Algebra 1

April 20 – April 23

Time Allotment: 40 minutes per day

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!

Algebra 1
April 14 – April 17

Packet Overview

Date	Objective(s)	Page Number
Monday, April 20	Identify axis of symmetry and vertex of a parabola both algebraically and graphically.	3-5
Tuesday, April 21	Name the relationship between the axis of symmetry and the roots.	6-8
Wednesday, April 22	Write inequalities for domain and ranges for parabolas. Practice a variety of quadratics problems.	9-11
Thursday, April 23	Graph and identify characteristics of parabolas.	12-14
Friday, April 24	Holiday – Battle of the Flowers Home Edition	

Dear Algebra 1 students,

In person, we would have paused at the beginning of class and taken a "trip down math memory lane" together, but this paragraph will do. 😊 As a small child, you learned how to count… then you added, subtracted, multiplied, and divided. Then you were introduced to variables or symbols to represent numbers. Then in Pre-Algebra you practiced "equal sign highway" a LOT, specifically with first degree equations like $2x - 1 = 5$.

Quadratic equations (2^{nd} degree equations) are a culminating topic of your current math journey. Mathematicians always want to study patterns, play with symbols, and figure out uknowns from given relationships. If we can solve $2x - 1 = 5$ using inverse operations, we should be able to solve the 2nd degree equation $2x^2 - 5x = 1$ with inverse operations too, especially since we know roots are in inverse operations of exponents! However, to isolate x, we have to play with lots of algebra, such as completing the square to make the left side of the equation be a Perfect Square Trinomial (PST!) so that taking the square root actually does isolate x. Note: $\sqrt{2x^2 - 5x}$ can't even be simplified down, so taking the square roots of both sides without completing the square first will leave us at a dead end.

Now, the amazing thing about math is how CONSISTENT it is. It is beautiful how different processes, when executed correctly, lead you to the very same end. Our goal for you this week is to enjoy how so many different topics about quadratics relate together and affirm each other. We can't wait to dive in with you!

Email us anytime. We miss you!!!

With much love, Ms. Steger and Ms. Brintnall

Zoom Office Hours	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

Reminder of how to turn in packets

Last week Great Hearts Texas rolled out different tools to help you as students turn work in and get feedback on it. Your families can choose one of these two ways (please note – you will get feedback from your teacher faster if you use Google classroom because we don't have to wait for the physical papers to de-germ 😊)

1. Google classroom – you will scan/take pictures of whatever pages you showed work on (this could be a printed version of this packet or loose-leaf)

OR

2. Dropping paper off at school – whatever you drop off for us must have **your name, Algebra 1, and your teacher's name on the very front and the papers should be stapled together.**

Whether you are using Google classroom to turn work in or paper, you should keep your work organized by labeling each day and keeping any loose-leaf papers together in one stapled packet.

- ***I see where I will turn in my daily work (any paper you show work on, which could be this packet itself or loose-leaf pages) on the Google classroom website.***

- ***OR If I choose to turn my papers in at school instead, I will have my name, Algebra 1 and my teacher's name on the very front and all papers will be stapled together.***

Academic Honesty

I certify that I completed this assignment independently in accordance with the GHNO Academy Honor Code.	I certify that my student completed this assignment independently in accordance with the GHNO Academy Honor Code.
Student signature:	*Parent signature:*
_____	_____

Algebra 1
April 14 – April 17

Monday April 20

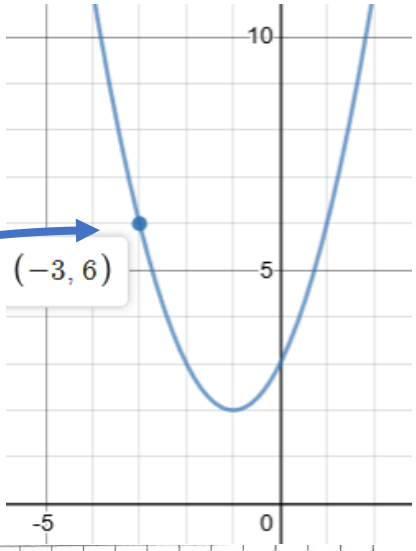
Lesson 1

Objective: Identify axis of symmetry and vertex of a parabola both algebraically and graphically.

A quick reminder of function notation so it stays fresh in your mind: $g(x)$ (read "g of x") is another name for the y-variable (also called the output and dependent variable). So when you see an equation in function notation like $f(x) = x^2 + 2x + 3$ you could just replace the $f(x)$ with y and get $y = x^2 + 2x + 3$.

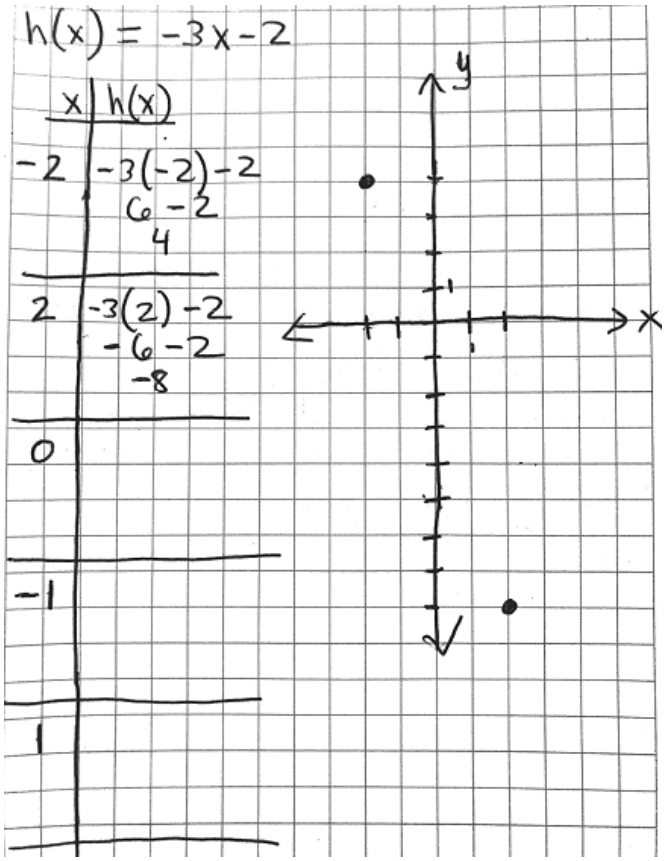
$$f(x) = x^2 + 2x + 3$$
$$f(-3) = (-3)^2 + 2(-3) + 3$$
$$= 9 - 6 + 3$$
$$= 6$$

