Warm-up

What is the center and radius of the following circles?

1. $(x - 2)^2 + (y + 3)^2 - 9 = 0$ $(2, -3)$ $r = 3$

2. $x^2 + y^2 - 10x + 24 = 0$ $(5, 0)$ $r = 1$

   $x^2 - 10x + 25$

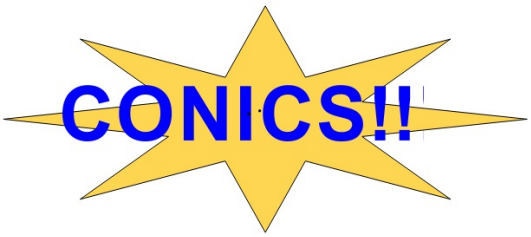
3. $x^2 + y^2 + 4x - 6y - 3 = 0$ $(-2, 3)$ $r = 4$

Simplify the following radicals:

4. $\sqrt{128}$ $8\sqrt{2}$

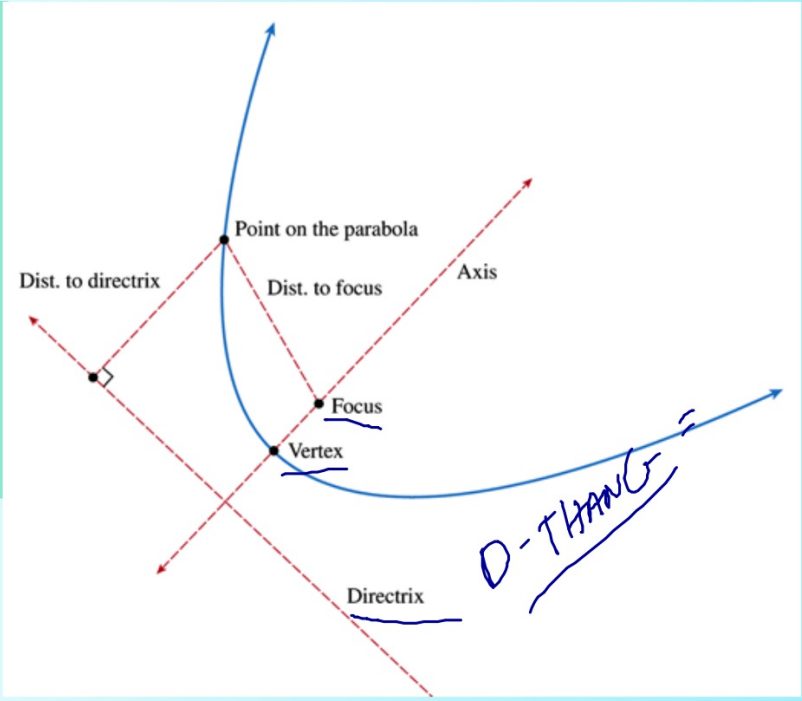
5. $\sqrt{54}$ $3\sqrt{6}$

Introduction Video



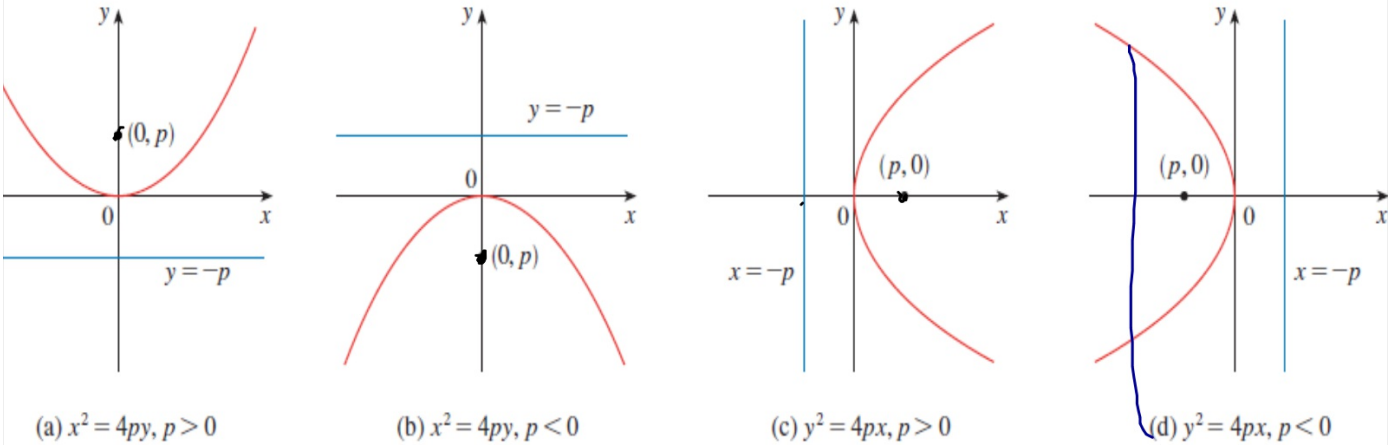
Objective: Write equations of parabolas
Describe parabolas from their equations

