a) 360 – N (b) 360 x N (c) $^{360}/_{N}$ (d) 360 + N
5. The perpendicular distance from the vertex to the base of triangles is called _____(a) vetoed (b) Aptitude (c) Altitude (d) Interior

THEORY

1. Construct a rectangle of length 7cm and breadth 5cm with the aid of compass and ruler.
2. Construct a square with diagonal 5cm.

TOPIC: - CONSTRUCTION OF QUADRILATERALS AND POLYGONS

CONTENT: -

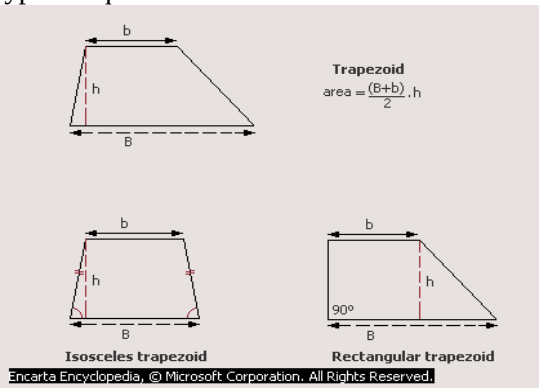
1. Types of Quadrilaterals
2. Construction of a rectangle given its diagonal and one side
3. Construction of a rhombus given its side and a diagonal
4. Construction of a rhomboid given its diagonal and one side.
5. Types of polygon
6. Construction of different polygons

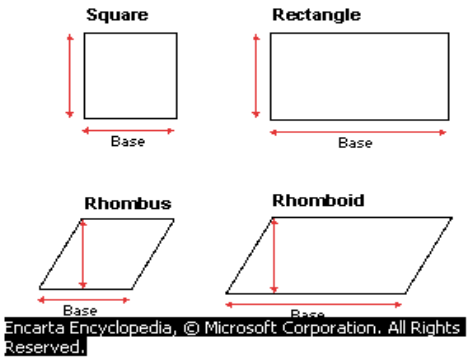
QUADRILATERALS

Quadrilaterals are plane figures bounded by four straight lines. The sum of angles in a quadrilateral is 360^0.

A straight line called the diagonal may join any two opposite angular points.

Types of quadrilateral





1. Parallelogram: This is a quadrilateral with it's opposite sides equal and parallel.
2. Square: A square is a parallelogram, which has its entire sides equal and each angle a right angle.
3. Rhombus: A rhombus is a parallelogram, which has its sides equal but no angle is a right angle.
4. Rectangle: A rectangle is a parallelogram, which has each angle a right angle.
5. Rhomboid: A rhomboid is a parallelogram, but no angle is right angled.

EVALUATION

1. What is a quadrilateral?
2. What is a diagonal?
3. State the types of quadrilateral

Construction of quadrilaterals

To construct a square upon a given side.

Procedure

(i) Draw a line and mark off AB equal to the side of the square.
(ii) At A, erect a perpendicular AC marking AC equal to AB.
(iii) With center C and a radius equal to AB, strike an arc with center B and the same radius; strike another arc to intersect the previous one at D.
(iv) Joint CD and BD to obtain the required square ABCD

B. ***To construct a square given the length of its diagonal.***

Procedure

(i) Draw a horizontal line and a vertical line, which intersect at O.

(ii) With center O and a radius equal to half the length of the given diagonal, cut the horizontal line at A and B, and the vertical line at C and D.
(iii) Join AD, DB, BC and CA to obtain the required square ADBC.

