Presentation on Conic Sections
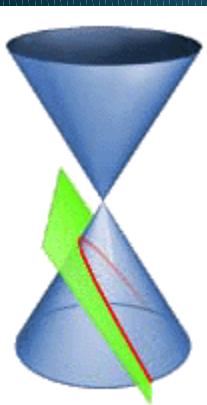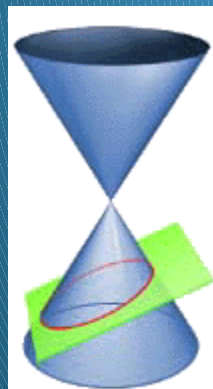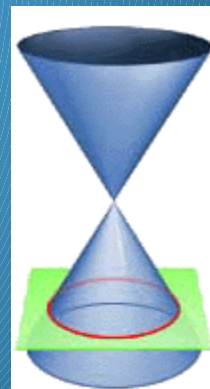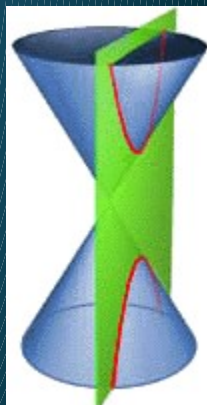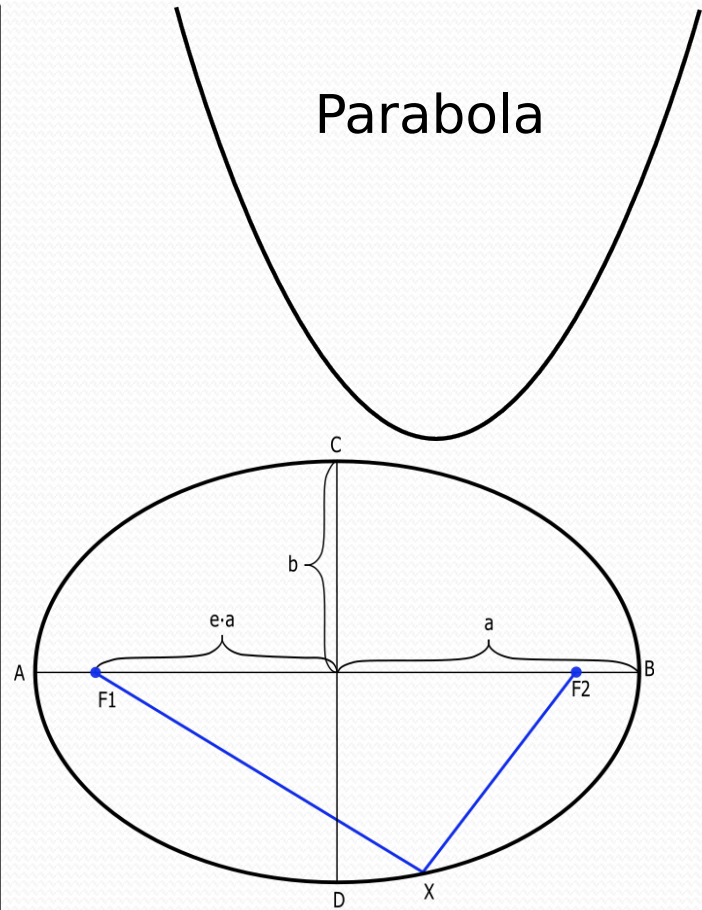
Parabola

Ellipse

Circle

Hyperbola

Definition

- There is no better example of this than the work done by the ancient Greeks on the curves known as the conics: the ellipse, the parabola, and the hyperbola. They were first studied by one of Plato's pupils. No important scientific applications were found for them until the 17th century, when Kepler discovered that planets move in ellipses and Galileo proved that projectiles travel in parabolas.

- In mathematics, a conic section is a curve obtained by intersecting a right circular conical surface with a plane.