So when $x = -3$, the output is 6. Another way we can say this is "f of -3 equals 6." This corresponds to:

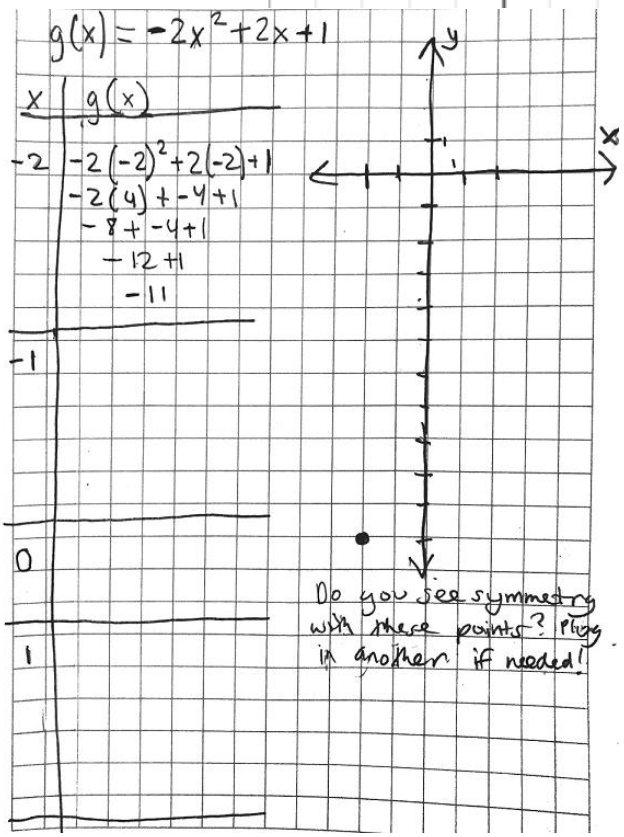


Let's warm up by graphing a linear equation and quadratic equation written in function notation. Complete the table of values, being careful about showing a lot of work so you avoid little algebra errors like negatives!

1.



2.



A reminder from the Week of March 30th (hint: use page 384 of your textbook if you need to!)

3. What is the name of the shape of the graph of a quadratic equation? _____

4. What is a vertex? _____

Parabolas have an axis of symmetry that divides them into two symmetrical halves. This is a vertical line that goes directly through the vertex.

5. Look carefully at your parabola on #2. The axis of symmetry LOOKS like it is at $x =$_____.

Recall that the equation of the axis of symmetry can be found using the formula $x = \frac{-b}{2a}$.

6. Write the ***equation*** of the axis of symmetry for #2 $g(x) = -2x^2 + 2x + 1$.

$a =$ ____ $b =$ _____ $c =$ _____ _____

Equation of axis of symmetry (make sure you write equation, not just a number)

We know that the axis of symmetry always goes through the vertex, so the x-coordinate of the vertex matches the x-value in the axis of symmetry equation.

7. Now that you know the x-value of the vertex, we need to find the corresponding y-value. Do the necessary calculations below and write the coordinate of the vertex for #2 $g(x) = -2x^2 + 2x + 1$.

Vertex: (___ , _____)

8. Was this vertex a minimum or maximum point of this parabola? How could you know this WITHOUT graphing and just be looking at the equation $g(x) = -2x^2 + 2x + 1$. (2-3 sentences total in your answer):

_____
_____
_____
_____

Note to students and parents: if you do not know how to do this step on your own, you really need to reach out to Ms. Steger and Ms. Brintnall and schedule a time to talk through this material. We are purposefully not giving more guidance here to check understanding (so we know what we can assume people know how to do from afar). No question is silly! This is simply your marker point for "do I need to reach out for more help?" We are here for you!!!

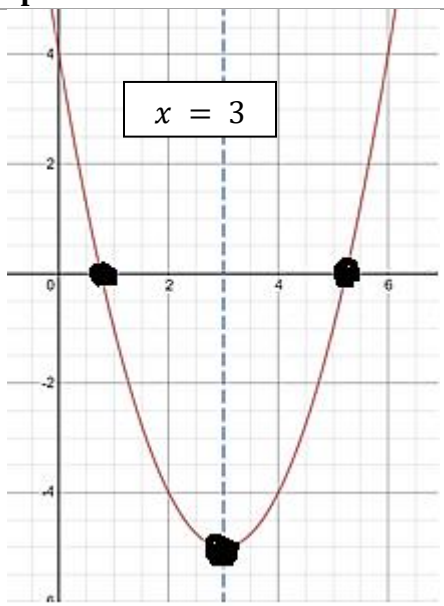
It is important to be familiar with the "anatomy of a parabola" so we are going to ask you to review something you looked at in the Week of March 30th packet for our practice problems today.

Look at the following parabolas and follow the directions. The first one is done for you.

