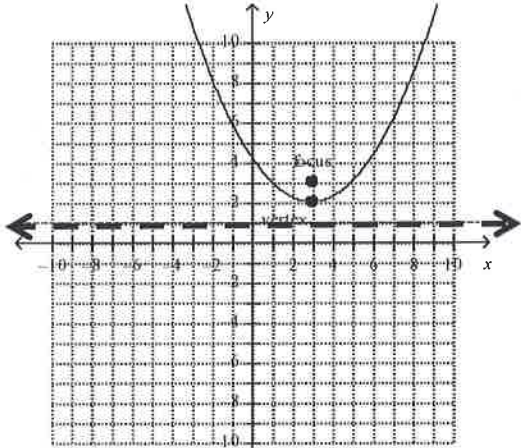


Objective: Determine patterns in parabolas

Exploration:

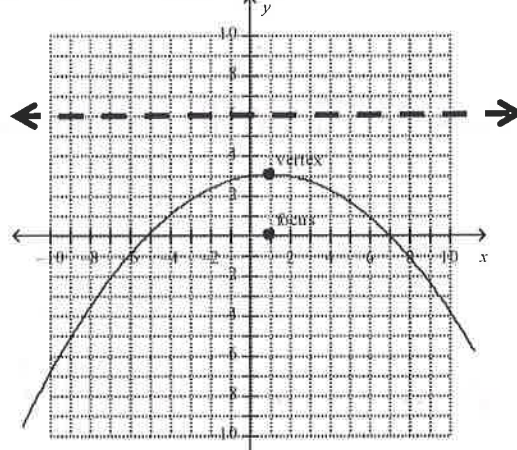
Look at the equations below and the graphs. For each of the following, identify the vertex and focus by giving their coordinate points. The dotted line represents the directrix of the parabola – provide the equation for that line. Then answer the questions below. Let's look at some equations with the x term squared.

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



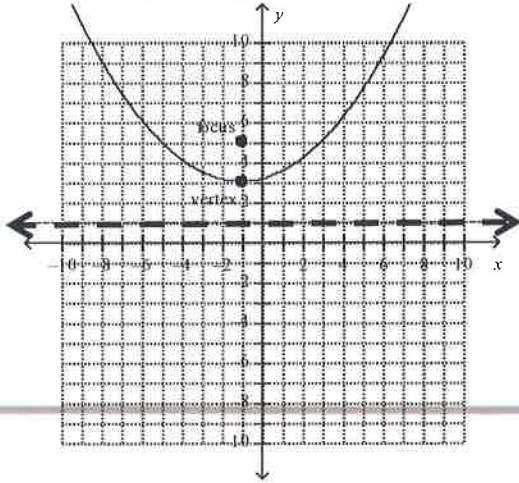
- a. Vertex: (3, 2)
 b. Focus: (3, 3)
 c. Directrix: y = 1

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



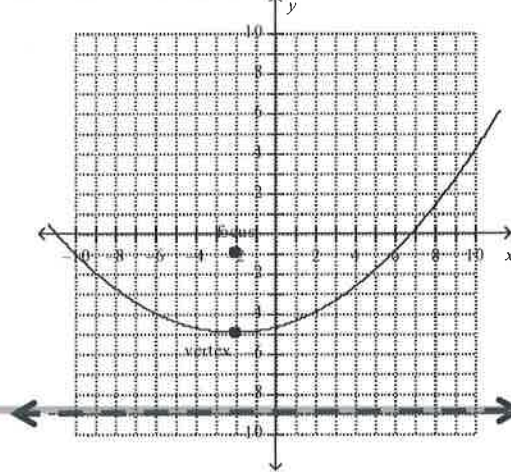
- a. Vertex: (1, 3)
 b. Focus: (1, 0)
 c. Directrix: y = 6

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



- a. Vertex: (-1, 3)
 b. Focus: (-1, 5)
 c. Directrix: y = 1

4. $(x + 2)^2 = 16(y + 5)$



- a. Vertex: (-2, -5)
 b. Focus: (-2, -1)
 c. Directrix: y = -9

Questions to answer based on your information on the previous page:

1. What do you notice about the equation and the vertex?

The vertex comes from the equation (x from the x portion and y from the y portion); they are opposites of the given sign.

2. What do you notice about the distance between your vertex to your focus and the distance between your vertex and your directrix? They are the same distances.

3. What do you notice about that distance and the equation?

The number in front of the parenthesis is four times that distance.

