Name: _____

Algebra 1

May 4 – 8

Time Allotment: 40 minutes per day

Zoom Guided Instruction	Day/Time this Week
1st Period Ms. Steger	Monday & Wednesday, 10:00 – 10:50am
2nd Period Ms. Steger	Monday & Wednesday, 11:00 – 11:50am
3rd Period Ms. Brintnall	Monday & Wednesday, 1:00 – 1:50pm
4th Period Ms. Brintnall	Tuesday & Thursday, 10:00 – 10:50am

Student Name: _____

Teacher Name: _____

Teacher emails: Vanessa.steger@greatheartsnorthernoaks.org and melanie.brintnall@greatheartsnorthernoaks.org. Ms. Brintnall will be teaching Mrs. Chubb's Algebra 1 class for the remainder of the school. If you were in Mrs. Chubb's class, you should email Ms. Brintnall for help if needed!

Academic Honesty

I certify that I completed this assignment independently in accordance with the GHNO Academy Honor Code.

Student signature:

_____

I certify that my student completed this assignment independently in accordance with the GHNO Academy Honor Code.

Parent signature:

_____

Algebra 1
May 4 – May 8

Name: _____

Packet Overview

Date	Objective(s)	Page Number
Monday, May 4	Transform a standard form quadratic equation into vertex form.	3 – 5
Tuesday, May 5	Transform vertex form equations into standard form.	6 – 8
Wednesday, May 6	Identify key features of equations written in both standard and vertex form, such as the axis of symmetry, vertex, concavity, y-intercepts, and x-intercepts.	9 – 11
Thursday, May 7	Review transforming between vertex and standard form; take minor assessment	12 – 14
Friday, May 8	Describe key features of a quadratic function in context.	15 – 17
	Answer key for daily work	18 – 20

Dear Algebra 1 students,

Thank you to those of you regularly attending Zoom Guided Instruction sessions. We love seeing you and talking about math together! We truly miss seeing you all in class at school every day, and it's been such a joy to continue teaching you in our virtual classrooms!

This week, we will reach the maximum point 😊 of our study of quadratics! We will continue to explore different features of quadratic equations and their graphs by practicing transforming between standard form and vertex form, continuing to identify to find key features of graphs (intercepts, the vertex, axis of symmetry, etc.), and interpreting the significance of these points in a Function of the Week activity.

Email us anytime. We miss you!!!

With much love,

and


Algebra 1
May 4 – May 8

Name: _____

Monday, May 4

Lesson 1 objective: Transform quadratic equations from standard form into vertex form.

First, let's review our example from last Friday on how to transform quadratic equations from standard form to vertex form:

STEPS	EXPLANATION
$y = x^2 + 16 + 71$	This is an equation in standard form. I want it in vertex form, so it needs a PST. How do we build a PST?
$y = x^2 + 16x + \_\_\_\_ + 71$	I'm going to move the 71 out of the way and focus on the x^2 and $16x$. These are the building blocks of our PST.
Time to complete the square!	
$64 + y = x^2 + 16x + 64 + 71$	We want the number 64 to be in the blank! So, let's add 64 to both sides (we must follow the law of equality - whatever we do to one side, we must do to the other).
$64 + y = (x+8)^2 + 71$	Let's factor the PST!
$64 + y = (x+8)^2 + 71$ $-64 \quad\quad -64$ $y = (x+8)^2 + 7$	Now, we have to ensure y is all by itself on one side, so subtract 64 from both sides.
	Hooray! It's now in vertex form!

	x	$+8$
x	x^2	$8x$
$+8$	$8x$	64

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Now, let's transform the following two equations from standard form into vertex form:

1. $y = x^2 - 12x + 46$

2. $f(x) = x^2 + 10x + 33$

Check your answers with those at the back of the packet.

Now let's walk through another example problem together. Read through this *twice* and then answer the questions on the following page:

$y = x^2 + 9x + 20$ Standard form!

$y = x^2 + 9x + \_\_ + 20$

Complete the square. Oh no! 9 is odd! That's ok - we can still divide it in half as either 4.5 or $\frac{9}{2}$. $\frac{9}{2}$ will be easier to work with!

	x	$+\frac{9}{2}$
x	x^2	$\frac{9}{2}x$
$+\frac{9}{2}$	$\frac{9}{2}x$	$\frac{81}{4}$

$\frac{81}{4} + y = x^2 + 9x + \frac{81}{4} + 20$ Add $\frac{81}{4}$ to both sides.

