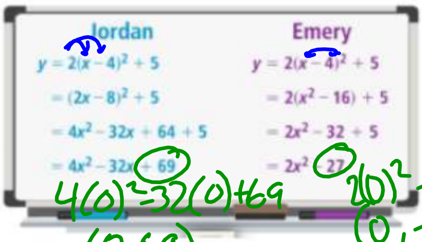
Jordan and Emery are rewriting the vertex form of the quadratic function $y = 2(x - 4)^2 + 5$ in the form $y = ax^2 + bx + c$.

$(4,5)$

Drag the slider to reveal the rest of their solutions.

$(0, ?)$



$4(0)^2 - 32(0) + 69$

$(0,69)$

$2(0)^2 - 27$

$(0,-27)$

A. Communicate Precisely Did Jordan rewrite the equation correctly? Did Emery? Explain.

Jordan did it incorrectly he distributed before exponents

Emery applied exponent incorrectly

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

$2(x-4)(x-4)+5$

$2(x^2-4x-4x+16)+5$

$2(x^2-8x+16)+5$

$2x^2-16x+32+5$

$\boxed{2x^2-16x+37}$

B. Without rewriting the equation, how could you prove that Jordan or Emery's equations are not equivalent to the original?

plug in 0 and see if you get the same value

$y = 2(0-4)^2+5 = 37 \rightarrow (0,37)$

How can you find the vertex of a quadratic function written in standard form?

~~B. What is the vertex of the function $f(x) = 4x^2 - 56x + 10$?~~

Y-Intercept: $(0,c)$

Axis of Symmetry: $x = \dfrac{-b}{2a}$

Vertex: $\left(\dfrac{-b}{2a}, f\left(\dfrac{-b}{2a}\right)\right)$

Plug in A.o.S. value for x to get y value

$y = ax^2 + bx + c$

Try It!

1. What is the vertex of the graph of the function $f(x) = x^2 - 8x + 5$?

Y-Intercept:

$(0,c)$

$\boxed{(0,5)}$

$a = 1$

$b = -8$

$c = 5$

Axis of Symmetry:

$x = \dfrac{-b}{2a} = \dfrac{-(-8)}{2(1)}$

$x = \dfrac{8}{2}$

$x = 4$

Vertex:

$y = (4)^2 - 8(4) + 5$

$y = 16 - 32 + 5$

$y = -16 + 5$

$y = -11$

$(4,-11)$

Try It!

2. Use the key features to graph the function $f(x) = x^2 - 6x - 1$.

Y-Intercept: Axis of Symmetry: Vertex:

$(0,-1)$

$x = \frac{-(-6)}{2(1)}$

$x = \frac{6}{2}$

$x = 3$

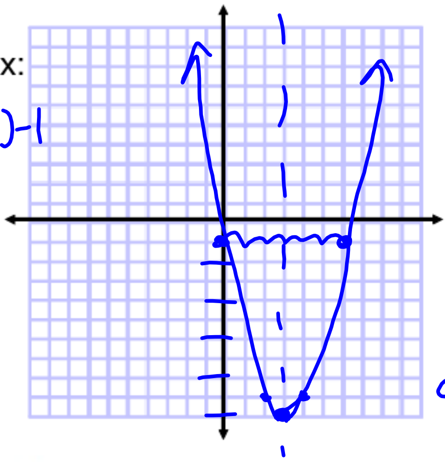
$f(3) = (3)^2 - 6(3) - 1$

$f(3) = 9 - 18 - 1$

$f(3) = -9 - 1$

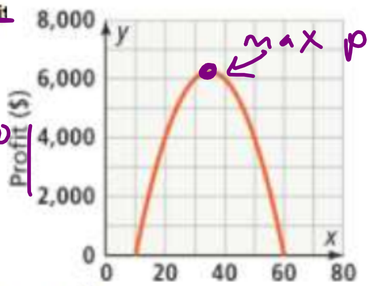
$f(3) = -10$

$V: (3, -10)$



$a = 1$

The graph of the function $f(x) = -10x^2 + 700x - 6000$ shows the profit a company earns for selling headphones at different prices. What is the maximum profit the company can expect to earn?



max profit y of vertex

$x = \frac{-(700)}{2(-10)}$

$x = \frac{-700}{-20}$

$x = 35$

$y = -10(35)^2 + 700(35) - 6000$

$y = -12250 + 24500 - 6000$

$\boxed{y = \$6250}$

max profit

Interpret

The vertex is at $(35, 6{,}250)$.

