Non-Euclidean Geometry

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Conventional Geometry

The following are the postulates of Euclidean Geometry:

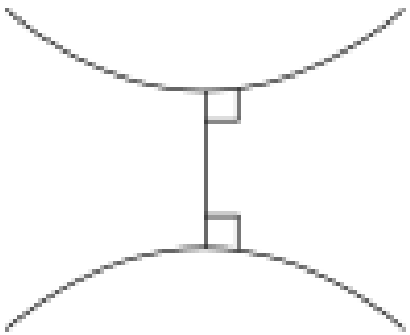
- A straight line can be drawn between any two points.
- A straight line drawn between two points can be continued infinitely.
- A circle is defined as a set of points which are at the same distance from the center point.
- All right angles are equal to one another.
- The distance between parallel lines are equal.

Why is Non-Euclidean geometry needed

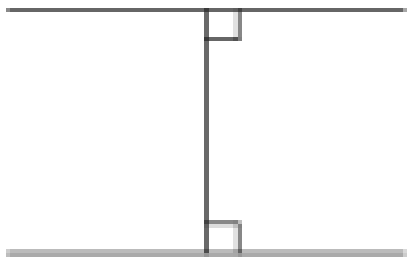
If any of the above five postulates are not applicable then the realm of Non-Euclidean geometry begins. There are three forms of Non-Euclidean geometry:

1. Spherical
2. Hyperbolic
3. Elliptical

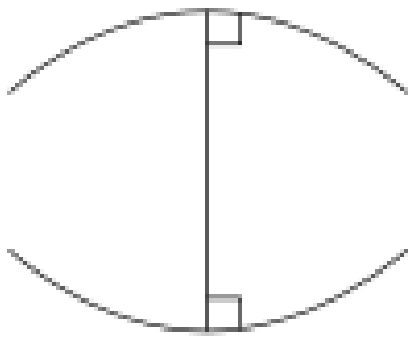
Non-Euclidean Geometry



Hyperbolic



Euclidean



Elliptic

Spherical Geometry

- Spherical Geometry is based on the surface of a sphere and not a plane.
- There is no notion of a straight line on a sphere.
- The line between two points on a sphere is called a geodesic.
- Great circle.

Hyperbolic Geometry

- The distance between parallel lines increases.
- This is also called Bolyai-Lobachevskian Geometry.
- Was discovered by Gauss 20 years before.

Elliptical Geometry

- The distance between the parallel lines decreases.
- There are no parallel lines in this Geometry.

Some examples of Non-Euclidean Geometry

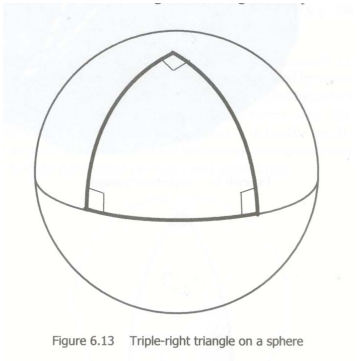


Figure: 3 right angled triangle

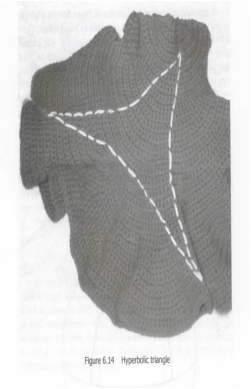


Figure: Triangle angle less than 180

Interesting Facts

- Mercury's orbit can be more accurately calculated using Non-Euclidean Geometry.
- Airline path from Florida to Phillipines is via Alaska - even though it is towards North?

Applications

- TSP in real world cannot take Euclidean distance directly.
- Mapping paths of planets and planning space shuttles.
- Graph theory applications

Thank You

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