Types Of conic Sections

- Ellipse(including Circles)
- Hyperbola
-

Hyperbola
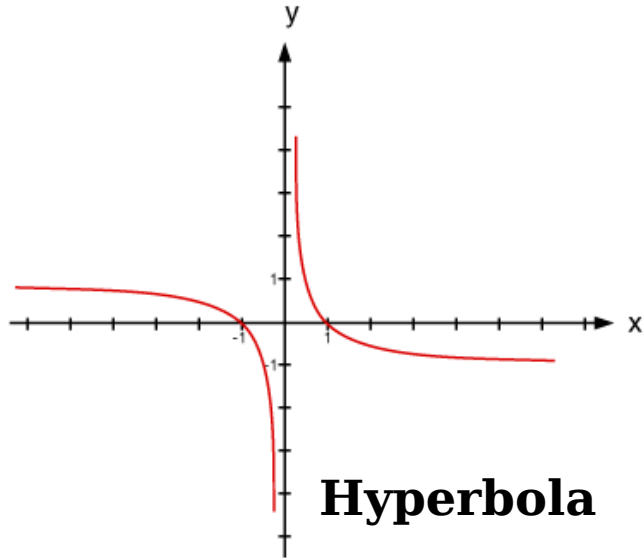
Parabola

Ellipse

Parabola
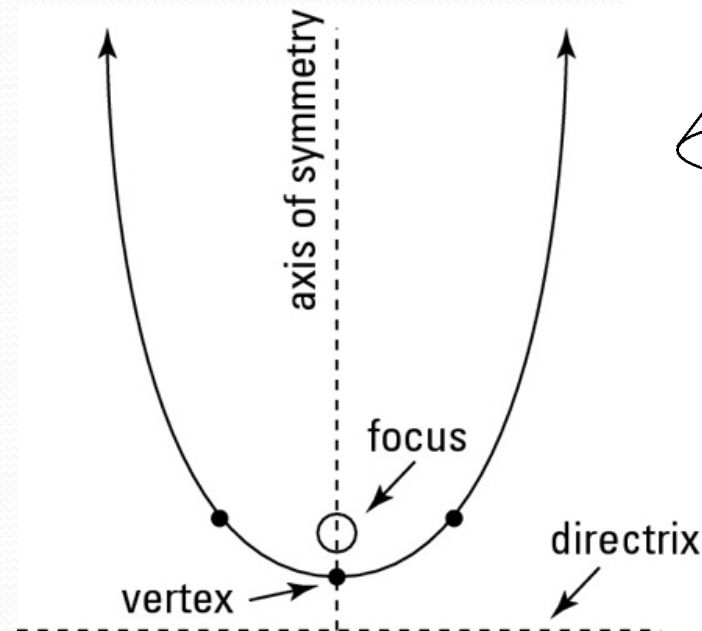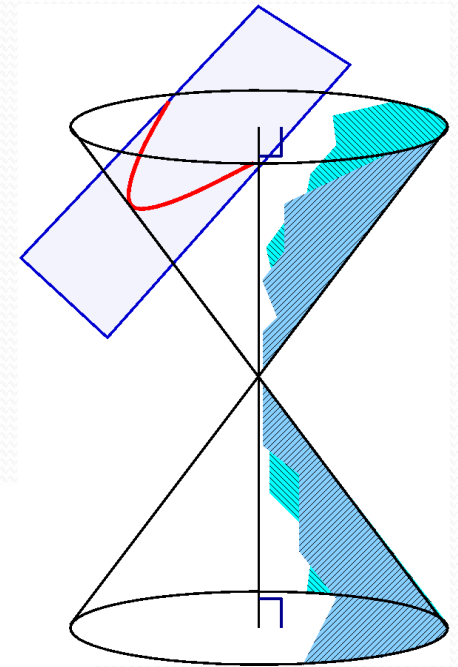
The parabola is a conic section, the intersection of a right circular conical surface and a plane parallel to a generating straight line of that surface.

OR

Given a point (the focus) and a corresponding line (the directrix) on the plane, the locus of points in that plane that are equidistant from them is a parabola.

axis of symmetry

focus

directrix

vertex

Parts Of A Parabola

Properties Of Parabola

- One of nature's best known approximations to parabolas is the path taken by a body projected upward and obliquely to the pull of gravity, as in the parabolic trajectory of a golf ball. The friction of air and the pull of gravity will change slightly the projectile's path from that of a true parabola, but in many cases the error is insignificant.

