Warm-Up (EOC-Type) 3/24/2021

The product of two consecutive positive odd integers is k. Rachel uses the following steps to solve for k.

Step 1: $(x)(x + 1) = k$

Step 2: $x^2 + x - k = 0$

Step 3: $$x = \frac{-1 - \sqrt{1 + 4k}}{2},$$
$$x = \frac{-1 + \sqrt{1 + 4k}}{2}$$

Step 4: Reject extraneous solution
$$x = \frac{-1 - \sqrt{1 + 4k}}{2}$$
because x must be positive.

Which best describes Rachel's error?

A. Rachel's error is in Step 1; her factors should be (x) and $(x + 2)$.

B. Rachel's error is in Step 2; the final term k should be added instead of subtracted.

C. Rachel's error is in Step 3; the term $4k$ should be subtracted in each discriminant.

D. Rachel's error is in Step 4; she does not have enough information to determine whether either solution is extraneous.

Quick Check!!!

Go to Nearpod

Quadratic Functions - Standard Form Name: _____

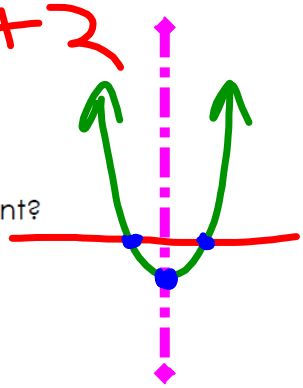
0 1 2 3 4

1. What is the value of the function $f(x) = x^2 - 5x + 2$ evaluated at $x = 2$?

A. $f(2) = 16$
B. $f(2) = 6$
C. $f(2) = 2$
D. $f(2) = -4$

$f(2) = (2)^2 - 5(2) + 2$

$f(2) = -4$

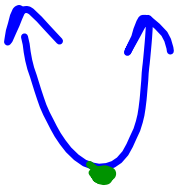


2. The axis of symmetry of a parabola does not always contain which point?

A. maximum or minimum
B. vertex
C. midpoint of the x-intercepts
D. y-intercept

3. Does the function $f(x) = x^2 - 10x + 18$ have a maximum or a minimum and what is its value?

A. Maximum at y = 93
B. Minimum at y = 93
C. Maximum at y = -7
D. Minimum at y = -7



$x = \frac{-b}{2a}$

Essential Question 3/24/2021

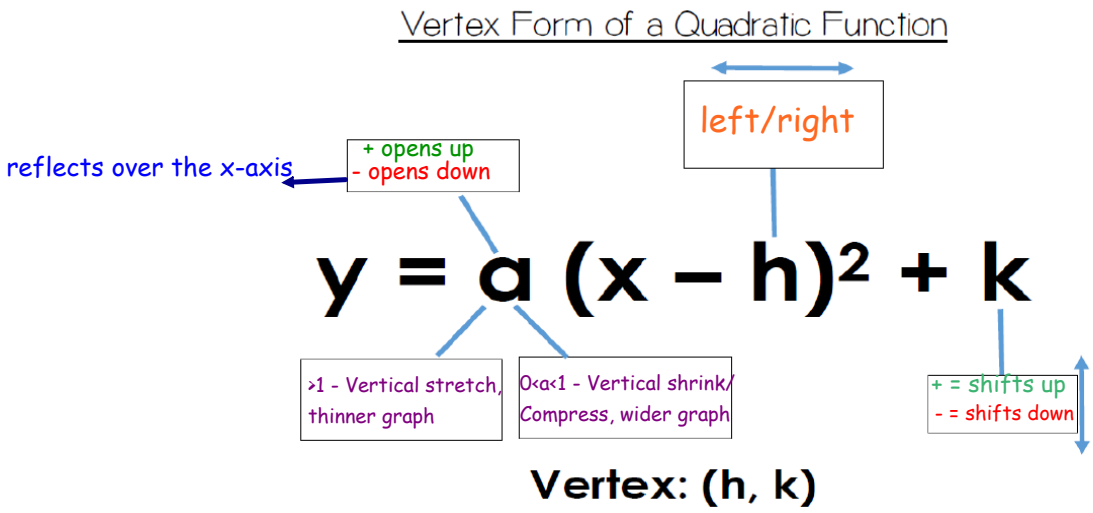
How can I graph a Quadratic function from the vertex form of the equation?