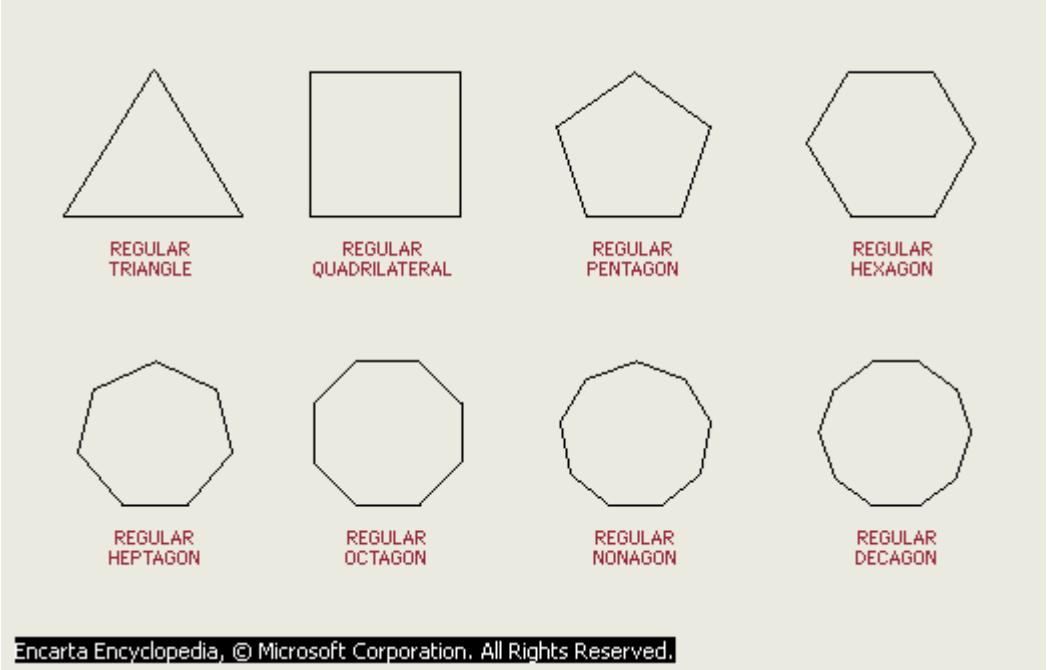
EVALUATION

1. What do you understand by a square?
2. Construct a square given the length of its diagonal.

REGULAR POLYGONS

What is a polygon?

A polygon is a plane figure with five or more straight sides. A polygon is said to be regular it all its sides are equal and its angles are equal.



Types of polygons

1. Pentagon: A pentagon is a polygon with five sides.
2. Hexagon: A hexagon is a polygon with six sides
3. Heptagon: A heptagon is a polygon with seven sides.
4. Octagon: An octagon is a polygon with eight sides.
5. Nonagon: A nonagon is a polygon with nine sides.
6. Decagon: A decagon is a polygon with ten sides.

EVALUATION

1. What is a polygon?
2. Explain different types of polygon.

Construction of a regular Hexagon given its side.

(A) Using 60^o set - square

Procedure

(i) Draw a horizontal line and mark off AB equal to the side of the hexagon.
(ii) Through A, draw a line at 60^o and mark off AC equal to AB
(iii) Through B, draw a line at 60^o and mark off BD equal to AB.
(iv) Through C, draw a line at 60^o parallel to BD and mark off CE equal to AB.
(v) Through D, draw a line at 60^o parallel to AC and mark off DF equal to AB.
(vi) Join EF to complete the hexagon.

(B) Using compasses: - This method is called constant radius rule.

Procedure

(i) Draw a circle whose radius is equal to the side of the hexagon. Draw the horizontal diameter AB.

(ii) With center A and the same radius, cut the circle above AB at C and below AB at D

(iii) With center B and the same radius, cut the circle above AB at E and below AB at F.

(iv) Join AD, DF, FB, BE, EC and CA to obtain the hexagon.

EVALUATION

1. What is a hexagon?
2. Using 60^o set – square, construct a regular hexagon given its side.

READING ASSIGNMENT

Read about QUADRILATERAL AND POLYGON

REFERENCE MATERIALS

- EVANS-BASIC TECHNOLOGY BOOK 2, page
- NERDC- BASIC TECHNOLOGY BOOK 2, page

ASSIGNMENT

1. Which of the following is not a polygon? (a) Circle (b) Triangle (c) Decagon (d) Heptagon.
2. Two angular points are joined by a _____ (a) diagonal (b) vertex (c) horizon (d) pinnacle
3. A polygon is a plane figure with _____or more straight sides. (a) Five (b) three (c) four (d) two
4. A regular polygon has _____ of its sides and angles equal (a) five (b) all (c) three (d) four
5. A Octagon is a polygon with _____ sides (a) 5 (b) 6 (c) 7 (d) 8

THEORY

1(a) Define (i) quadrilateral (ii) polygon

(b) Explain 5 types of (i) quadrilateral (ii) polygon

2. Construct (i) a square of side 70mm (ii) a regular hexagon of side 70mm.

TOPIC: AREA OF PLANE FIGURE

When a plane figure is drawn, it occupies o certain amount of space. At times, it is important to know the amount of space of a figure occupies, when it is drawn. This way, it will be possible to draw a different shape that has the same amount of space with it.

