Problem 1 – Exploring Vertex Form

Grab the parabola on page 1.3 by the vertex (the cursor should change to ✣) and move the parabola to each quadrant. The equation will be given in vertex form: $y = (x - h)^2 + k$.

Record four different equations for the parabola in each quadrant.

Quadrant I	Quadrant II	Quadrant III	Quadrant IV

Use the vertex form of the equations to answer the questions below.

1. In which quadrants is *h* positive?

2. In which quadrants is *k* positive?

Problem 2 – Happy and Sad Parabolas

On page 2.2, you will see examples of a "happy" parabola and a "sad" parabola. On page 2.4, grab the parabola by one of its branches (the cursor should change to ✎). Make the "happy" parabola wider and narrower by moving farther or closer to the *y*-axis. Make the parabola open down, "sad" by dragging below the *x*-axis. Record four "happy" and four "sad" parabolas.

"Happy" Parabolas	"Sad" Parabolas

3. How does the equation change when the parabola is wider or narrower?

4. For what values of *a* is the parabola "happy" (opens up) or "sad" (opens down)?

5. Is $f(x) = 3.5(x - 2)^2 + 5$ a "happy" or "sad" parabola? How do you know?

6. Tell whether the following parabolas open up or down.

$a(x) = 2.5x^2 - 5$

$b(x) = 6 + 3(x - 3)^2$

$c(x) = -(x - 2)^2 - 5$

$d(x) = 7(x + 1)^2 - 1$

Extension – Parabola Hunt

For each of the points given on page 3.2, find an equation of a "happy" parabola so that the vertex of the parabola is located at the given point. Then, find an equation of a "sad" parabola at each vertex point. Use integer values for *a*, *h*, and *k*. Check your work using the sliders on the right side of the screen.

Point 1	Point 2	Point 3	Point 4

Compare your equations with a classmate. Using all of your equations listed above, rank the parabolas from widest to narrowest.

Bonus: Find the equation of a parabola that passes through any two of the labeled points on page 3.2.