

Lec(6)

The parabola with vertex (h,k)

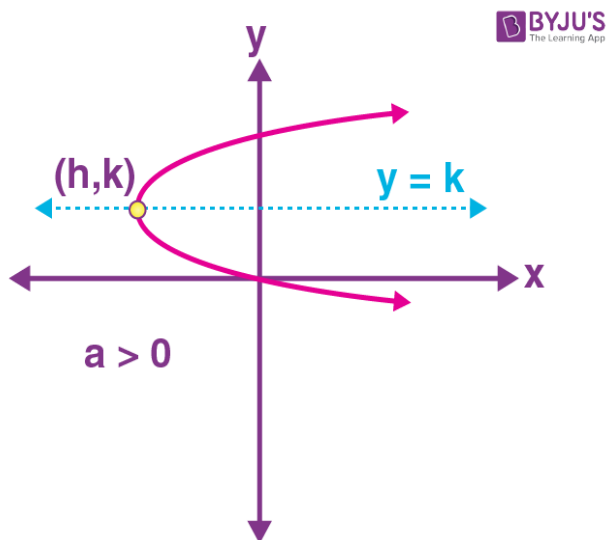
Case (1):-

The parabola with vertex (h,k) and open in the positive x-direction the equation of it with respect to

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

This is a parabola with vertex (h,k) focus(h+a,k) and the equation of directrix is $x = h - a$

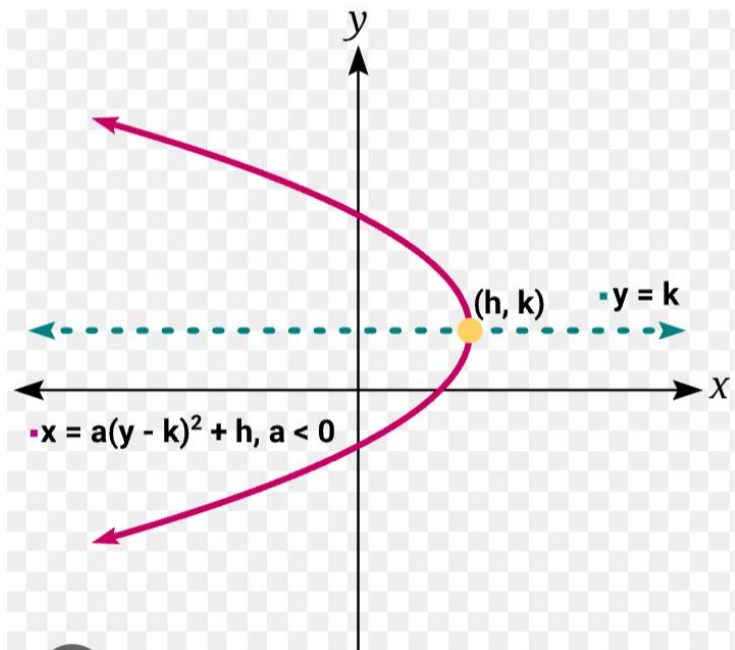
Parabola axis is parallel to x-axis



Case 2 :-

Parabola axis is parallel to x-axis , vertex (h,k) open in the negative x-direction , focus $(h - a, k)$ and the equation of directrix $x = h + a$

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



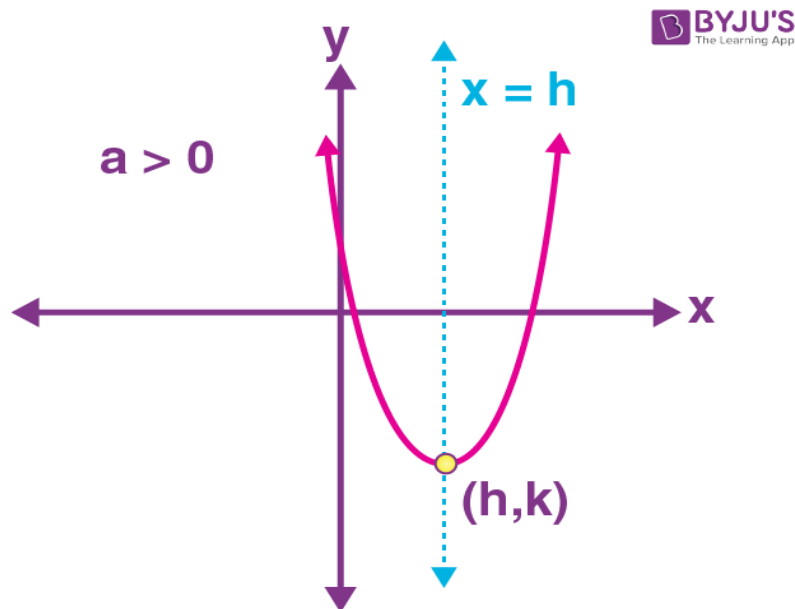
Case (3):-

The parabola with vertex (h,k) and open in the positive Y-direction the equation of it with respect to

