Nonlinear Functions

Text: CORD Algebra 1 – Learning in Context
Volume: third edition Chapter: 5
Unit number: _____ Title of unit: _____
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Attach the Following Documents:

1. **Lab Instructions**
2. **Student Handout(s)**
3. **Rubric and/or Assessment Tool**

Short Description (Be sure to include where in your unit this lab takes place):

The students will be shaking containers to simulate time passage and then removing peas that are in contact with a colored circle. They will extract those peas and then repeat until half of the peas have been removed, reaching a "half-life" for their container. The students record the number of seeds removed after each time cycle. This activity comes as one of the introductory pieces at the beginning of the students work with nonlinear equations.

Radioactive Decay

LAB PLAN

TEACHER: *(Teacher Prep/Lab Plan)*

- **Lab Objectives**
  - Recognize some nonlinear equations (involving squares, square roots, and reciprocals of the variable) and become familiar with their graphs.
  - Solve a nonlinear equation, draw its graph, and check your work.

- **Statement of prerequisite skills needed**
  - Graphing ordered pairs on a coordinate system.
  - Experience with linear functions on a graph.

- **Vocabulary**
  - Coordinate system, Exponential decay, limit, evaluate a function, nonlinear function, linear function, half-life, trials, average

- **State Standards addressed:** *(Highlight "Green" Standards, you may use your District's Power Standards if applicable)*
  - **Math:**
    - A1.1.E Solve problems that can be represented by exponential functions and equations.
    - A1.7.A Sketch the graph for an exponential function of the form $y = a(b)^n$ where *n* is an integer, describe the effects that changes in the parameters *a* and *b* have on the graph, and answer questions that arise in situations modeled by exponential functions.
  - **Reading:**
    - 3.1 Read to learn new information

- **Writing:**
  - 2.2 Write for different purposes, such as telling stories, presenting analytical responses to literature, persuading, conveying technical information, completing a team project, and explaining concepts and procedures
- **Leadership:**
  - 1.4 The student will be involved in activities that require applying theory, problem-solving, and using critical and creative thinking skills while understanding outcomes of related decisions.
  - 2.1 The student will communicate, participate, and advocate effectively in pairs, small groups, teams, and large groups in order to reach common goals.
- **SCAN Skills/Workplace Skills:**
  - Uses quantitative data to construct logical explanations for real world situations
  - uses tables, graphs, diagrams, and charts to obtain or convey quantities information

- **Teacher Preparation:** *(What materials and set-up are required for this lesson?)*
  - Materials:
    - Small plastic containers with lids, peas (seeds or rice) (100 per container)
  - Set-Up Required:
    - With permanent marker color a circle on the underside of each tub, the size and location of the circle should be different on each one. Add 100 seeds to each container.
    - Students will need or need to create a data sheet and will need a sheet of graph paper.

- **Lab Organizational Strategies:**
  - Grouping/Leadership/Presentation Opportunities:
    - Cooperatively share roles and responsibilities to collect information
  - Cooperative Learning:
    - Play a defined role within the group.
  - Expectations:
    - One student will collect and manipulate the materials. The second student will serve as the record keeper.
    - Both students will sketch a graph of the data collected
    - Teams will exchange their container with another group until they have five sets of data.
  - Time-line:
    - DAY ONE: Introduction with Youtube and teacher reference to carbon dating, unstable isotopes and nuclear decay. Introduce the lab and demonstrate the student process. Students should have enough time to collect data for their first container.
    - DAY TWO: Students finish data collection for two other containers. Teams share data and each student creates a graph to represent their three sets of data.

- **Post Lab Follow-Up/Conclusions** *(to be covered after student completes lab)*
  - Graphs will be sketched on day two as will an introduction of how to interpret the data and graph.
  - Discuss real world application of learning from lab: carbon dating and other isotopes used for historic research
  - Career Applications: Archeologists and Anthropologist use nuclear decay patterns to date organic materials.
  - Optional or Extension Activities: Find out the half-life for commonly used to radioactive isotopes.

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Nuclear Decay Lab Instructions

1. Make sure the lid on your container is closed.
2. Record the number written on the side of the box to identify which box you have. Each box has 100 peas inside.
3. Shake your box gently in a back and forth motion on the table top for 10 seconds.
4. Carefully remove the lid and remove any seed in contact with the area identified by the colored circle on the underside of the box.
5. Count and record the number of seeds removed.
6. If you have not yet removed a total of 50 peas, repeat steps 3-5.
7. Once you have reached 50 peas, note this as the half-life of your element.
8. Return all peas to your container and repeat steps 3 – 7 twice more.
9. Now trade your filled container with another group.
10. Repeat step nine twice.
11. Return materials to the instructor.
12. Exchange the data with your partner and both of you should now graph the three sets of average data onto the provided graph paper.