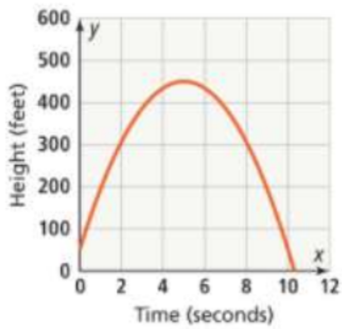
The selling price of $35 per item gives the maximum profit of $6,250.

Try It!

3. A water balloon was thrown from a window. The height of the water balloon over time can be modeled by the function $y = -16x^2 + 160x + 50$. What was the maximum height of the water balloon after it was thrown?

Enter your answer

CHECK ANSWER



$x = \frac{-(160)}{2(-16)}$

$x = \frac{-160}{-32}$

$x = 5$

$y = -16(5)^2 + 160(5) + 50$

$y = -400 + 800 + 50$

$y = 400 + 50$

$\boxed{y = 450 \text{ ft max height}}$

Try It!

4. What is the equation of a parabola that passes through the points $(2, -12)$, $(-1, -15)$, $(-4, -90)$?

1st 2nd 3rd

$y = ax^2 + bx + c$

$y = \underline{-4}\,x^2 + \underline{5}\,x + \underline{-6}$

Ⓐ $-12 = a(2)^2 + b(2) + c$

$(-12 = 4a + 2b + c) \cdot -1$

$12 = -4a - 2b - c$

Ⓑ $-15 = a(-1)^2 + b(-1) + c$

$-15 = a - b + c$

Ⓒ $-90 = a(-4)^2 + b(-4) + c$

$-90 = 16a - 4b + c$

$$\boxed{y = -4x^2 + 5x - 6}$$

Ⓐ $12 = -4a - 2b - c$

Ⓑ $+\ -15 = a - b + c$

Ⓓ $(-3 = -3a - 3b) \cdot -2$

Ⓓ $6 = 6a + 6b$

Ⓔ $+\ -78 = 12a - 6b$

$-72 = 18a$

$\frac{-72}{18} = \frac{18a}{18}$

$-4 = a$

Ⓐ $12 = -4a - 2b - c$

Ⓒ $+\ -90 = 16a - 4b + c$

Ⓔ $-78 = 12a - 6b$

Ⓓ $-3 = -3(-4) - 3b$

$-3 = 12 - 3b$

$-15 = -3b$

$5 = b$

Ⓑ $-15 = (-4) - (5) + c$

$-15 = -9 + c$

$-6 = c$

Try It!

4. What is the equation of a parabola that passes through the points $(2, -12)$, $(-1, -15)$, $(-4, -90)$?

A) $-12 = a(2)^2 + b(2) + c$

$(-12 = 4a + 2b + c) \cdot 2$

B) $-15 = a(-1)^2 + b(-1) + c$

$(-15 = a - b + c) \cdot 2$

C) $-90 = a(-4)^2 + b(-4) + c$

$-90 = 16a - 4b + c$

A) $-12 = 4a + 2b + c$
$+$
C) $-30 = 2a - 2b + 2c$

D) $-42 = 6a + 3c$

A) $-24 = 8a + 4b + 2c$
$+$
C) $-90 = 16a - 4b + c$

E) $(-114 = 24a + 3c) \cdot -1$

D) $-42 = 6a + \cancel{3c}$
$+$
E) $+114 = -24a - \cancel{3c}$

$72 = 18a$

$4 = a$

D) $-42 = 6(4) + 3c$

$-42 = 24 + 3c$

$\frac{-66}{3} = \frac{3c}{3}$

$-22 = c$

B) $-15 = a - b + c$

$-15 = (4) - b + (-22)$

$-15 = -b - 18$

$3 = -b$

$-3 = b$

$y = \underline{4}\,x^2 + \underline{-3}\,x + \underline{-22}$

$\boxed{y = 4x^2 - 3x - 22}$

5. A fan threw a souvenir football into the air from the top of the bleachers toward the bottom of the bleachers. The table shows the height of the football, in feet, above the ground at various times, in seconds.

Time (s) x	0	0.2	0.4	0.6	0.8	1.0
Height (ft) y	10	11.76	12.24	11.44	9.36	6.0

If the football was not touched by anyone on its way to the ground, about how long did it take the football to reach the ground after it was thrown?

