Exploration of Parameter *a*

Complete the following worksheet with your partner. Each individual should fill out their own sheet, but you are encouraged to collaborate and discuss ideas and findings with your partner.

1. Open the GeoGebra applet found at this link: <http://www.geogebratube.org/student/mhWEpfKFQ?lang=en>
2. The applet is graphing the function $y-k=a\left(x-h\right)^{2}$.
	1. What shape is this function, and what form is this equation in? What do *h* and *k* represent?
3. Use the sliders to adjust the three parameters.
	1. How does moving *h* effect the graph?
	2. *k*?
	3. *a*?
4. The distance between the focus, F, and the vertex V, is labeled as $\overbar{FV}$ and the shortest distance between the vertex, V, and the directrix, D, is labeled as $\overbar{VD}$.
	1. As you adjust the sliders, what do you notice about $\overbar{FV}$?
	2. The shortest distance between the vertex, V, and the directrix, D, is labeled as $\overbar{VD}. $As you adjust the sliders, what do you notice about $\overbar{VD}$?
	3. What is the relationship between $\overbar{FV}$ and $\overbar{VD}$?
5. Set your *h* and *k* to fixed values (don’t change them anymore.) You can choose these values, but make sure the vertex remains comfortably within the viewing window of the applet. Record your *h* and *k* values that you chose below.
6. Without changing *h* and *k*, you are now going to explore how *a* effects $\overbar{FV}$ and $\overbar{VD}$. Use the slider to adjust *a* to the values that are listed in the table below. Verify that the values for $\overbar{FV}$ or $\overbar{VD}$ (why do we not need to consider both?) correspond to the values of *a*. (You may need a calculator to verify these values.)

|  |  |
| --- | --- |
| *a* | $\overbar{FV}$ or $\overbar{VD}$ |
| 1 | $$^{1}/\_{4}$$ |
| 2 | $^{1}/\_{8}$  |
| 3 | $$^{1}/\_{12}$$ |
| 4 | $$^{1}/\_{16}$$ |

1. Let’s say now label $\overbar{FV}$ and $\overbar{VD}$ as parameter *p*. Using the table above, write a relationship between *a* and *p*.
	1. Now test that relationship for when *a=5.* Does your conjecture hold? If so, move on. If not, reevaluate your conjecture and make a new one.
2. What about when *a* is negative?
	1. How does this affect the graph of the parabola?
	2. How does this affect the value of *p* according the applet?
3. Why do you think *p* does not become negative when *a* is negative?
4. Using what you now know, consider the function $y-3=^{1}/\_{32}\left(x+2\right)^{2}$
5. What shape does the function make?
6. What is the vertex of this shape?
7. What is the value of *p* in this function?
8. What does the value of *p* represent?
9. Using the graph below, plot and label the vertex, the focus, and the directrix of the function. Then sketch the graph of the function.