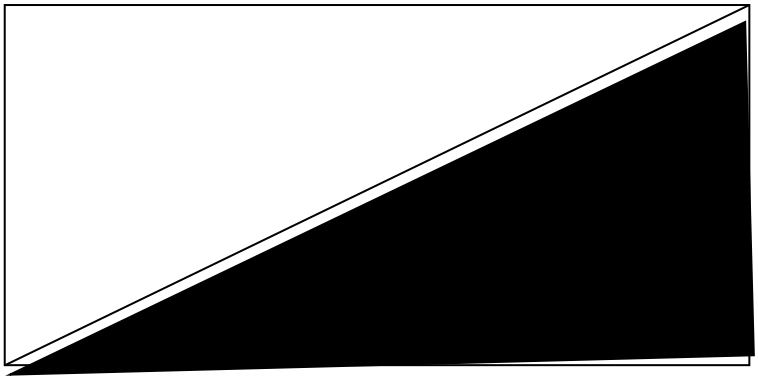
Therefore, area of a plane figure can be defined as the space it occupies.

Area of a rectangle

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2									
3									
4									
5									

Area of rectangle = 10 x 5 = 50 units

AREA OF TRIANGLE



Area = ½ of (L xW)

Note: The area of any plane figure (polygon) can be reduced to a combination of areas of rectangles (Or squares) and triangles each of which can be computed and the total area together.

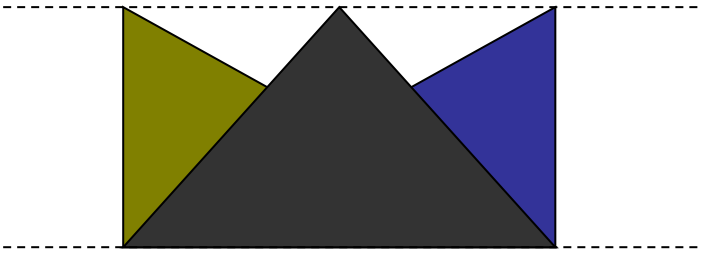
Evaluation

- **Define the area of plane shape.**
- **State the area of (i) triangle (ii) rectangle**

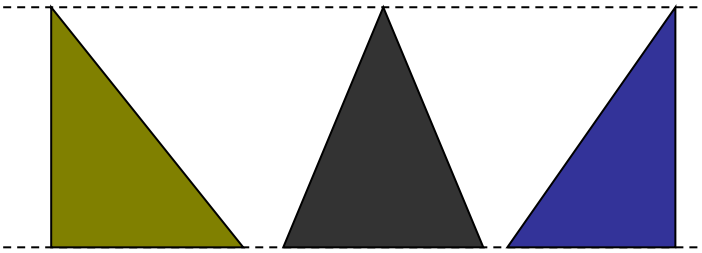
THEOREMS

In construction regular plane figure of equal areas, some geometrical laws, generally called theorems, are applied. For instance, the following are will be relevant to this topic:

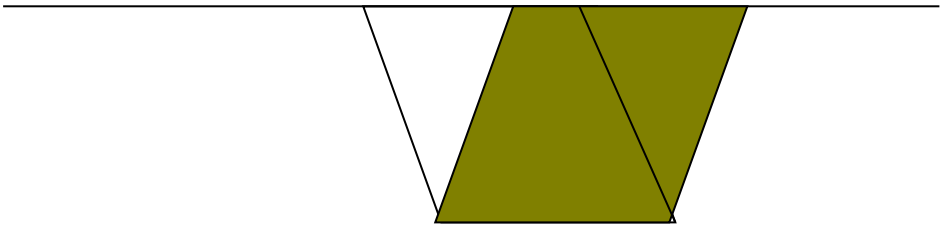
1. **Triangles on the same base and between the same parallels are equal in area.**