- Parabolas exhibit unusual and useful reflective properties.
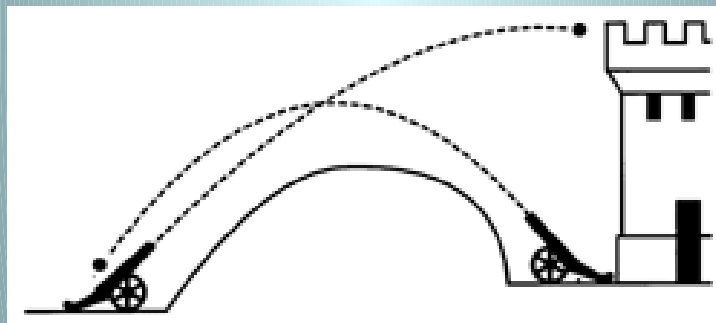
- Parabolas exhibit unusual and useful reflective properties. If a light is placed at the focus of a parabolic mirror (a curved surface formed by rotating a parabola about its axis), the light will be reflected in rays parallel to said axis. In this way a straight beam of light is formed. It is for this reason that parabolic surfaces are used for headlamp reflectors. The bulb is placed at the focus for the high beam and a little above the focus for the low beam.

The opposite principle is used in the giant mirrors in reflecting telescopes and in antennas used to collect light and radio waves from outer space: the beam comes toward the parabolic surface and is brought into focus at the focal point.
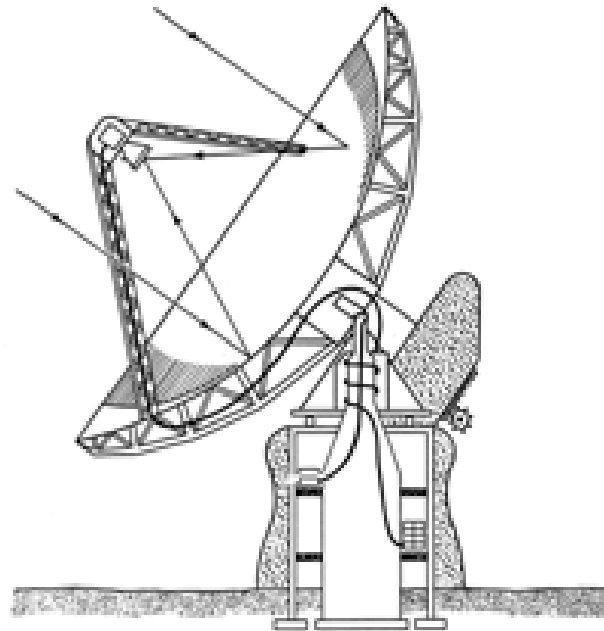
# *How Parabolic Dish Antennas work?*
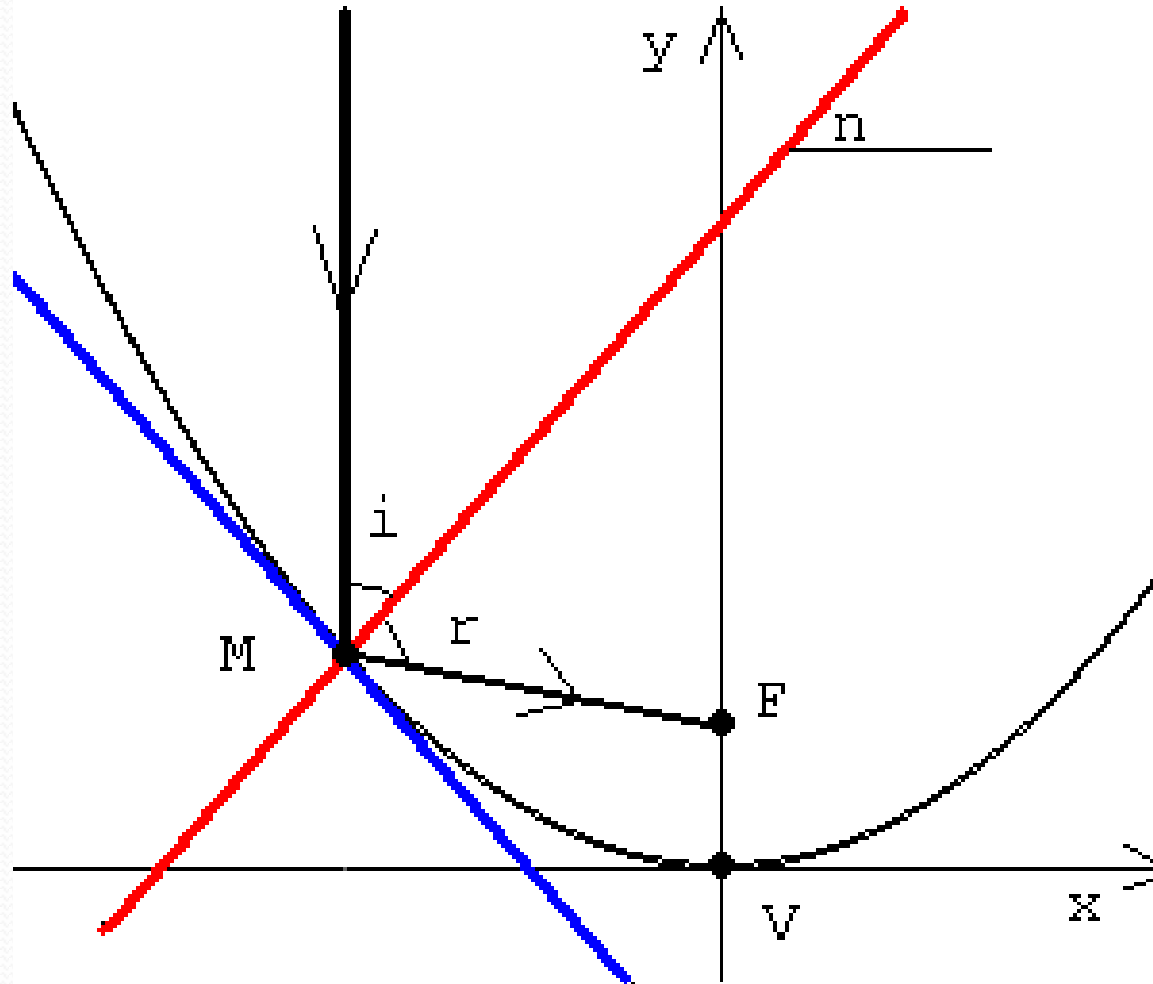
Point M is the point at which the ray hits the parabolic dish. "I" is the angle made by the incident ray and the normal (in red) which is perpendicular to the tangent (in blue) to the parabola at point M. r is the angle made by the reflected ray and the normal. According to the laws of reflection, angles "I" and "R" are equal.

