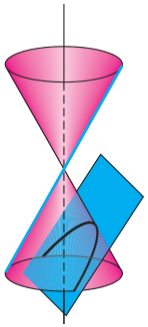
9.2: The Parabola

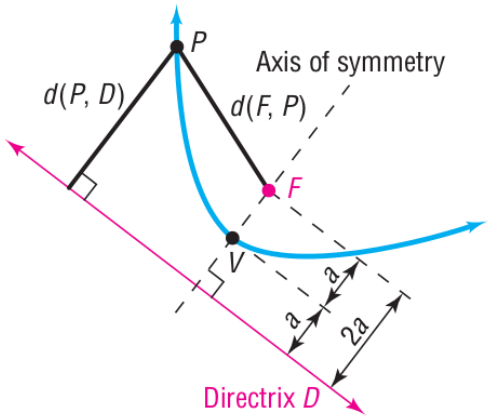
Supplementary Notes

A *parabola* is an example of a *conic* since it is the cross-section of a cone with a plane parallel to a line on the face of the cone.

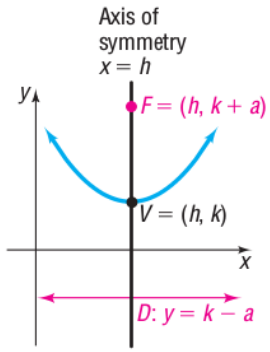


A *parabola* is the collection of points in the xy-plane equidistant from a fixed point F and line D. F is called the *focus* and D is called the *directrix*.

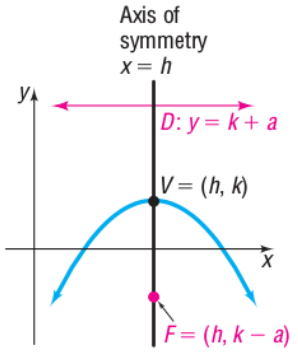
- (distance from vertex V to focus F) $= a$
- (distance from vertex V to directrix D) $= a$



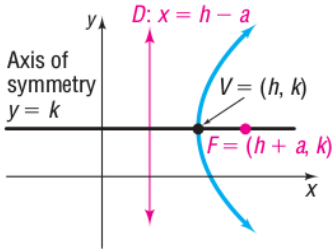
Equations of parabolas with vertex (h, k) and axis of symmetry parallel to a coordinate axis, $a > 0$					
Equation	Axis of Symmetry		Opens	Focus	Directrix
$(x-h)^2 = 4a(y-k)$	vertical	$x = h$	up	$(h, k+a)$	$y = k-a$
$(x-h)^2 = -4a(y-k)$			down	$(h, k-a)$	$y = k+a$
$(y-k)^2 = 4a(x-h)$	horizontal	$y = k$	right	$(h+a, k)$	$x = h-a$
$(y-k)^2 = -4a(x-h)$			left	$(h-a, k)$	$x = h+a$



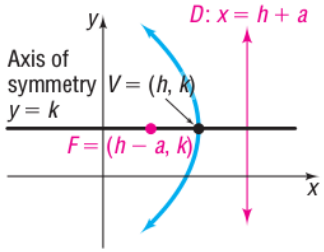
$(x-h)^2 = 4a(y-k)$



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



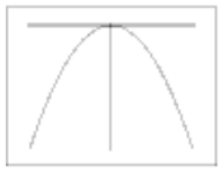
$(y-k)^2 = 4a(x-h)$



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

Exercises

1. Select the equation of the following graph



   A. $x^2 = -by$, $b < 0$
   B. $y^2 = -bx$, $b < 0$
   C. $y^2 = bx$, $b < 0$
   D. $x^2 = by$, $b < 0$

2. Sketch the graph of $y^2 = -cx$, $c < 0$.

3. Find the focus of the parabola given by $y^2 = x$.

4. Find the focus of the parabola with equation $(x-2)^2 = (y+1)$.

5. Find the directrix of the parabola given by $x^2 = -8y$.

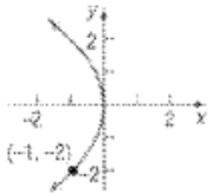
6. Find the directrix of the parabola with equation $(y-3)^2 = 2(x-1)$.

7. Write (using lowercase x and y) the equation of the parabola with focus $(0,-1)$ and vertex $(0,0)$.

8. Write (using lowercase x and y) the equation of the parabola with directrix $x = \frac{1}{2}$ and vertex at $(1,3)$.

9. Write (using lowercase x and y) the equation of the parabola with focus $(2, \frac{5}{2})$ and directrix $y = \frac{7}{2}$.

10. Write (using lowercase x and y) the equation of the following parabola.



11. Write (using lowercase x and y) the equation of the following parabola if the parabola contains the point $(2,-1)$.