Chapter 9.1 Quadratic Graphs & Their Properties

Quadratic Function:

Review from 8.1:

DEGREE	NAME	SHAPE	DIMENSION

Standard Form of Quadratic Function:

Examples:

Most Basic Quadratic Parent Function:

Parabola:

Parts of a parabola:

Vertex:

Line (axis) of symmetry:

#1: Graph the following functions: First complete the table by finding each range, given each domain. Then graph each quadratic equation. (Make sure to plot all the ordered pairs, that it looks like a parabola, the parabola is extends through the entire CP.) Use the online graphing calculator to help guide you.

A) $y = x^2$		B) $y = 2x^2$		C) $y = 2x^2 + 1$		D) $y = 2x^2 - 4x$	
x	y	x	y	x	y	x	y
3		3		3		3	
2		2		2		2	
1		1		1		1	
0		0		0		0	
-1		-1		-1		-1	
-2		-2		-2		-2	
-3		-3		-3		-3	

#2: In the chart above, highlight the order pair that is the vertex for each parabola. How did you know that ordered pair was the vertex by looking at the graph?

How did you know that ordered pair was the vertex by looking at the table?

#3: What is the <u>equation</u> for line that divides the graph in half?

A) B) C) D)

#4: What is the "c" value for each quadratic?

A) B) C) D)

#5 What does the "c" value tell you about the parabola?

#6: How is the equation of $y = 2x^2$ related to the equation of $y = x^2$?

How is the graph of $y = 2x^2$ related to the graph of $y = x^2$?

#7: How is the equation of $y = 2x^2+1$ related to the equation of $y = 2x^2$?

How is the graph of $y = 2x^2+1$ related to the graph of $y = 2x^2$?

#8: How is the equation of $y = 2x^2 - 4x$ related to the equation of $y = 2x^2$?

How is the graph of $y = 2x^2 - 4x$ related to the graph of $y = 2x^2$?

#9: Knowing the fact that a parabola is symmetric, how can you graph a quadratic function quickly?

#10: Graph the following additional functions: First complete the table by finding ordered pairs that work for that function. (You now choose which domains to use.) Then graph each quadratic equation on the SAME graph. (Make sure to plot all the ordered pairs, that it looks like a parabola, the parabola is extends through the entire CP.) Use the online graphing calculator to help guide you.

E) $y = -x^2$			F) $y = -\frac{1}{3}x^2$	
x	y		x	y

#11: How is the equation of $y = -x^2$ related to the graph of $y = -\frac{1}{3}x^2$?