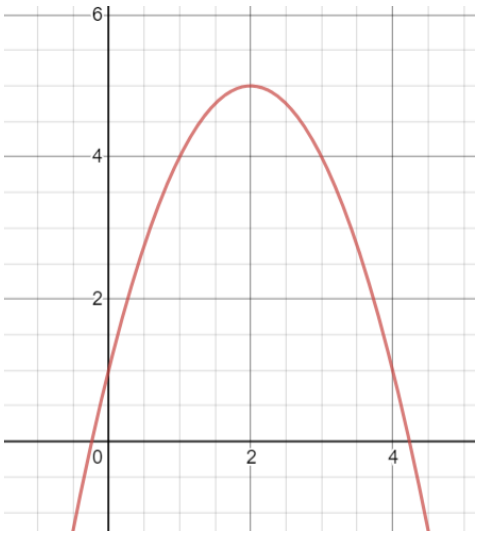
a) ***Mark*** the **zeros**. (remember all your synonyms of zeros!)
b) ***Mark and write*** down the coordinate for the **vertex**. **Choose** if the vertex is a maximum or minimum.
c) ***Draw*** a dotted, vertical, line through the **axis of symmetry**.
d) ***Label*** the axis of symmetry with its equation.
e) ***Identify*** the **y-intercept.**

9. Vertex: **(3, -5)** is a **minimum point**

y-intercept: **(0, 4)**



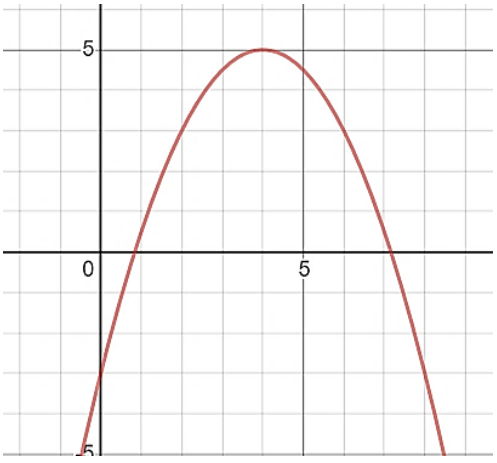
10.



Vertex: _____ is a _____

y-intercept: _____

11.



Vertex:

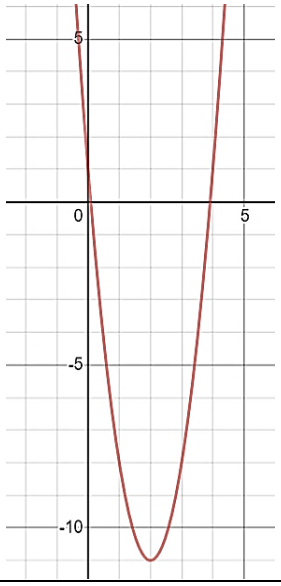
_____ is a

_____

y-intercept:

_____

12.



Vertex:

_____ is a

_____

y-intercept:

_____

Hint: the y-intercept is NOT at the origin!

Okay – we are finished for today but we are going to pick right back up with these concepts tomorrow!

Tuesday, April 21

Lesson 2

Objective: Name the relationship between the axis of symmetry and the roots.

1. Look at the graphs on page 5. Where are the roots in relation to the axis of symmetry? Do you think this will always be true for ALL parabolas, or was it just coincidental on these four? (2-3 sentences in your answer)

_____

_____

_____

2. There are four methods that we know to find the x −intercepts of parabolas (notice how I use all the synonyms for x −intercepts interchangeably… I am purposefully doing this to keep the different words fresh!). What are the four methods? Hint: you used three of them on your quiz last week!
   1. Graphing _____
   2. _____
   3. _____
   4. _____

3. Now let's CALCULATE the x-intercepts for #2 on page 3 $g(x) = -2x^2 + 2x + 1$. In this case let's use **the quadratic formula** (at this point we won't provide the place to identify a, b, and c or give the formula, but it would be a good idea to get in the habit of writing those down yourself before you even start! 😊

$x =$ _____

4. We want to draw your attention to why, even if your work is right, you might not have gotten the answer on the answer key. To do that, let's separate the two solutions:

$x =$ _____ and $x =$ _____

And now let's write the division as two separate fractions ➡ and SIMPLIFY.

$x =$ _____ + _____ and $x =$ _____ − _____ ➡ $x =$ _____ + _____ and $x =$ _____ − _____

Do you see how your answer matches the answer key now? Email or hop on Zoom Office Hours if not!!

5. Finally, let's ESTIMATE our irrational answers. For example $\sqrt{5}$ is about 2.1 because $\sqrt{4} < \sqrt{5} < \sqrt{9}$.

Write the proper inequality: ____ < ____ < _____. Now estimate your square root: ____ ≈ _____. And now use that estimation in your fractions to find the approximate coordinates of your x-intercepts.

(~ _____ ,0)and (~_____ ,0)

6. Look at your graph for #2 on page 3. Does your estimation match the graph? Circle one:

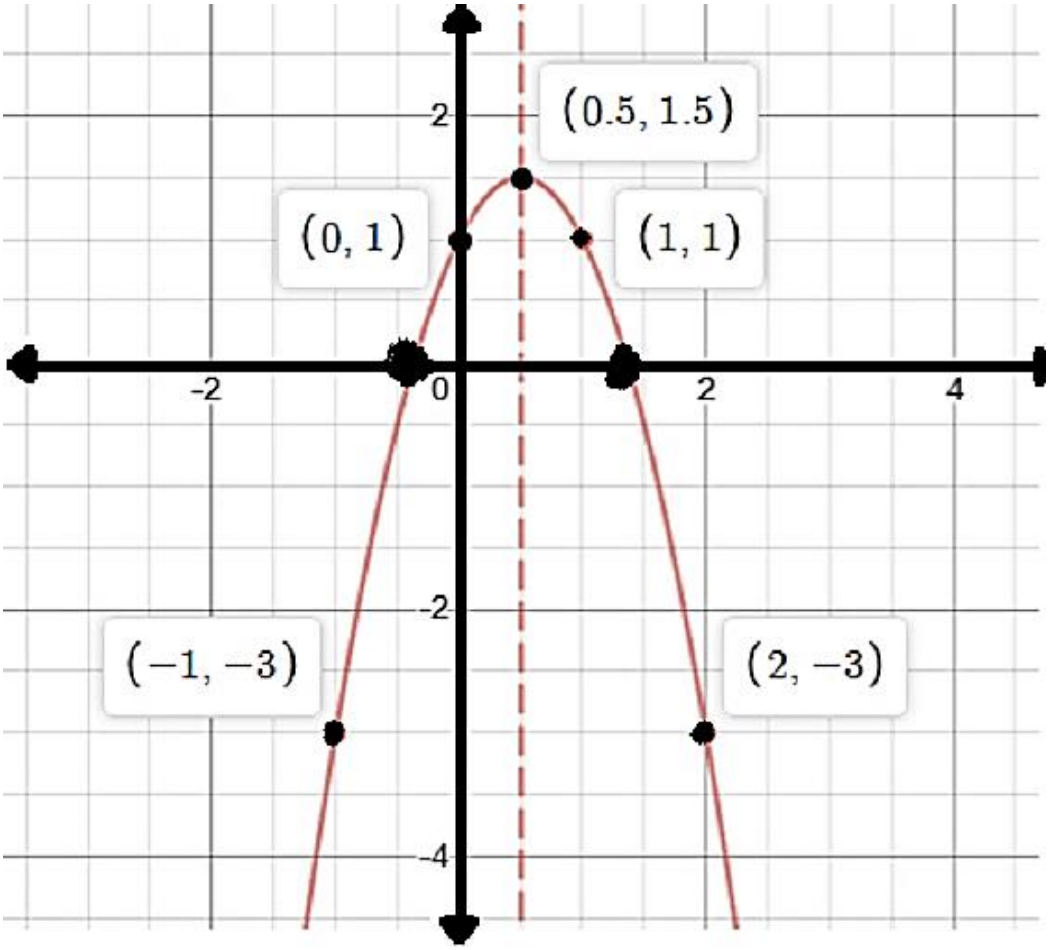
   Yes it matches! No it doesn't – I'm confused! I will email my teacher for help.

