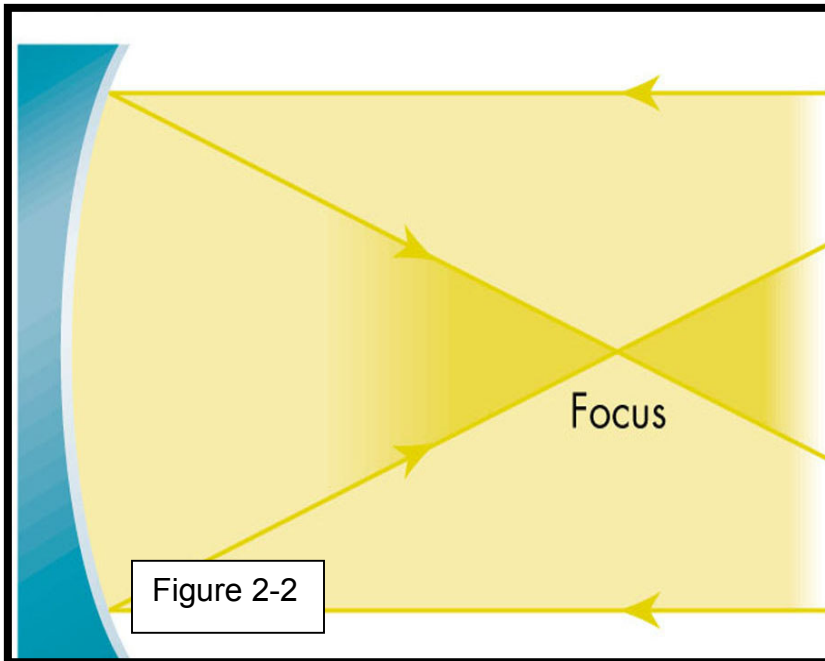
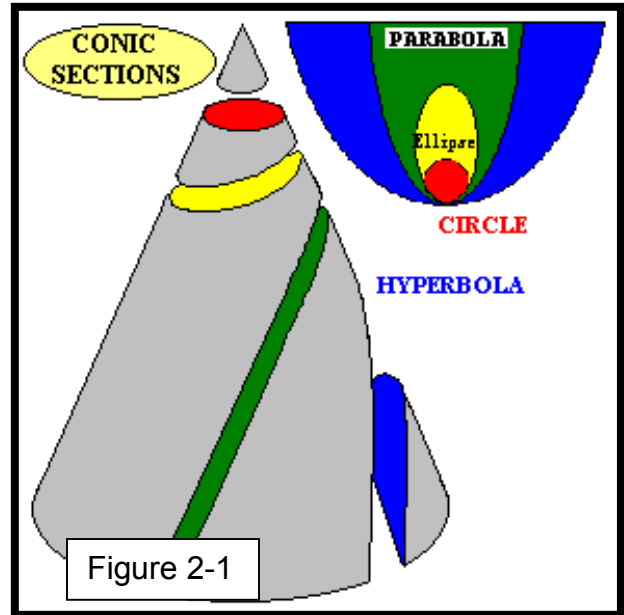


Conic Sections

If you were to take a right circular cone and slice it at various angles you would create a series of plane surfaces as shown in Figure 2-1 at right. If these surfaces were allowed to rotate the result would be geometric solids. A circle generates a sphere, a an ellipse an ellipsoid, a parabola a paraboloid, and a hyperbola a hyperboloid.

In creating a mirror for a Newtonian telescope the initial task is to produce a surface that is part of a sphere, and then “deepen” it slightly to form a parabolic surface.