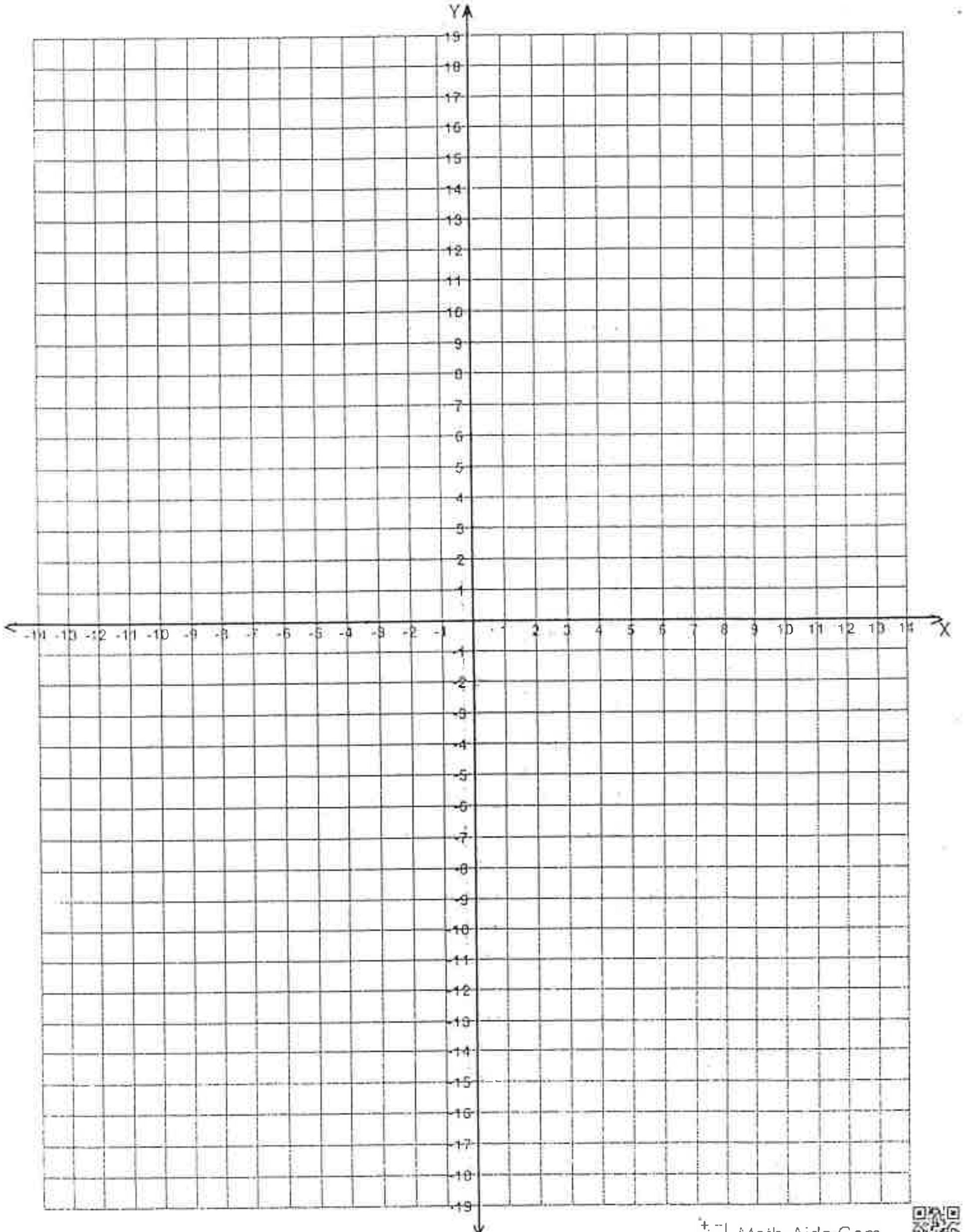
How is the graph of $y = -x^2$ related to the graph of $y = -\frac{1}{3}x^2$?