7. Here is a nice zoomed-in graph of our $g(x)$ equation from #2 on page 3. In your own words, how can you justify the fact that this parabola is *symmetrical* using the coordinates you see? To help you, here is a sample sentence you should use as a guide: "I can see that this graphed equation is symmetrical because $(1,1)$ and $(0,1)$ seem to be mirrors of each other – both are $\frac{1}{2}$ units away from the axis of symmetry."

_____

_____.

$$g(x) = -2x^2 + 2x + 1$$



All right, now let's see something really fun…..

Here is the equation for the axis of symmetry

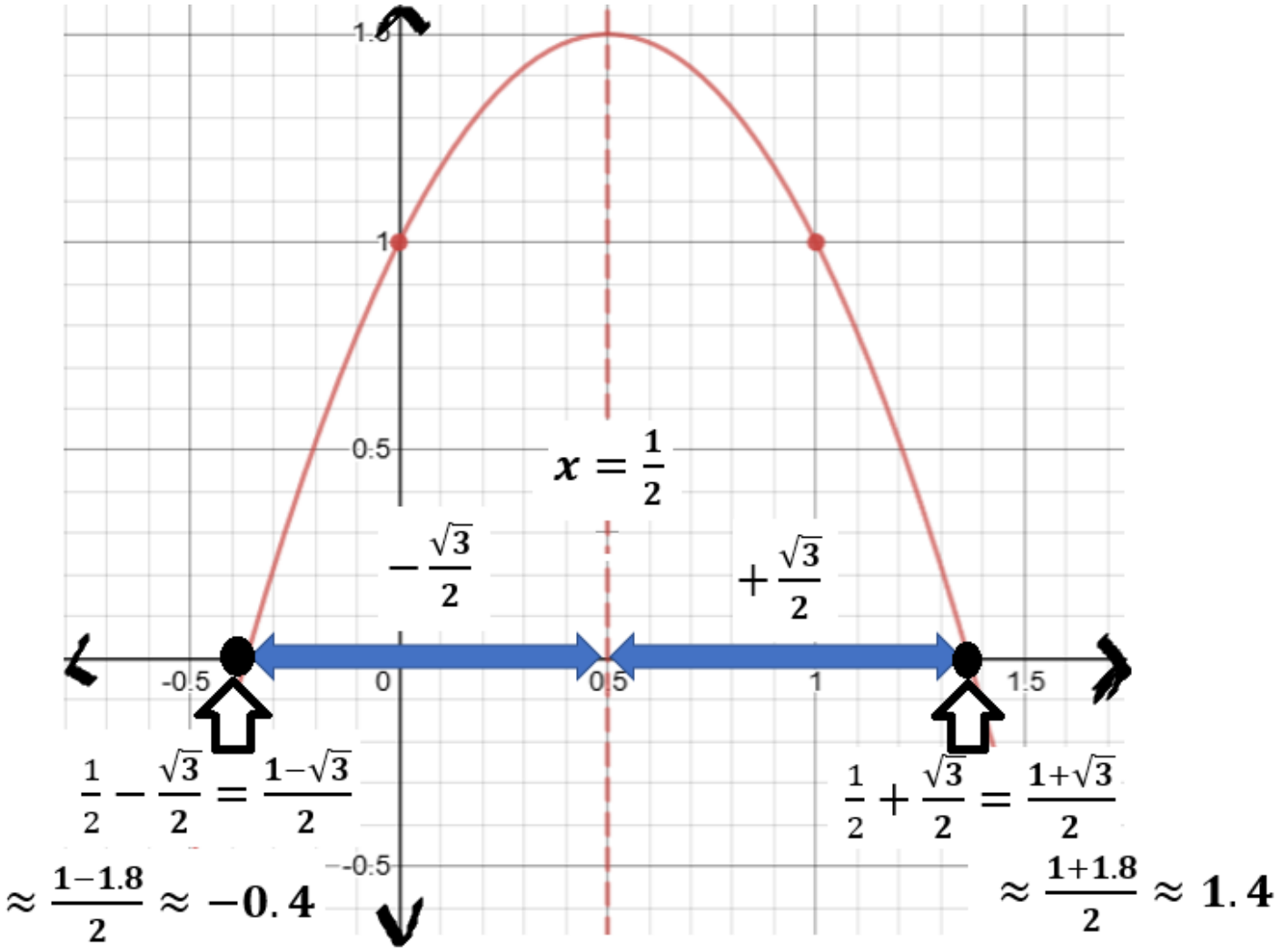
$$x = \frac{-b}{2a}$$

… and here is the equation for the x-intercepts:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

What do you notice?

