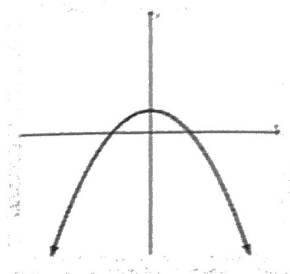
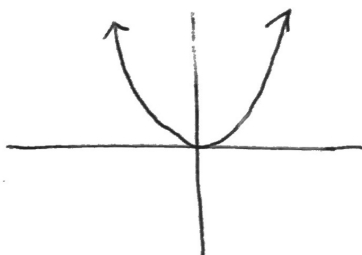


Today's Objectives:

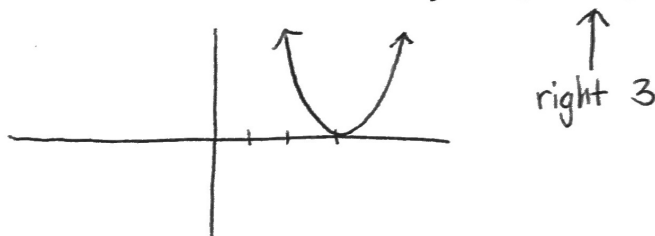
- Analyze and graph equations of parabolas.
- Write equations of parabolas.



Sketch the graph of $y = x^2$.

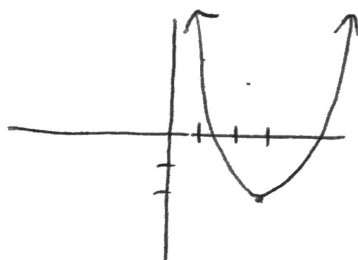


Can you use a translation to sketch $y = (x - 3)^2$ by hand?



Now graph $y + 2 = (x - 3)^2$. Identify the translations and sketch by hand.

$$y = (x - 3)^2 - 2 \quad \text{right } 3, \text{ down } 2$$



Could you use translations to sketch $y = x^2 - 6x + 9$? *yes, but more difficult*

- What do you know about this graph from the given equation?

$$y\text{-int: } (0, 9)$$

- How could we rewrite the equation to find the vertex?

$$y = (x - 3)^2 + 9 - 9 \quad (\text{complete the square})$$

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

Could you use translations to sketch $y = x^2 + 4x + 11$?

- What do you know about this graph from the given equation?

$$y\text{-int: } (0, 11)$$

- How could we rewrite the equation to find the vertex?

$$y = (x+2)^2 + 11 - 4$$

$$y = (x+2)^2 + 7$$

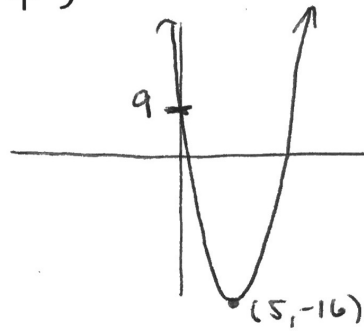
$$\text{Vertex: } (-2, 7)$$

You Try: Sketch $y = x^2 - 10x + 9$

$$y\text{-int: } (0, 9)$$

$$y = (x-5)^2 + 9 - 25$$

$$y = (x-5)^2 - 16$$

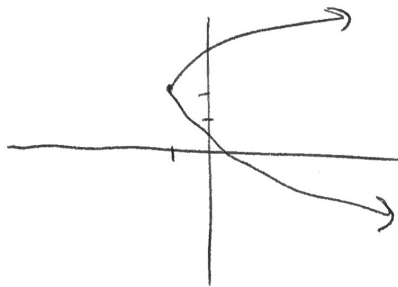


What is different about this equation? $(y-2)^2 = x+1$

What do you think it will look like?

The y is squared instead of the x . Will be a sideways parabola.