Quadratic Regression

using a List coming up with the Quadratic Equation that matches data

Steps for TI 84

1) click Stat
2) 'Enter' to select "Edit"
3) Put in x values for L1 and y values for L2
4) click Stat again
5) Arrow to the right for 'Calc'
6) Arrow down to #5 QuadReg
7) Click Enter twice

$y = ax^2 + bx + c$

$a = -16$

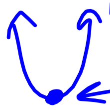
$b = 12$

$c = 10$

$\boxed{y = -16x^2 + 12x + 10}$

Standard Form Features to graph:

ax^2+bx+c



1. $f(x) = 2x^2 + 8x + 6$

$a=2 \quad b=8 \quad c=6$

Y-Intercept: $(0,c) \rightarrow (0,6)$

Dilation: $a=2>1$ stretch by 2

~~Reflection~~/Opens: up or down

a is positive

Axis of Symmetry: $x=\frac{-b}{2a}$ $\frac{-(8)}{2(2)}$ $x=\frac{-8}{4}=-2$

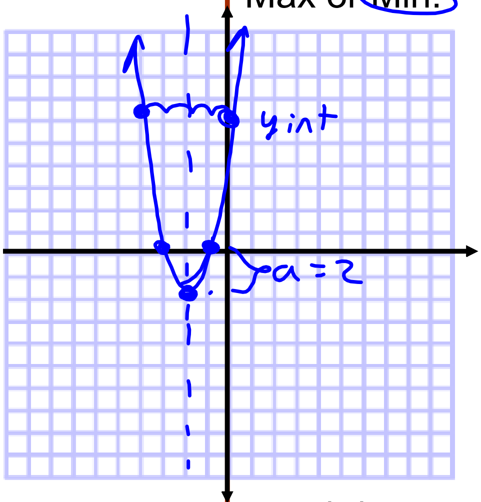
Vertex: Plug in A.o.S. for x and solve for y

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

$y=-2$

$V: (-2,-2)$

Max or Min:



y int

a = 2

2. $y = x^2 + 6x$

Y-Intercept:

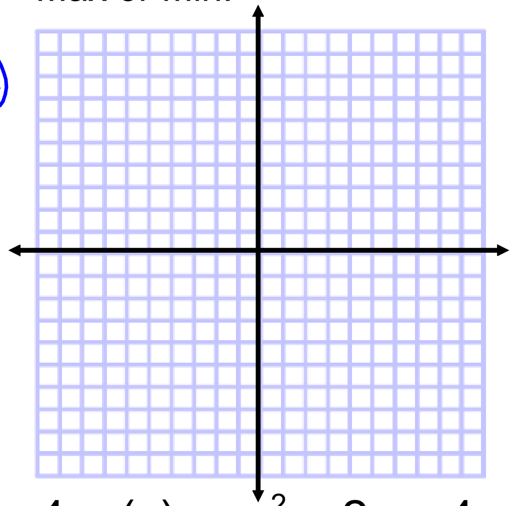
Dilation:

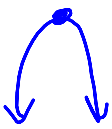
Reflection/Opens: up or down

Axis of Symmetry:

Vertex:

Max or Min:





3. $h(x) = -3x^2 +15x - 4$

Y-Intercept: $(0,-4)$

Dilation: stretch by 3

Reflection/Opens: up or down

Axis of Symmetry: $x=\frac{-(15)}{2(-3)}=\frac{-15}{-6}$

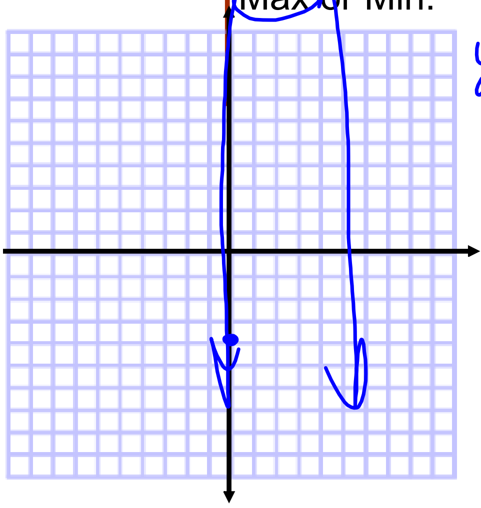
Vertex: $(2.5, 33.75)$ $x=2.5$

33.75

Max or Min:

$y=-3(2.5)^2+15(2.5)+15$

$y=33.75$



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

Y-Intercept:

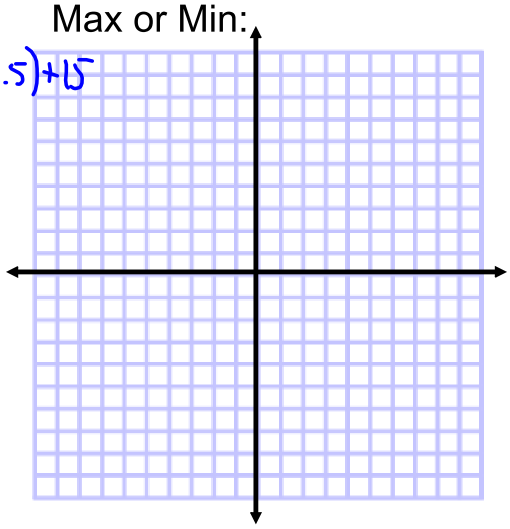
Dilation:

Reflection/Opens: up or down

Axis of Symmetry:

Vertex:

Max or Min:



Homework: Standard Form Features to graph:

5. $f(x) = -2x^2 - 4x + 6$

Y-Intercept:

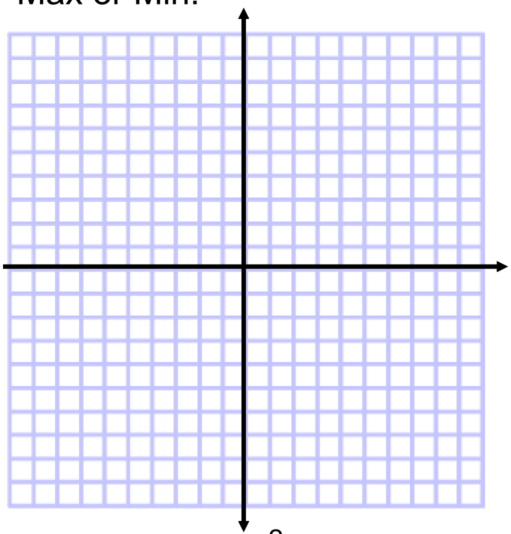
Dilation:

Reflection/Opens: up or down

Axis of Symmetry:

Vertex:

Max or Min:



6. $g(x) = -x^2 + 7x - 8$

Y-Intercept:

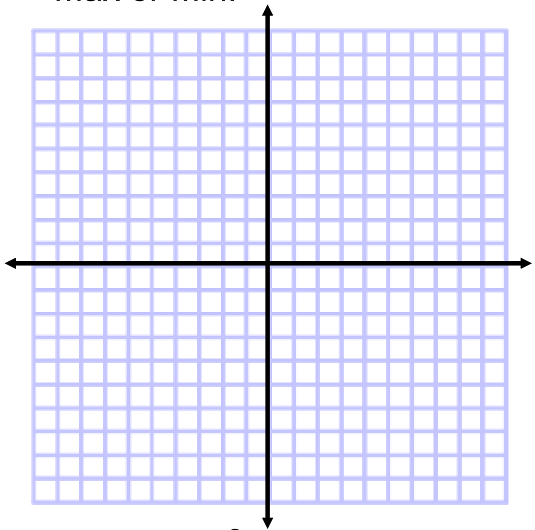
Dilation:

Reflection/Opens: up or down

Axis of Symmetry:

Vertex:

Max or Min:



7. $f(x) = 0.5x^2 - 3x$

Y-Intercept:

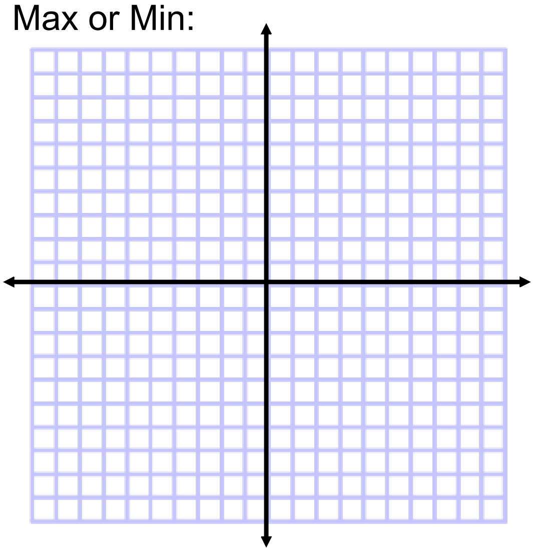
Dilation:

Reflection/Opens: up or down

Axis of Symmetry:

Vertex:

Max or Min:



8. $f(x) = -x^2 + 7$

Y-Intercept:

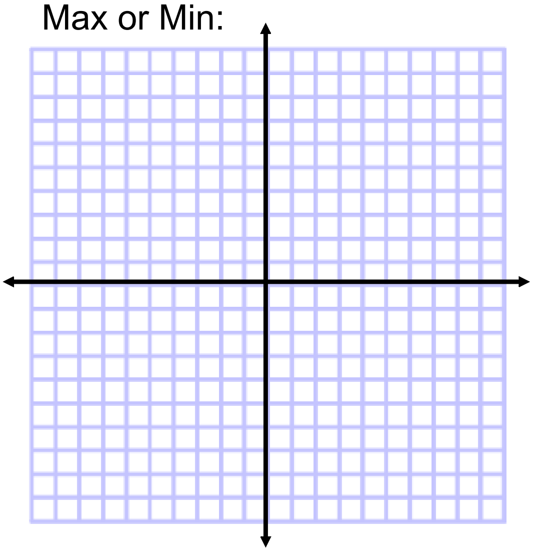
Dilation:

Reflection/Opens: up or down

Axis of Symmetry:

Vertex:

Max or Min:



Savvas Workbook pg. 38

1. **ESSENTIAL QUESTION** What key features can you determine about a quadratic function from an equation in standard form?

2. **Error Analysis** Cameron said that the y-intercept of a quadratic function always tells the maximum value of that function. Explain Cameron's error.

3. **Vocabulary** Write a quadratic function in standard form.

4. **Make Sense and Persevere** Why do you need at least three points to graph a quadratic function when not given an equation?

5. Find the vertex and y-intercept of the quadratic function. AND determine if it is a maximum or a minimum.

$y = 3x^2 - 12x + 40$

6. Find the vertex and y-intercept of the quadratic function. AND determine if it is a maximum or a minimum.

$y = -x^2 + 4x + 7$

7. Find the maximum or minimum value of the parabola.

$$y = -2x^2 - 16x + 20$$

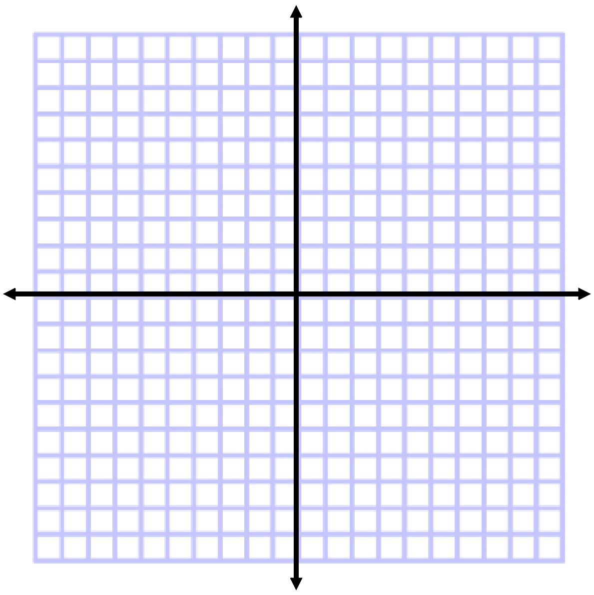
8. Find the maximum or minimum value of the parabola.

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

9. Find the equation in standard form of the parabola that passes through the points $(0, 6)$, $(-3, 15)$, and $(-6, 6)$.

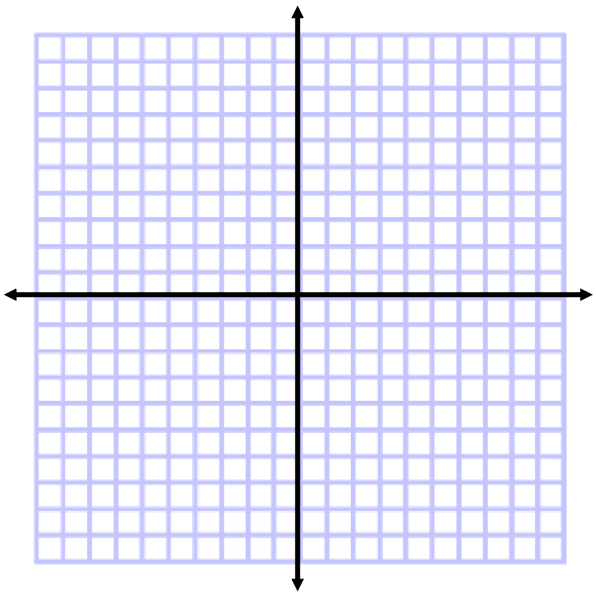
10. Graph the parabola.

