

# Reflection property of a parabola

While the parabola has many beautiful geometric properties as we have seen, it also has a remarkable property known as the reflection property, which is used in such diverse places as car headlights and satellite dishes. A car headlight emits light from one source, but is able to focus that light into a beam so that the light does not move off in all directions — as lamplight does — but is focused directly ahead. Satellite dishes do the opposite. They collect electromagnetic rays as they arrive and concentrate them at one point, thereby obtaining a strong signal.

Headlight reflectors and satellite dishes are designed so their cross-sections are parabolic in shape and the point of collection or emission is the focus of the parabola.

To show how this works we need a basic fact from physics: when light (or any electromagnetic radiation) is reflected off a surface, the angle of incidence equals the angle of reflection. That is, when a light ray bounces off the surface of a reflector, then the angle between the light ray and the normal to the reflector at the point of contact equals the angle between the normal and the reflected ray. This is shown in the following diagram.