A **parabola** is the set of all points in a plane equidistant from a particular line (the **directrix**) and a particular point (the **focus**) in the plane.



Parabolas with Vertex (0,0)

- Standard equation $x^2 = 4py$ $y^2 = 4px$



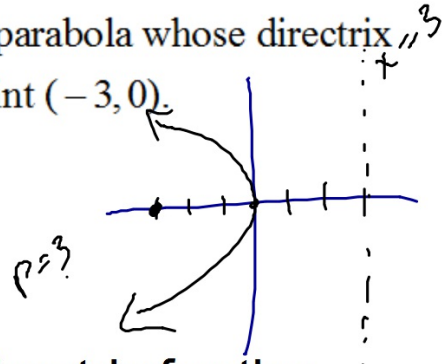
(a) $x^2 = 4py, p > 0$ (b) $x^2 = 4py, p < 0$ (c) $y^2 = 4px, p > 0$ (d) $y^2 = 4px, p < 0$

- Focal width $|4p|$ $|4p|$

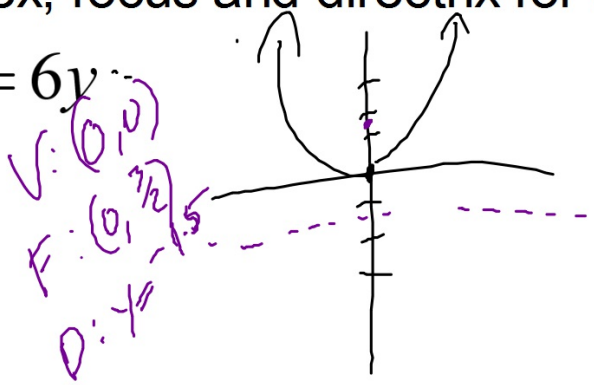
Example **Finding an Equation of a Parabola**

1. Find an equation in standard form for the parabola whose directrix is the line $x = 3$ and whose focus is the point $(-3, 0)$.

$y^2 = -12x$



2. Find the vertex, focus and directrix for the parabola: $x^2 = 6y$



$4p = 6$

$p = 1.5$

Parabolas with Vertex (h,k)

Standard equation	$(x-h)^2 = 4p(y-k)$	$(y-k)^2 = 4p(x-h)$
Opens	Upward or downward	To the right or to the left
Focus	$(h,k+p)$	$(h+p,k)$
Directrix	$y = k-p$	$x = h-p$
Axis	$x = h$	$y = k$
Focal length	p	p
Focal width	$\|4p\|$	$\|4p\|$

1–8 ■ Find the vertex, focus, and directrix of the parabola and sketch its graph.