$$y = 3x^2 + 6x - 2$$



11. Graph the parabola.

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



Standard Form Features to graph:

$f(x) = 2x^2 + 8x + 6$

$a=2 \quad b=8 \quad c=6$

Y-Intercept: $(0,6)$

Dilation: stretch by 2

~~Reflection~~/Opens: up or down

no

Axis of Symmetry: $x = \frac{-(8)}{2(2)} = \frac{-8}{4}$

$x=-2$

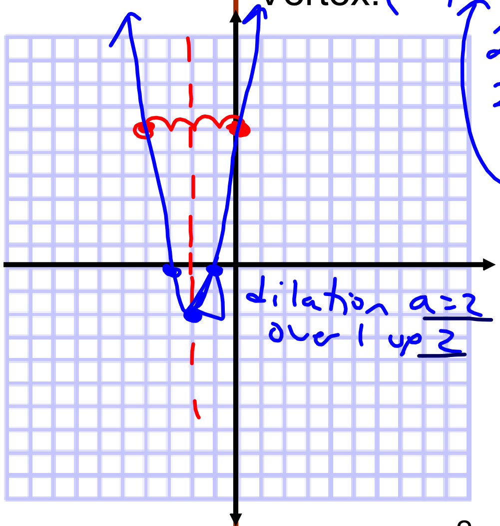
Vertex: $(-2,-2)$

$2(-2)^2+8(-2)+6$

$2(4)+-16+6$

$8-16+6$

$y=-2$



dilation $a=2$

over 1 up 2

$y = x^2 + 6x$

$a=1 \quad b=6 \quad c=0$

Y-Intercept: $(0,0)$

Dilation: None

~~Reflection~~/Opens: up or down

Axis of Symmetry: $x = \frac{-(6)}{2(1)} = \frac{-6}{2}$

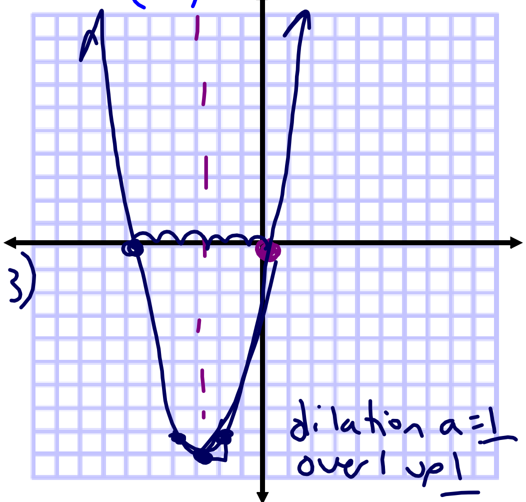
$x=-3$

Vertex: $(-3,-9)$

$y=(-3)^2+6(-3)$

$y=9-18$

$y=-9$



dilation $a=1$

over 1 up 1

$h(x) = -3x^2 + 12x - 4$

$a=-3 \quad b=-11 \quad c=-4$

Y-Intercept: $(0,-4)$

Dilation: stretch by 3

Reflection/Opens: up or down

a is negative

Axis of Symmetry: $x=\frac{-b}{2a} = \frac{-(-11)}{2(-3)}$

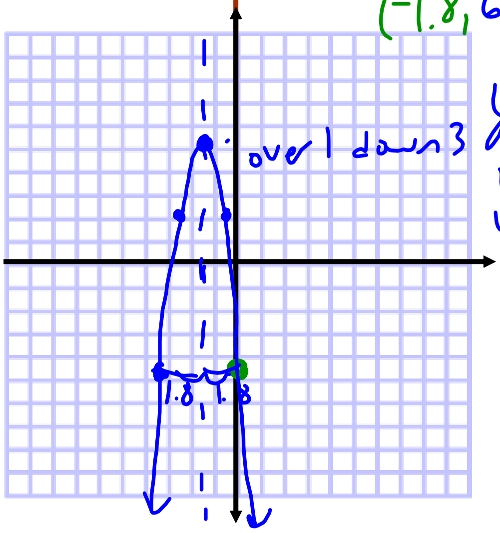
$x=\frac{11}{-6}=-1.8$

Vertex: $(-1.8, 6.08)$

$y=-3(-1.8)^2-11(-1.8)-4$

$y=-9.72+19.8-4$

$y=6.08$



over 1 down 3

1.8 1.8

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

Y-Intercept: $(0,4)$

Dilation: None

Reflection/Opens: up or down

$a=-1$

Axis of Symmetry: $x=\frac{-(2)}{2(-1)} = \frac{-2}{-2}$