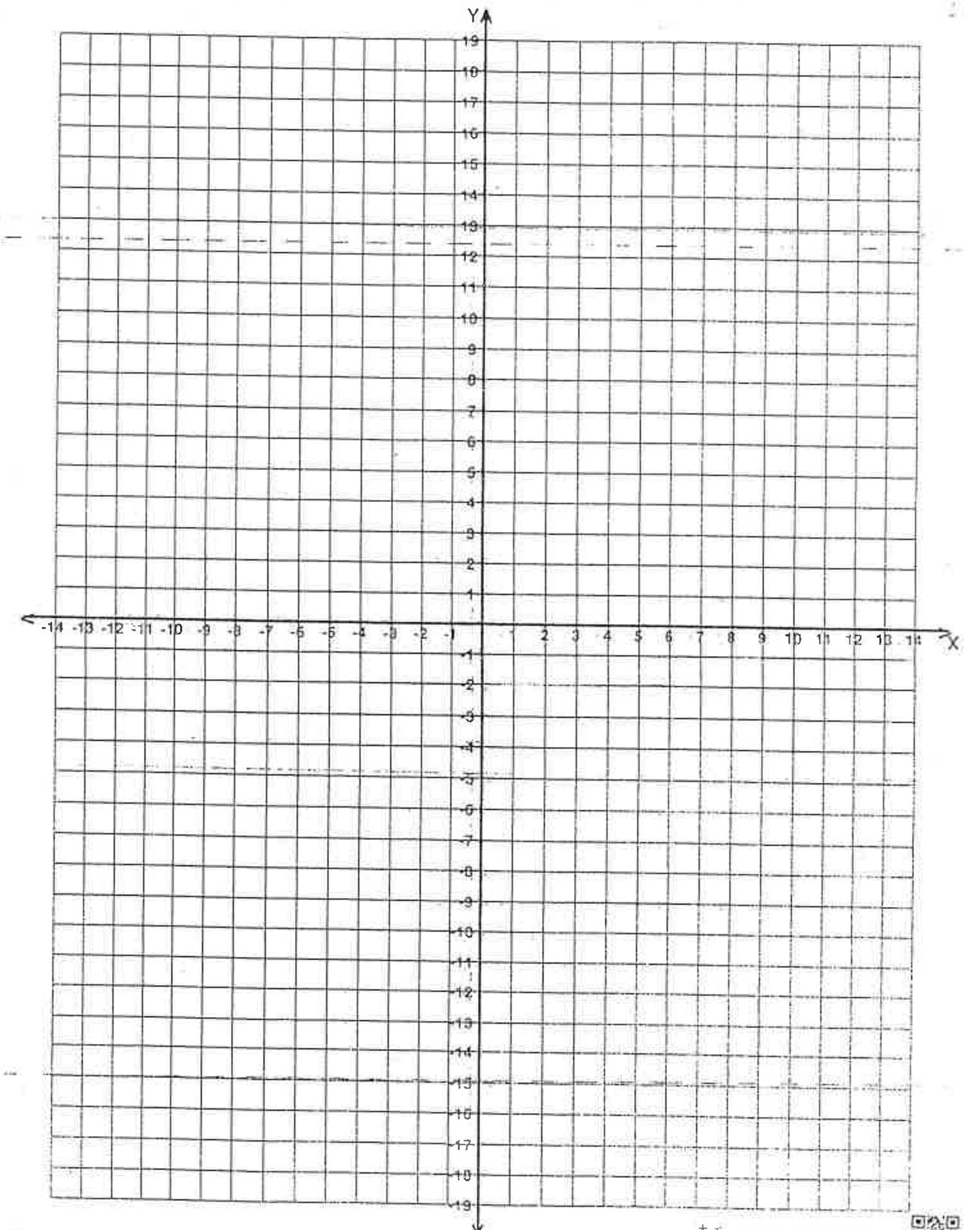
#12: Looking at any quadradic equation, explain how each value of the following values change the look of the graphed parabola:

Value of "A":

Value of "Bx":

Value of "C"