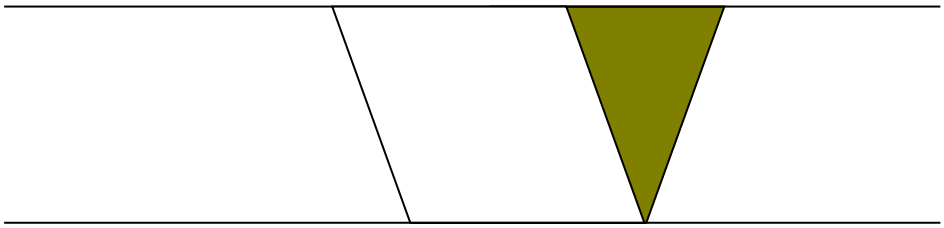
2. **Triangles on equal bases and between the same parallels are equal in area.**



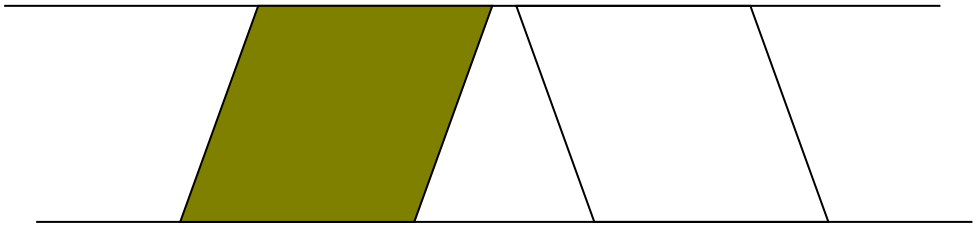
3. **Parallelograms on the same base and between the same parallels are equal in area.**



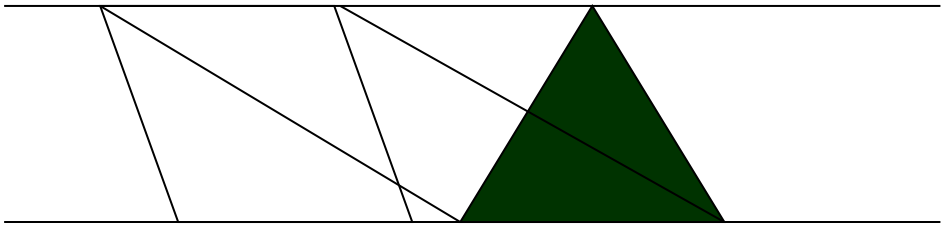
4. **Parallelograms on equal base and between the same parallel are equal in area.**



5. **A triangle on the same parallels with a parallelogram is half the area of the parallelogram.**



6. **if a triangle and a parallelogram are on equal bases and between the same parallels, the triangle is half the area of the parallelogram**



Evaluation

1. State 6 theorems of area of plane shape
2. Sketch diagrams that demonstrate the theorems of plane shape.

ASSIGNMENT

1. The space which a plane shape occupies is known as _____ (a) triangle (b) rectangle (c) parallelogram (d) area
2. The units of area are as follows except (a) mm^2 (b) cm^2 (c) kg^2 (d) m^2
3. Triangles on the same base and between the same parallels are equal in area (a) True (b) False (c) None of the above (d) All of the above
4. A triangle on the same base and between the same parallels with a parallelogram. (a) True (b) False (c) None of the above (d) All of the above
5. The area of a triangle is ____(a) ½ B x H (b) B x H (c) B^2 x H (d) B x H^2

Theory

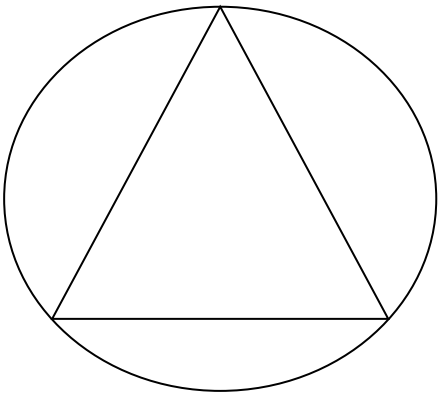
1. State 6 theorems of area of plane shape
2. Construct a right-angled triangle, which has the same area with an equilateral triangle of side 60mm.

