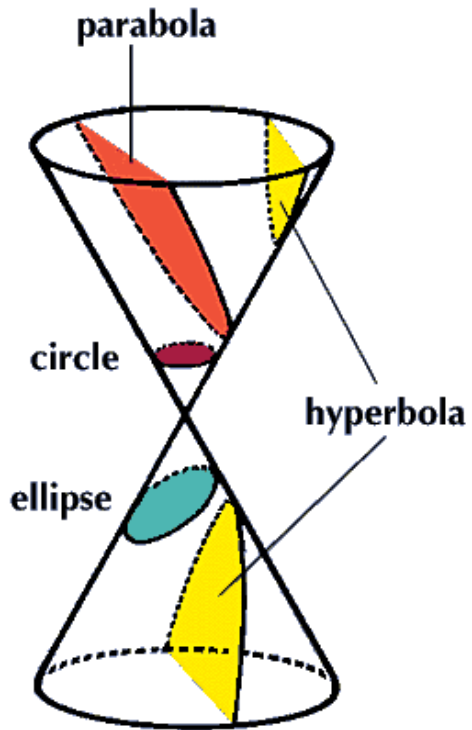


Cypress College Math Review: The Parabola for College Algebra

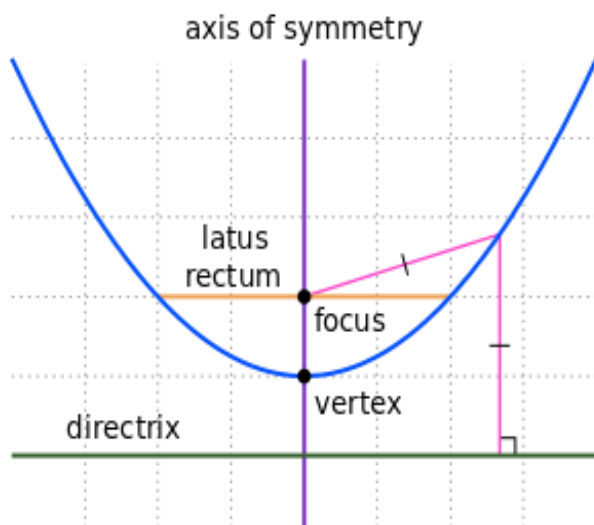
Recall that the equation of a parabola is $y = c(x - h)^2 + k$ with vertex (h, k) .

We would graph $y = x^2$, then multiply the y-coordinates by c , move right h , then up k .



A parabola is one of the conic sections. A conic section is the intersection of a plane with a right circular cone.

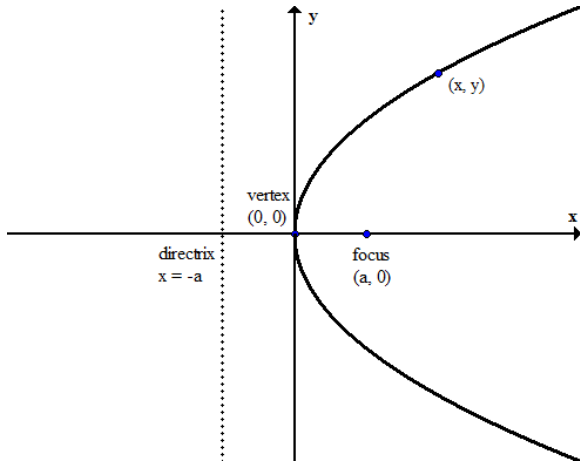
Definition: A **parabola** is a set of points in a plane equidistant from a fixed line and a fixed point. The fixed line is called the **directrix** and the fixed point is the **focus**.



The **axis of symmetry** is the line that goes through the vertex and focus of the parabola. It is perpendicular to the directrix.

The **latus rectum** is the line segment that is perpendicular to the axis of symmetry that goes through the focus. Graph the endpoints of the latus rectum when you graph a parabola.