Learning Target

Graphing quadratic function in vertex form

Graphing in Vertex Form

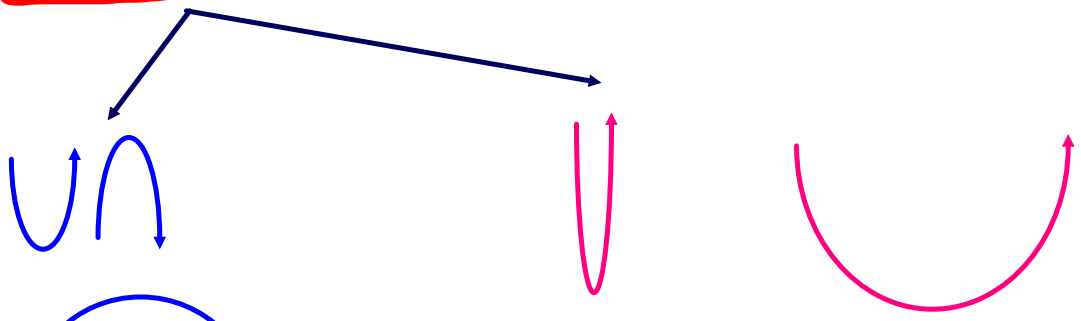
Standard(s): MGSE9-12.F.IF.7 Graph functions expressed algebraically and show key features of the graph both by hand and by using technology.



Transformation of a Parabola: A-Value

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

$V = (h, k)$



$a > 1$ $a < 1$

$a = 3$ $a = \frac{1}{4}$

$y = 3(x-5)^2 + 4$

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

Transformation of a Parabola: h & k values

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

+ h, left

- h, right

+ k, up

- k, down

Transformations

The axis of symmetry is $x = h$. (Opposite of h)

The vertex is on the axis of symmetry line at (h, k). **Remember: the sign of "h" is the opposite.**

The a-value determines whether your graph "goes up" on both sides or "goes down" on both sides of your vertex.

- opens up : a-value is positive (looks like a "U")
- opens down: a-value is negative (looks like an "∩")

A good PARABOLA has at least five points. Make a table of values with your vertex in the middle and plot them to make a good graph.

Transformations

- If the a-value is negative, your graph has been REFLECTED over the x-axis.
- If the a-value (ignoring the negative) is less than one, your graph has been SHRUNK or COMPRESSED vertically.
- If the a-value (ignoring the negative) is bigger than one, your graph has been STRETCHED vertically.
- The location of the vertex determines where the graph has been SHIFTED or TRANSLATED.

* If the vertex is not on 0, 0, then the Parabola has been shifted or translated.

Identifying the Vertex

Find the vertex of the following:

1) $y = (x - 18)^2 + 9$ Vertex = (18, 9) (h, k)

2) $y = 4(x + 6)^2 - 7$ Vertex = (-6, -7)

3) $y = (x - 2)^2 - 2$ Vertex = (2, -2) (h, k)

Find the vertex for each of the following quadratics and determine whether the graph opens up or down:

a) $y = (x - 1)^2 - 2$ Vertex = (1, -2) Graph Opens up because a is +

b) $y = -3(x + 4)^2 + 1$ Vertex = (-4, 1) Graph Opens down because a is −

c) $y = 2x^2 + 3$ Vertex = (0, 3) Graph Opens up because a is +

d) $y = -(x - 3)^2$ Vertex = (3, 0) Graph Opens down because a is −

On your calculator:

1. Press Table

2. Enter function $(x-2)^2 - 2$ and enter

Press X^{yzt}_{abc} for the x variable.

3. Press enter 4 times

Graphing in Vertex Form

Example 1 - I do

Example 1: Graph $y = (x-1)^2 - 2$.

a = 1 h = 1 k = −2

Vertex = (1, −2)

Transformations?