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

This is a parabola with vertex (h,k) focus $(h,k+a)$, open in the positive y- direction and the equation of directrix is $y = k - a$

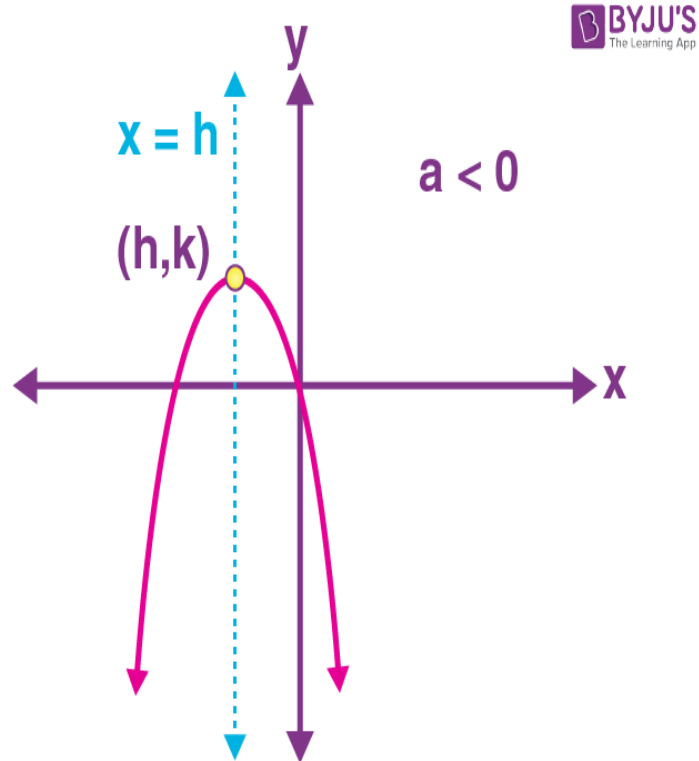
Parabola axis is parallel to x-axis



Case 4:-

Parabola axis is parallel to y-axis , vertex (h,k) open in the negative y-direction , focus $(h, k - a)$ and the equation of directrix $y = k + a$

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



Example:-

Find the equation of parabola if

1) The vertex(3,2)and the focus (3,7)

Solution

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

$$(h, k) = (3, 2)$$

$$a = 5$$

$$(x - 3)^2 = 20(y - 2)$$

The diretrix $y = k - a$

$$y = 2 - 5$$

$$y = -3$$

$$x = 3$$

2) The vertex(5,0)and the equation of directrix $y=5$

Solution

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

$$(h, k) = (5, 0)$$

$$a = 5$$

$$(x - 5)^2 = -(4)(5)(y - 0)$$

$$(x - 5)^2 = -20(y)$$

The focus (5,-5)

The axis $x=5$

3) The vertex(2,3)and the focus (7,3)

Solution

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

$$(h, k) = (2, 3)$$

$$a = 5$$

$$(y - 3)^2 = 20(x - 2)$$

The directrix $x = h - a$

$$x = 2 - 5$$

$$x = -3$$

$$y = 3$$

4) The vertex $(-3, -1)$ and the focus $(-5, -1)$

Solution

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

$$(h, k) = (-3, -1)$$

$$a = 2$$

$$(y + 1)^2 = -(4)(2)(x + 3)$$

$$(y + 1)^2 = -8(x + 3)$$

The directrix $x = h + a$

$$x = -3 + 2$$

$$x = -1$$

$$y = -1$$

ii) find the coordinates of vertex, focus, and the equation of the directrix of the following equation

1) $(x - 1)^2 = -16(y + 2)$

2) $y^2 = 4(x - 3)$

3) $(y + 3)^2 = 8(x - 1)$