Y
X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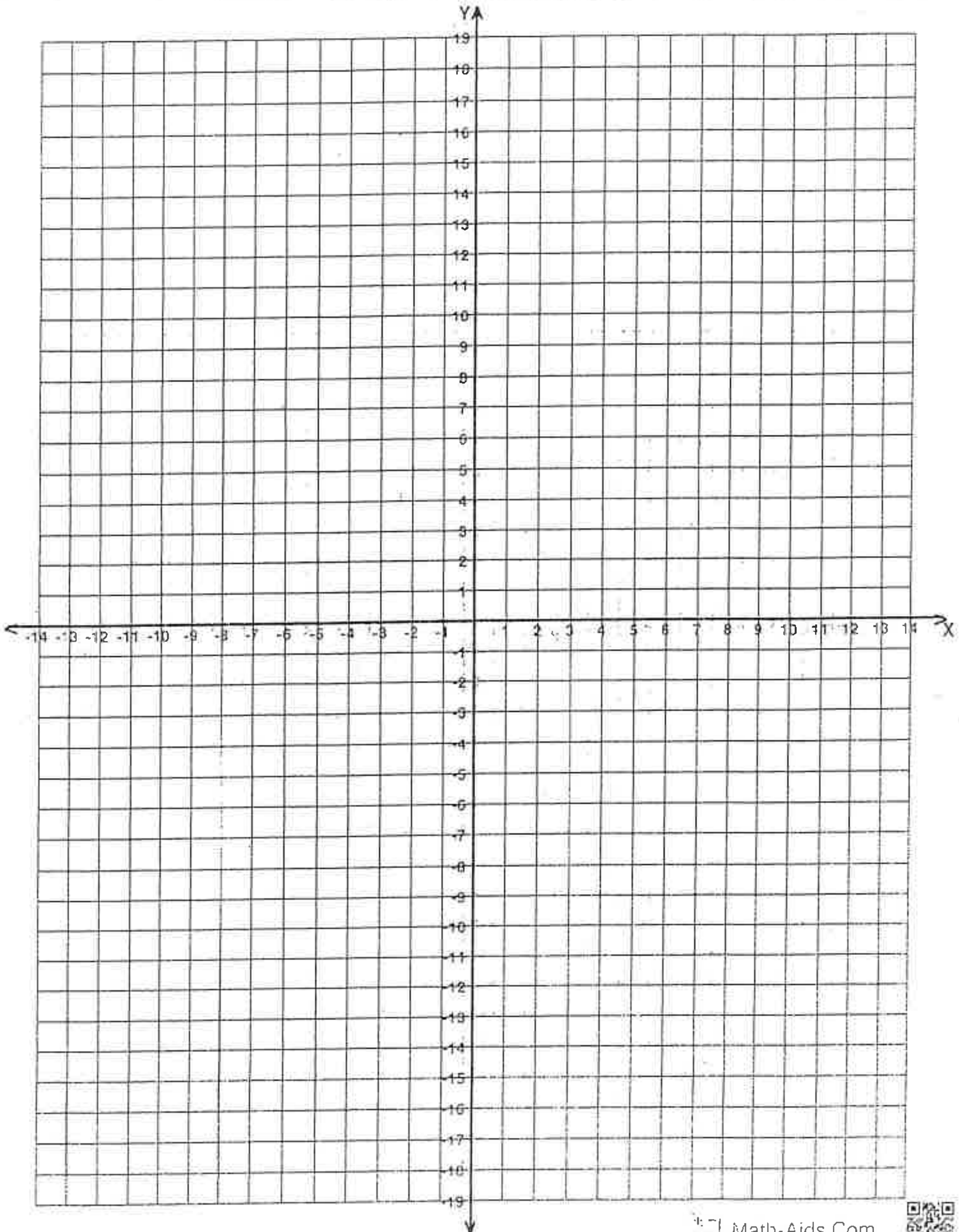
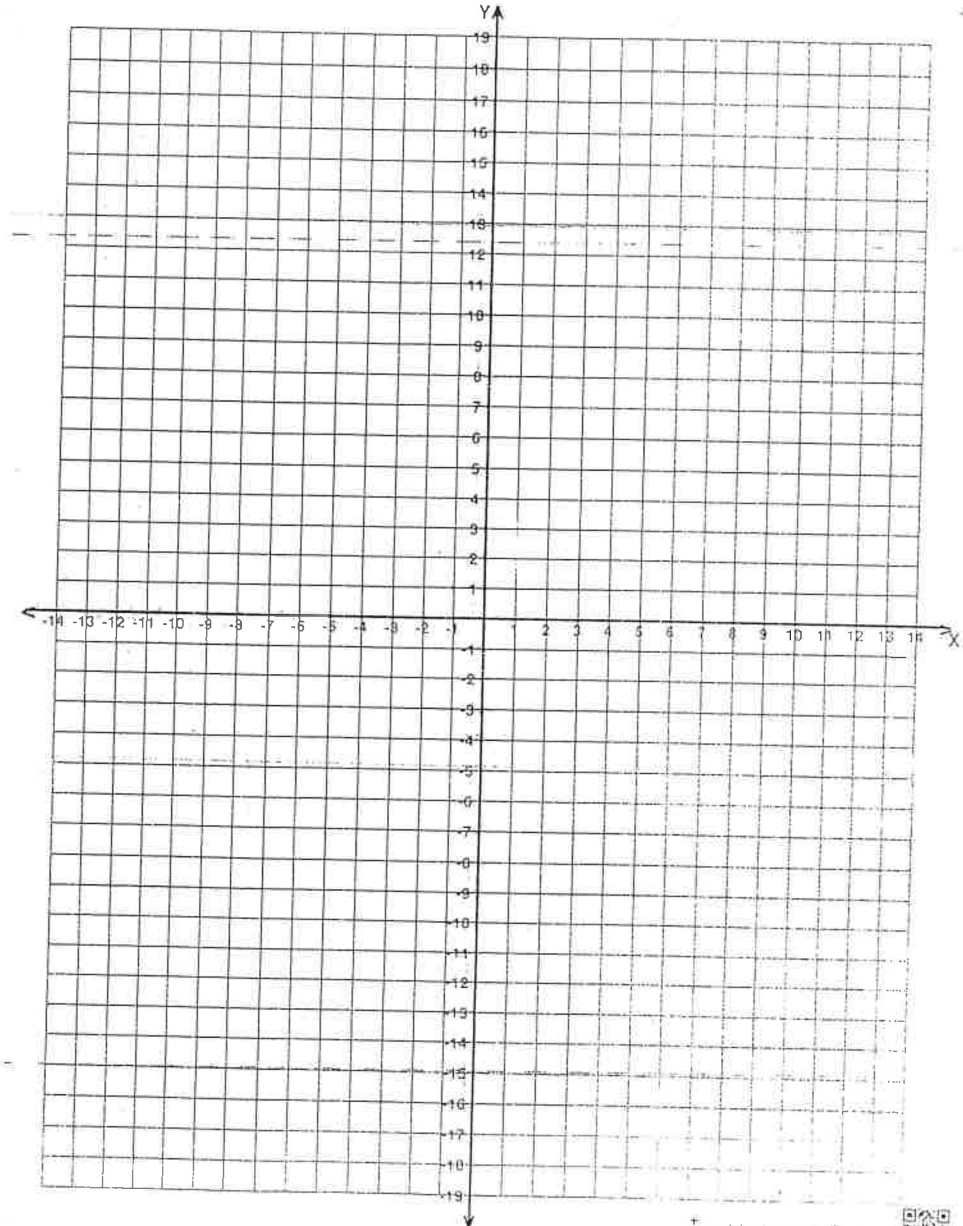