$\frac{81}{4} + y = \left(x + \frac{9}{2}\right)^2 + 20$ Factor the PST.

$20\frac{1}{4} + y = \left(x + \frac{9}{2}\right)^2 + 20$ $\frac{81}{4}$ is equal to $20\frac{1}{4}$.

$-20\frac{1}{4}$ $-20\frac{1}{4}$ Subtract $20\frac{1}{4}$ from each side

$$\boxed{y = \left(x + \frac{9}{2}\right)^2 + \frac{3}{4}}$$

Name: _____

3. What made this equation different from the ones we have transformed so far? Which term caused this difference, *a*, *b*, or *c*?

_____

_____

Practice: Transform the following equations from standard form into vertex form using the process above. Write down the vertex and the axis of symmetry.

4. $y = x^2 - 5x + 7$

Vertex form equation:

$y =$

Axis of symmetry equation:

$x =$

Vertex (as a coordinate):

(,)

5. $f(x) = x^2 - 12x - 40$

Vertex form equation:

$f(x) =$

Axis of symmetry equation:

$x =$

Vertex (as a coordinate):

(,)

6. $y = x^2 + 11x - 1$

Vertex form equation:

$y =$

Axis of symmetry equation:

$x =$

Vertex (as a coordinate):

(,)

It is very important to write an equation (something with an equal sign) when that's what the directions ask for, and also to ALWAYS use parentheses with ordered pairs (also called coordinates). We provided those things for you in these practice problems, but we won't always! Make sure this correct mathematical language and formatting is something that makes sense to you and that you practice remembering 😊.

Check your work with the answer key at the end of the packet. You are now done with Algebra I work for Monday, May 4!

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Name: _____

Tuesday, May 5

Lesson 2 objective: Transform vertex form equations into standard form.

Bell work: Simplify the following expressions using the order of operations (PEMDAS).

1. $(x-8)^2$
2. $\left(x+\frac{1}{2}\right)^2$
3. $2(x-3)^2$

Recently, we have been transforming standard form quadratic equations into vertex form. The first thing we will work on today is changing vertex form quadratic equations back into standard form. Let's read through the following examples:

Ex. 1 $y = (x+9)^2 - 23$ Equation in vertex form.

$x+9$ times $x+9$:

	x	$+9$
x	x^2	$9x$
$+9$	$9x$	81

Expand the binomial.

$y = x^2 + 18x + 81 - 23$ Simplify w/ like terms: $81-23$

$y = x^2 + 18x + 58$ Standard form!

Why did we start by expanding the binomial? Because we always simplify with PEMDAS. Exponents occur before addition and subtraction in the order of operations.

Ex. 2 $y = -2(x-3)^2 + 7$ Equation in vertex form.

$y = -2(x-3)^2 + 7$ (exponent, multiplication, addition)

Once again, we must follow the order of operations (PEMDAS) Let's look at the operations here:

$x-3$ times $x-3$:

	x	-3
x	x^2	$-3x$
-3	$-3x$	$+9$

Start w/ exponents (expand binomial). Replace binomial w/ trinomial

$y = -2(x^2 - 6x + 9) + 7$ Multiply by distributing the -2.

$y = -2x^2 + 12x - 18 + 7$ Simplify like terms w/ addition

$y = -2x^2 + 12x - 11$ Standard form!

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Now, practice a few on your own! Use the examples on the previous page to help you as needed.

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

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

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

Check your work with the answers at the back of the packet. Then, complete the following practice problems based on your general knowledge of quadratic equations.

7. Transform the following equation into vertex form: $f(x) = x^2 - 2x + 6$.

What is the axis of symmetry? _____

What is the vertex? (_____,_____)

What is the y-intercept? (_____,_____)

8. The table of values for quadratic function g is shown below.

x	$g(x)$
-3	48
-2	30
-1	16
0	6
2	-2
3	0
4	6
6	30

If 1 is a solution to $g(x) = 0$, what is the other solution?

a. -1 c. 6
b. 3 d. -2

9. Which statement about the quadratic functions below is FALSE?

$f(x) = -\frac{3}{4}x^2 + 6$

$g(x) = -2x^2 - 5$

$h(x) = \frac{1}{4}x^2 + 1$

a. The graphs of two of these functions have a minimum point.

b. The graphs of all these functions have the same axis of symmetry.

c. The graphs of two of these functions do not cross the x-axis.

d. The graphs of all of these functions have different y-intercepts.

