Travis Kim – Lesson Plan Example: Introduction to Quadratic Functions

Summary: This lesson was one of my favorites to teach while I was a middle/high school math teacher. It introduces students to quadratic functions once they've developed proficiency with linear functions. The lesson also combines two of my core identities, educator and magician, by using a card trick I regularly perform to spark curiosity and introduce a new concept in a memorable way.

Goal: Students will develop an understanding of quadratic functions by analyzing projectile motion. Students will use a quadratic equation to predict the height of an object at a given time and explain how the math describes physical motion.

Objective: Students will be able to plug time values into a quadratic function, compute the corresponding height, and interpret their answers in context.

Standards: Aligned to Common Core, High School Math, Functions with emphasis on interpreting quadratic functions and modeling real-world motion.

- HSF-IF.B.4: Interpret key features of quadratic functions in real-world contexts
- HSF-IF.C.7a: Graph quadratic functions and identify the vertex
- HSA-SSE.B.3: Evaluate quadratic expressions to model projectile motion

Lesson Flow (designed for an hour-long class):

1. **Ask students to place phones in "Phone Daycare" (1 minute)**
   a. *Purpose: Students place smartphones in a designated pocket system to minimize distractions and support focus during class. This routine reinforces consistent and predictable classroom norms and accountability. Also allows for an easy and visual way to take attendance if each student has a specific pocket number assigned.*
2. **Warm-Up: Pick one: Nerdle, Set Puzzle, or teach magic trick. (5 minutes)**
   a. *Purpose: Students are given structured choice in selecting a warm-up activity. The intent is to start off each class with a fun problem-solving activity.*
3. **Review: Individual review problems of Systems of Equations world problems. Review in groups, then as a class. (10 minutes)**
   a. *Purpose: Activates prior knowledge and builds confidence before introducing new information/content.*
4. **Parabola Interactive Demo (20 minutes)**
   a. Critical thinking question of projectile trajectory and vertical speed
   b. Introduction of parabola shape
   c. Perform card to mouth trick
   d. Explain how I perform the trick to increase consistency of success, introducing definition of the vertex, and parabolas that open both up and down.
      i. *Purpose: Students explore a new topic through guided questioning, visual modeling, all while watching their teacher present a human side of themselves.*
5. **Introduce projectile motion word problems, and go over two as a class. Examine the differences between what a quadratic function looks like compared to a linear function. (10 minutes)**
   a. *Purpose: Introduces quadratic functions in a real-world context while allowing comparisons to prior knowledge.*

6. **Group work: work through third example problem in groups, then review as class. (8 minutes)**
    a. *Purpose: Have students engage in collaborative problem-solving and exploration. Allow students to ask each other questions before relying on teacher. (3 before me rule: refer back to previous problems and notes first, then another peer, then a second peer. Then they may ask me a question).*
7. **Exit ticket for assessment. Submitted before leaving class. (5 minutes)**
    a. Question: A ball is launched into the air. Its height is modeled by the function:
    $$h(t) = -16t^2 + 32t + 5$$
    1. What is the height of the ball at $t = 1$ second?

    2. In one sentence: What does this value represent in real life?

8. **Have students turn in exit ticket and pick up homework assignment upon submission. (1 minute)**