TOPIC: MISCELLANEOUS CONSTRUCTION- Triangle

How to inscribe an equilateral triangle in a circle

Procedure

1. Draw the given circle.
2. Take the radius of the circle and step it off six times on the circumference.
3. Join every second point on the circumference to complete the equilateral triangle.

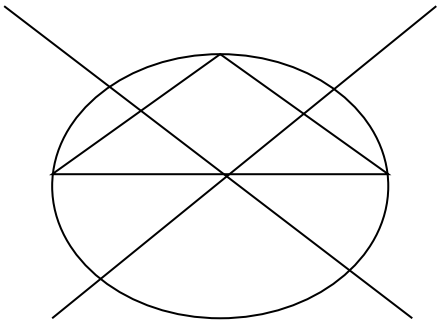


How to circumscribe a circle to a given triangle

To circumference a circle to a given triangle means to draw a circle round a triangle.

Procedure

1. Draw the given triangle ABC.
2. Bisect any two sides of the triangle.
3. Draw the bisecting lines to intersect at O.
4. O is the center of the circle. With center O and radius OA, draw the circle to pass through points A, B and C.



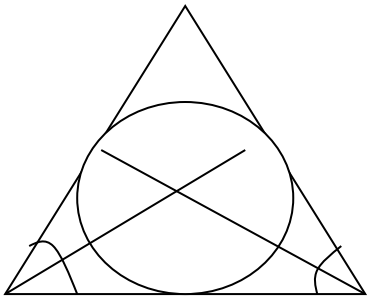
Evaluation

1. Explain the differentiate the inscribing and circumscribing
2. Inscribe an equilateral triangle of side 60mm in a circle

How to construct an inscribed circle to a given triangle.

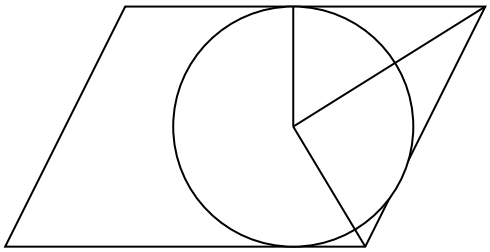
Procedure

1. Draw the given triangle ABC.
2. Bisect any two angles.
3. Draw the bisecting line to intersect at O.
4. O is the centre of the circle.
5. Draw a perpendicular to any side from O.
6. With centre O and radius OD, draw the required circle



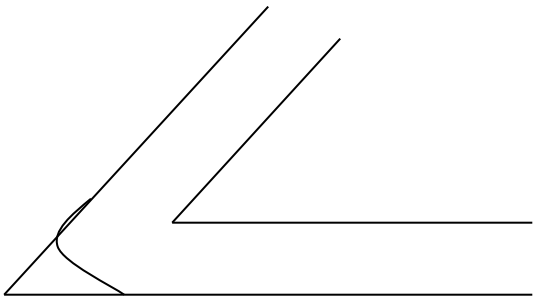
How to construct a circle to touch three given lines
Procedure

1. Draw the three given lines.
2. Bisect the two angles.
3. The bisecting lines should be extended to intersecting at C.
4. O is the centre of required circle.
5. Draw a line perpendicular to any side from centre O to given.
6. With centre O and radius OA draw the required circle.



How to construct a circle or an arc of a given radius to touch two given converging lines.
Procedure

1. Draw the given lines AB and AC.
2. Draw lines parallel to AB and AC at a distance equal to radius (r) of the circle.
3. Extend the lines to intersect at O.
4. Draw a line perpendicular to AB or AC from O.
5. With centre O, and radius OD, draw the arc to touch the two converging lines.



Evaluation

1. Construct an arc of a 60mm radius to touch two given converging lines
2. Construct an inscribed circle to a triangle ABC, AB= 50mm, BC= 70mm AC=80mm.

