CIRCUMCIRCLE AND INCIRCLE
OF A TRIANGLE WITH ITS IMPACT IN DEVELOPMENT OF SKILL

MANOJ KUMAR SRIVASTAV*

Champdani Adarsh Sharmik Vidyamandir,
3, R. B. S. Road, Champdani, Post-Baidyabati, Dist.-Hooghly, Pin-712222, (W.B.), India.

ABSTRACT

The two geometrical figure -circle and triangle are made up of distinct conception. The triangle is made with straight lines, whereas circle is made by curve lines (arcs). The beauty of Circum- circle and In-circle of a triangle is a combination of a triangle and a circle. A circle may be in motion. The motion on a circle may be either rotational or translational with rotation.

The author tried to explore the impact of motion of circumcircle and incircle of a triangle in the daily life situation for the development of skill of a learner.

Key words: circumcircle, incircle, rotational, translational.

1. INTRODUCTION

Motion means movement. Motion can also be defined as a continuous change in the position of an object. Each type of motion is controlled by different type of force. Motion on circumcircle or incircle of a triangle can be co-related with its uses in daily life situation. A learner can create an innovative idea like tangential or normal acceleration on the motion of circumcircle and incircle of a triangle.

According to Newton's first law of motion, a moving body travels along a straight path with constant speed (i.e., has constant velocity) unless it is acted on by an outside force. For circular motion to occur there must be a constant force acting on a body, pushing it toward the center of the circular path. A learner can develop a skill to prepare different types of models from the circumcircle of a triangle to understand about a force which is acting towards the center of the circle. This type of force is called centripetal force.

According to Newton's third law of motion, for every action there is an equal and opposite reaction. The centripetal force, the action, is balanced by a reaction force- the centrifugal ("center-fleeing") force. The two forces are equal in magnitude and opposite in direction.

The learner will be able to develop a skill from the incircle of a triangle to understand about the centrifugal force which does not act on the body in motion; the only force acting on the body in motion is the centripetal force. The centrifugal force acts on the source of the centripetal force to displace it radially from the center of the path.

2. MATHEMATICAL DEFINITION OF CIRCLE, CIRCUMCIRCLE AND INCIRCLE

Definition: A **circle** is a simple shape in Euclidean **geometry**. It is the set of all points in a plane that are at a given distance from a given point, the centre; equivalently it is the curve traced out by a point that moves so that its distance from a given point is constant.

Definition: The circum center of a triangle is the point where the perpendicular bisectors of the sides intersect. It is also the center of the **circumcircle** of a triangle, the circle that passes through all three vertices of the triangle. The Circumcenter of a triangle is the point in the plane equidistant from the three vertices of the triangle.

Corresponding Author: Manoj Kumar Srivastav, Champdani Adarsh Sharmik Vidyamandir,*
3, R. B. S. Road, Champdani, Post-Baidyabati, Dist.-Hooghly, Pin-712222, (W.B.), India.

Definition: The incenter is one of the triangle points of concurrency formed by the intersection of the triangle's 3 angle bisectors. The incircle of a triangle is the largest circle that fits in a triangle and its center is the incenter. Its center is the one point inside the triangle that is equidistant from all sides of the triangle.

2.1 Corelation of circumcircle of a triangle with daily life situation

2.1.1 Construction method of circumcenter of a triangle:

The following steps are taken in the construction of circumcircle of a triangle
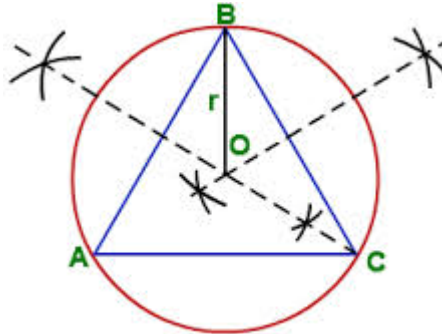
Steps:
   a) Construct the perpendicular bisector of one side of triangle.
   b) Construct the perpendicular bisector of another side
   c) Where they cross is the center of the Circumscribed circle
   d) Place compass on the center point, adjust its length to reach any corner of the triangle, and draw your Circumscribed circle