1. $x = 2y^2$

2. $4y + x^2 = 0$

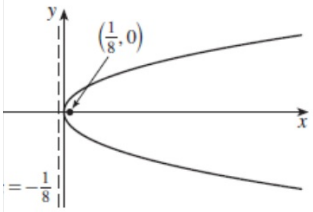
3. $4x^2 = -y$

4. $y^2 = 12x$

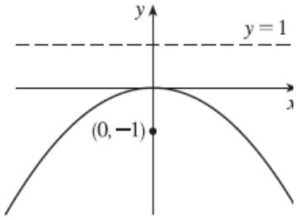
5. $(x + 2)^2 = 8(y - 3)$

6. $(x - 1) = (y + 5)^2$

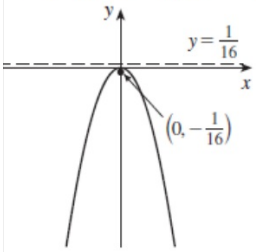
. $(0, 0), \left(\frac{1}{8}, 0\right), x = -\frac{1}{8}$



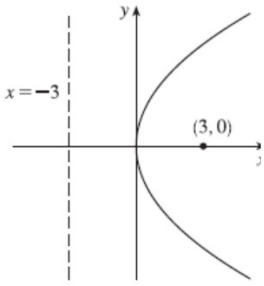
2. $(0, 0), (0, -1), y = 1$



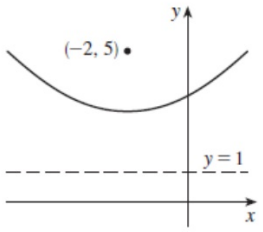
. $(0, 0), \left(0, -\frac{1}{16}\right), y = \frac{1}{16}$



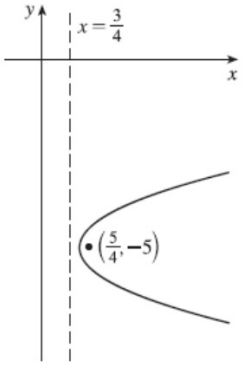
4. $(0, 0), (3, 0), x = -3$



5. $(-2, 3), (-2, 5), y = 1$



6. $(1, -5), \left(\frac{5}{4}, -5\right), x = \frac{3}{4}$

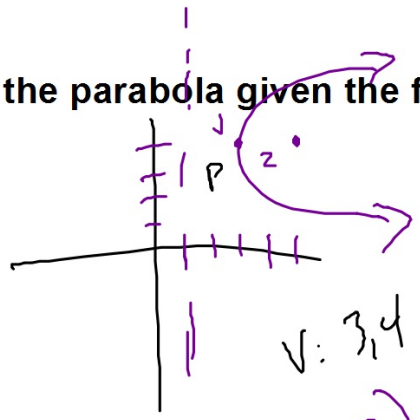


Hint: Always sketch a graph first!!!

Find the standard form of the equation of the parabola given the following:

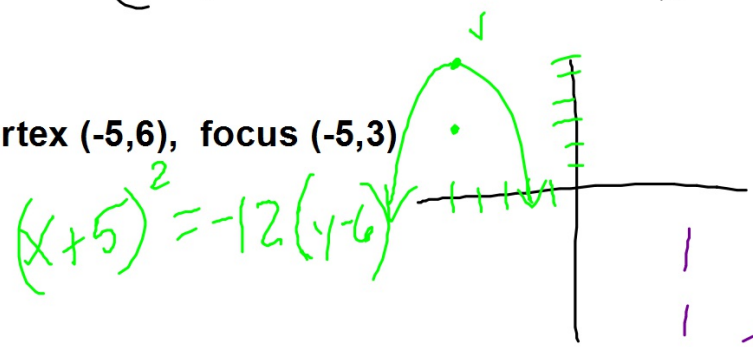
1. Vertex at (3, 4) and focus at (5, 4).

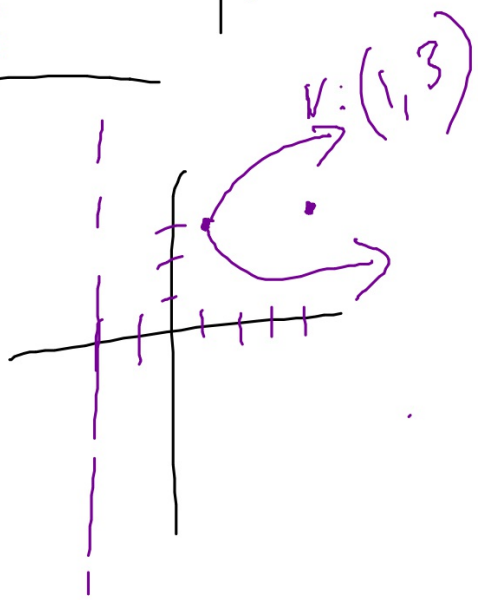
$(y-4)^2 = 8(x-3)$



2. Vertex (-5,6), focus (-5,3)

$(x+5)^2 = -12(y-6)$





3. focus (4,3) and directrix at x = -2

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

31–48 ■ Find an equation for the conic that satisfies the given conditions.

