Conics - Parabolas　　　1-4-16

A conic section is formed when you intersect a plane with with cones. There are 4 conic sections...

parabola　　circle　　ellipse　　hyperbola

Dec 17-7:28 PM

We've already seen parabolas...

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

opens up

vertex

opens down

$g(x) = x^2 - 2x + 2$

Dec 17-7:21 PM

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3 Things You Need to be Able to do with Parabolas:
- determine whether an equation is that of a parabola
- determine the vertex by looking at an equation
- determine the direction of opening by looking at an equation

Dec 19-11:20 AM

Equation of a Parabola

** Can only have 1 variable squared (x^2 OR y^2)**

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

$6x^2 + 12x - y + 15 = 0$

$y = x^2 - 2x + 2$

$x = \frac{1}{3}(y - 1)^2 - 7$

$x = y^2$

$x - y^2 - 6y - 4 = 0$

$x = -y^2 + 4y - 4$

Dec 17-9:50 PM

The vertex-form equation of a vertical parabola

that opens up or down

is

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

where a tells the direction of opening

and

the vertex is (h, k)

Dec 19-9:03 AM

Direction of Opening of Vertical Parabola $y = a(x - h)^2 + k$

Here's the graph of $y = 3(x - 1)^2 + 2$

What is the direction of opening?

UP

Here's the graph of $y = -3(x - 1)^2 + 2$

What is the direction of opening?

Down

What made the 2nd one go down?

a was negative

Dec 19-9:27 AM

Direction of Opening of Vertical Parabola $y = a(x - h)^2 + k$

Determining the Direction of Opening for a Vertical Parabola:
- $y =$ tells us the parabola opens up or down
  (because the y-axis runs up & down)
- If $a > 0$ (positive), the parabola opens up
- If $a < 0$ (negative), the parabola opens down

Dec 19-11:41 AM

Vertex of a Vertical Parabola $y = a(x - h)^2 + k$

Here's the graph of $y = (x + 2)^2 + 4$

What is the vertex? $(-2, 4)$

Here's the graph of $y = (x - 3)^2 - 5$

What is the vertex? $(3, -5)$

What happened to the sign of the number in the parentheses getting squared?

opposite

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Vertex of a Vertical Parabola $y = a(x - h)^2 + k$

Determining the Vertex of a Vertical Parabola:
- the opposite sign of the number with the x (h) is the x-value
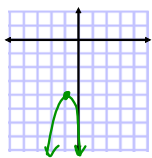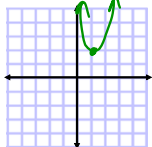- the other number (k) is the y-value

Dec 19-11:33 AM

Given the equation, find the vertex.

1. $y = (x - 1)^2 + 2$ $(1, 2)$
2. $y = (x + 5)^2 - 7$ $(-5, -7)$
3. $y = (x + 1)^2 + 7$ $(-1, 7)$
4. $y = (x + 2)^2$ $(-2, 0)$
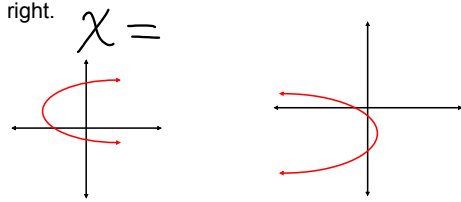5. $y = x^2 - 11$ $(0, -11)$

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**Determine the vertex and direction of opening.
Then sketch the graph.**

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

   Vertex = $(-1, -4)$

   Dir.Opening = ↓

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

   Vertex = $(1, 2)$

   Dir.Opening = ↑

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So far, we've only had vertical parabolas that open up or down, but we can also have horizontal parabolas that open left and right. $x =$

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The vertex-form equation of a horizontal parabola

that opens left or right

is

$a +$ ~~Rt.~~
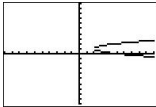
$a -$ left

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

where a tells the direction of opening

and (x, y)

the vertex is (h, k)

Dec 19-12:04 PM

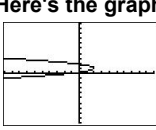Direction of Opening of Horizontal Parabola $x = a(y - k)^2 + h$

Here's the graph of $x = 3(y - 1)^2 + 2$

What is the direction of opening?

Rt.

Here's the graph of $x = -3(y - 1)^2 + 2$

What is the direction of opening?

left

What made the 2nd one go left?

negative a

Dec 19-9:27 AM

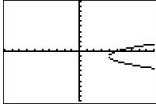Direction of Opening of Horizontal Parabola $x = a(y - k)^2 + h$

Determining the Direction of Opening for a Horizontal Parabola:
- x = tells us the parabola opens left or right
  (because the x-axis runs left & right)
- If a > 0 (positive), the parabola opens right
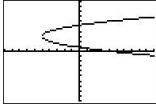- If a < 0 (negative), the parabola opens left

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Vertex of a Horizontal Parabola $x = a(y - k)^2 + h$

Here's the graph of $x = (y + 1)^2 + 4$

What is the vertex? $(4, -1)$

Here's the graph of $x = (y - 3)^2 - 5$

What is the vertex? $(-5, 3)$

What happened to the sign of the number in the parentheses getting squared?

opposite

Dec 19-9:03 AM

Vertex of a Horizontal Parabola $x = a(y - k)^2 + h$

Determining the Vertex of Left/Right Parabola:
- the opposite sign of the number with the y (k) is the y-value
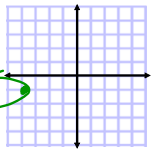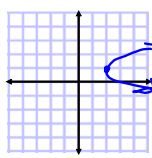- the other number (h) is the x-value

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Given the equation, find the vertex.

1. $x = (y - 1)^2 + 2$
2. $x = (y + 5)^2 - 7$ $(-7, -5)$
3. $x = (y - 6)^2 - 12$
4. $x = y^2 + 7$ $(7, 0)$
5. $x = (y+3)^2$ $(0, -3)$

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Determine the vertex and direction of opening. Then sketch the graph.

1. $x = -2(y+1)^2 - 4$
   Vertex = $(-4, -1)$
   Dir.Opening = left

2. $x = 3(y-1)^2 + 2$
   Vertex = $(2, 1)$
   Dir.Opening = Rt

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Conclusion

1. What is the vertex on $y=a(x-h)^2+k$? (h, K)
2. What is the vertex on $x=a(y-k)^2+h$? (h, K)
3. How do you know if it's going to open up/down OR left/right? $x = \begin{array}{l} a+ \text{ Rt} \\ a- \text{ left} \end{array}$ $y = \begin{array}{l} a+ \uparrow \\ a- \downarrow \end{array}$
4. What does a negative a do on an x=equation? left y=equation? Down
5. Questions???

Dec 19-9:49 AM

5

Assignment:
Parabola Wkst

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