Okay, there are a LOT of details below, but the work should feel familiar from page 6. Study this picture carefully – in the classroom, we would have had the graph on Desmos projected and we would have labeled things with an Expo marker. *Talk about this graph with someone!* You could tell your parent what you notice (wow them with your ability to correctly use vocabulary like "axis of symmetry," "roots" and "irrational numbers"), call a classmate, hop on Zoom office hours, or tell a sibling about it. THEN write 3-4 sentences about what you have learned about the relationship between the axis of symmetry, roots, and the quadratic formula in the last two days on the lines below.



☐ I have talked to someone about this graph and its significance, using vocabulary like "axis of symmetry," "roots" and "irrational numbers" and referencing the quadratic formula. I am ready to write my 3-4 sentences!

8. _____
_____
_____
_____
_____

Wednesday April 22

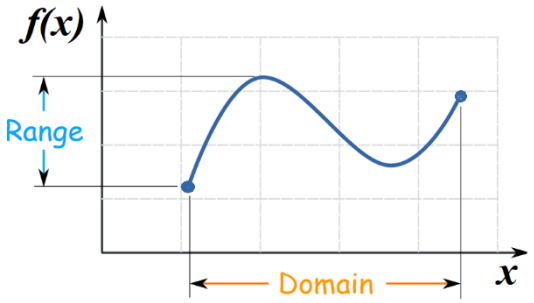
Lesson 3

Objective: Write inequalities for domain and ranges for parabolas. Practice a variety of quadratics problems.

All right, for the last four weeks of distance learning we have learned a LOT about quadratics! For the next few days, we would like you to work on some Chapter 12 practice problems. Since these problems are "cumulative" (they are from the last four weeks) our answer key for them has much more detail and work, so you can check that as you go along if you need help.

Before we dive in though, we want to give one reminder about DOMAIN and RANGE – an important algebraic concept that we haven't talked about in over 6 weeks now! WOW we miss you guys!! Even if you don't think you have questions, *please please please* join our Zoom office hours – we can go through the packet together like a mini lesson! 😊

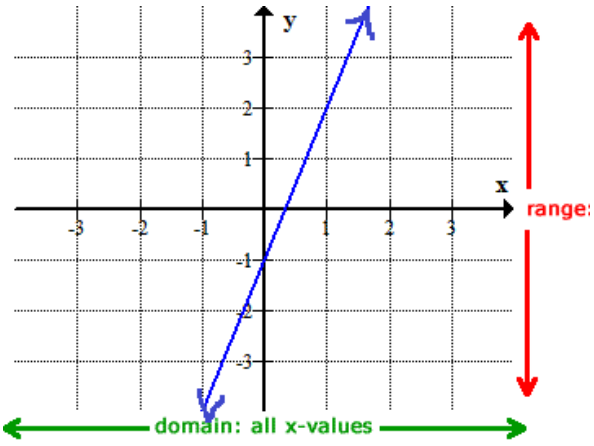
Remember when we talk about domain, we are thinking "all the possible values of x" or "all the possible inputs." When we talk about range, we are thinking "all the possible values of y" or "all the possible outputs." On a graph, we can look right to left for the domain, and up and down for the range, like you see here:



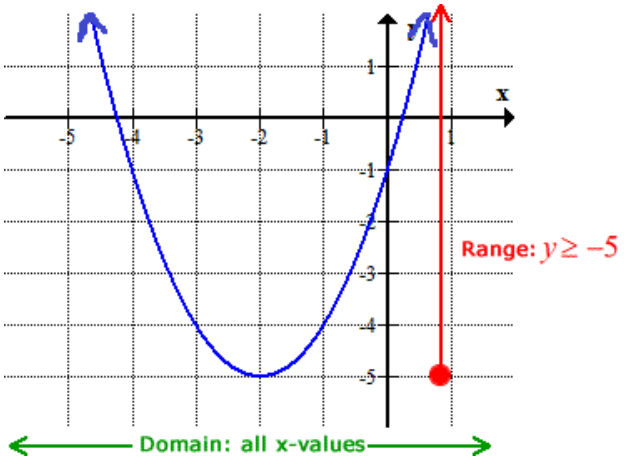
Check for understanding: What is domain? _____

What is range? _____

Examples:



The line has arrows and so goes on forever, therefore the domain and range are both "all real numbers" or $-\infty < x < \infty$ for domain and $-\infty < y < \infty$ for range.



In this case, the domain is all real numbers or $-\infty < x < \infty$, but the possible y values are only -5 or larger, so range is $y \geq -5$.

Okay we are ready to jump in with practice – again, the answer key shows work so use it if you are stuck!

What are *x-intercepts*? Describe them and list all other names we use to refer to them.

Solve the following equations and BOX your answer(s). If there is not solution, say so. You only need to find the **EXACT** solutions.

1. $36x^2 = 49$	2. $3(a-5)^2 = 21$

Find the solution(s), if any, using the given method. BOX your final answer. You only need to find the **EXACT** solutions (so you don't have to estimate irrational answers).

3. $3b^2 - 12b = 15$; complete the square	4. $y^2 + 6y - 23 = 0$; quadratic formula
5. $7x^2 - 3x = 0$; any method	6. $x^2 + 2x = -5$; any method

7. Write ONLY the portion of the quadratic formula called the discriminant: _____

For #8-10, a) find the value of the discriminant, b) circle how many roots the parabola has, and c) circle whether the parabola's vertex lies above, below, or on the x-axis. (Hint: Think about whether the parabola is concave up or concave down and DRAW A QUICK SKETCH where needed).