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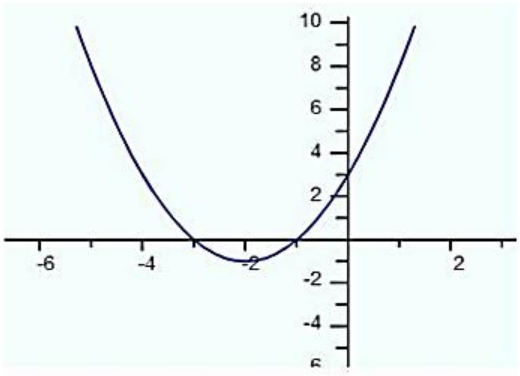
10. Which of the following represents a different quadratic function than the others?

A) $y=x^2+4x+3$

B)



C)

x	y
-4	3
-1	0
4	35

D) Y= (x+4)(x-1)

12. Which equation would show a narrower parabola than $f(x) = 4x^2 - 3x + 8$?

a) $f(x) = 4(x+3)^2 - 7$
b) $f(x) = -5x^2 + 7x - 2$
c) $f(x) = -2x^2 + 10$
d) $f(x) = 6x^2$

13. If you were to shift the graph of $y = 2(x-3)^2 + 1$ seven units down, what would the new equation be?

a) $y = 2(x-3)^2 + 7$
b) $y = 2(x-3)^2 - 6$
c) $y = 2(x-3)^2 + 6$
d) $y = 2(x-3)^2 - 7$

14. Which standard form equation is equivalent to $y = 3(x-2)^2 + 1$?

a) $y = x^2 - 4x + 5$
b) $y = 3x^2 - 12x + 5$
c) $y = 3x^2 - 11$
d) $y = 3x^2 - 12x + 13$

15. Describe how the graph of $f(x) = \frac{1}{2}(x-3)^2 + 2$ will be affected if the equation changes to…

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

_____

_____

b) $f(x) = \frac{1}{2}(x+1)^2 + 2$

_____

_____

Check your work with the answers at the back of the packet. You are finished with Tuesday's work!

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Wednesday, May 6

Lesson 3 Objective: Identify key features of equations written in both standard and vertex form, such as the axis of symmetry, vertex, concavity, y-intercepts, and x-intercepts.

Answer the written questions in complete sentences. Calculate the answers to the other questions and BOX your final answers.

1. A) Is the equation $f(x) = -3x^2 - 2x + 1$ in standard form or vertex form?

   _____

   B) Calculate the axis of symmetry for the parabola: $f(x) = -3x^2 - 2x + 1$

   C) Describe how to find the axis of symmetry for this equation's parabola. *Try talking it out as if you were explaining to a table partner what to do so you can tell what to write first.*

2. A) Is the equation $f(x) = \frac{1}{4}(x-2)^2 + 3$ in standard form or vertex form?

   _____

   B) Determine the axis of symmetry for the parabola (HINT: What is the vertex of this equation? If you know the vertex, what is the axis of symmetry?): $f(x) = \frac{1}{4}(x-2)^2 + 3$

   C) Describe how to find the axis of symmetry for this equation's parabola. *Having to write out in words the algebraic steps you take will really help you remember this.*

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3. A) Calculate the vertex of
$f(x) = -3x^2 - 2x + 1$

B) Describe how to find the vertex given an equation for a parabola in standard form.

_____

_____

_____

_____

_____

_____

_____

_____

_____

4. A) Calculate the vertex of
$f(x) = \frac{1}{4}(x-2)^2 + 3$

B) Describe how to find the vertex given an equation for a parabola in vertex form.

_____

_____

_____

_____

_____

_____

_____

_____

_____

5. The shape of the graph of $f(x) = -3x^2 - 2x + 1$ is called a _____. This shape will be (circle one)

a) concave up. b) concave down.

B) How did you know whether the graph of this quadratic function will be concave up or concave down?