2.1.2 Position of the circumcenter when the triangle is right, obtuse, or equilateral
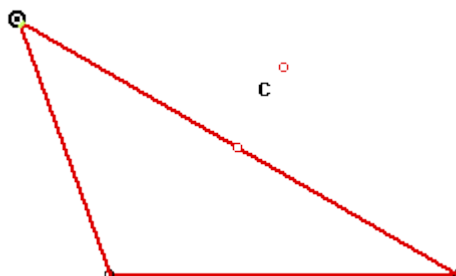
Location for right triangles:
When the triangle is right, the circumcenter is the midpoint of the hypotenuse.
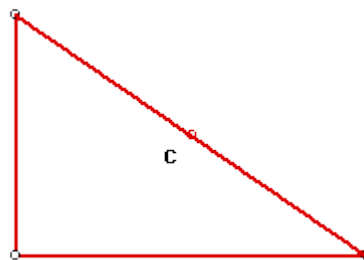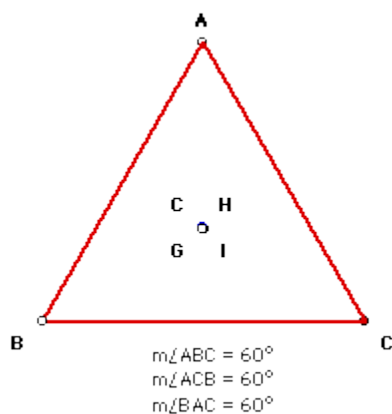

Location for obtuse triangles:
When the triangle is obtuse, the point that is the same distance from the vertices is outside of the triangle.

Location for equilateral triangles:
When the triangle is equilateral, the circumcenter is located at the same position as the centroid, circumcenter, and incenter.

m∠ABC = 60°
m∠ACB = 60°
m∠BAC = 60°

2.1.2 Model related to circum center, circumcircle of a triangle:

To make the use of circumcenter, circumcircle of a triangle with its impact in daily life situation, a learner can be able to prepare different types of models. For example let us consider the following model of Aeroplane.


In this example, the similarity between the fan of aeroplane and circumcircle of a triangle is given below:

Circumcircle of a triangle	Fan of an Aeroplane
Three vertices of a triangle	Three extreme point of blades of the fan represent vertices of a triangle
Circumcenter of a circumcircle	The concurrent (intersection)point of blades of a triangle.
Circumference of a Circle	The circle prepared after motion of the fan of aeroplane.

### 2.1.3 Development of skill for the use the circumcenter of a triangle

The conception of centripetal force, normal acceleration can be generated from the motion on circumcircle of a triangle. It is also observe that atleast three non-linear points is needed to draw a circle.

Also there may exist different type of mathematical relation – one example is given below.

A circle divided into
six equal parts

A circle with correct
fold lines
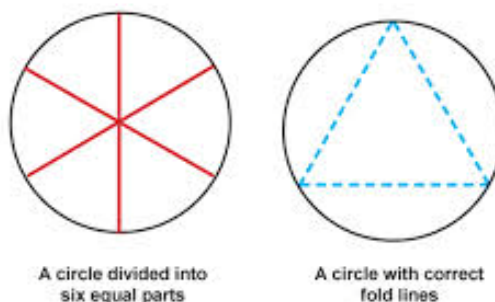
2.2 Corelation of incircle of a triangle with daily life situation

2.2.1 Construction method to draw incenter of a triangle
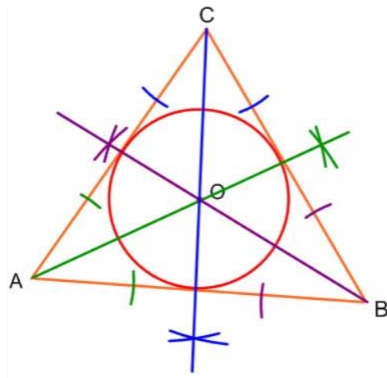
Steps:
a) Bisect one of the angles
b) Bisect another angle
c) Where they cross is the center of the inscribed circle
d) Construct a perpendicular from the center point to one side of the triangle
e) Place compass on the center point, adjust its length to where the perpendicular crosses the triangle, and draw your inscribed circle!