Right 1 by 1 unit
down by 2 units

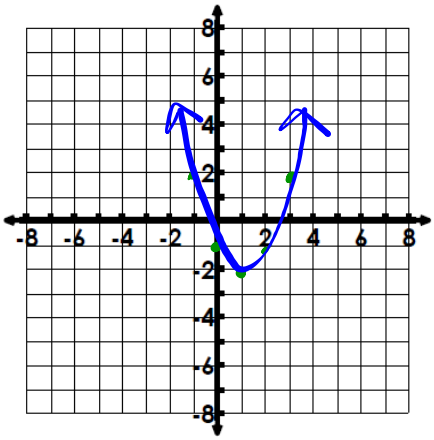
Up or Down?

Maximum or Minimum?

y = −2

minimum

x	y
−1	2
0	−1
1	−2
2	−1
3	2



Example 2 - You do

Example 2: Graph: $y = -3(x + 4)^2 + 1$.

$a = -3$ $h = -4$ $k = 1$

Vertex = $(-4, 1)$

Transformations?

① Reflects over x-axis

② Vertical stretch by a factor 3

③ Left by 4 units

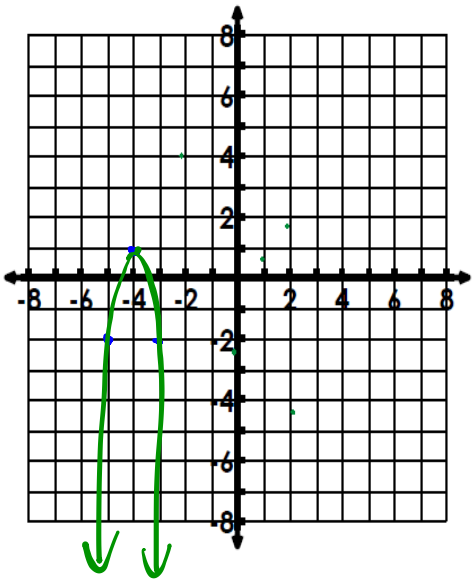
④ Up by 1 unit.

Up or Down?

Maximum or Minimum?

$y = 1$

x	y
-6	-11
-5	-2
-4	1
-3	-2
-2	-11



Example 3 - You do

Example 3: Graph $y = 2x^2 + 3$.

a = 2 h = 0 k = 3

Vertex = (0, 3)

(h, k)

Transformations?

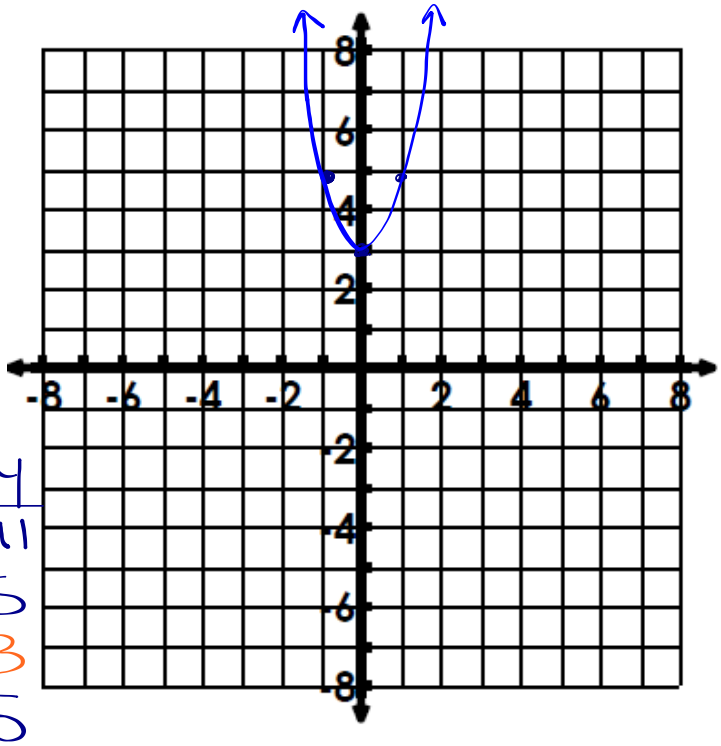
① Vertical stretch by a factor of 2

② up by 3

Up or Down?