Distance from directrix to vertex = Distance from vertex to focus = |a|



The distance from any point on the parabola to the directrix $x = -a$ must equal the distance to the focus $(a, 0)$.

distance 1 = distance 2

$$|x - (-a)| = \sqrt{(x - a)^2 + y^2}$$

$$(a + x)^2 = (x - a)^2 + y^2$$

$$a^2 + 2ax + x^2 = x^2 - 2ax + a^2 + y^2$$

$$y^2 = 4ax$$

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

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

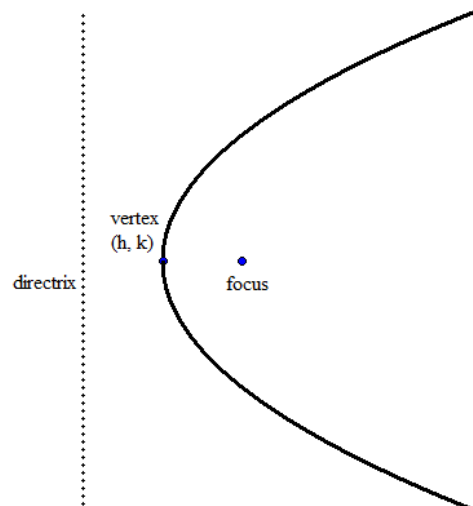
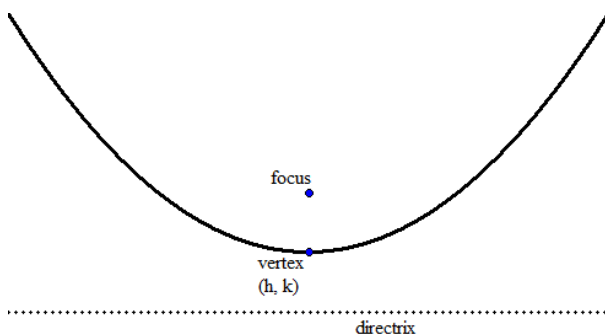
$$y - k = c(x - h)^2$$