_____

_____

6. A) The shape of the graph of $f(x) = \frac{1}{4}(x-2)^2 + 3$ is called a _____. This shape will be (circle one)

a) concave up. b) concave down.

B) How did you know whether the graph of this quadratic function will be concave up or concave down?

_____

_____

7. A) What is the discriminant? Write the expression here: _____

(HINT: Refer to the lesson on Wednesday, April 15 from the Week 4 packet if need be!)

7B) Calculate the discriminant of
$f(x) = -3x^2 - 2x + 1$

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7C) What does the discriminant tell us about the graph of a quadratic equation? Reference all three possibilities in your response.

_____

_____

_____

_____

_____

_____

_____

8. A) What is an x-intercept?

8C) Select one of the methods in 4B to find the **exact roots** of $f(x) = -3x^2 - 2x + 1$

8B) List all methods we have learned to find the x-intercepts of quadratic functions.

1. _____
2. _____
3. _____
4. _____

9. A) What is a y-intercept?

9D) Describe how to find the y-intercept for any quadratic function.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

9B) Calculate the y-intercept for

$$f(x) = -3x^2 - 2x + 1$$

9C) Calculate the y-intercept for

$$f(x) = \frac{1}{4}(x - 2)^2 + 3$$

Check your answers with those at the end of the packet. You are now finished with Wednesday's work!

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Thursday, May 7

Lesson 4 Objective: Review transforming between vertex and standard form; take minor assessment

Review of vertex form:

1. Write the formula for the standard form of a quadratic equation:

2. Write the formula for the vertex form of a quadratic equation:

3. Will the graph of $f(x) = 5x^2 + 2x - 3$ be a concave up or concave down parabola? How do you know?

Circle one: Concave up Concave down

Explain:

_____
_____
_____

4. Will the graph of $f(x) = -3(x-2)^2 - 7$ be a concave up or concave down parabola? How do you know?

Circle one: Concave up Concave down

Explain:

_____
_____
_____

5. Consider the equation $y = x^2 + 6x + 9$

a) What is the value of its discriminant?

b) How many roots does this equation have?

c) Transform $y = x^2 + 6x + 9$ into vertex form.

Write the vertex as an ordered pair: _____

Write the equation for *this graph's* axis of symmetry: _____

6. Consider the equation $y = x^2 - 5x + 6$

a) What is the value of its discriminant?

b) How many roots does this equation have?

c) Transform $y = x^2 - 5x + 6$ into vertex form.

Write the vertex as an ordered pair: _____

Write the equation for *this graph's* axis of symmetry: _____

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Now, check your answers with those in the answer key at the back of the packet. Once you have corrected the review problems above and reached out to Ms. Brintnall or Ms. Steger with any questions you have. Complete the checklist below. Then, you may turn the page to begin your minor assessment.

Make sure you have memorized how to find the discriminant, standard form and vertex form of a quadratic equation!

Minor Assessment (Quiz)

Please read these boxes carefully before starting on the minor assessment.

- ☐ I understand that I am NOT allowed to use this packet during my quiz.
- ☐ I understand that I am NOT allowed to use my own loose-leaf packet during my quiz.
- ☐ I understand that while Ms. Steger and Ms. Brintnall estimate that the quiz will take 10 minutes, it is okay to spend the time I need.
- ☐ I understand that I am NOT allowed to ask a parent, family member, or friend for help during my quiz.
- ☐ I understand that I am NOT allowed to use the internet or any other resource to help with my quiz.

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Week 7 Minor Assessment

1. Write the formula for quadratic equations in

Standard form:_____

Vertex form: _____

2. Will the graph of $f(x) = -\frac{1}{2}(x+1)^2 - 3$ be a concave up or concave down parabola? How do you know?

Circle one: Concave up Concave down

Explain:

_____
_____
_____

5. Consider the equation $y = x^2 - 4x + 5$

a) What is the value of the discriminant?

b) How many roots does this equation have?

c) Transform $y = x^2 - 4x + 5$ into vertex form.

Equation in vertex form: _____

Write the vertex as an ordered pair: _____

Write the equation for *this graph's* axis of symmetry: _____

If you are submitting your work through Google classroom, please scan this page and upload it to the "minor assessment submission" assignment for this week.

You have finished Thursday's Algebra I work!

