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| **Lesson 1 : Exploring Tunnels & Writing Equations** | **Unit #: 1** | **Lesson #: 1** | **Activity #: 2** |
| **Activity 1.1.2: Writing Function Equations in Context** |

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| **Estimated Lesson Duration:** | **4-5 days** |
| **Estimated Activity Duration:** | **2 days** |

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| **Setting:** | **classroom** |

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| **Activity Objectives:*** **Analyze piece-wise functions: graph using restricted domains**
* **Use lines, quadratics equations to build piece-wise functions, restrict their domains, and graph**
* **Write equations of functions for real world problems**
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| **Activity Guiding Questions:*** **How do we write equations of lines, parabolas?**
* **What information is needed to write these equations?**
* **What is a piece-wise function?**
* **How is a piece-wise function different from other functions?**
* **How do we graph a piece-wise function?**
* **How do we restrict the domain of a piece-wise function?**
* **What do we look for when writing an equation that models a real world situation?**
* **How do we write an equation for a real world situation?**
* **How does all this relate to our Big Idea and Essential Question?**
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| **Next Generation Science Standards (NGSS)**  |
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| **Science and Engineering Practices (Check all that apply)**  | **Crosscutting Concepts (Check all that apply)** |
| ☐ Asking questions (for science) and defining problems (for engineering) | ☒ Patterns |
| ☒ Developing and using models | ☐ Cause and effect |
| ☐ Planning and carrying out investigations | ☒ Scale, proportion, and quantity |
| ☒ Analyzing and interpreting data | ☐ Systems and system models |
| ☒ Using mathematics and computational thinking | ☐ Energy and matter: Flows, cycles, and conservation |
| ☐ Constructing explanations (for science) and designing solutions (for engineering) | ☒ Structure and function.  |
| ☐ Engaging in argument from evidence | ☐ Stability and change.  |
| ☒ Obtaining, evaluating, and communicating information  |  |

| **Ohio’s Learning Standards for Science (OLS)** |
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| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| ☐ Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| ☐ Demonstrating Science Knowledge **(D)** |
| ☐ Interpreting and Communicating Science Concepts **(C)** |
| ☐ Recalling Accurate Science **(R)** |

| **Ohio’s Learning Standards for Math (OLS) and/or** **Common Core State Standards -- Mathematics (CCSS)** |
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| **Standards for Mathematical Practice (Check all that apply)** |
| ☒ Make sense of problems and persevere in solving them | ☐ Useappropriate tools strategically |
| ☐ Reason abstractly and quantitatively | ☒ Attendto precision |
| ☒ Construct viable arguments and critique the reasoning of others | ☒ Look for and make use of structure |
| ☒ Model with mathematics | ☐ Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, OLS and/or CCSS):*** A-REI.4 Solve quadratic equations in one variable. (complete the square, extract roots, quadratic formula, factoring)
* A-REI.11 Represent & solve equations graphically. (technology, table, approximations)
* F-IF.4 For a function that models a relationship between 2 quantities, interpret key features of graphs /tables in terms of the quantities, sketch graphs
* F-IF.7 Graph functions, show key features
* F-IF.8 Write a function
* F-BF.1 Build a function that models a relationship between 2 quantities
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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies)* Larson, R., *College Algebra: A Graphing Approach, 5th ed.,*
* Intro to Piecewise Functions Worksheet
* Piecewise Function Graphs Worksheet
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| **Teacher Advance Preparation:*** **Find a game that will review prior knowledge of linear and quadratic functions. This will be the opening for day 1.**
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| **Activity Procedures:*** **Day 1 – open with a review game covering linear and quadratic equations. This might be a matching game that connects equations to graphs to situations or other characteristics. In observing the students, I will make note of any gaps in understanding that need to be addressed as we use these equations to introduce piecewise functions.**
* **Introduction to piecewise functions – short direct instruction that defines piecewise functions, restricted domains, and how to graph them.**
* **Day 2 – continue piecewise functions by doing word problems found in text book that illustrate how piecewise functions are good models for certain types of problems.**
* **Small Goup/Whole group discussion of how a piecewise function might model a tunnel shape. Teams will brainstorm, then share with entire class.**
* **Short quiz over graphing piecewise function equations.**
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**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

* Game
* Intro to Piecewise Functions Worksheet
* Piecewise Function Graphs Worksheet

**Summative Assessments:** These are optional; there may be summative assessments at the end of a set of Activities or only at the end of the entire Unit.

* Piecewise Function Quiz

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| **Differentiation:** Describe how you modified parts of the Lesson to support the needs of different learners. Refer to Activity Template for details. As students worked on individual worksheets, I traveled to each small group and checked their process. I reinforced the direct instruction by asking questions about how to graph piecewise functions. I spent more time with those students who seemed to be having difficulties. |

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson. This content is always difficult for students. I think it would be good to use more technology to demonstrate graphs of piecewise functions. The students also need more practical examples of the use of piecewise functions before we start graphing. I need to also make more connections to prior knowledge of graphing other types of functions and relations. |