Lesson Title: Transformations of Functions 3: Reflections
Date:_____

Subject: Algebra I or Algebra II	T**opic:** Reflections of Functions
Grade: 9, 10, or 11	**Designer:** Jessica Ulcickas

Stage 1 – Desired Results

Lesson Overview: This activity teaches students about reflections of basic functions. A reflection takes place when the graph of a function flips over the x-axis or over the y-axis. The function retains its basic shape; however by adding a negative sign to the function, the graph becomes a mirror image of itself. By the end of the activity students will be able to identify a given function's reflection, identify which axis the graph will flip over, and graph a sketch of the reflected function.

Standards Addressed:

CCSS.Math.Content.HSF-BF.B.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative), or find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Recognize even and odd functions from their graphs and their algebraic expressions.

Enduring Understanding:	**Essential Questions**:
Although there are many different types of functions, they all share similar properties. All functions respond in the same way when their equations are changed by adding a negative sign. When a negative sign is placed in front of the equation of the function, the graph of the function will reflect over the x-axis. When a negative sign is placed in front of the x variable, the graph of the function will reflect over the y-axis. These reflections apply to all functions, no matter the equation or shape.	How does the equation of a function affect its graphical representation? How does adding a negative sign to the equation of a function affect its graphical representation? How does adding a negative sign to the x variable of a function affect its graphical representation?
Students will need to know:	**Students will be able to**:
Students will need to have basic knowledge of functions and what their graphical representations are. This can be used at the beginning of a unit on functions as a preview of coming attractions for function shapes, or towards the end of a year spent working with various functions in order to help students make connections.	• Identify a function reflection given an equation. • Identify which axis a function will reflect across based on its equation. • Sketch a graph of a reflected function given the graph of the original function.

Stage 2 – Assessment Evidence

Performance Tasks: In this activity: • Asking students to make predictions about how a specific change to the equation of a function will change the graph of the function. • Asking students to graph a transformed function given a new equation.	**Other Evidence**: • To be decided by the teacher.

Stage 3 – Learning Plan

Lesson Procedure: <u>Many Days Before</u>: Students will be introduced to the topic of functions. Students should have a general knowledge of basic functions and the shapes of their graphs. <u>Day Of</u>: Students will go to the computer lab in order to complete this activity. For the duration of the activity, the teacher will monitor student progress to ensure that students complete the activity properly and do not simply click to complete. The activity will not take all class period, so the remainder of the class period will be at the discretion of the classroom teacher.	Required Materials: • Computers for each student.
Possible Discussion Questions for Students: • Do you notice any patterns that could help you remember these rules? • Can you name any functions other than $f(x) = x^2$ that might be an even function? • Can you name any functions that might be odd other than $f(x) = x^3$?	**Sample Answers to Discussion Questions**: • Answers will vary. Sample answer: There are usually parentheses involved when there is a reflection over the y-axis. • Answers may vary. Sample answers: $f(x) = x^4$, $f(x) = x^6$, etc. • Answers may vary. Sample answers: $f(x) = x, f(x) = x^5$, etc.