**Lesson Title: Transformations of Functions Part 2: Dilations Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| **Subject:** Algebra I or Algebra II T**opic:** Translations of Functions  **Grade:** 9, 10, or 11 **Designer:** Jessica Ulcickas | |
| **Stage 1 – Desired Results** | |
| **Lesson Overview**: This activity teaches students about dilations of basic functions. A dilation is a stretch or compression vertically or horizontally. The function retains its basic shape, however by simply multiplying the function by a number the shape will stretch or compress in different directions depending on the number. By the end of the activity students will be able to identify a given function dilation, identify the direction the graph will stretch or compress in, and graph a sketch of the dilated function.  **Standards Addressed**:   * [CCSS.Math.Content.HSF-BF.B.3](http://www.corestandards.org/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); 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. | |
| **Enduring Understanding**:  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 via multiplication by a constant. When a number multiplies a function, the function will stretch or compress vertically. When a number multiplies the x variable of a function, the function will stretch or compress horizontally. These dilations apply to all functions, no matter the equation or shape. | **Essential Questions**:  How does the equation of a function affect its graphical representation?  How does multiplying a constant by a function affect its graphical representation?  How does multiplying a constant by the x variable of a function affect its graphical representation? |
| **Students will need to know**:  Students will need to have basic knowledge of functions and what their graphical representations are. This activity 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. | **Students will be able to**:   * Identify a function dilation given an equation. * Identify which direction a function will stretch or compress in based on its equation. * Sketch a graph of a dilated 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**:  Many Days Before:  Students will be introduced to the topic of functions. Students should have general knowledge of parent functions (the most basic functions) and the shape of their graphs.  Day Of:  Students will need computers 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**:   * How are vertical stretches and horizontal compressions related? * If vertical stretches and horizontal compressions are related, are vertical compressions also related to horizontal stretches? * In what type of function would a horizontal dilation and vertical dilation be the same? | **Sample Answers to Discussion Questions**:   * Vertical stretches and horizontal compressions are the same in some functions, specifically polynomial functions. * Yes. They are related in a similar way. * Sample answers: Polynomial functions, linear functions, quadratic functions. |