All reflected rays due to incident rays, at different positions, intercept the axis of the parabola y axis) at the same.

Used in Searchlights

Light rays leaving the focus reflect out in parallel...
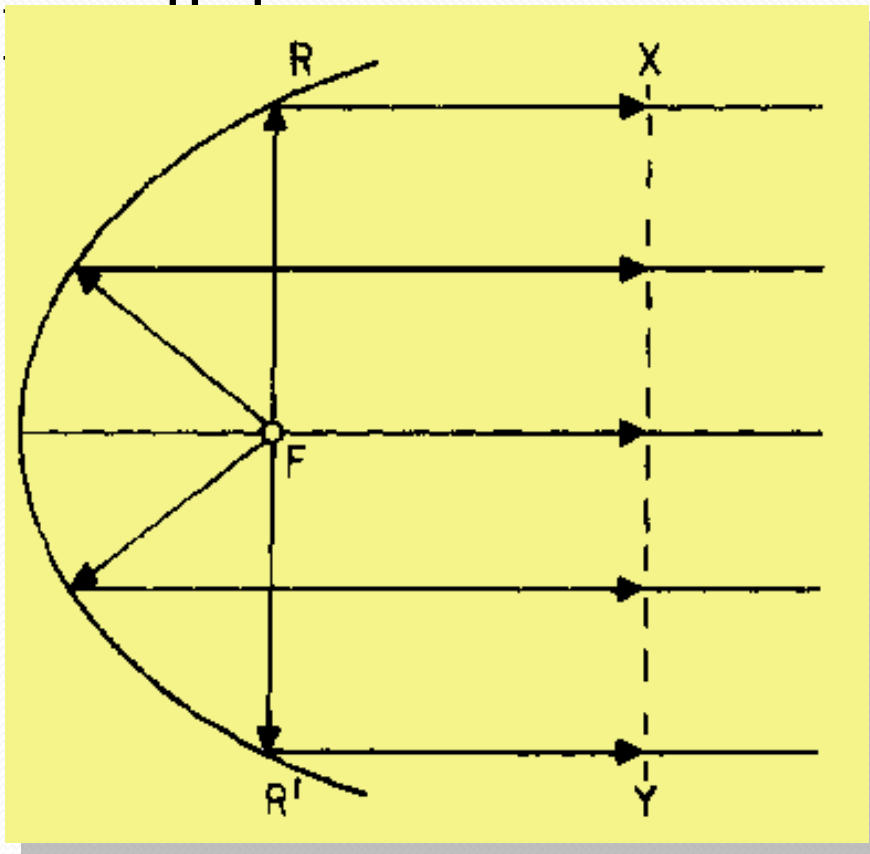
Used for Searchlights

Ellipse

An ellipse is a plane curve that results from the intersection of a cone by a plane in a way that produces a closed curve.

OR

An ellipse is also the locus of all points of the plane whose distances to two fixed points add to the same constant.

An ellipse obtained as the intersection of a cone with a

- Though not so simple as the circle, the ellipse is nevertheless the curve most often "seen" in everyday life. The reason is that every circle, viewed obliquely, appears elliptical.

- On a far smaller scale, the electrons of an atom move in an approximately elliptical orbit with the nucleus at one focus.
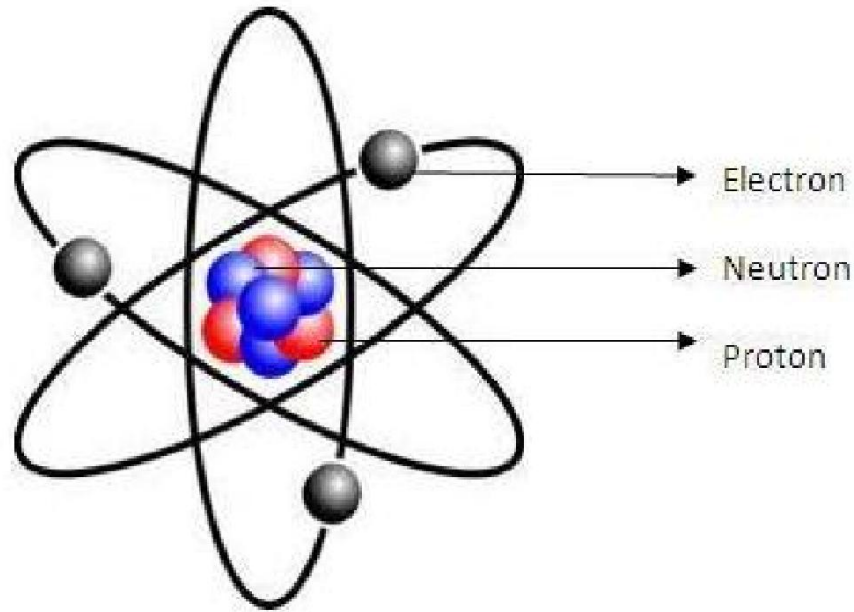
Real life applications

- The ellipse has an important property that is used in the reflection of light and sound waves. Any light or signal that starts at one focus will be reflected to the other focus. This principle is used in *lithotripsy*, a medical procedure for treating kidney stones. The patient is placed in a elliptical tank of water, with the kidney stone at one focus. High-energy shock waves generated at the other focus are concentrated on the stone, pulverizing it.

The principle is also used in the construction of "whispering galleries" such as in St. Paul's Cathedral in London. If a person whispers near one focus, he can be heard at the other focus, although he cannot be heard at many places in between.