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Friday, May 8

Lesson 5 Objective: Describe key features of a quadratic function in context.

With remote learning, we have missed out on our Functions of the Week! For today's lesson, please complete the following Function of the Week assignment. Remember that functions have two variables, two ideas that we are measuring, and one value *depends* on the other.

Function of the Week

A toy rocket is launched vertically upward from ground level with an initial velocity of 128 ft per second. Its height *h(t)* after *t* seconds is given by the equation $h(t) = -16t^2 + 128t$.

Answer a) through e) *before* checking your answers with the key in the back of the packet.

a) What are the two key *variables* (things being measured in relation to one another) in this scenario?
_____ and _____

b) In this scenario, _____ depends on _____. We could also say that _____ is a function of _____.

c) Independent variable (include units): _____
Dependent variable (include units):_____

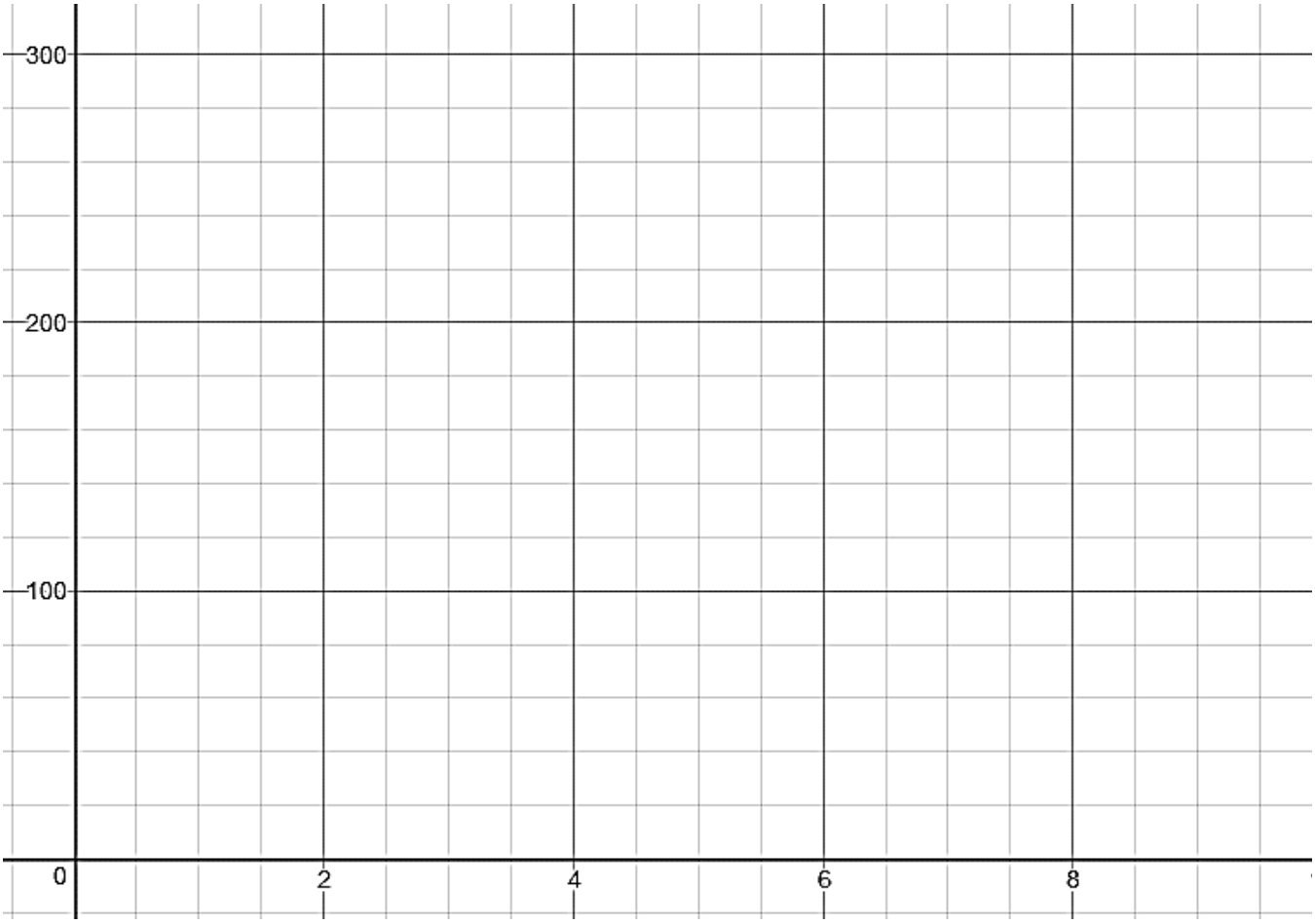
d) What is the name of the shape this equation will form? _____

e) Calculate the equation for the axis of symmetry. BOX your final answer.