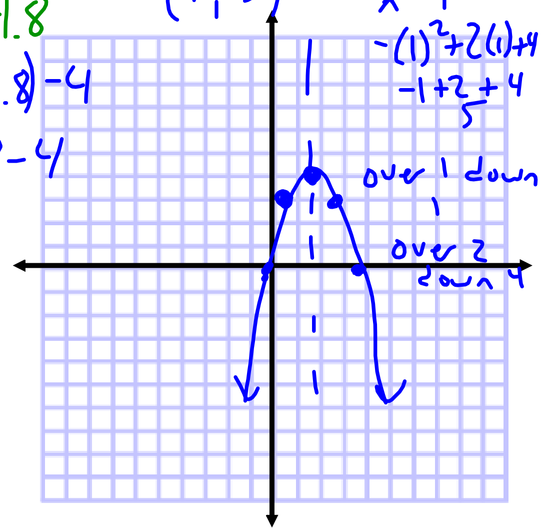
$x=1$

Vertex: $(1,5)$

$-(1)^2+2(1)+4$

$-1+2+4$

5



over 1 down 1

over 2 down 4

Homework Key: Standard Form Features to graph:

1. $f(x) = -2x^2 - 4x + 6$

Y-Intercept: $(0, 6)$

Stretch: $a = -2$ stretch by 2

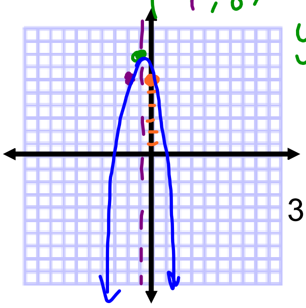
Reflection/Opens: up or down a is neg.

Axis of Symmetry: $x = \frac{-b}{2a} = \frac{-(-4)}{2(-2)} = \frac{4}{-4} = -1$

Vertex: $(-1, 8)$

$y = -2(-1)^2 - 4(-1) + 6$

$y = 8$



2. $g(x) = -x^2 + 7x - 8$

Y-Intercept: $(0, -8)$

Stretch: $a = -1$ No Dilation

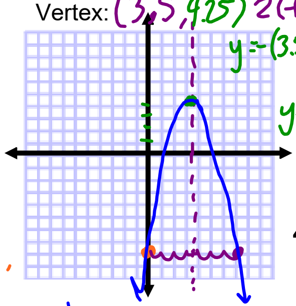
Reflection/Opens: up or down a is neg.

Axis of Symmetry: $x = \frac{-(7)}{2(-1)} = 3.5$

Vertex: $(3.5, 4.25)$

$y = -(3.5)^2 + 7(3.5) - 8$

$y = 4.25$



3. $f(x) = 0.5x^2 - 3x + 0$

Y-Intercept: $(0, 0)$

Stretch: $a = 0.5$ shrink by $\frac{1}{2}$

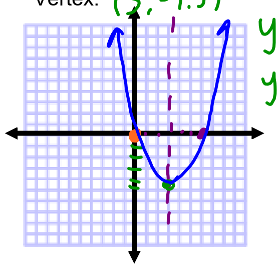
Reflection/Opens: up or down a is positive No

Axis of Symmetry: $x = \frac{-(-3)}{2(0.5)} = \frac{3}{1} = 3$

Vertex: $(3, -4.5)$

$y = 0.5(3)^2 - 3(3)$

$y = -4.5$



4. $f(x) = -x^2 + 7 = -1x^2 + 0x + 7$

$a \cdot x^2 + b \cdot x + c$ $\boxed{b = 0}$

same if $b = 0$

Y-Intercept: $(0, 7)$

Stretch: $a = -1$ No Dilation

Reflection/Opens: up or down Yes a is neg

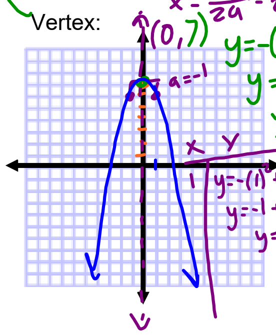
Axis of Symmetry: $x = \frac{-b}{2a} = \frac{-0}{2(-1)} = 0$