Statuary Hall in the U.S. Capital building is elliptic. It was in this room that John Quincy Adams, while a member of the House of Representatives, discovered this acoustical phenomenon. He situated his desk at a focal point of the elliptical ceiling, easily eavesdropping on the private conversations of other House members located near the other focal point.
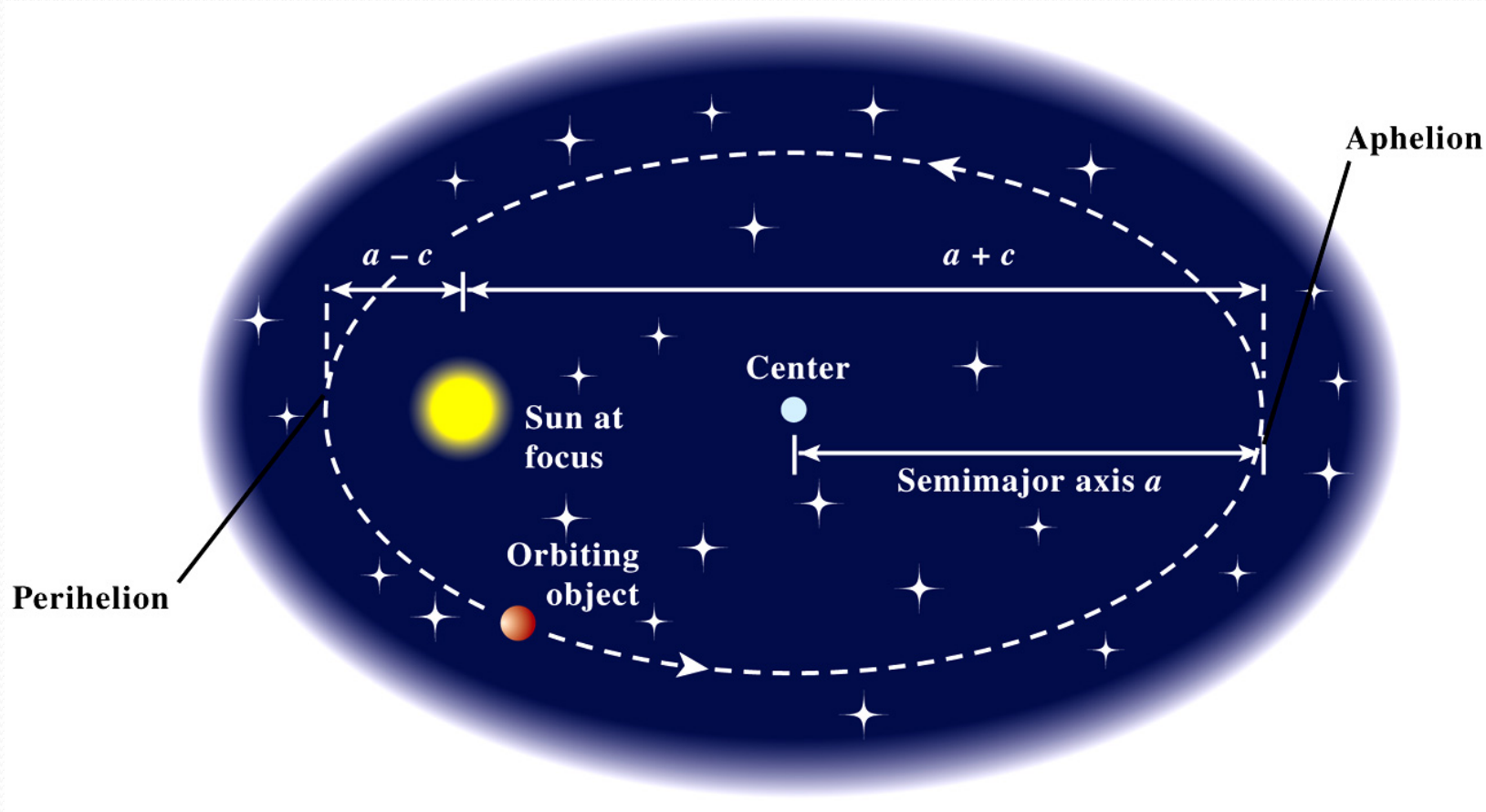
Most comets travel around the Sun in elliptical or open-ended parabolic and hyperbolic orbits.