f) Find at least five points that will appear on the graph.

t	*h(t)*

g) Graph the equation using the points you calculated. <u>Label your axes, vertex, and root(s).</u>



h) How long does it take the rocket to return to the ground? _____

i) How high will the rocket be after 6 seconds? _____

j) After how many seconds will the rocket be 112 feet off the ground? Find your answer by **factoring.** HINT: Start with the original equation: $h(t) = -16t^2 + 128t$. Set *h(t)*, the rocket's height, equal to 112. You then want to make sure one side is equal to zero so you can *factor*. Think – what is our first step in factoring? Look for a common factor…

_____ second(s) and _____ second(s)

k) What points on your graph represent these two values? (____, ____) and (____, ____)
l) How long does it take the rocket to reach its maximum height? _____

m) What is the vertex? _____
Is it a maximum or a minimum? _____
Label the vertex and write its coordinates on your graph.
What is the significance of this point in the context of the problem?

_____
_____
_____

n) What are the roots? _____ and _____
Label the roots and write their coordinates on your graph.
What is the significance of these points in the context of the problem?

_____
_____
_____

o) What are the domain and range of this function?

Domain	Range
Variable Label:	Variable Label:
Inequality:	Inequality:

Check your work with the answer key at the end of the packet. As always, reach out to us with any questions!

You are now finished for the week! Remember to upload your pictures of the daily work and minor assessment to the Google Classroom, OR prepare one packet of papers with your name, Algebra 1, and your teacher's name on the very front stapled together to drop off at school. Again, we are checking for following directions when grading! 😊

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Answer Key for the Daily Work

Lesson 1 (Monday)

Review from Friday:

1. $y = x^2 - 12x + 46$

$y = x^2 - 12x + \_\_\_ + 46$

	x	-6
x	x^2	$-6x$
-6	$-6x$	36

$36 + y = x^2 - 12x + 36 + 46$

$36 + y = (x-6)^2 + 46$

$-36 \quad\quad -36$

$y = (x-6)^2 + 10$

2. $f(x) = x^2 + 10x + 33$

$f(x) = x^2 + 10x + \_\_\_ + 33$

	x	+5
x	x^2	$5x$
+5	$5x$	25

$25 + f(x) = x^2 + 10x + 25 + 33$

$25 + f(x) = (x+5)^2 + 33$

$-25 \quad\quad -25$

$f(x) = (x+5)^2 + 8$

3. *b* had always been an even number, but this time *b* was odd, so fractions emerged when we tried to complete the square.

4. $y = x^2 - 5x + 7$

$y = x^2 - 5x + \_\_\_ + 7$

	x	$-\frac{5}{2}$
x	x^2	$-\frac{5}{2}x$
$-\frac{5}{2}$	$-\frac{5}{2}x$	$\frac{25}{4}$