Maximum or Minimum? 0

x	y
-2	11
-1	5
0	3
1	5
2	11



Quick Check - 1

Find the vertex and state the minimum or maximum.

h k

a. $y = 2(x - 28)^2 + 72$

Vertex = (28, 72)

Minimum : $y = 72$

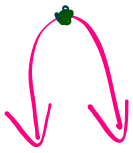
b. $y = (x + 500)^2 - 250$

Vertex = (−500, −250)

Minimum : $y = -250$

c. $y = -(x + 22)^2 + 22$

Vertex = (−22, 22)



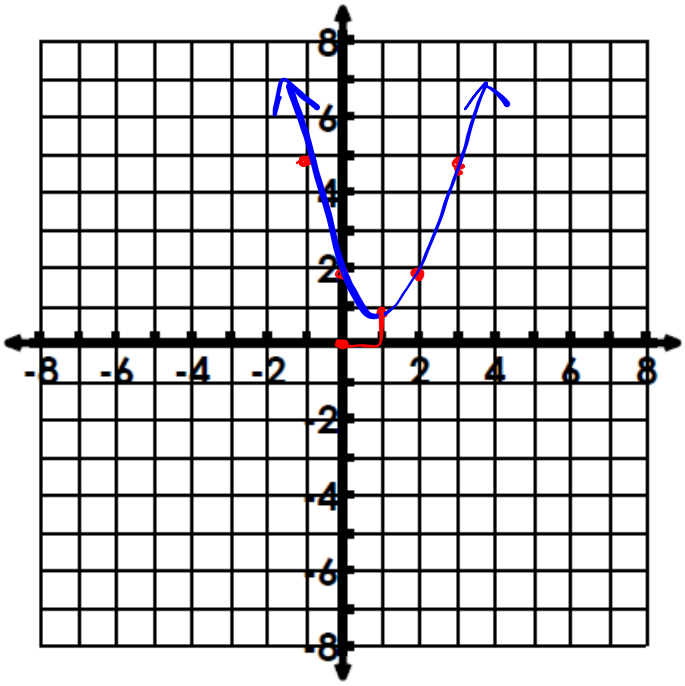
maximum = $y = 22$

Quick

Check - 2

Graph the quadratic function.

$$y = (x - \overset{h}{1})^2 + \overset{k}{1}$$



Vertex: (1, 1)

x	y
-1	5
0	2
1	1
2	2
3	5

Transformations:

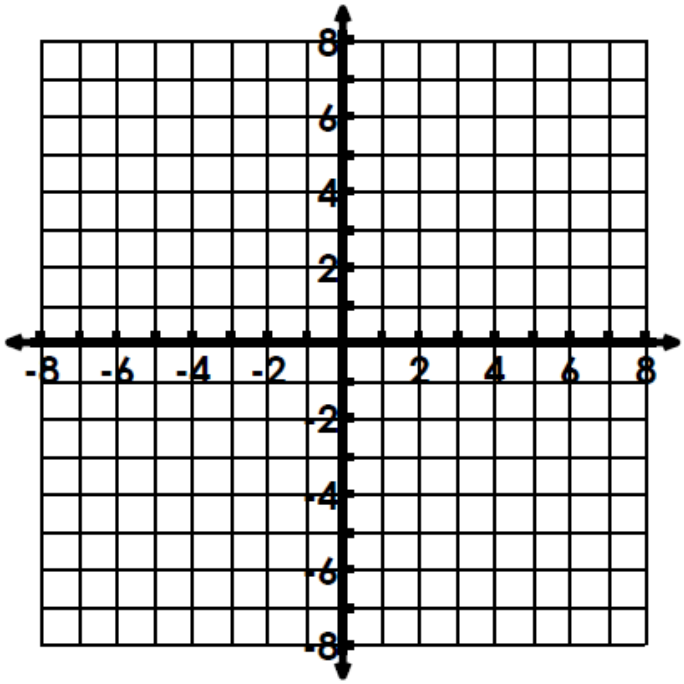
⇒ Right by 1 unit

⇒ up by 1 unit

Quick Check - 3

Graph the quadratic function.