ASSIGNMENT

1. To circumscribe a circle to a given triangle means to draw a circle ___ a the triangle (a) inside (b) round (c) outside (d) beside
2. To inscribe a circle in a triangle means to draw a circle ___ a the triangle (a) inside (b) round (c) outside (d) beside
3. To circumscribe a circle to a given triangle, bisect any two sides of the triangle. (a) True (b) False (c) Partial (d) None of the above
4. To inscribe a circle in a triangle, bisect any two angles (a) True (b) False (c) Partial (d) None of the above
5. Inscribing is possible for a scalene triangle (a) True (b) False (c) Partial (d) None of the above

Theory

1. Construct an arc of a 60mm radius to touch two given converging lines
2. Construct an inscribed circle to a triangle ABC, AB= 50mm, BC= 70mm AC=80mm.

TOPIC: MISCELLANEOUS CONSTRUCTION- Quadrilateral

Construction of Rectangles

(A) To construct a rectangle given its length and breadth

Procedure

(i) Draw a line and mark off AB equal to the length of the rectangle.
(ii) At A, erect a perpendicular AC making AC equal to the breadth of the rectangle.
(iii) With center C and a radius equal to AB, strike an arc. With center B and a radius equal to AC, strike another arc to intersect the previous one at D.
(iv) Join CD and BD to obtain the required rectangle ABDC

(B) To construct a rectangle given its diagonal and one side.

Procedure

(i) Draw a line and mark off AB equal to the given diagonal.
(ii) Bisect AB at C, and with center C draw a circle with AB as diameter.
(iii) With center A and a radius equal to the given side of the rectangle, cut the circle on any side of AB at D. with center B and the same radius, cut the circle on the other side of AB at E.
(iv) Join AE, EB, BD and DA to obtain the required rectangle AEBD.

EVALUATION

1. What is a rectangle?
2. Draw a rectangle given its length and breadth.

(A) To construct a rhombus given its side and a diagonal.

Procedure

(i) Draw a line and mark off AB equal to the given diagonal.
(ii) With center A and a radius equal to the side, strike arcs above and below AB.
(iii) With center B and the same radius, cut the previous arcs at C and D.
(iv) Join AD, DB, BC and CA to obtain the required rhombus ADBC.

(B) To construct a rhomboid given a diagonal and two sides.

Procedure

(i) Draw AB equal to the given diagonal.
(ii) With centers A and B and a radius equal to one of the sides, strike arcs above and below AB respectively.
(iii) With center B and a radius equal to the other side, strike arcs to intersect the previous ones at C and D respectively.
(v) Join AD, DB, BC and CA to obtain the required rhomboid ADBC.

Evaluation

1. *Construct a rhombus side 40mm and diagonal 70mm.*
2. *Construct a rhomboid diagonal 80mm and side AB=30mm and BC= 60mm.*

ASSIGNMENT

1. A plane figure bounded by four equal sides is called ___ (a) square (b) rectangle (c) trapezium (d) kite
2. Opposite sides of a parallelogram are _____ (a) diagonal (b) parallel (c) vertex (d) straight
3. The diagonals in a rhombus bisect each other at (a) 90^0 (b) 60^0 (c) 45^0 (d) 70^0
4. A quadrilateral with only two parallel sides is called ____ (a) square (b) rectangle (c) trapezium (d) kite
5. The diagonals in a trapezium bisect each other to give (a) 90^0 (b) equal opposite angles (c) parallel opposite angles (d) 45^0

Theory

1. Construct (i) a square and (ii) rectangle with diagonal of 120mm
2. Construct (i) a square WXYZ side 60mm (ii) rectangle ABCD, AB=40mm BC=70mm

TOPIC: MISCELLANEOUS CONSTRUCTION- Polygon

Constructing a regular hexagon the distance across flats.

Procedure

(i) Draw a circle whose diameter is equal to the distance across flats. Draw the vertical diameter AB.
(ii) Draw diameter CD and EF at 30^o.
(iii) Through A and B, draw horizontal tangents.
(iv) Through C, D, E, F, in turn, draw tangents at 60^o. The figure that is formed by the intersection of the tangents is the required hexagon.

This is the procedure when describing a regular hexagon about a given circle.

To construct a regular Octagon given its sides

Procedure

(i) Draw a horizontal line mark off AB equal to the given side.
(ii) Through A and B, draw lines at 45^o and mark off AC and BD equal to AB.
(iii) Through C and D, draw vertical lines and mark off CE and DF equal to AB.
(iv) Through E and F, draw lines at 45^o and mark off EG and FH equal to AB.
(v) Join GH to complete the octagon.