8. $f(x) = 7x + 2 - 3x^2$ a) Value of discriminant: _____ b) Number of roots: 0 1 2 c) Vertex lies above/below/on the x-axis.	9. $2x^2 + 3x + 2 = y$ a) Value of discriminant: _____ b) Number of roots: 0 1 2 c) Vertex lies above/below/on the x-axis.	10. $y = x^2 + 4x + 4$ a) Value of discriminant: _____ b) Number of roots: 0 1 2 c) Vertex lies above/below/on the x-axis.

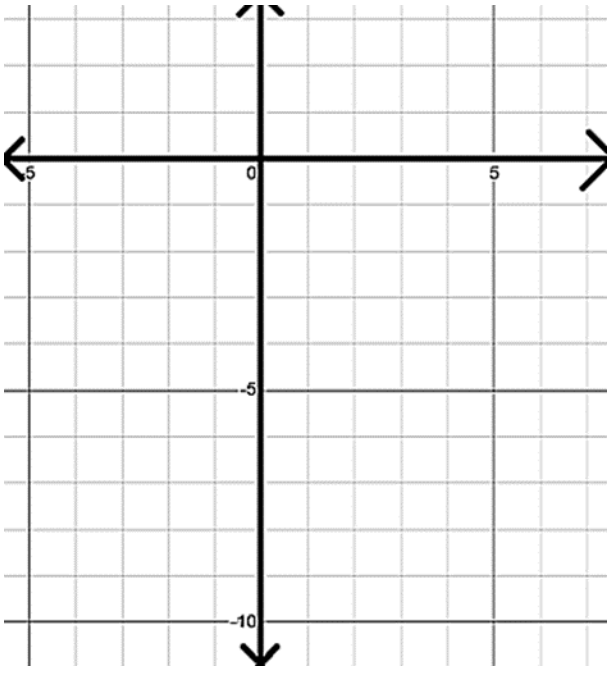
11. Graph the following equation with at least 5 points (use the space below to create your table of values).

$$\boldsymbol{f(x) = -x^2 + 4x - 2}$$

a) What is the **equation** for *this graph's* axis of symmetry?
_____

b) What is the vertex? (_____,_____)

c) Is it a minimum or a maximum? _____
d) What is the y-intercept? (_____,_____)
e) What is the domain? _____
f) What is the range? _____



This last problem is very important! Please make sure to email us if you are confused about it!!

Thursday April 23

Algebra 1 Unit: Chapter 12 Quadratic Equations
Lesson 4: Review and Quiz

Objective: Graph and identify characteristics of parabolas.

Before we keep going with our quadratics practice, we want to linger over #11 on page 11 (how lucky! 😊) This is a very important type of problem because it brings together many ideas. Today we are going to:

- Spend time reviewing the ideas in #11 on page 11.
- Do another practice problem like it.
- Take a minor assessment that is similar to that problem.

Let's get going! There are some guiding questions to help you know what to review, but you do NOT have to fill out answers for your daily work unless that is helpful to you.

- Spend time reviewing the ideas in #11 on page 11.
  - ❖ What is the formula for the axis of symmetry?
  - ❖ How can you calculate the vertex once you have the axis of symmetry?
  - ❖ How do you know whether the vertex is a minimum or a maximum just be looking at the equation?
  - ❖ What is domain? What is range? How do you write these as inequalities?

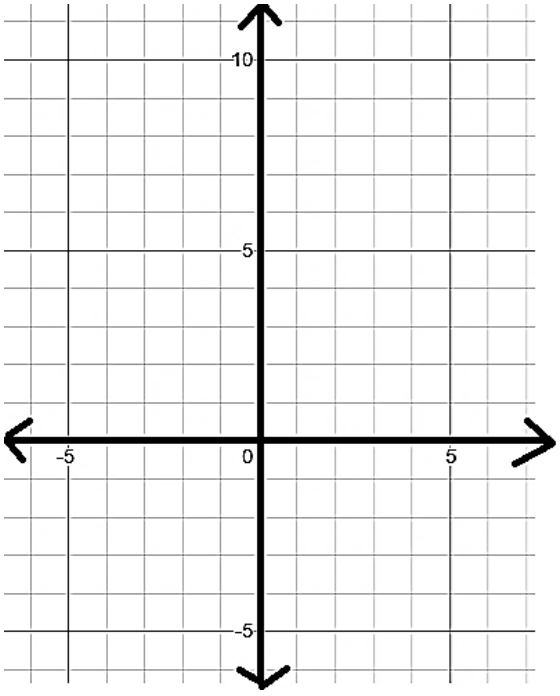
- Do another practice problem like it. – This IS part of your daily work:

Graph the following equation with at least 5 points (use the space below to create your table of values). $\boldsymbol{f(x) = 3x^2 - 6x - 1}$

a) What is the **equation** for *this graph's* axis of symmetry?
_____

b) What is the vertex? (_____,_____)

c) Is it a minimum or a maximum? _____
d) What is the y-intercept? (_____,_____)
e) What is the domain? _____
f) What is the range? _____



Make sure you have asked your questions you and have the formula for the axis of symmetry memorized before you turn to the next page!

Algebra 1
April 14 – April 17

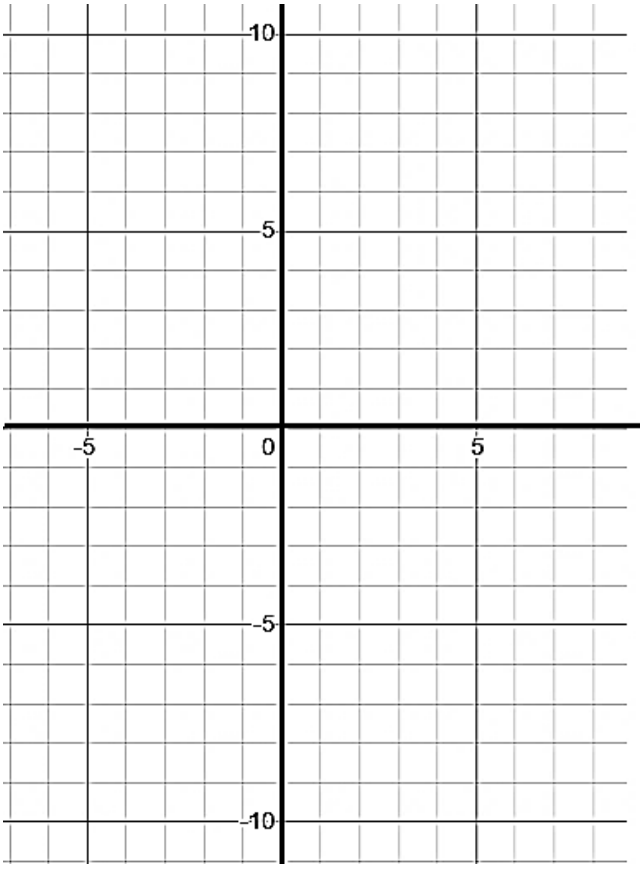
Minor Assessment (Quiz)

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.

