**Subject area/course**: Mathematics/Calculus

**Grade level/band**: 11-12

**Task source**: Summit Public Schools

**Book of Limits**

**STUDENT INSTRUCTIONS**

1. **Task context**:

Limits are all around us. There are speed limits to follow when you're driving. There are limits to how many students a college is able to accept. There are limits that we impose on ourselves (some good...like not taking on more than we can handle; some bad...like limiting the experiences or people we open ourselves up to). And then you have those who say to "live your life with no limits." Juxtaposing these notions of "limits being everywhere" and there being "no limits at all" is actually a great way to begin the mathematical exploration of limits and continuity.

Perhaps something even more important to consider when trying to understand continuity is this: What happens in life--whether in your life or in the world around you--when connections are broken? What happens when things don't run smoothly? Does chaos ensue? Is it possible to repair the broken connections, or is the damage irreparable? If the latter is the case, are you able to dig yourself out and work around the disrepair? Can you find meaning in it all? In a world where being connected is oftentimes crucial for success, these questions are incredibly important to think about. Part of the goal of this project will be to challenge you to figure out what to do when things don't go as planned.

This project will provide you an opportunity to fully investigate the concepts of limits and continuity by extending your knowledge of piece-wise defined functions and transformations of functions.

1. **Final product**:

Your task is to create your own graph of a complicated piece-wise defined function comprised of twelve different functions (i.e. the "pieces") that you've worked with throughout your mathematics career.

As you create your graph, you will be making sure to abide by certain constraints that ensure you demonstrate your knowledge and application of the following concepts: "parent" functions and transformations of them; continuity and discontinuity (removable, jump, and infinite); and limits (one-sided, etc.).

Your final product will include both a hand-drawn graph and a computerized version of your graph. You will also produce completed graphic organizers that will allow you to demonstrate your knowledge of functions, limits, and continuity. These graphic organizers will provide you a way to "defend your graph" - to prove that you have created a graph satisfying all of the constraints. You will present all of your creations in front of your peers for the conclusion of your project (think of it as defending your mathematical thesis!).

See *Book of Limits Performance Task Instructions* document for detailed task instructions.

**Additional Information**

1. **Knowledge and skills you will need to demonstrate on this task:**

* Analysis of Information: You will be required to interpret multiple constraints and create a graph matching those constraints
* Use of Technology: You will use a graphing utility to create a graph meeting all of the constraints outlined in the problem

1. **Materials needed:**

Documents:

* Item A. Book of Limits Performance Task Instructions
* Item B. Entry Event
* Item C. We Belong Together Lab
* Item D. We Belong Together Student Document
* Item E. Exploring Limits Algebraically and Graphically
* Item F. Exploring Limits through Graphing

1. **Time requirements:**

You will have approximately two weeks to complete this task. Your teacher will build in checkpoints for peer and teacher feedback.

1. **Scoring:**

Your work will be scored using the Summit Public Schools Book of Limits rubric. You should make sure you are familiar with the language that describes the expectations for proficient performance.