Hyperbola

If a right circular cone is intersected by a plane parallel to its axis, part of a hyperbola is formed.
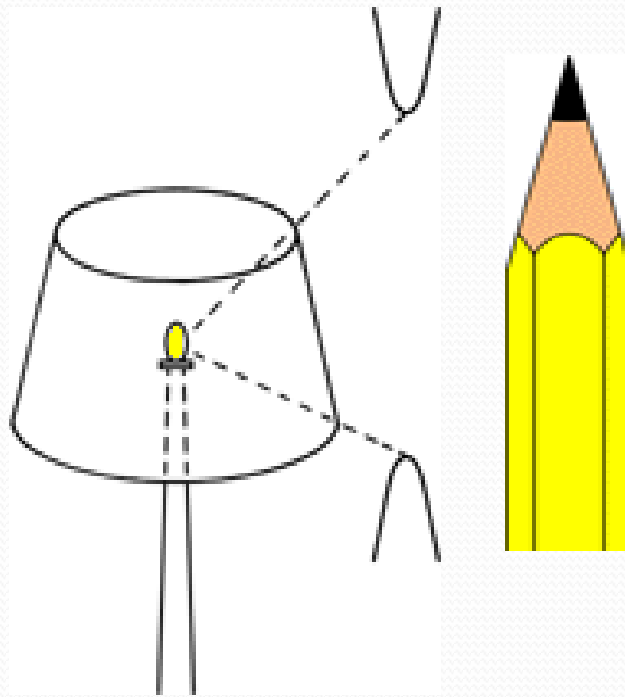
Such an intersection can occur in physical situations as simple as sharpening a pencil that has a polygonal cross section or in the patterns formed on a wall by a lamp shade.
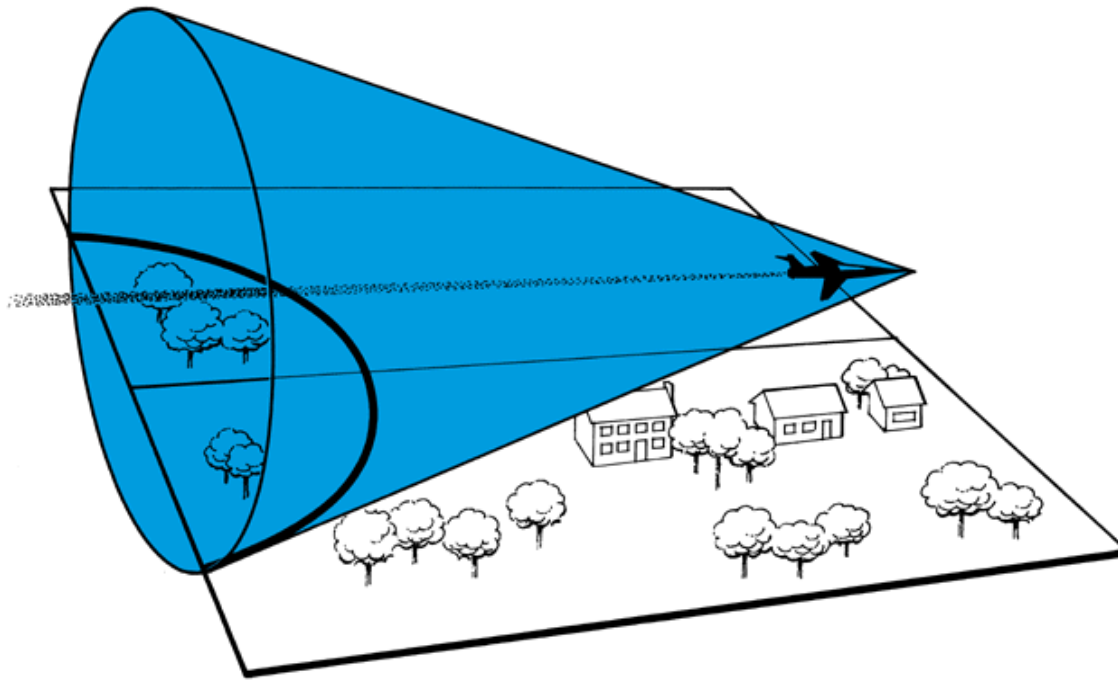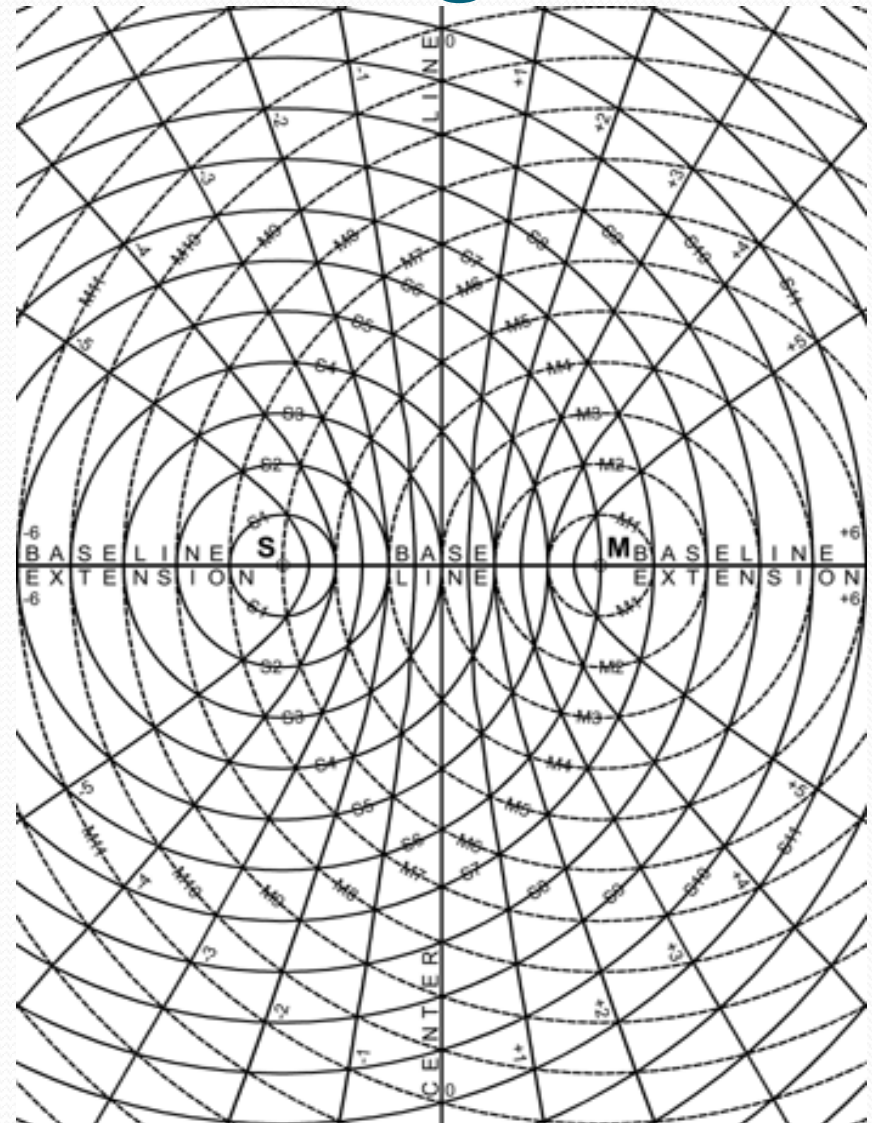
A sonic boom shock wave has the shape of a cone, and it intersects the ground in part of a hyperbola. It hits every point on this curve at the same time, so that people in different places along the curve on the ground hear it at the same time. Because the airplane is moving forward, the hyperbolic curve moves forward and eventually the boom can be heard by everyone in its path.

Radio waves and Navigation

Radio waves and hyperbolas can be used in navigation.

If the centre of each circle gives out a radio signal then the signals will intersect each other in hyperbolas.

This is how hyperbolic radio navigation systems were created.

Thank You