$$\frac{y - k}{c} = (x - h)^2$$

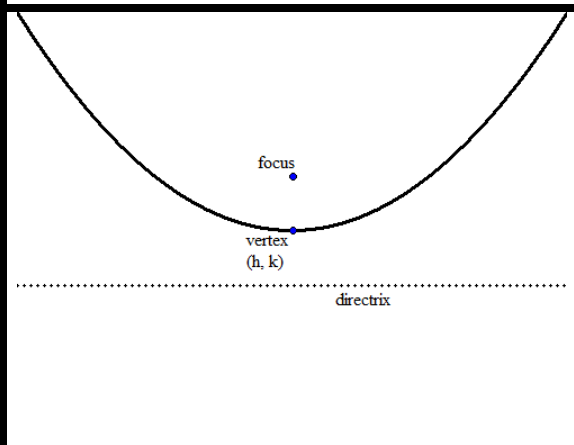
$$(x - h)^2 = \frac{1}{c}(y - k)$$

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

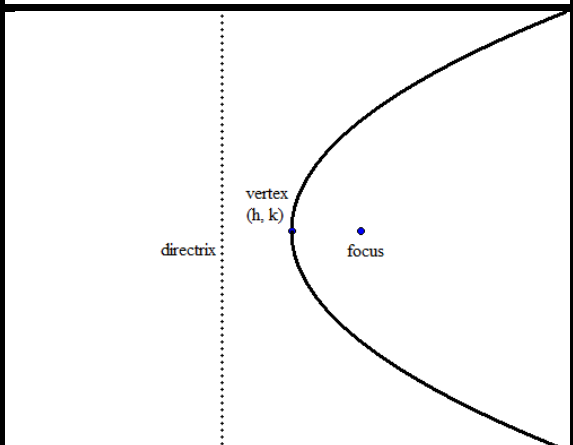
where $4a = \frac{1}{c}$



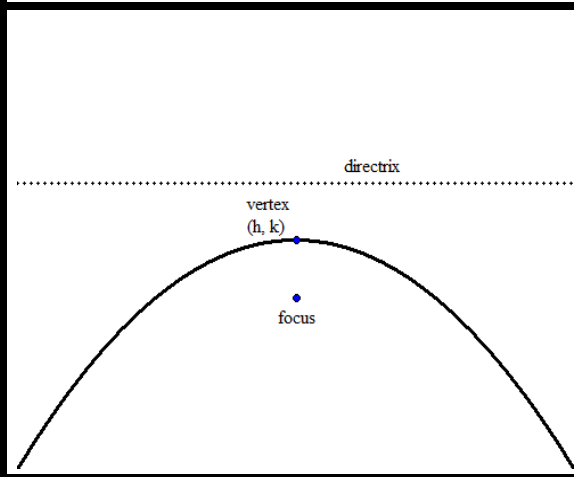
Equation:



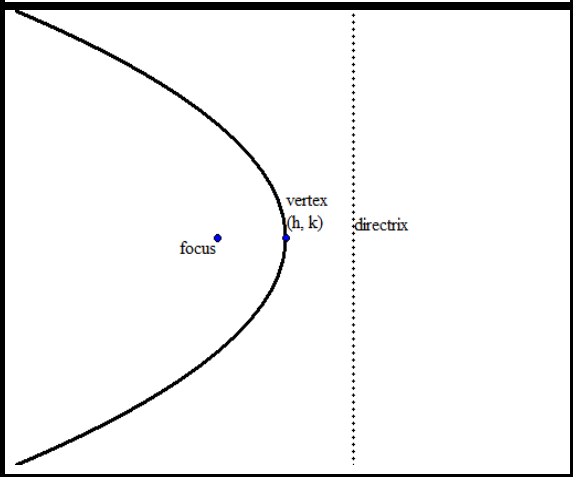
Equation:



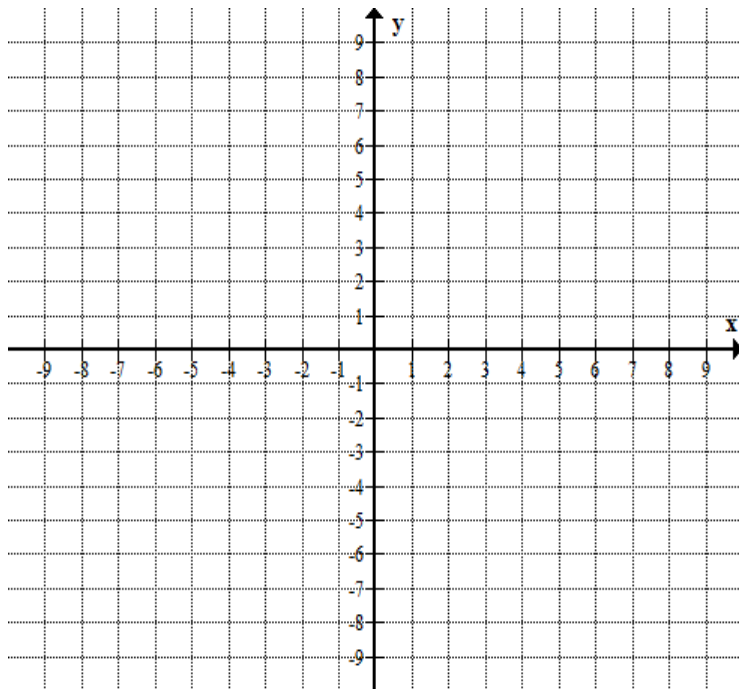
Equation:



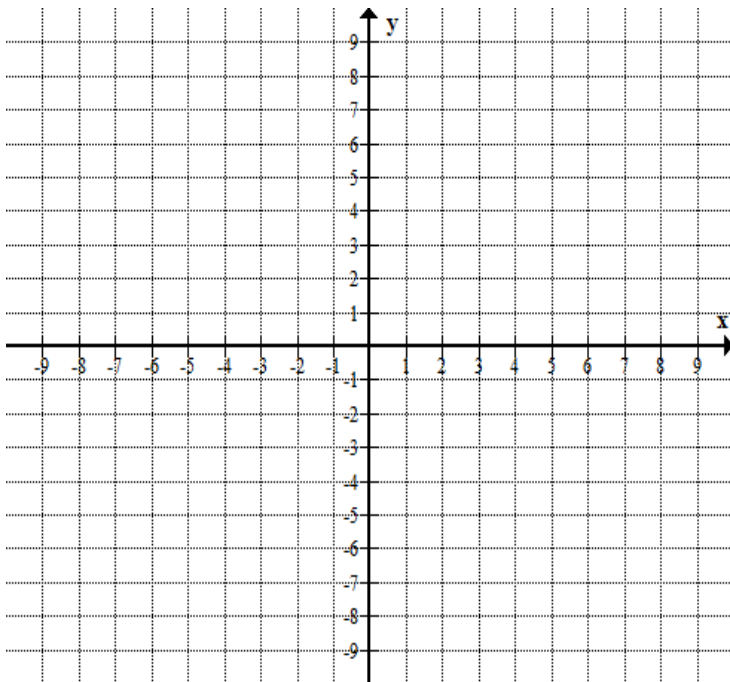
Equation:



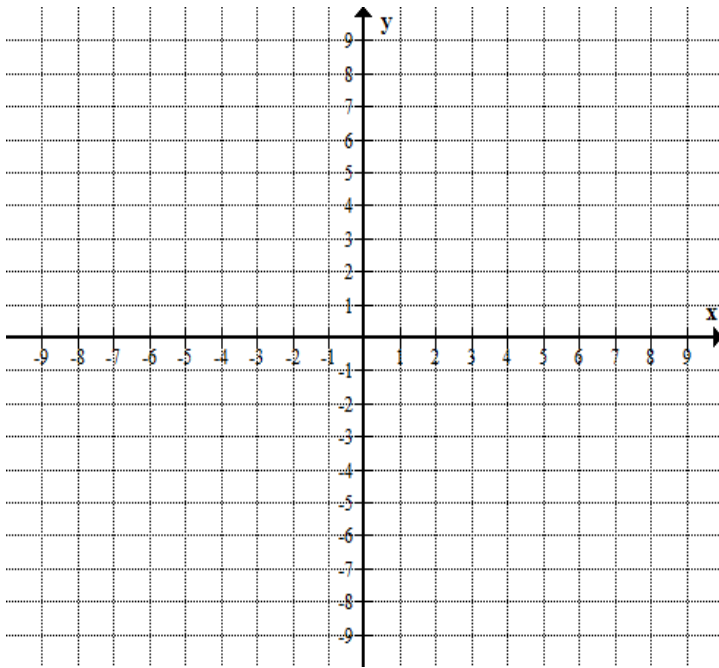
Example) $(y-3)^2 = -12(x+1)$



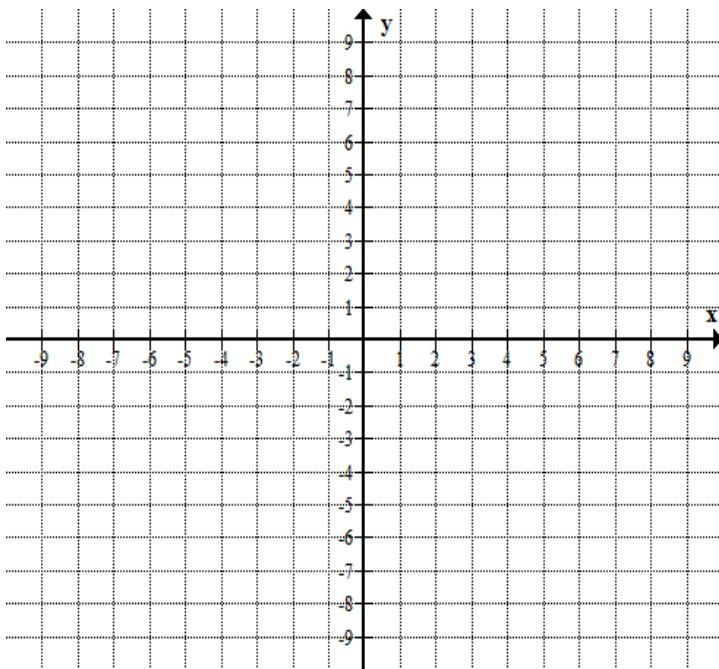
Example) $x^2 + 8x - 8y - 8 = 0$



Example) Find the equation of the parabola with focus $(1, 7)$ and vertex $(4, 7)$.

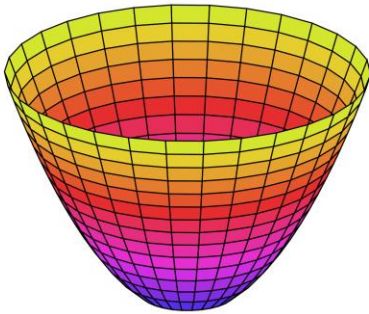


Example) Find the equation of the parabola with focus $(3, -7)$ and directrix $y = -3$.

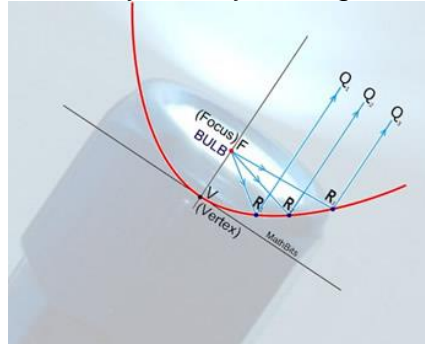


Applications of parabolas are extensive.

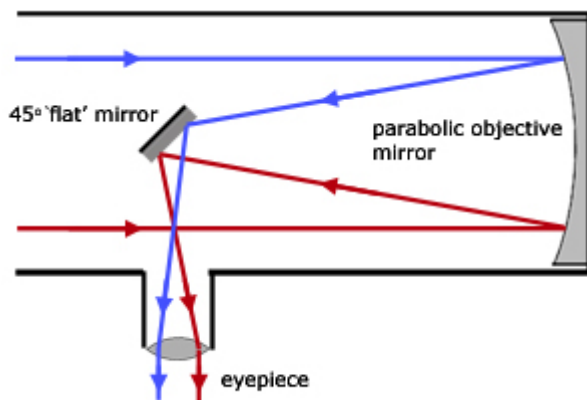
A **paraboloid of revolution** is a surface formed by rotating a parabola around the axis of symmetry.



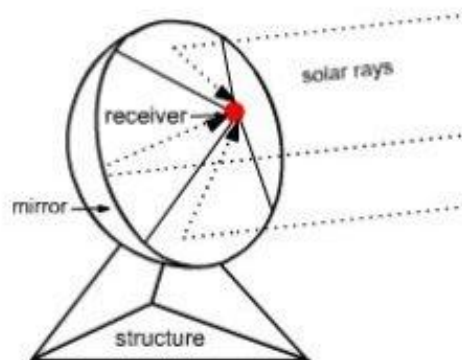
If a flashlight, or searchlight, is constructed where the light source is at the focus and the mirror around the light source is a paraboloid of revolution, then the rays of light will emanate from the flashlight parallel to the axis of symmetry. This gives a strong beam of light.



In telescopes rays of light come in and strike the mirror at the back of the telescope. The mirror is a paraboloid of revolution. The rays reflect toward the focus.



Satellite dishes work similarly, all of the signals strike the dish and are reflected back to the focus. The receiver is placed at the focus.



Example) A reflecting telescope contains a mirror shaped like a paraboloid of revolution. If the mirror is 16" across at its opening and it is 2 feet deep, where will its light be concentrated? Write your answer accurate to two decimal places.