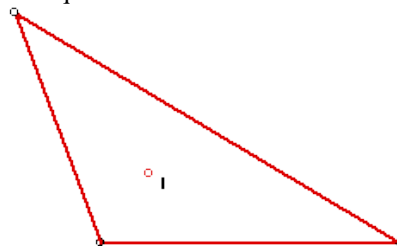**2.2.2 Position of the incenter when the triangle is right, obtuse, or equilateral.**

Location for right triangles:
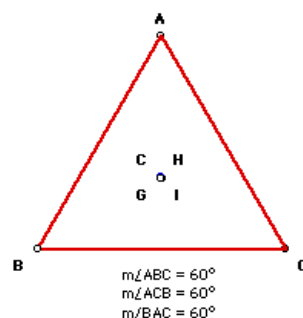When the triangle is right, the incenter is inside the triangle.
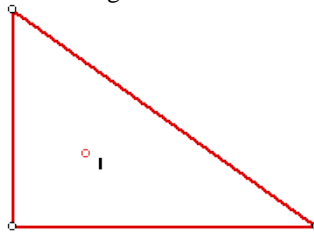
Location for obtuse triangles:
When the triangle is obtuse, the point that is equidistant from the sides is inside the triangle.

Location for equilateral triangles:
When the triangle is equilateral, the incenter is located at the same position as the centroid, circumcenter, and incenter.

The location of the in center will always be inside the triangle.

2.2.2 Model related to incenter of a triangle

The different types of models can be prepared on the basis of or techniques of an incenter of a triangle.

For example, let us consider an example of model of a Watch. The center of the watch is like incenter of the triangle. The Second-hand of watch is working similar to radius of the incircle. The length of second –hand of the clock may not be equal but a learner can create a conception regarding the motion of radius of in circle of a triangle.


Incircle of a triangle	Hand(Wrist) watch model
Three vertices of a triangle	Three extreme point of the sides of triangle(in watch) represent vertices of a triangle
incenter of an incircle	The concurrent (intersection)point of hour-hand,minute-hand and second-hand in the watch
Circumference of a Circle	The circle prepared after motion of the second-hand of the watch.

2.2.3 Development of skill from the incenter of a triangle:

The conception of centrifugal force, tangential acceleration can be generated from the motion of incircle of a triangle. It is also observe that three tangent are drawn on the circumference of a circle**.**
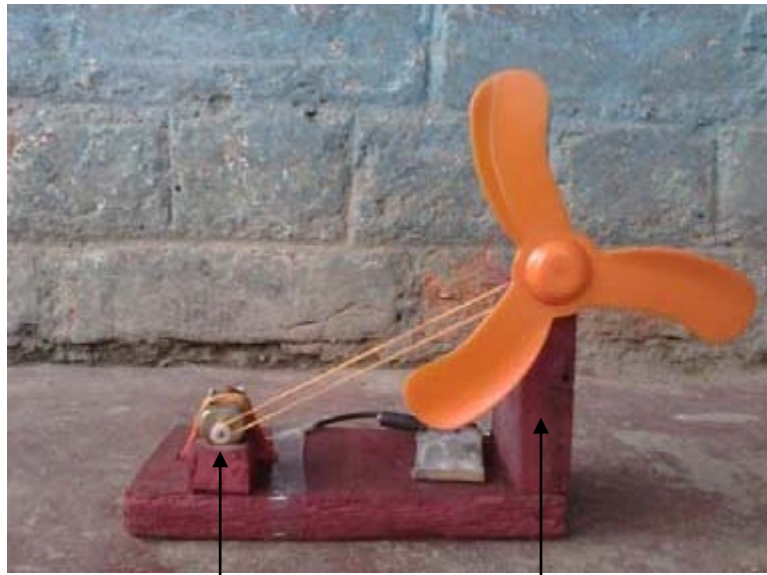
3. FUNCTIONAL RELATION BETWEEN CIRCUMCIRCLE AND INCIRCLE OF A TRIANGLE AND CIRCLE

The three geometrical models are functionally related with each other. There may be different models which are made with the help of circumcircle and incircle of a triangle and circle.