Chapter 9.1 Quadratic Graphs & Their Properties

Key

Quadratic Function:

- type of non-linear function that models certain situations where the rate of change is not constant
- "quadri" means 4
- "quadrus" means square (b/c it has 4 sides)
- "quadratus" means squared
- looks like a parabola when graphed (where all numbers are real numbers)

Review from 8.1:

DEGREE	NAME	SHAPE	DIMENSION
1	linear	line	1
2	quadratic	square	2
3	cubic	cube	3

Standard Form of Quadratic Function: $y = ax^2 + bx + c$, where a, b, & c are all real numbers and $a \neq 0$

Examples: $y = -x^2 + 2x + 3$ and $y = 2x^2$

Most Basic Quadratic Parent Function: $y = x^2$

Parabola:

- 2-dimensional graph of a quadratic function
- symmetrical curve which is approximately a "U" shape
- at the VERY LEAST need 3 points to graph (Vertex & 2 other points)

Parts of a parabola:

Vertex: maximum or minimum point of a parabola (highest or lowest point). It is an ordered pair.

Line (axis) of symmetry: line (equation) at which the a parabola can be folded in half so that the two sides of the parabola coincide

#1: Graph the following functions: First complete the table by finding each range, given each domain. Then graph each quadratic equation. (Make sure to plot all the ordered pairs, that it looks like a parabola, the parabola is extends through the entire CP.) Use the online graphing calculator to help guide you.