To construct a rectangular octagon given the distance across flats.

Procedure

(i) Draw a circle whose diameter is equal to the distance across flats. Draw a horizontal diameter AB and a vertical diameter CD.
(ii) Draw diameters EF and GH at 45^o
(iii) Draw vertical tangents through A and B and horizontal tangents through C and D.
(iv) Through E, F, G, H, in turn draw tangents at 45^o. the figure formed by the intersection of the tangents is the required octagon.

This is the procedure when describing a regular octagon about a given circle.

EVALUATION

1. What is an octagon?
2. Draw a regular octagon given the distance across flats.

General methods for constructing a regular polygon on a given base.

(A) The External – $\frac{360^o}{N}$ Rule

Procedure

(i) Obtain the external angle of the required polygon by dividing 360^o by the number of side (N) of the polygon, i.e. external angle = $^{360o}/_{N}$

(ii) Draw a horizontal line and mark off AB equal to the given base.

(iii) Through A, draw a line at $360^o/N$ and mark off a length equal to AB. Also at B, draw a line at $360^o/N$

N and mark off a length equal to AB.

(iv) Continue the process until you have obtained the polygon of N sides where N = 5, 6, 7, 8, 9, 10…… Suppose that at N = 5, then external angle = $360^o/5 = 72^o$

(B) THE TWO–TRIANGLE RULE.

Procedure

(i) Draw a horizontal line and mark off AB equal to the given base.

(ii) Bisect AB and produce its bisector as long as it is convenient.

(iii) On AB as base, draw an isosceles triangle with base angle 45^o and an equilateral triangle so that the apexes of the two triangles lie on the bisector of AB. Denote the apex of the isosceles triangle as F.

(iv) Bisect FD to obtain point e.

(v) Along the bisector of AB, from point f, step off length de (or if) to obtain points G, H, L, J, e.t.c. The points D, E, F, G, H, L, J, are the centers of the circumscribing circles for a square, regular pentagon, hexagon and decagon respectively.

(vi) Suppose you want to draw a polygon of 8 sides (octagon).
With center h and radius HA (or HB) draw a circle. Take length AB and step it off on the circle to obtain the points C, D, E, F, G, H, I. Join the points to obtain the required regular nonagon. Note that D = 4; E = 5;F = 6;G = 7;H = 8;L = 9;J = 10.

Conclusion

A polygon may be regular or irregular. When it is regular, all its sides are equal, and its angles are also equal. Polygons include pentagons, hexagons, heptagons, octagons, nonagons, and decagons, which have five, six, seven, eight, nine, and ten sides respectively.

Evaluation

1. Construct a hexagon using the 60^0 by 30^0 set-square
2. State the formula for generally constructing a polygon

ASSIGNMENT

1. A pentagon is a polygon with ____ sides. (a) 5 (b) 6 (c) 9 (d) 12
2. A dodecagon is a polygon with ___ sides. (a) 5 (b) 6 (c) 9 (d) 12
3. The exterior angle of a nonagon is a regular polygon. (a) 45^0 (b) 60^0 (c) 40^0 (d) 90^0
4. An octagon is a polygon with ___ sides. (a) 8 (b) 6 (c) 9 (d) 12
5. The exterior angle of an octagon is a regular polygon. (a) 45^0 (b) 60^0 (c) 40^0 (d) 90^0

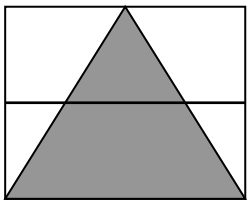
Theory

1. Construct a regular pentagon using the two-triangle rule, side 60mm.
2. Construct a regular hexagon using a pair of compasses.

TOPIC: MISCELLANEOUS CONSTRUCTION- Similar Area of plane shape

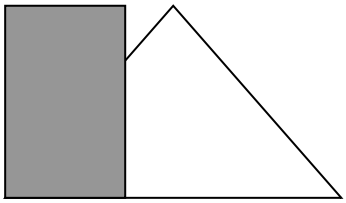
Drawing a triangle equal in area to a given rectangle
Procedure

1. Draw the rectangle ABCD
2. Project line CD and mark off DE, using the distance equal to CD.
3. Draw a horizontal line from point F to line BA parallel to BC.
4. Locate point G anywhere on line EF.
5. Join point G to B and C respectively, to obtain the triangle equal in area to rectangle ABCD. Triangle BCG is equal to the given rectangle.