31. Parabola, vertex $(0, 0)$, focus $(0, -2)$

32. Parabola, vertex $(1, 0)$, directrix $x = -5$

33. Parabola, focus $(-4, 0)$, directrix $x = 2$

34. Parabola, focus $(3, 6)$, vertex $(3, 2)$

35. Parabola, vertex $(0, 0)$, axis the x-axis, passing through $(1, -4)$

36. Parabola, vertical axis, passing through $(-2, 3)$, $(0, 3)$, and $(1, 9)$

31. $x^2 = -8y$ **32.** $y^2 = 24(x - 1)$ **33.** $y^2 = -12(x + 1)$

34. $(x - 3)^2 = 16(y - 2)$ **35.** $y^2 = 16x$

36. $2x^2 + 4x - y + 3 = 0$ **37.** $\frac{x^2}{25} + \frac{y^2}{21} = 1$

Completing the Square to find the Standard Form

8. $y^2 - 6x + 2y + 13 = 0$ is a parabola, find it's vertex, focus, and directrix.

$y^2 + 2y + 1 = 6x - 13 + 1$

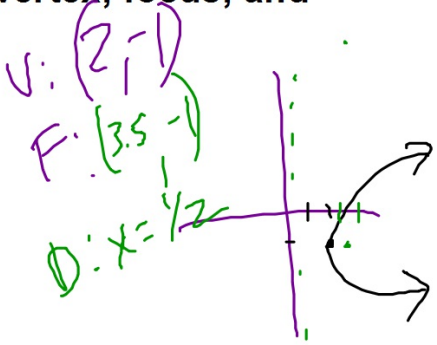
$(y+1)^2 = 6x - 12$

$(y+1)^2 = 6(x-2)$

V: (2, -1)

F: (3.5, -1)

D: $x = 1/2$



9. $x^2 - 2x + 8y + 9 = 0$

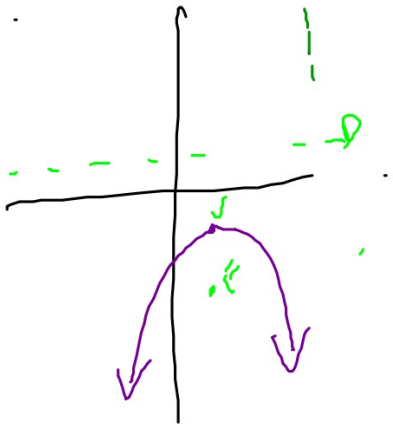
$x^2 - 2x + 1 = -8y - 9 + 1$

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

V: (1, -1)

F: (1, -3)