$\frac{25}{4} + y = x^2 - 5x + \frac{25}{4} + 7$

$\frac{25}{4} + y = (x - \frac{5}{2})^2 + 7$

$-\frac{25}{4} \quad\quad -\frac{25}{4} \rightarrow 7 - 6\frac{1}{4}$

$y = (x - \frac{5}{2})^2 + \frac{3}{4}$

Vertex: $(\frac{5}{2}, \frac{3}{4})$ Axis of sym: $x = \frac{5}{2}$

5. $f(x) = x^2 - 12x - 40$

$f(x) = x^2 - 12x + \_\_\_ - 40$

	x	-6
x	x^2	$-6x$
-6	$-6x$	36

$36 + f(x) = x^2 - 12x + 36 - 40$

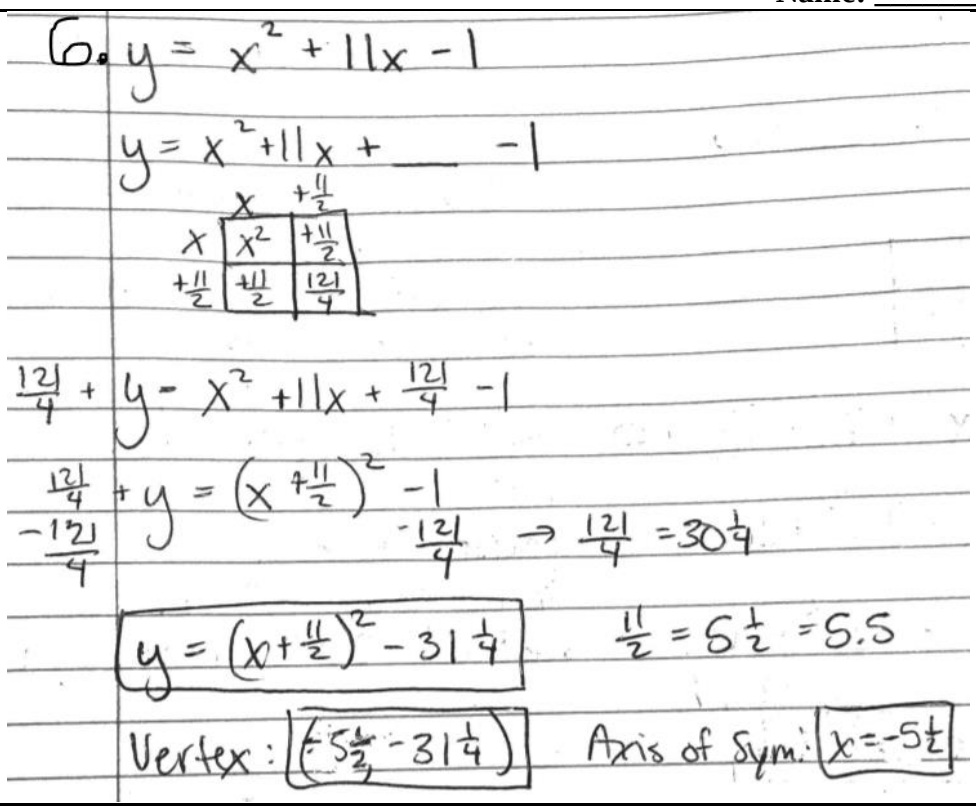
$36 + f(x) = (x-6)^2 - 40$

$-36 \quad\quad -36$

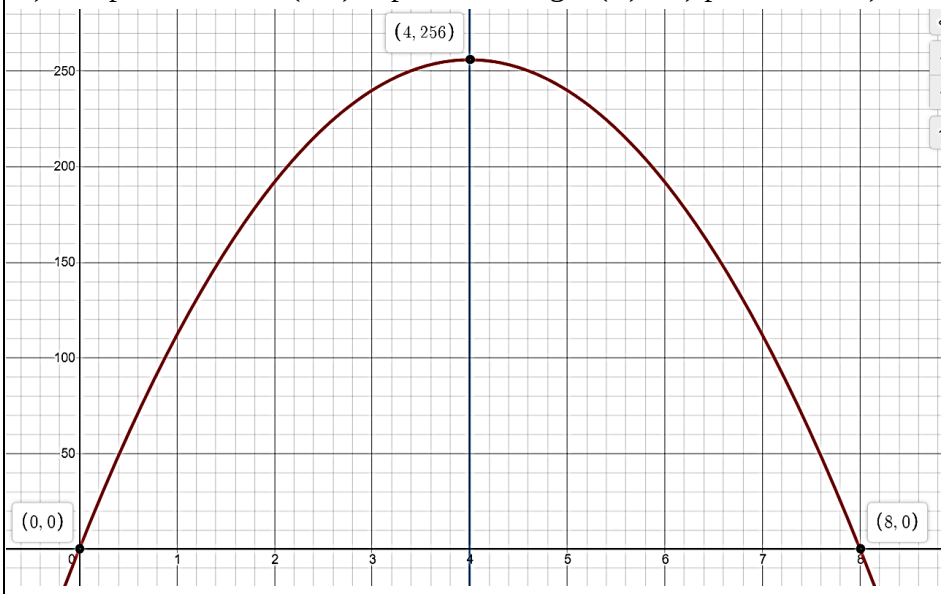
$f(x) = (x-6)^2 - 76$

Vertex: $(6, -76)$

Axis of sym: $x = 6$



Lesson 2 Tuesday	1. $x^2 - 16x + 64$ 2. $x^2 + x + \frac{1}{4}$ 3. $2x^2 - 12x + 18$ 4. $y = x^2 + 4x - 1$ 5. $y = 3x^2 - 6x + 7$ 6. $f(x) = -x^2 + 8x - 21$ 7. $f(x) = (x-1)^2 + 5$; axis of symmetry: x=1; Vertex: (1, 5); y-intercept: (0, 6) 8. b 9. a 10. d 11. c 12. b 13. d 19. a) The parabola will become narrower because *a* increased from ½ to 2. b) The parabola will shift 4 units to the left as *h* changes from 3 to -1.
Lesson 3 Wednesday	1. A) Standard form B) $\boldsymbol{x = -\frac{1}{3}}$ C) Identify the values for a, b, and c. Then, plug the values into the formula for the axis of symmetry, $\boldsymbol{x = \frac{-b}{2a}}$, and simplify. 2. A) Vertex form B) $x = 2$ C) Find the vertex by plugging in the value that will make the squared binomial equal to zero. Then, set *x* equal to the *x*-coordinate in the vertex. 3. A) $(-\frac{1}{3}, 1\frac{1}{3})$ B) Take the *x* value from the equation for the axis of symmetry and plug it into the original equation to get the output. 4. A) $(2, 3)$ B) When an equation is in vertex form, the vertex is always (a, k). Essentially, plug in the value that makes the squared binomial equal and simplify to get the output, *k*. 5. The parabola is concave down because the *a* value is negative. 6. The parabola is concave up because the *a* value is positive. 