Drawing a rectangle equal in area to a given triangle
Procedure

1. Draw the given triangle ABC.
2. Draw a line through A, parallel to BC.
3. Bisect line BC perpendicular at D and to meet the line through at D and to meet the line through A at E.
4. Draw a perpendicular to BC at B meet the line through A at F.
5. FBDE is the rectangle required

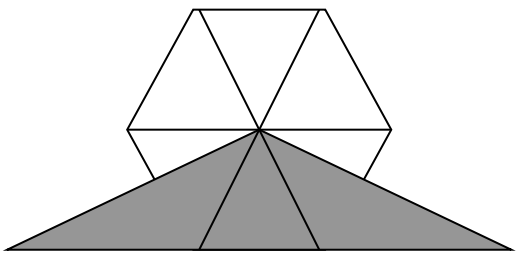


Evaluation

1. Drawing a triangle equal in area to a rectangle AB=50mm, BC=60mm.
2. Drawing a rectangle equal in area to a triangle ABC, AB= 40mm, AC=70mm and BC=60mm

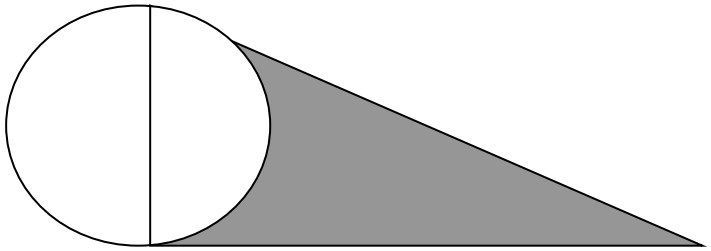
Constructing a triangle equal in area to any regular polygon
Procedure

1. Draw the regular polygon (hexagon) ABCDEFG
2. Draw the diagonals to intersect at the centre of the polygon O.
3. Draw HI equal in length to the length of side x number of sides. In this exercise, GH is equal to six times, the length of the side of the hexagon. (HI= 6 x y mm)
4. Join O to G and H, GOH is required triangle



Drawing a triangle equal in area to a given circle
Procedure

1. Draw the given circle of diameter AB and centre O.
2. Divide the radius OA into 7 equal parts
3. Draw a perpendicular line at A equal in length to 3 1/7
4. Join C to B.ACB is the required triangle



Reducing an irregular quadrilateral to half its original area.
Procedure

1. Draw the given irregular quadrilateral ABCD
2. Draw a diagonal BD
3. Bisect AB perpendicular at E
4. With centre E and radius EA, draw an arc to meet the bisector at F.
5. With centre B and radius BF, draw an arc, which meets the bisector at F.
6. From G and GH parallel to AD, also draw HI parallel to DC.
7. GBIH is required reduced irregular quadrilateral.

Evaluation

1. Constructing a triangle equal in area to any regular hexagon 50mm.
2. Drawing a triangle equal in area to a given circle of radius 40mm.

READING ASSIGNMENT
Read about MORE ON PLANE FIGURE OF THE SAME AREA.
REFERENCE MATERIALS

1. EVANS-BASIC TECHNOLOGY BOOK 2, page
2. NERDC- BASIC TECHNOLOGY BOOK 2, page 61-63

ASSIGNMENT

1. Which of the following is not a type of scale drawing? (a) Reduced (b) Enlarged (c) Extended (d) Full.
2. Building plan of a house is drawn in ___ scale drawing. (a) reduced (b) enlarged (c) extended (d) full.
3. Triangles on equal bases and between the same parallels are equal in area. (a) True (b) False (c) None (d) Partial
4. If a triangle and a parallelogram are on equal bases and between the same parallels, the triangle is half the area of the parallelogram. (a) True (b) False (c) None (d) Partial
5. Parallelograms on equal base and between the same parallel are equal in area. (a) True (b) False (c) None (d) Partial

THEORY

1. Constructing a triangle equal in area to any regular hexagon 50mm.
2. Drawing a triangle equal in area to a given circle of radius 40mm.