$$\text{Vertex: } (-1, 2)$$



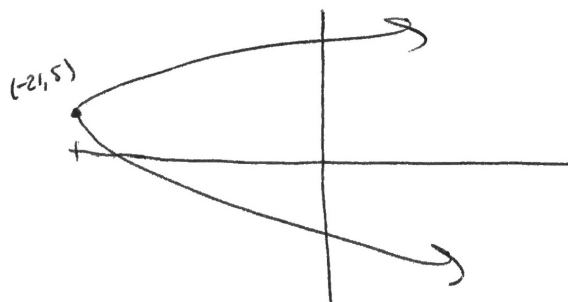
Sketch $y^2 - 10y = x - 4$

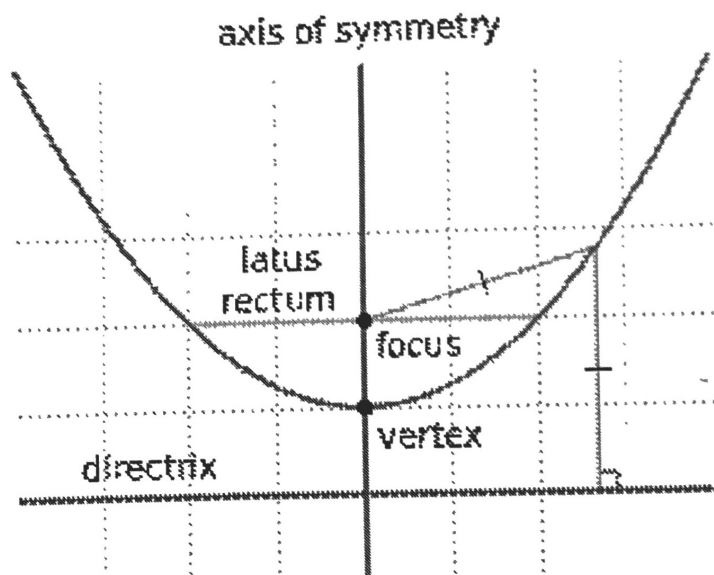
$$(y-5)^2 - 25 = x - 4$$

$$(y-5)^2 = x - 4 + 25$$

$$(y-5)^2 = x + 21$$

$$\text{Vertex: } (-21, 5)$$





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

For all conic equations, the squared terms are written on the left side.

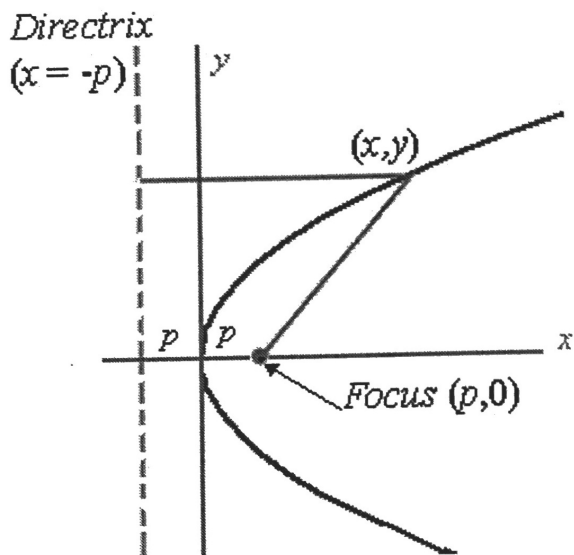
Orientation: opens vertically

Vertex: (h, k)

Focus: $(h, k + p)$

Axis of Symmetry a: $x = h$

Directrix d: $y = k - p$



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

Orientation: opens horizontally

Vertex: (h, k)

Focus: $(h + p, k)$

Axis of Symmetry a: $y = k$

Directrix d: $x = h - p$

For $(x + 1)^2 = -4(y - 2)$, identify the vertex, focus, axis of symmetry, and directrix. Then graph the parabola.

next page

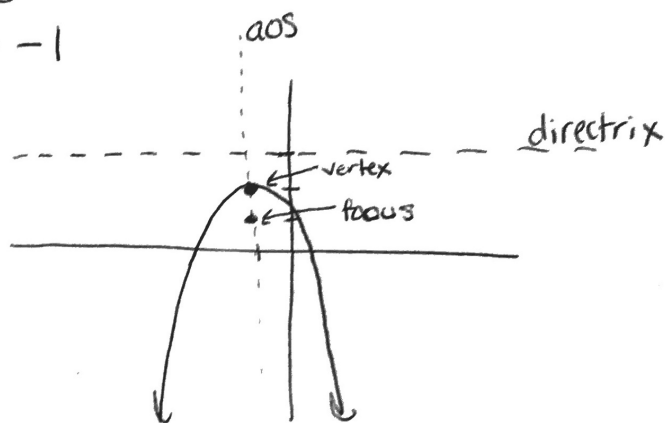
$$(x+1)^2 = -4(y-2) \quad -4 = 4p \quad p = -1$$

$$\text{vertex: } (-1, 2)$$

$$\text{focus: } (-1, 2 + (-1)) = (-1, 1)$$

$$\text{aOS: } x = -1$$

$$\text{directrix: } y = 2 - (-1) \\ y = 3$$



For $(y - 3)^2 = -8(x + 1)$, identify the vertex, focus, axis of symmetry, and directrix. Then graph the parabola.