1. What is the **FORMULA for any parabola's** axis of symmetry? _____

2. Make a table of values with at least 5 points for the equation and then graph the parabola:
   $\boldsymbol{h(x) = -2x^2 + 8x + 1}$



3. What is the ***equation for this graph's*** axis of symmetry? _____. Show your work here:

4. What is the vertex? (_____,_____). Show your work here as needed:

5. Is it a minimum or a maximum? _____

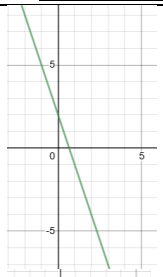
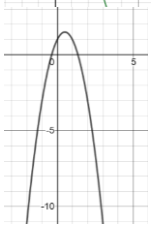
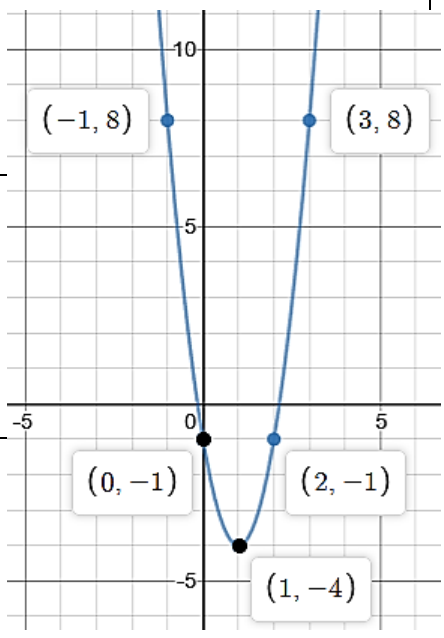
6. What is the y-intercept? (_____,_____)

7. What is the domain? _____

8. What is the range? _____

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! 😊

Answer Key for the Daily Work

Lesson 1 (Monday)	1.  2.  3. Check your answer on pg 384 in the textbook. 4. Check your answer on pg 384 in the textbook.	5. $x = \frac{1}{2}$ 6. $x = \frac{1}{2}$ 7. $\left(\frac{1}{2}, \frac{3}{2}\right)$ 8. Maximum – look at the a value (your answer should be more complete than this – if you don't know how to answer, that is a sign that you need to reach out for help!) 9. Done as an example 10. $(2,5)$maximum, $(0,1)$ 11. $(4,5)$maximum, $(0,-3)$ 12. $(3,-11)$minimum, $(0,1)$
Lesson 2 (Tuesday)	1. Free response 2. Complete the square, factoring, quadratic formula 3. $x = \frac{1 \pm \sqrt{3}}{2}$ 4. Reach out for help if you don't know if you got these!	5. Answers could vary 6. It should match! 7. Follow sample given. 8. Free response after talking with someone about the graph.
Lesson 3 (Wednesday)	On the next two pages with details!!	
Lesson 4 (Thursday)	a) $x = 1$ b) $(1,-4)$ c) Minimum d) $(0,-1)$ e) $-\infty < x < \infty$ f) $y \geq 1$	graph: 

GreatHearts®

★ x-intercepts - where the line crosses the x-axis, where $y=0$, also called roots, solutions, zeros

1. $\frac{36x^2}{36} = \frac{49}{36}$ → $x^2 = \frac{49}{36}$ $\sqrt{49}=7$ $\sqrt{36}=6$

$x = \frac{7}{6}$ $x = \frac{-7}{6}$

2. $\frac{3(a-5)^2}{3} = \frac{21}{3}$ → $\sqrt{(a-5)^2} = \sqrt{7}$

$a-5 = \sqrt{7}$ $a-5 = -\sqrt{7}$

$a = 5+\sqrt{7}$ $a = 5-\sqrt{7}$

3. $\frac{3b^2-12b}{3} = \frac{15}{3}$ ← Notice common factor of 3 on this one!

$b^2-4b+4 = 5+4$

	b	-2
b	b^2	$-2b$
-2	$-2b$	4

There are several correct options here, but your answer should be the same

$\sqrt{(b-2)^2} = \sqrt{9}$

$b-2 = \pm 3$ → $b = 3+2$, $b = -3+2$

$b = 5$ $b = -1$

4. $y^2+6y-23=0$ $a=1$ $b=6$ $c=-23$

$x = \frac{-6 \pm \sqrt{b^2-4ac}}{2a}$ ← memorize!

$x = \frac{-6 \pm \sqrt{36-4(1)(-23)}}{2(1)} = \frac{-6 \pm \sqrt{36+92}}{2}$

$x = \frac{-6 \pm \sqrt{128}}{2}$ simplify → 128 = 4 · 32, 32 = 16 · 2

$\sqrt{128} = \sqrt{4}\cdot\sqrt{16}\cdot\sqrt{2}$

$= 2 \cdot 4 \cdot 2$

$= 8\sqrt{2}$

$x = \frac{-6 \pm 8\sqrt{2}}{2} = \frac{-6}{2} \pm \frac{8\sqrt{2}}{2}$

$x = -3 \pm 4\sqrt{2}$

5. $7x^2-3x=0$ Factoring is easiest here!