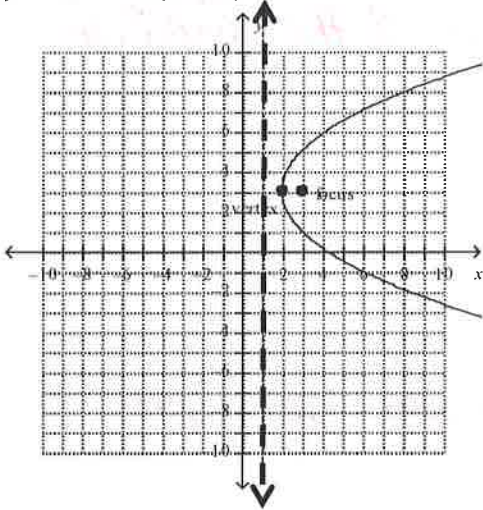
4. What do you notice about the direction the parabola opens and the equation?

If p is positive it opens up and if negative, it opens down.

5. If (h, k) represents the vertex and p represents the distance from the vertex to the focus, complete the equation: $(x - h)^2 = 4p(y - k)$

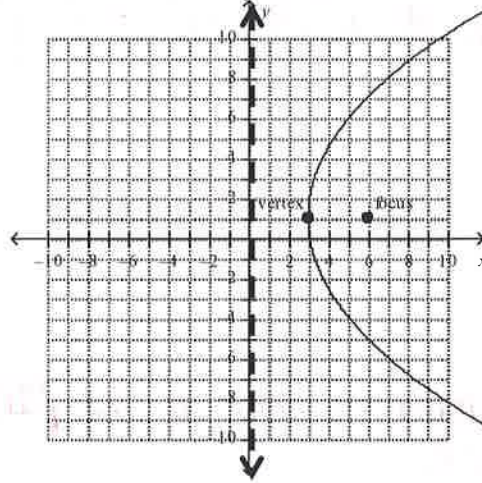
Let's look at some equations with the y term squared.

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



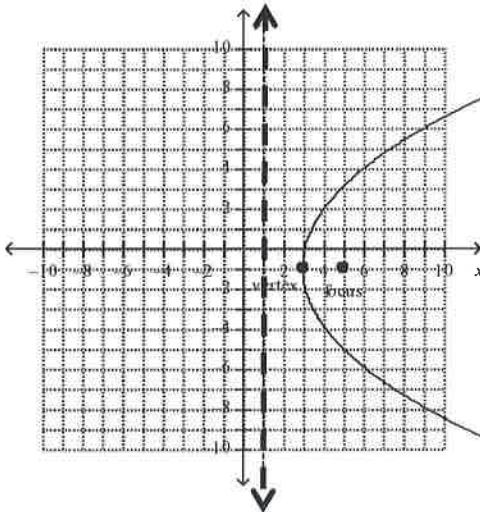
- a. Vertex: (2, 3)
- b. Focus: (3, 3)
- c. Directrix: X=1

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



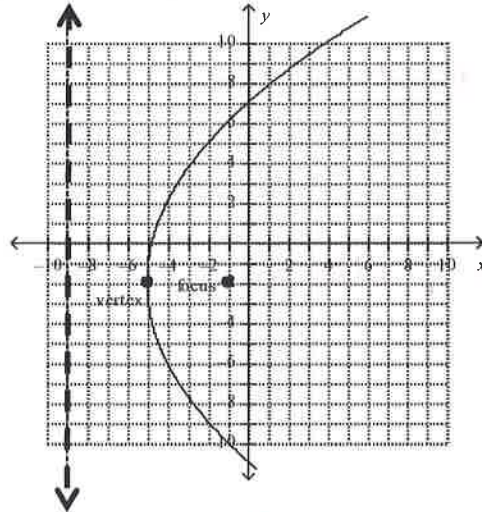
- a. Vertex: (3, 1)
- b. Focus: (6, 1)
- c. Directrix: X=0

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



- a. Vertex: (3, -1)
- b. Focus: (5, -1)
- c. Directrix: X=1

4. $(y + 2)^2 = 16(x + 5)$



- a. Vertex: (-5, -2)
- b. Focus: (-1, -2)
- c. Directrix: X=-9

Questions to answer based on your information on the previous page:

1. What do you notice about the equation and the vertex?

The vertex comes from the equation (x from the x portion and y from the y portion); they are opposites of the given sign.

2. What do you notice about the distance between your vertex to your focus and the distance between your vertex and your directrix? They are equal.

3. What do you notice about that distance and the equation?

The number in front of the parenthesis is four times that distance.

4. What do you notice about the direction the parabolas open?

If p is positive, it opens to the right. If p is negative, it opens left.

5. If (h, k) represents the vertex and p represents the distance from the vertex to the focus, complete the equation:

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

6. How do you think the equation would have to change to get the parabolas to open in the opposite direction?

Make p negative.

IF YOU'RE CONFIDENT IN THE PATTERNS, CONTINUE WITH THE FOLLOWING; IF YOU'D LIKE TO CHECK YOUR ANSWERS, PLEASE RAISE YOUR HAND. THEN BEGIN THE NEXT SECTION UNTIL I GET TO YOUR GROUP.