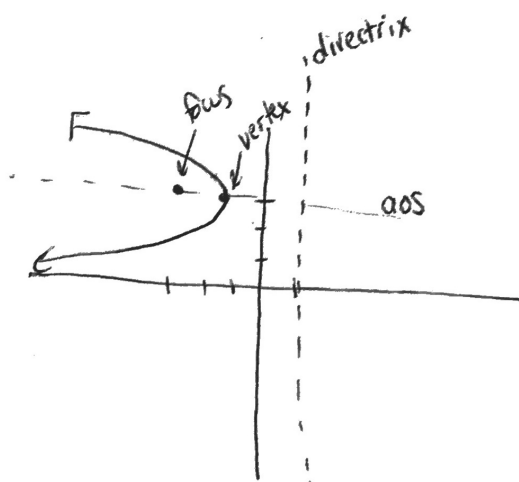
$$(y-3)^2 = -8(x+1) \quad 4p = -8 \quad p = -2$$

$$\text{vertex: } (-1, 3)$$

$$\text{focus: } (-1 + (-2), 3) = (-3, 3)$$

$$\text{aOS: } y = 3$$

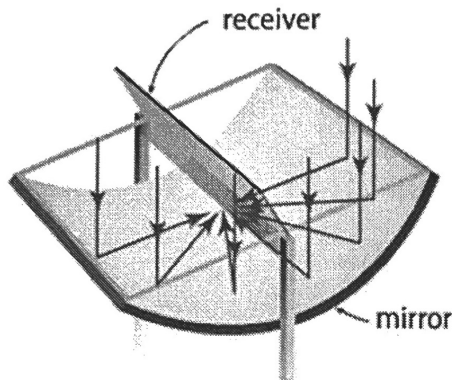
$$\text{directrix: } x = -1 - (-2) \\ x = 1$$



* focus is always inside the parabola
directrix is always outside the parabola

Real-World Example 2 Characteristics of Parabolas

SOLAR ENERGY A trough solar collector is a length of mirror in a parabolic shape that focuses radiation from the Sun onto a linear receiver located at the focus of the parabola. The cross section of a single trough can be modeled using $x^2 = 3.04y$, where x and y are measured in meters. Where is the linear receiver located in this cross section?



$$\text{focus: } (h, k+p)$$

$$(0, 0+0.76)$$

$$(0, 0.76)$$

$$x^2 = 3.04y$$

$$(x-0)^2 = 3.04(y-0)$$

$$4p = 3.04$$

$$p = 0.76$$

Write $x^2 - 8x - y = -18$ in standard form. Identify the vertex, focus, axis of symmetry, and directrix. Then graph the parabola.

$$x^2 - 8x = y - 18$$

$$(x-4)^2 = y - 18 + 16$$

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

$$4p = 1$$

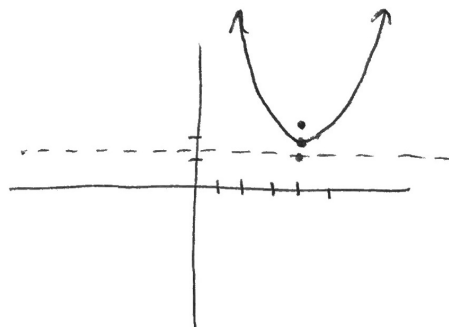
$$p = \frac{1}{4}$$

$$\text{vertex: } (4, 2)$$

$$\text{focus: } (4, 2+0.25) = (4, 2.25)$$

$$\text{axis: } x = 4$$

$$\text{directrix: } y = 2 - 0.25 = 1.75$$



Write $y^2 + 16x = 55 - 6y$ in standard form. Identify the vertex, focus, axis of symmetry, and directrix. Then graph the parabola.

$$y^2 + 6y = -16x + 55$$
$$(y + 3)^2 = -16x + 55 + 9$$
$$(y + 3)^2 = (-16x + 64)$$
$$(y + 3)^2 = -16(x - 4)$$

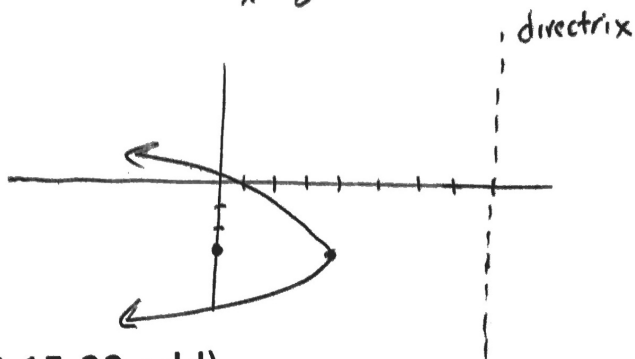
$$4p = -16$$
$$p = -4$$

$$\text{vertex: } (4, -3)$$

$$\text{focus: } (4 + (-4), -3) = (0, -3)$$

$$\text{a.o.s: } y = -3$$

$$\text{directrix: } x = 4 - (-4)$$
$$x = 8$$



Assignment: page 428 (1,3,11,13,15-23 odd)