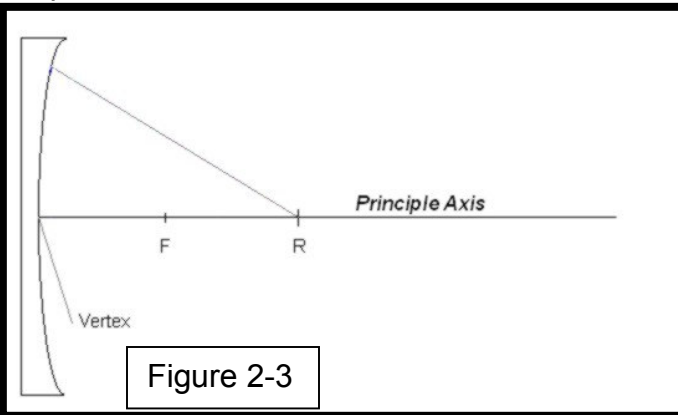


Parabolic Reflector

A parabolic reflector is unique in that rays of light from a distant object will come to a focus at a specific point as shown in Figure 2-2. The distant object produces incoming rays that are parallel to each other. If the object is not very distant, the incoming rays are not parallel and the focus point is further from the reflector.

Spherical Reflector

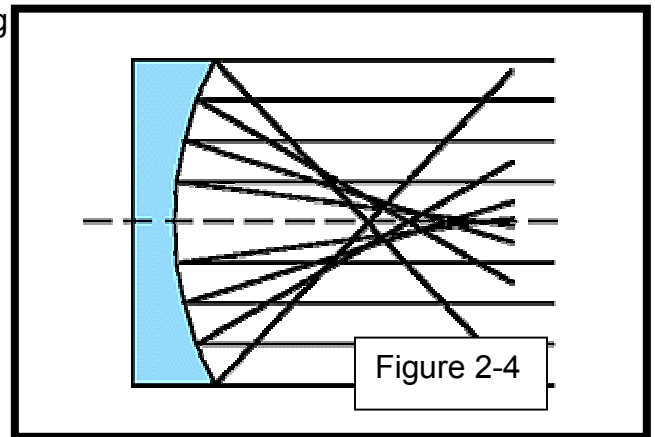
A spherical reflector manipulates light in a slightly different manner. In Figure 2-3 a spherical reflector has a Radius of Curvature , R.



Rays of light that originate at the center of curvature will also come to focus at the same point. This characteristic is very useful in determining the focal length of the mirror. It will become clear later on that the radius of curvature is equal to twice the focal length.

$$R = 2F$$

Unlike the parabolic reflector not all incoming rays parallel to the principle axis comes to an exact focus at F. This characteristic is called *spherical aberration*. Compare Figure 2-2 parabolic focus to Figure 2-4 spherical focus.



As you begin grinding your mirror the surface becomes concave. The surface will be very rough and will not normally reflect much light. Some light will be reflected if the mirror is sprayed with water. With practice you can get a good measurement of the focal length . Using a small light bulb, candle, or butane lighter in a dark room. look for a reflection off the surface of the mirror. Once you locate the reflection try to keep your eye and light source at the same distance from the mirror. If your eye and the light source are inside the center of curvature the light source and its reflection will move in the same direction. If the light source and reflection move in opposite directions you are outside the center of curvature. At the center of curvature the mirror will be full of light and it will be difficult to tell which direction the reflection is moving. Once you locate the center of curvature, measure the distance from the mirror and divide by two. You will need to keep the mirror wet and need to take several measurements to get a good average. This method becomes easier to perform and more accurate as you proceed to smaller grit sizes.

Telescope Making Part II Spheres and Parabolas

As you proceed to the polishing stages light reflects fairly nicely without water. The knife edge test or the Foucault Test,, to be described in another section, uses a slit restricted light source and a straight edge. For a perfectly spherical surface movement of the straight edge **inside** the center of curvature appears in the **same direction**. **Outside** the center of curvature the appearance of the straight edge is in the **opposite direction**. At the center of curvature the straight edge appears to darken the mirror instantaneously and uniformly.

If the mirror is not spherical it will not be uniformly lit. A parabola exhibits a very characteristic light pattern.

Fortunately, performing these tests is easier than to explaining them.

