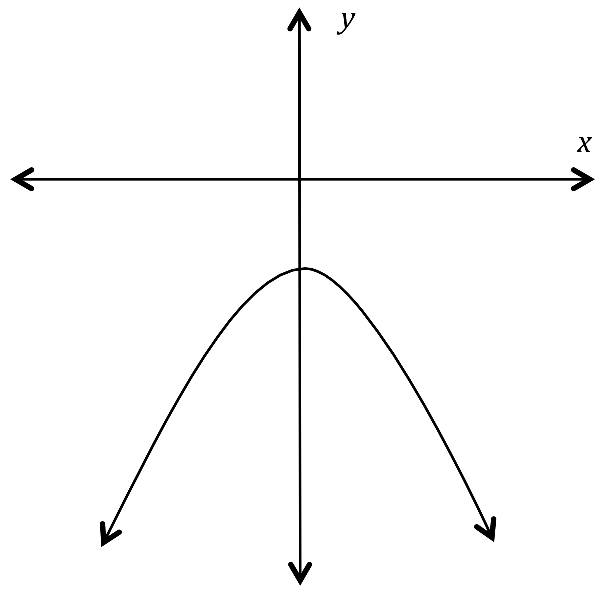
Write an equation that could represent the graph below. Justify why your equation is appropriate for this graph.



Top Score Response:

Students write a quadratic equation of the form $y = ax^2 + bx + c$. They justify that this is a quadratic equation because its graph is parabolic. a should be negative and between −½ and −1 ½. Students justify this because the graph is concave down (a is negative) and looks to be about as narrow/wide as the father function $y = -x^2$ (a is approximately −1). $b = 0$ because the graph is not shifted to the left or right, and is only shifted down. c should be negative and at least −1. Students justify this because the graph intersects the y-axis below the origin.

Some example responses could be: $y=-x^2-1$, $y=-\frac{1}{2}x^2-2$, $y=-x^2-4$, etc.

Rubric:

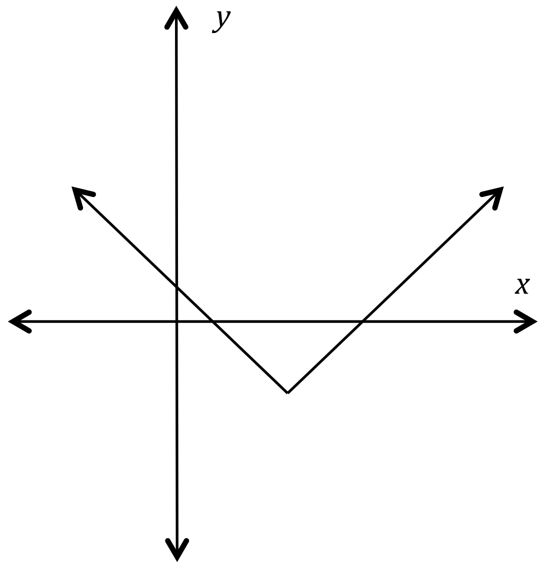
2 points:	Student has all of the requirements above for a top response. Student justifies each of these decisions.
1 point:	Student has the correct equation but does not justify their choices. OR student has one of the components of his quadratic equation incorrect (eg. incorrect coefficient on x^2, $b \neq 0$, incorrect y-intercept).
0 points:	Student has two or more components of the quadratic equation incorrect. OR student does not create a quadratic equation.

Building Functions F.BF

Build new functions from existing functions

3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

Write an equation that could represent the graph below. Justify why your equation is appropriate for this graph.



Top Score Response:

Students write an absolute value equation of the form $y = a|x - h| + k$. They justify that this is an absolute value because its graph is *v*-shaped. a should be 1 or very close to 1. Students justify this because the graph is concave up (a is positive) and looks to be about as narrow/wide as the father function $y = |x|$ (a is approximately 1). h should be positive and approximately 3, because the graph is shifted approximately 3 units to the right. k should be negative and at least –1 because the graph is shifted down 1 or 2 units.

Some example responses could be $y = |x - 3| - 2$, $y = |x - 4| - 2$, etc.

Rubric:

2 points: Student has all of the requirements above for a top response. Student justifies each of these decisions.

1 point: Student has the correct equation but does not justify their choices. OR student has one of the components of his absolute value equation incorrect (eg. incorrect coefficient on the absolute value, $y = |x \mathbf{+ 3}|$ indicating that student does not know that shifting to the right means subtracting from inside the absolute value, $y = |x - 3| \mathbf{+ 2}$ indicating that the student does not know that shifting down means subtracting from outside the absolute value).

0 points: Student has two or more components of the absolute value equation incorrect. OR student does not create an absolute value equation.

Building Functions F.BF

Build new functions from existing functions

3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*