Warmup

The equation below represents a circle. Complete the square to put it in the standard form for circles.

$(x - h)^2 + (y - k)^2 = r^2$

$2x^2 + 2y^2 - 4x + 16y + 2 = 0$

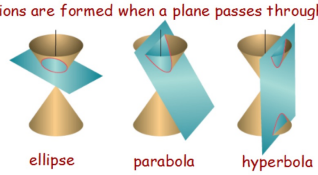
8.1 Conic Sections & Parabolas

ESSENTIAL QUESTIONS

Can you identify which conic sections are formed by the intersection of cones and planes?

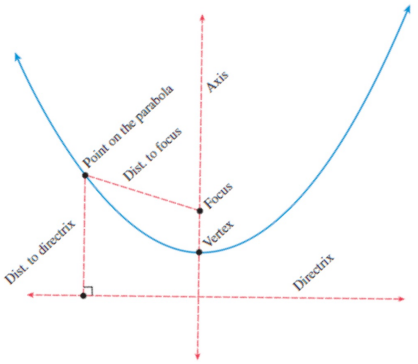
Where are parabolas seen in science and nature?

Conic sections are formed when a plane passes through cones.



Definition of Parabola

A parabola is the set of all points that are equidistant from a fixed point (focus) and a fixed line (directrix).

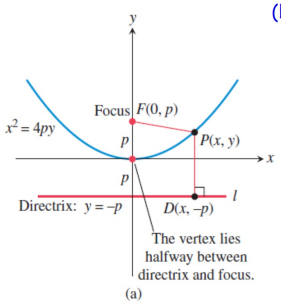


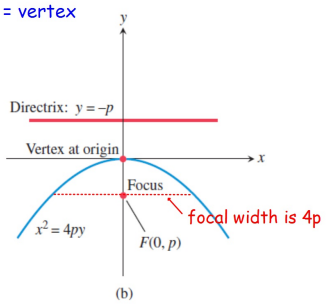
Parabolas that open up or down in the coordinate plane can be written in the form

$4p(y - k) = (x - h)^2$

p = focal length

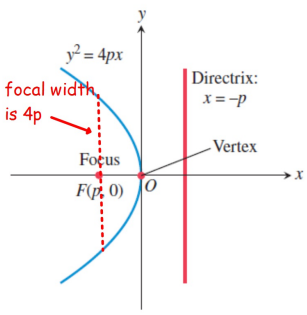
(h, k) = vertex

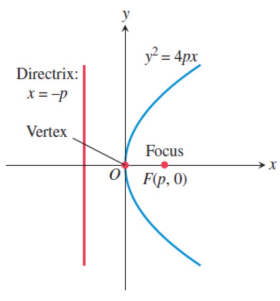




Likewise, parabolas that open left or right can be written in the general form

$4p(x - h) = (y - k)^2$

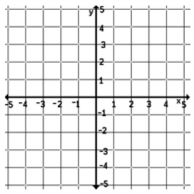




examples:

1. Find the focus, the directrix, and the focal width of the parabola $y = -\frac{1}{2}x^2$.

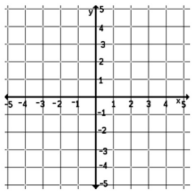
2. Find an equation in standard form for the parabola whose directrix is the line x = 2 and whose focus is the point (-2, 0).



3. Find an equation in standard form for the parabola that opens down, with vertex (-3, 3), and with focal width 20.

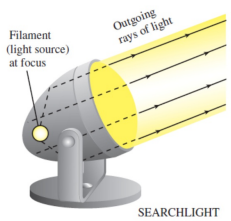
4. Prove algebraically that the graph of $y^2 - 6x + 2y + 13 = 0$ is a parabola.
(Hint: Show that the equation can be put in the form $(y - k)^2 = 4p(x - h)$.)

5. Use what you know about parabolas to find the vertex, focus, and directrix of $3x^2 - 6x - 6y + 10 = 0$. Then graph the parabola.

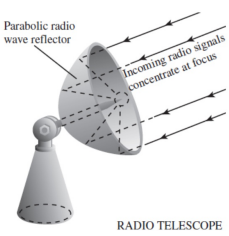


Why are parabolas important?

Paraboloids are parabolas that have been rotated around their axis of symmetry to form a 3-D figure. Paraboloids have amazing reflective properties, so this shape is used for things like headlights and satellite dishes.



SEARCHLIGHT



RADIO TELESCOPE

6. See Bright, Inc., makes parabolic headlights for cars. If one model of its headlights has a parabolic surface generated by the parabola $x^2 = 12y$, how far from the vertex should the light bulb be placed?