A) $y = x^2$		B) $y = 2x^2$		C) $y = 2x^2 + 1$		D) $y = 2x^2 - 4x$	
x	y	x	y	x	y	x	y
-3	9	-3	18	-3	19	-3	30
-2	4	-2	8	-2	9	-2	16
-1	1	-1	2	-1	3	-1	6
0	0	0	0	0	1	0	0
1	1	1	2	1	3	1	-2
2	4	2	8	2	9	2	0
3	9	3	18	3	19	3	6

#2: In the chart above, highlight the order pair that is the vertex for each parabola. How did you know that ordered pair was the vertex by looking at the graph?

The vertex is the minimum point or lowest of each parabola. The vertex is also on the line of symmetry.

How did you know that ordered pair was the vertex by looking at the table?

The y- values are at the lowest value. Also you can see that the other points are reflective points.

#3: What is the <u>equation</u> for line that divides the graph in half?

A) y- axis or x =0 **B)** y- axis or x =0 **C)** y- axis or x =0 **D)** x = 1

#4: What is the "c" value for each quadratic?

A) 0 **B)** 0 **C)** 1 **D)** 0

#5 What does the "c" value tell you about the parabola? It is the y-intercept.

#6: How is the equation of $y = 2x^2$ related to the equation of $y = x^2$? "a" value increases from 1 to 2.

How is the graph of $y = 2x^2$ related to the graph of $y = x^2$? the parabola gets narrower

#7: How is the equation of $y = 2x^2+1$ related to the equation of $y = 2x^2$? "c" value increases to 1

How is the graph of $y = 2x^2+1$ related to the graph of $y = 2x^2$? the parabola moves up one unit

#8: How is the equation of $y = 2x^2 - 4x$ related to the equation of $y = 2x^2$? there is a "bx" value

How is the graph of $y = 2x^2 - 4x$ related to the graph of $y = 2x^2$? The line of symmetry and vertex changes. The line of symmetry is not the y-axis anymore and the vertex does not lay on the y-axis anymore.

#9: Knowing the fact that a parabola is symmetric, how can you graph a quadratic function quickly? If you know the vertex, the line of symmetry and one other ordered pair, you can quickly graph a third ordered pair, by using the line of symmetry to reflect points.

#10: Graph the following additional functions: First complete the table by finding ordered pairs that work for that function. (You now choose which domains to use.) Then graph each quadratic equation on the SAME graph. (Make sure to plot all the ordered pairs, that it looks like a parabola, the parabola is extends through the entire CP.) Use the online graphing calculator to help guide you.

E) $y = -x^2$	
x	y
-3	-9
-2	-4
-1	-1
0	0
1	-1
2	-4
3	-9

F) $y = -\frac{1}{3}x^2$	
x	y
-9	-27
-6	-12
-3	-3
0	0
3	-3
6	-12
9	-27

*Be careful with negatives!

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

$y = -\frac{1}{3}(-9)^2$

$y = -\frac{1}{3}(81)$

$y = -27$

#11: How is the equation of $y = -x^2$ related to the graph of $y = -\frac{1}{3}x^2$?

The "a" values are both negative. One "a" value has an absolute value of less than 1.

How is the graph of $y = -x^2$ related to the graph of $y = -\frac{1}{3}x^2$?

The graph of $y = -x^2$ is narrower than the graph of $y = -\frac{1}{3}x^2$

#12: Looking at any quadradic equation, explain how each value of the following values change the look of the graphed parabola:

Value of "A":

Determines if the parabola is upward facing or downward facing.

- **A positive "a" value is upward facing**
- **A negative "a" value is downward facing**

Determines how narrow or wide the parabola is.