D: $y = 1$



Find vertex, focus and directrix

7. $y^2 + 2y + 12x + 25 = 0$

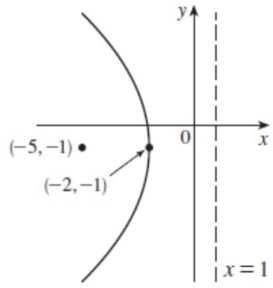
8. $y + 12x - 2x^2 = 16$

7. $y^2 + 2y + 12x + 25 = 0$

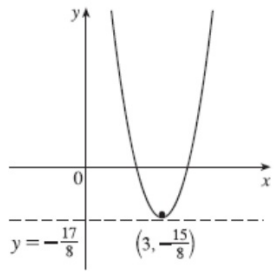
8. $y + 12x - 2x^2 = 16$

Find vertex, focus and directrix

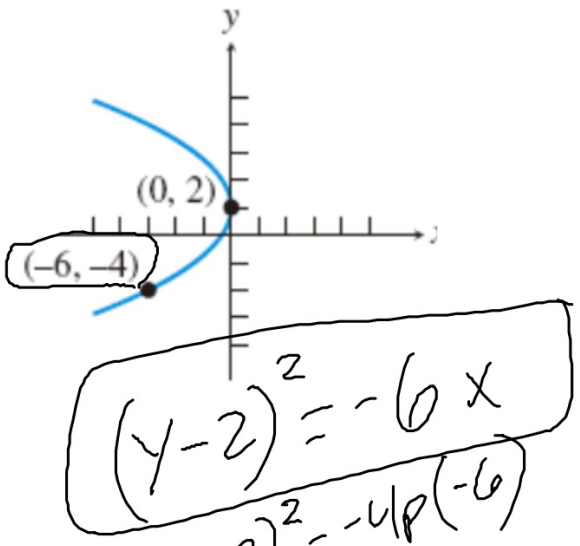
7. $(-2, -1), (-5, -1), x = 1$



8. $(3, -2), \left(3, -\frac{15}{8}\right), y = -\frac{17}{8}$



Write the equation for the parabola.



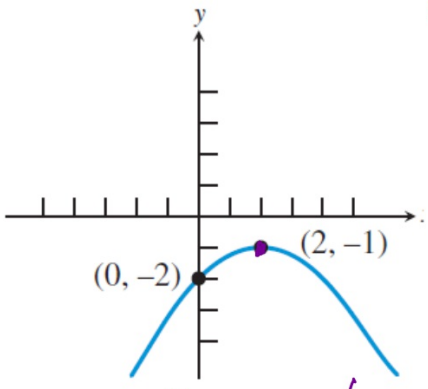
$(y-2)^2 = -6x$

$(-4-2)^2 = -4p(-6)$

$36 = 24p$

$1.5 = p$

5



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

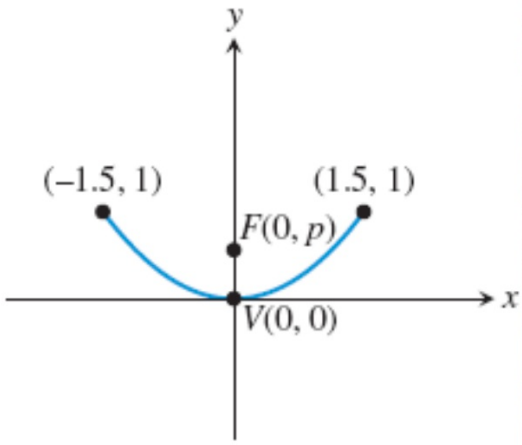
$(0-2)^2 = -4p(-2+1)$

$4 = 4p$

$1 = p$

11. Studying a Parabolic Microphone

On the sidelines of each of its televised football games, the FBTV network uses a parabolic reflector with a microphone at the reflector's focus to capture the conversations among players on the field. If the parabolic reflector is 3 ft across and 1 ft deep, where should the microphone be placed?



ch the equation of the parabola with its graph.

$4y - 12x - 44 = 0$

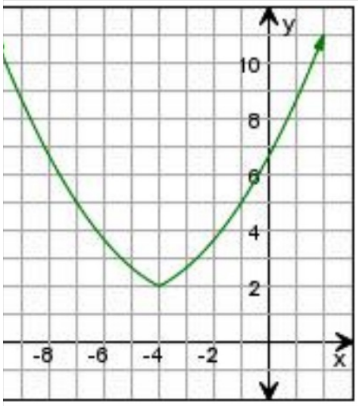
$-18y + 24x - 75 = 0$

$-2x^2 - 16x + 8y - 48 = 0$

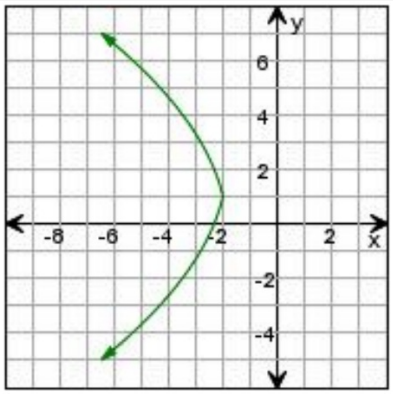
$-2y^2 - 16y + 16x - 48 = 0$

$-2y^2 + 4y - 16x - 34 = 0$

$y^2 + 6y - 8x + 1 = 0$



2.