Circle

Circumcircle   Incircle
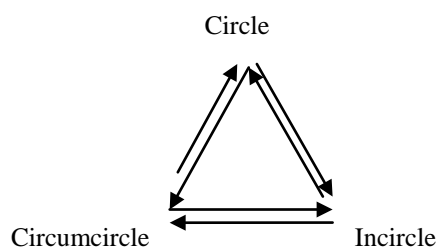
Function: If A and B are two non-empty sets then function f from set A to B is an association which associates every elements of set A to a unique element of set B.
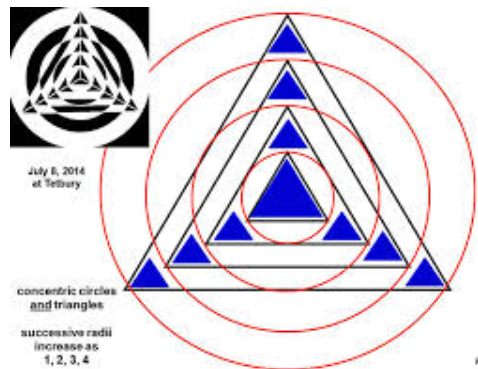
Example 1: A model showing relation between Circle and circumcircle of triangle
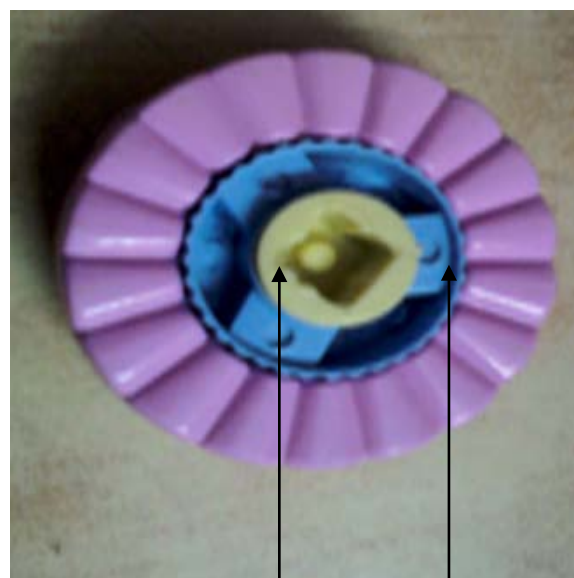
Circle   Circumcircle

Example2: A model showing relation between Circle and incircle of a triangle

Example3: A model showing relation between Circumcircle and incircle of triangle

Incircle   Circumcircle

4. CONCLUSION AND FUTURE SCOPE

The mathematical problem related to circle, circumcircle and in circle of a triangle will be helpful to prepare different types of models in optimal time and with optimal cost. There is an scope to develop a skill related to centripetal and centrifugal force or tangential or normal acceleration on the arc of different type of curve. Also there is a scope to understand the conception of concentric circle because when the triangle is equilateral, the circumcenter is located at the same position as the centroid, circumcenter, and incenter.

REFERENCES

1. Manoj Kumar Srivastav, Motion on A Circle and its Impact In The Development of Skill, International Journal of Mathematical Archive 5(8), August-2014.
2. Dynamics of a particle and of Rigid Bodies-S.L. Loney-1998
3. Mathematics-Text Book of class ix –National council of Educational Research and Training-2006
4. Mathematics-Text Book of class x –National council of Educational Research and Training-2006
5. Mathematics-Text Book of class ix – West Bengal Board of secondary Education, 2013
6. Teaching of Mathematics-Dr. Arun Kumar Kulshrestha- R.Lall Book Depot,2003
7. Real Analysis , S.K.Mapa, publication-Asoke Prakasan, year1998
8. Higher Algebra, S.K.Mapa, publication-Sarat Book Distribution, year 2000.
9. centripetal force and centrifugal force http://www.infoplease.com/encyclopedia/science/centripetal-force-centrifugal-force.html#ixzz3Zedx7dHH
10. http://jwilson.coe.uga.edu/emat6680fa05/evans/assignment%204/assignment%204.htm
11. http://www.infoplease.com/encyclopedia/science/centripetal-force-centrifugal-force.html
12. http://www.mathopenref.com/constcircumcenter.html
13. en.wikipedia.org/wiki/Circle
14. http://www.skwirk.com/p-c_s-11_u-399_t-990_c-3787/types-of-motion/nsw/science-technology/forces-and-their-effects/motion-and-equilibrium
15. http://jwilson.coe.uga.edu/emt668/EMT668.Folders.F97/Nipper/Assignment%204/circum%20position.html
16. http://thumbs3.ebaystatic.com/d/l225/m/mllkLpcdRxjqthlsAVJzYYQ.jpg
17. http://image.mathcaptain.com/cms/images/113/construction-of-circumcircle.png
18. http://exchangedownloads.smarttech.com/public/content/1c/1c7c7324-458a-4673-a6ac-772429a11ef6/previews/medium/0001.png
19. imagarcade.com
20. http://creativejewishmom.typepad.com/.a/6a011570601a80970b0120a4cc5de0970b-pi

Source of support: Nil, Conflict of interest: None Declared