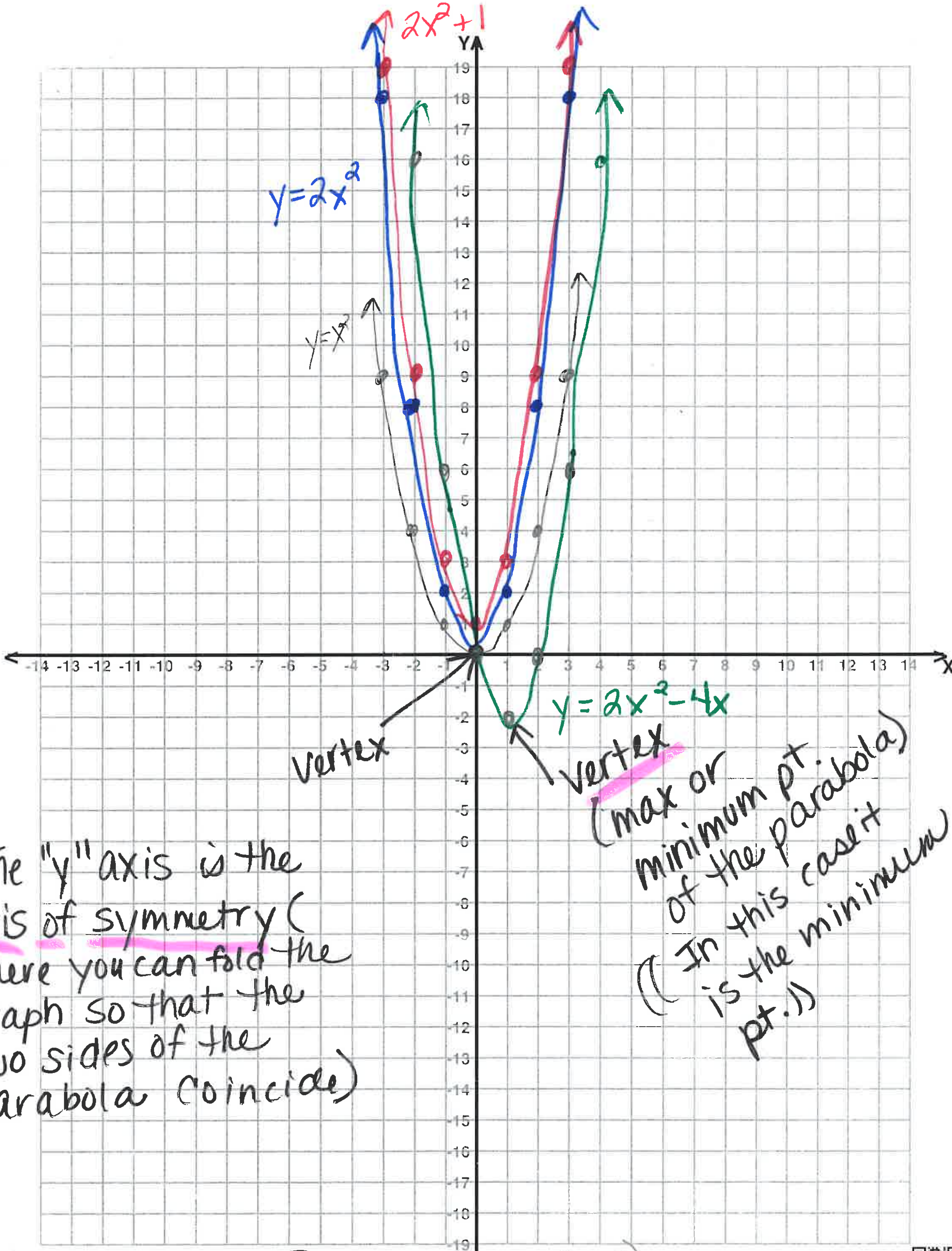
- **If the $|a|$ is greater than 1, the parabola will be more narrow than the parent function**
- **If the $|a|$ is less than 1 (but not equal to zer), the parabola will be wider than the parent function**

Value of "Bx":

- **If a "bx" DOES NOT exist, the line of symmetry is the y-axis (x=0) and therefore the vertex lies on the y-axis.**

- **If a "bx" DOES exist, the line of symmetry is NOT the y-axis (x=0) and therefore the vertex DOES NOT lies on the y-axis.**

Value of "C": It is the y-intercept.