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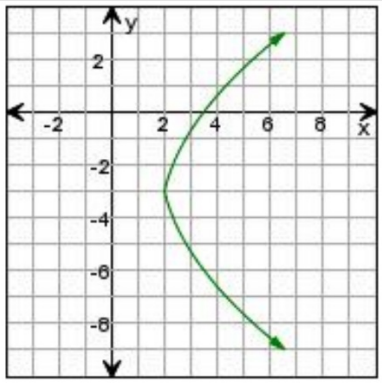

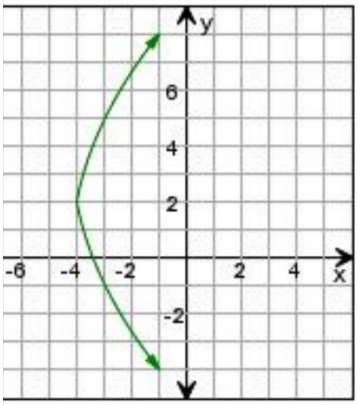

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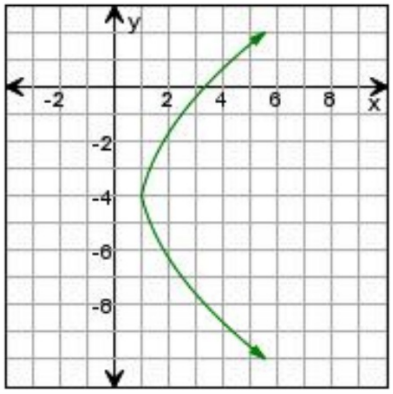

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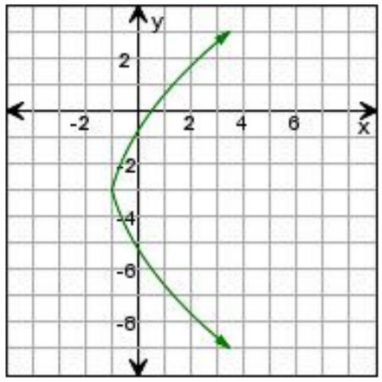


Homework Section 8.1

In Exercises 11–30, find an equation in standard form for the parabola that satisfies the given conditions.

11. Vertex (0, 0), focus $(-3, 0)$

14. Vertex (0, 0), directrix $x = -2$

17. Vertex (0, 0), opens to the right, focal width $= 8$

20. Vertex (0, 0), opens upward, focal width $= 3$

23. Focus (3, 4), directrix $y = 1$

26. Vertex (3, 5), directrix $y = 7$

30. Vertex (2, 3), opens to the right, focal width $= 5$

In Exercises 31–36, sketch the graph of the parabola by hand.

32. $x^2 = 8y$

34. $(y + 2)^2 = -16(x + 3)$

36. $(x - 5)^2 = 20(y + 2)$

In Exercises 49–52, prove that the graph of the equation is a parabola, and find its vertex, focus, and directrix.

50. $3x^2 - 6x - 6y + 10 = 0$

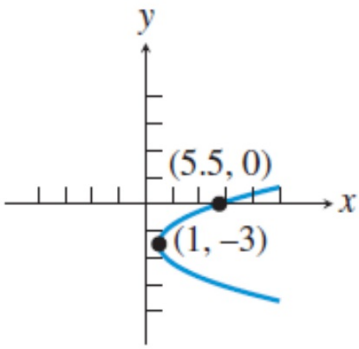
52. $y^2 - 2y + 4x - 12 = 0$

50. Completing the square, the equation becomes $(x - 1)^2 = 2(y - 7/6)$, a parabola with vertex $(1, 7/6)$, focus $(1, 5/3)$ and directrix $y = 2/3$.

52. Completing the square, the equation becomes $(y - 1)^2 = -4(x - 13/4)$, vertex $(13/4, 1)$, focus $(9/4, 1)$, and directrix $x = 17/4$.

In Exercises 53–56, write an equation for the parabola.

54.



56.