7. A) $b^2 - 4ac$ B) 16 C) The discriminant is the part of the quadratic formula that tells us how many solutions there are. A positive discriminant means there are two solutions, a discriminant of zero means that here is one solution, and a negative discriminant means that there are no solutions.

	8. A) The x-intercepts are where a graph crosses the x-axis (y is 0). Synonyms are "roots", "solutions", and "zeroes". B) Factoring, completing the square, the quadratic formula, graphing C) $(\frac{1}{3}, 0)$ and (-1, 0) 9. A) The y-intercept is where a graph crosses the y-axis (x is 0). B) (0, 1) C) (0,4) D) "*x*" is always zero at the y-axis, so plug in 0 for *x*, and the output will be the *y*-intercept.
Lesson 4 Thursday	1. $f(x) = ax^2 + bx + c$ 2. $f(x) = a(x-h)^2 + k$ 3. The parabola is concave up because *a* is positive. 4. The parabola is concave down because *a* is negative. 5. $y = x^2 + 6x + 9$ $y = (x+3)^2$ Vertex: $(-3, 0)$ Axis of Sym: $x = -3$ 6. $y = x^2 - 5x + 6$ $\frac{25}{4} + y = x^2 - 5x + \frac{25}{4} + 6$ $\frac{25}{4} + y = (x - \frac{5}{2})^2 + 6$ $6\frac{1}{4} + y = (x - \frac{5}{2})^2 + 6$ $y = (x - \frac{5}{2})^2 - \frac{1}{4}$ Vertex: $(\frac{5}{2}, -\frac{1}{4})$ Axis of Sym: $x = \frac{5}{2}$
Lesson 5 (Friday)	a) time (in seconds) and height (in feet) b) height depends on time; height is a function of time c) independent: time (sec) dependent: height (ft) d) parabola e) x = 4  f) Answers will vary g) (graph) h) 8 seconds i) 192 ft j) 1 second and 7 seconds k) (1, 112) and (7, 112) l) 4 sec m) (4, 256), maximum point; The vertex is significant because it shows that the rocket reached its highest point, 256 ft, 4 seconds after its launch. n) (0, 0) and (8, 0); These points show that the rocket was on the ground at its launch (0 seconds) and returned to the ground 8 seconds after its launch. o) Domain: time (sec); $0 \leq x \leq 8$ Range: height (ft); $0 \leq y \leq 256$