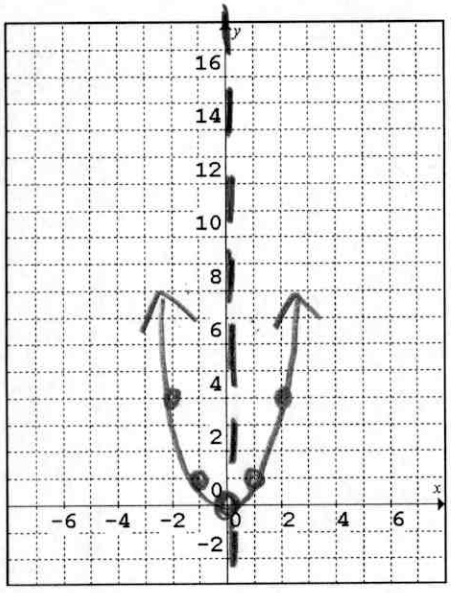
Name: KEY **Unit 4 Lesson 1 – Quadratic Transformations Lab** Date: _____

SWBAT: transform graphs of $y=x^2$

Work together in your group with graphing calculators . Do each of the following tasks and answer each question in **complete sentences** wherever appropriate.

1. **Enter the function $f(x)=x^2$ into the graphing calculator**. Draw an accurate sketch on the grid.
2. What are the coordinates of the vertex? (0,0)



3. Which direction does the parabola open? up
4. Describe the symmetry of the graph. through origin
5. Give the *equation* of the axis of symmetry: $x=0$
6. **Now change the equation of your graph to:** $f(x)=x^2+3$
7. Describe the change: up 3

You have just done a **transformation** of the parabola!

8. Without graphing, make a conjecture about the graph of $f(x)=x^2+5$: up 5
9. **Now enter the above function into the graphing calculator**. Were you correct? yes :)
10. What are the coordinates of the vertex of $f(x)=x^2+3$? (0, 3)
11. What are the coordinates of the vertex of $f(x)=x^2+5$? (0, 5)
12. Make another conjecture about the graph of $f(x)=x^2-4$. (0, -4) vertex down 4
13. Complete this sentence: "**The graph of $f(x)=x^2+k$ moves** K units up/down **and the vertex of this parabola is at** (0, K)."

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14. **Now enter the equation $f(x)=(x-3)^2$ into your calculator**, and describe the transformation. Right 3
15. What are the coordinates of the vertex of this parabola? (3, 0)
16. **Now enter the equation $f(x)=(x+4)^2$. into your calculator**, and describe the transformation. Left 4
17. What are the coordinates of the vertex of this parabola? (-4, 0)

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18. Notice that the graph moved **left** when you + something to x in the parentheses, and moved **right** when you − something from x in the parentheses. (INSIDE opposite !)

19. Complete this sentence: "**The graph of** $f(x)=(x-h)^2$ **will move** right h units **and its vertex is at** (h, 0), **The graph of** $f(x)=(x+h)^2$ **will move** left h units **and its vertex is at** (−h, 0)."

Now, please clear all equations out of the graphing calculator and proceed.

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20. **Now enter the equations** $f(x)=2x^2$, $f(x)=-5x^2$, $f(x)=0.5x^2$, **and** $f(x)=-0.2x^2$.

21. What do all these graphs have in common? parabola, vertex (0,0)

22. How are they different? up/down, wider/narrower

23. How would $f(x)=-3x^2$ look different from $f(x)=x^2$? Be clear and specific. narrower and reflected over x-axis

24. How would $f(x)=\frac{1}{3}x^2$ look different from $f(x)=x^2$? wider

25. Describe as clearly and completely as you can what happens to $f(x)=ax^2$ as a changes. Be sure to include various kinds of numbers.

If $a>1$, then the graph of $f(x)=ax^2$ is narrower

The bigger a gets, narrower

If $0<a<1$, then the graph of $f(x)=ax^2$ is wider

If $a<0$, then the graph of $f(x)=ax^2$ is reflected over x-axis

26. **It's time to summarize and combine what you've found. Use the variables *a*, *h*, and *k* to write the vertex form of a quadratic equation.** (hint: You are extremely hard to know!)

$f(x)=$ $a(x-h)^2+k$

27. A quick test: **In the function** $f(x)=-4(x-7)^2-3$ **the vertex coordinates are** (7, −3), **the graph opens** down **and the graph is** narrower **than a normal parabola.**

Great job! Now it's time to practice.