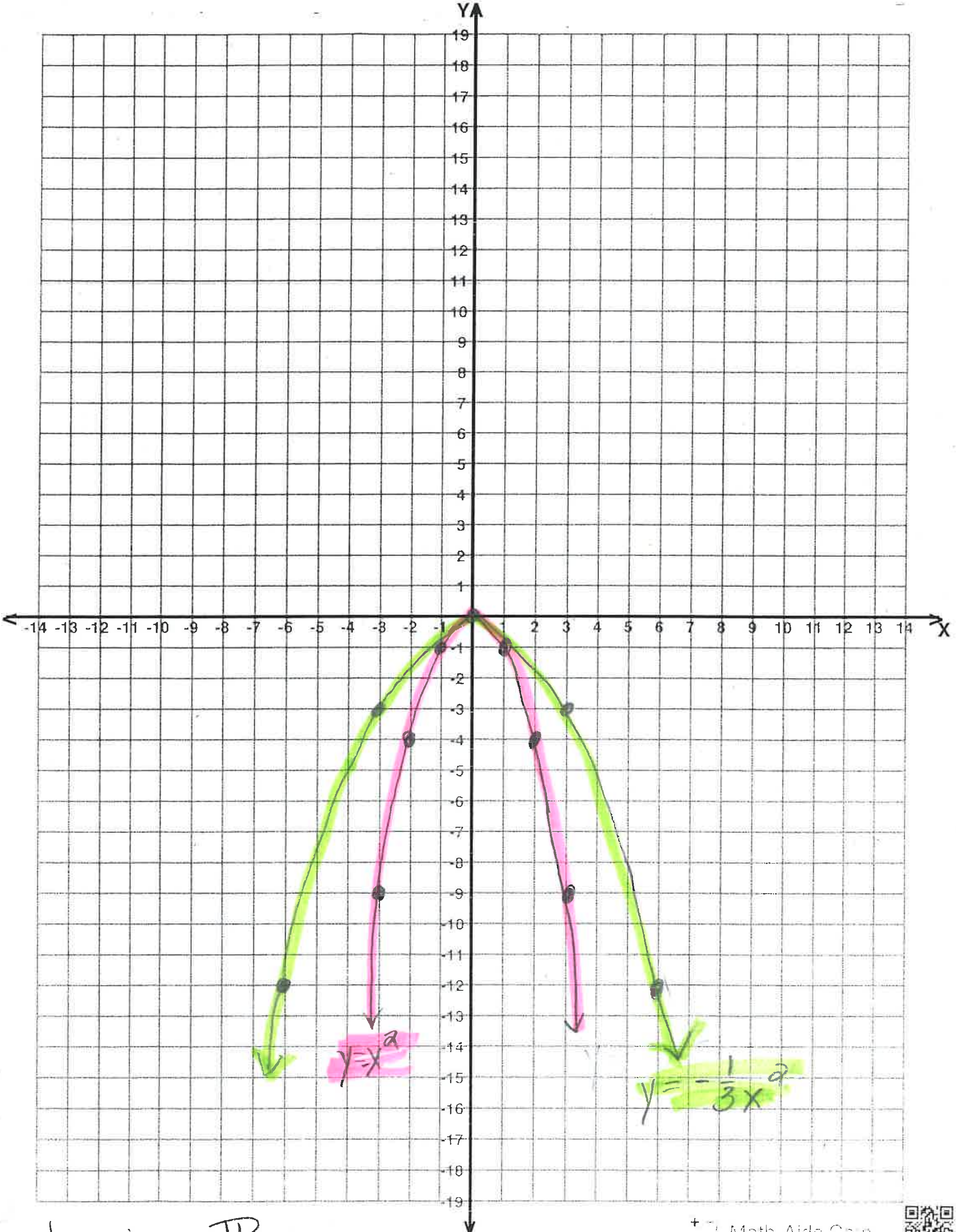


The "y" axis is the axis of symmetry (where you can fold the graph so that the two sides of the parabola coincide)

vertex (max or minimum pt. of the parabola) ((In this case it is the minimum pt.))

domain = $\mathbb{R}$ (all real numbers)

range = $y \geq 0$



domain = $\mathbb{R}$

range = $y \leq 0$