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



Vertex:

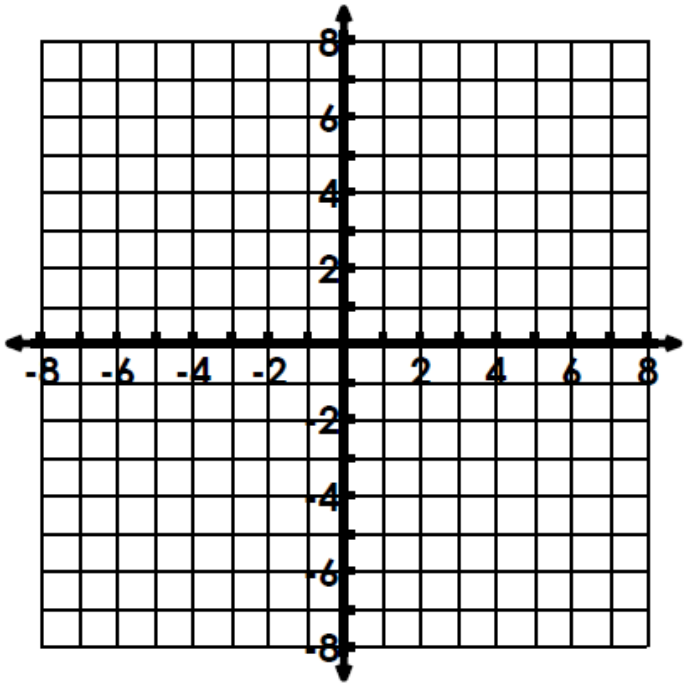
x	y

Quick

Check - 4

Graph the quadratic function.

$$-2(x - 2)^2 + 4$$

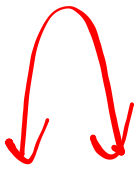


Vertex:

x	y

Math Talks - (EOC Type Question)

Which of the following equations represents a parabola that reaches its *maximum* value at (5, 13)?



A. $y = (x + 5)^2 - 13$

B. $y = (x - 5)^2 + 13$

C. $y = -(x + 5)^2 - 13$

D. $y = -(x - 5)^2 + 13$

Practice Finding the Vertex by Completing the Squares - I do

1) $f(x) = x^2 + 6x + 11$

$\frac{6}{2} = 3^2 = 9$

$f(x) = (x^2+6x+9) + 11 - 9$

perfect square trinomial

$f(x) = (x+3)^2 + 2$

h k

Vertex $= (-3, 2)$

Finding Vertex - We do!

2) $y = x^2 - 10x + 2$

$\frac{-10}{2} = (-5)^2 = 25$

$y = (x^2 - 10x + 25) + 2 - 25$

$y = (x - 5)^2 - 23$

h k

Vertex: $(5, -23)$

Finding Vertex - You do!

3) $y = \frac{2x^2 - 12x + 16}{2}$

$y = (x^2 - \frac{6}{2}x) + 8$

$\frac{6}{2} = (-3)^2 = 9$

$y = (x^2 - 6x + 9) + 8 - 9$

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

$h \quad k$

Vertex $= (3, -1)$

Finding Vertex - You do!

4) $h(x) = -2x^2 + 8x - 4$

-2

$h(x) = (x^2 - 4x) + 2$

$\frac{-4}{2} = (-2)^2 = 4$

$h(x) = (x^2 - 4x + 4) + 2 - 4$

$h(x) = (x-2)^2 - 2$

h k

Vertex $= (2, -2)$

Finding Vertex - You do!

5) $g(x) = -3x^2 + 24x - 42$

-3

$g(x) = (x^2 - 8x) + 14$

$2 = (-4)^2 = 16$

$g(x) = (x^2 - 8x + 16) + 14 - 16$

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

$h \quad k$

Vertex $= (4, -2)$

Finding Vertex - You do!

6) $h(x) = 6x^2 - 84x + 288$

6

$h(x) = (x^2 - 14x) + 48$

$2 = (-7)^2 = 49$

$h(x) = (x^2 - 14x + 49) + 48 - 49$

$h(x) = (x - 7)^2 - 1$

$h \quad k$

Vertex $= (7, -1)$