$x(7x-3)=0$

$x=0$ $7x-3=0$

$+3 \quad +3$

$7x=3$ → $x=\frac{3}{7}$

6. $x^2+2x=-5$

$x^2+2x+5=0$

$a=1$ $b=2$ $c=5$

I chose quadratic formula since I couldn't factor

$x = \frac{-2 \pm \sqrt{4-4(1)(5)}}{2(1)}$

$x = \frac{-2 \pm \sqrt{4-20}}{2}$ ↘ this will be negative!

no solutions

7. b^2-4ac ← memorize!

8. $f(x) = 7x + 2 - 3x^2$ (b, c, a) → concave down parabola

$a=-3$

$b=7$ a) b^2-4ac

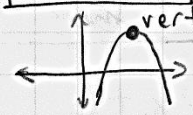
$c=2$ $49-4(-3)(2)$

$49+12(2)$

$49+24$ → 73

b) 2 roots (positive discriminant)

c)



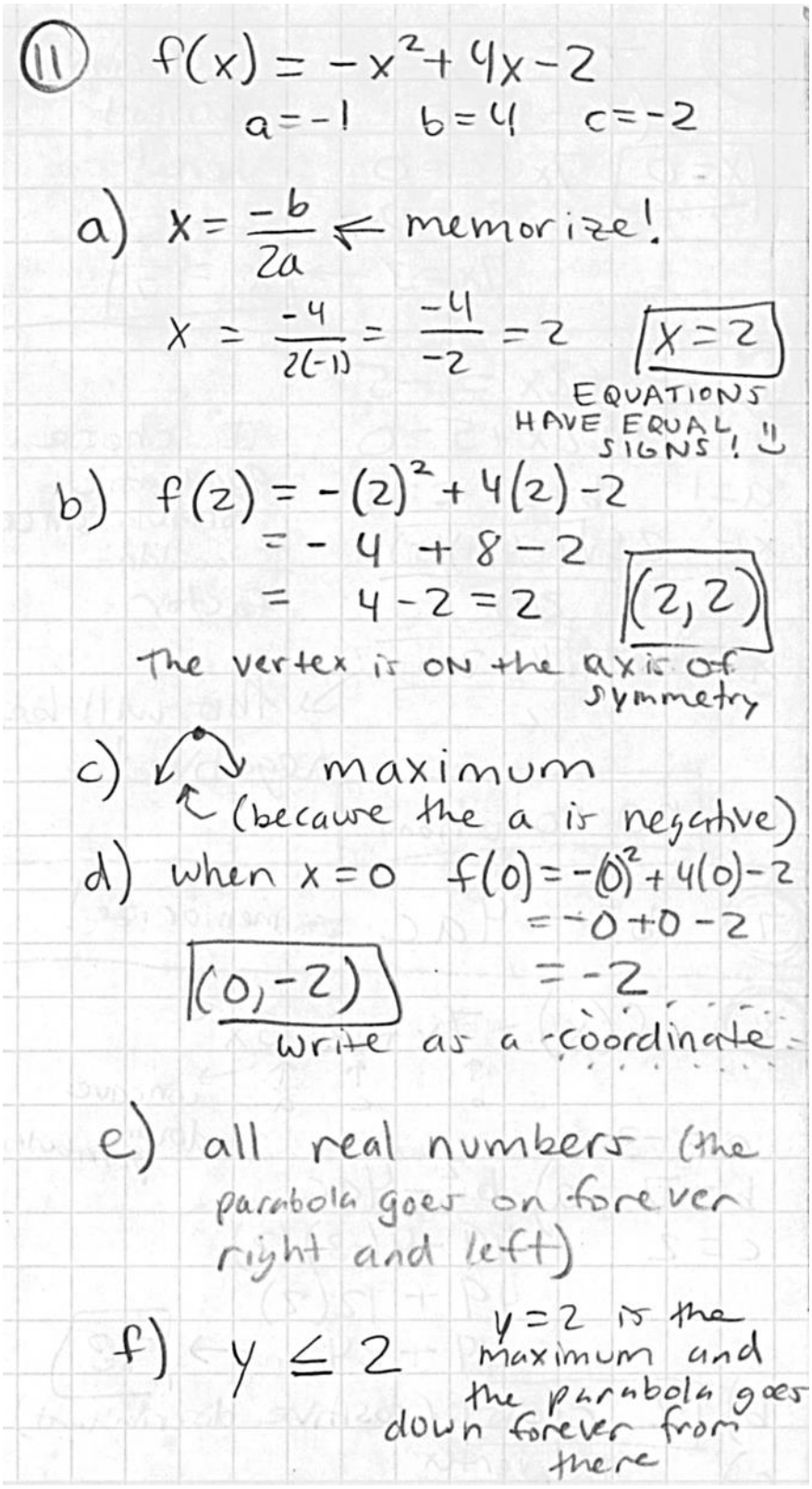
above (because of the negative a (-3) I know it's a sad face parabola, and I also know there are two roots, so the vertex must be above the x-axis. Quick sketches will help!

9. $a=2$ $b=3$ $c=2$

a) -7 b) zero roots c) above

10. $a=1$ $b=4$ $c=4$

a) 0 b) 1 root c) on the x-axis



(11) $f(x) = -x^2 + 4x - 2$

$a = -1 \quad b = 4 \quad c = -2$

a) $x = \frac{-b}{2a}$ ← memorize!

$x = \frac{-4}{2(-1)} = \frac{-4}{-2} = 2$ $\boxed{x = 2}$

EQUATIONS HAVE EQUAL SIGNS! ☺

b) $f(2) = -(2)^2 + 4(2) - 2$

$= -4 + 8 - 2$

$= 4 - 2 = 2$ $\boxed{(2, 2)}$

The vertex is ON the AX is of symmetry

c) maximum (because the a is negative)

d) when $x = 0$ $f(0) = -(0)^2 + 4(0) - 2$

$= -0 + 0 - 2$

$= -2$

$\boxed{(0, -2)}$

write as a coordinate

e) all real numbers (the parabola goes on forever right and left)

f) $y \leq 2$ $y = 2$ is the maximum and the parabola goes down forever from there