Vertex: $(0, 7)$

$y = -(0)^2 + 7$

$y = 0 + 7$

$y = 7$



x	y
1	$y = -(1)^2 + 7$, $y = -1 + 7$, $y = 6$ $(1, 6)$

Things to do Today:

1. Personal Chat: How did your first final go?

2. Check your homework

3. Open or print the 2.2 Quiz Review guide

4. Complete the Semester Reflection form assignment found in Teams

1. **ESSENTIAL QUESTION** What key features can you determine about a quadratic function from an equation in standard form?

CORRECT ANSWER

The key features that can be determined about a quadratic function from an equation in standard form are the axis of symmetry, vertex point, y-intercept, and whether it opens up or down.

2. **Error Analysis** Cameron said that the y-intercept of a quadratic function always tells the maximum value of that function. Explain Cameron's error.

CORRECT ANSWER

The y-intercept may or may not represent the maximum value. The y-intercept is the same as the y-coordinate of the vertex if the parabola opens downward and the vertex is on the y-axis.

3. **Vocabulary** Write a quadratic function in standard form.

CORRECT ANSWER

The answer can be any quadratic function in standard form. Sample: $y = 2x^2 + 6x - 1$.

4. **Make Sense and Persevere** Why do you need at least three points to graph a quadratic function when not given an equation?

CORRECT ANSWER

Since the standard form of the equation has 3 coefficients: a, b, and c, three ordered pairs are needed to determine the values of each coefficient. Solve the system of 3 equations to find the equation in standard form and then graph it.

5. Find the vertex and y-intercept of the quadratic function.

$y = 3x^2 - 12x + 40$

CORRECT ANSWER

The vertex is $(2,\ 28)$ and the y-intercept is $(0,\ 40)$.

6. Find the vertex and y-intercept of the quadratic function.

$y = -x^2 + 4x + 7$

CORRECT ANSWER

The vertex is $(2,\ 11)$ and the y-intercept is $(0,\ 7)$.

7. Find the maximum or minimum value of the parabola.

$y = -2x^2 - 16x + 20$

CORRECT ANSWER

The maximum value is 52.

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

$y = ?$

8. Find the maximum or minimum value of the parabola.

$y = -1x^2 + 12x - 15$

CORRECT ANSWER

The minimum is ~~−51.~~ 21

$x = \frac{-(12)}{2(-1)} = +6$

$y = -(+6)^2 + 12(+6) - 15$

$y = -36 + 72 - 15$

$y = 21$

9. Find the equation in standard form of the parabola that passes through the points $(0,\ 6)$, $(-3,\ 15)$, and $(-6,\ 6)$.

1st 2nd 3rd

CORRECT ANSWER

The equation in standard form is $y = -x^2 - 6x + 6$.

$y = ax^2 + bx + c$

(A) $6 = a(0)^2 + b(0) + c$

$6 = c$

(B) $15 = a(-3)^2 + b(-3) + c$

$15 = 9a - 3b + c$

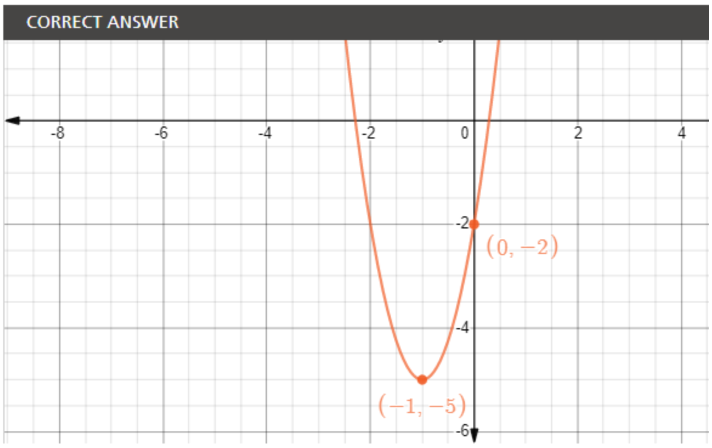
(C) $6 = a(-6)^2 + b(-6) + c$

$6 = 36a - 6b + c$

10. Graph the parabola.

$y = 3x^2 + 6x - 2$

Drag the points on the graph to change its position or shape.



11. Graph the parabola.

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

Drag the points on the graph to change its position or shape.