Algebra II

Summer Get-Ready Project

Name: _____

Date: _____

Welcome to Algebra II! This summer project gets you ready for three kinds of graphs we will use all year: lines, parabolas, and exponential curves. Work through the three parts in order. You do not need to know these topics yet — the point is to explore them yourself.

How this is graded:

- This is YOUR work. Write every answer in your own words and in your own handwriting.
- You must show where you looked things up. Every research box asks for the website you used.
- You must draw your graphs by hand on the grids provided. Neat, labeled sketches earn full credit.
- Answers with no sketch, no data table, or no source will not receive credit.

Part A — Become a Word Detective

Mathematicians use special words to describe graphs. Your job is to go online and find out what each word means, then explain it in a way that makes sense to YOU.

Instructions:

- Look up each word below using a search engine or a math help website.
- In the middle column, write what the word means in your own words (do not copy and paste).
- In the last column, write the web address of the page where you found your answer.
- Draw a tiny picture next to any word you can — a small sketch helps you remember it.

A1. Words about LINES (linear graphs)

linear graph		
slope		
y-intercept		
x-intercept		

constant rate of change		

A2. Words about PARABOLAS (quadratic graphs)

quadratic graph		
parabola		
vertex		
axis of symmetry		
maximum / minimum		

A3. Words about EXPONENTIAL graphs

exponential graph		
exponential growth		
exponential decay		
base (growth factor)		
asymptote		

A4. Find a real example

Search online for one real picture of each kind of graph (for example, in news, sports, science, or money). For each one, write the web address and one sentence about what it shows.

A real LINEAR graph	
A real QUADRATIC (parabola) graph	
A real EXPONENTIAL graph	

Part B — Build the Graphs Yourself

Now you will turn numbers into pictures. For each set of data below: (1) go online and find out what that kind of graph is supposed to look like, (2) plot the points from the table onto the grid, and (3) answer the questions.

How to plot a point:

Each pair of numbers is a point. Find the x-value on the bottom axis, go straight up to the y-value on the side axis, and make a dot. After all the dots are placed, join them the way your research says this type of graph should look.

B1. A Straight Line (Linear)

A small pool is being filled by a hose. The same amount of water is added every minute. Plot the points, then connect them.

	0	**1**	**2**	**3**	**4**	**5**
	10	20	30	40	50	60

Research box — what does a linear graph look like? (one sentence + website):

Questions:

- Do your points make a straight line or a curve?
- How many liters are added each minute? _____
- Predict: how much water would there be at 8 minutes? _____

B2. A U-Shaped Curve (Quadratic)

A ball is thrown straight up. The table shows how high it is each second until it lands. Plot the points, then connect them with a smooth curve.

	0	**1**	**2**	**3**	**4**
	0	15	20	15	0

Research box — what does a quadratic graph (parabola) look like? (one sentence + website):

Questions:

- At what time is the ball the highest? _____
- What is the highest point called? (Hint: check your Part A words.) _____
- Is the left side of your curve a mirror image of the right side? Why might that be?

B3. A Curve That Gets Steeper (Exponential)
A tiny group of bacteria doubles every hour. The table shows how many there are each hour. Plot the points, then connect them with a smooth curve.

	0	**1**	**2**	**3**	**4**	**5**
	1	2	4	8	16	32

Research box — what does an exponential graph look like? (one sentence + website):

Questions:
- Does the curve go up slowly at first and then very fast, or the other way around?
- Each hour, the number is multiplied by what? _____
- How is this curve different from the straight line in B1?

Part C — Moving Graphs Around (Translations)
A translation just means SLIDING a graph to a new spot without turning it or changing its shape. The amazing part is that a small change in the equation tells you exactly how the graph slides. In this part you will discover the pattern and then practice it.

We will start from two simple "parent" graphs:
- The line $y = x$
- The parabola $y = x^2$

C1. Sliding UP or DOWN
When you add a number to the OUTSIDE of the function, the whole graph slides up. When you subtract, it slides down.

$y = x^2 + 3$ slides the parabola UP 3 steps. **$y = x^2 - 3$** slides it DOWN 3 steps.

Why does this happen?
The "+ 3" adds 3 to every single answer (every y-value). If every point's height goes up by 3, then the whole picture lifts up by 3. The change in the equation and the change in the graph match exactly.

C2. Sliding LEFT or RIGHT
When you change the number INSIDE with x, the graph slides sideways — and it goes the OPPOSITE way from what most people expect.

$y = (x - 2)^2$ slides the parabola RIGHT 2 steps. **$y = (x + 2)^2$** slides it LEFT 2 steps.

Why the opposite way?

With $y = (x - 2)^2$, you must first subtract 2 from x before squaring. So x has to be 2 bigger than before to give the same answer. Because every x needs to be larger, every point moves to the right. "Minus" inside means move right; "plus" inside means move left.

Add a number on the outside: + k	Slides UP by k
Subtract on the outside: – k	Slides DOWN by k
Inside, with x: (x – h)	Slides RIGHT by h
Inside, with x: (x + h)	Slides LEFT by h

C3. Worked Example

Graph $y = x^2$ and then $y = (x - 2)^2$ on the same grid.

Step 1: Make a small table of points for the parent $y = x^2$. Step 2: For the new graph, every point slides 2 to the right (so add 2 to each x). Step 3: Plot both and compare.

(0, 0)	→	(2, 0)
(1, 1)	→	(3, 1)
(2, 4)	→	(4, 4)

Notice the shape never changed — the whole parabola just shifted 2 to the right, exactly like the "– 2" inside told us.

C4. Your Turn — Practice

For each problem: fill in the small table, then plot BOTH the parent graph and the new graph on the grid, and finish the sentence describing how it moved.

1. Graph **$y = x$** and then **$y = x + 4$** on the grid.

-2		
-1		
0		
1		
2		

The new graph slid _____.

2. Graph **$y = x$** and then **$y = x - 3$** on the grid.

-2		

-1		
0		
1		
2		

The new graph slid _____.

3. Graph $\mathbf{y = x^2}$ and then $\mathbf{y = x^2 + 1}$ on the grid.

-2		
-1		
0		
1		
2		

The new graph slid _____.

4. Graph $\mathbf{y = x^2}$ and then $\mathbf{y = (x - 3)^2}$ on the grid.

0		
1		
2		
3		
4		
5		

The new graph slid _____.

C5. Write the Equation (no graphing needed)
Use the pattern from the table on the earlier page. Write the new equation on the line.

- The line $y = x$ is slid DOWN 5. New equation: _____
- The parabola $y = x^2$ is slid LEFT 2. New equation: _____
- The parabola $y = x^2$ is slid UP 6. New equation: _____
- Challenge: the parabola $y = x^2$ is slid RIGHT 1 AND UP 6. New equation: _____

Last question:

In two or three sentences of your own, explain the link between changing the equation and moving the graph. Use the words “inside”, “outside”, “up/down”, and “left/right”.