Student Handout

Container Number ___________________

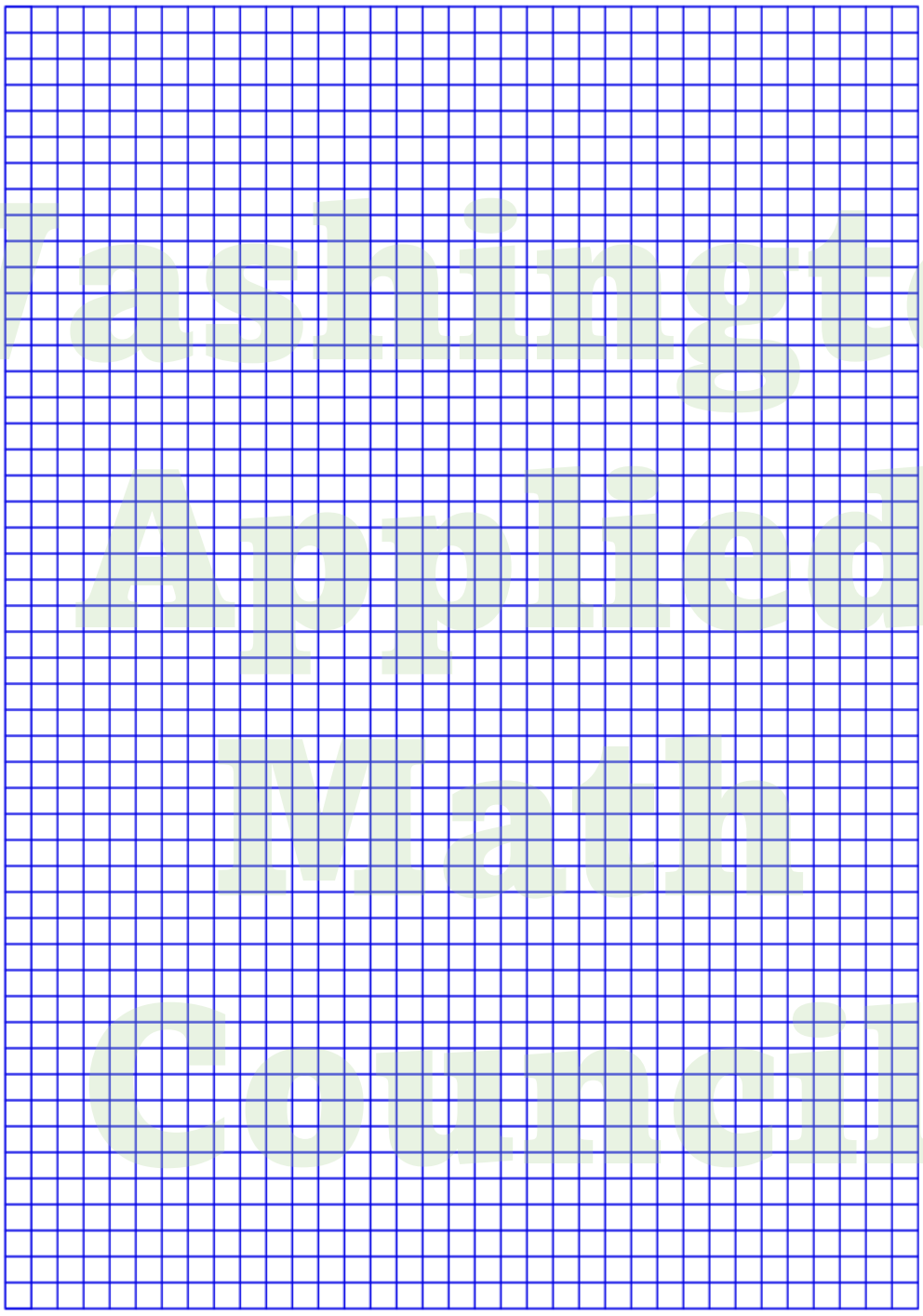
Shake	Peas Removed				Shake	Peas Removed			
	T1	T2	T3	Ave		T1	T2	T3	Ave
1					6				
2					7				
3					8				
4					9				
5					10				

Container Number ___________________

Shake	Peas Removed				Shake	Peas Removed			
	T1	T2	T3	Ave		T1	T2	T3	Ave
1					6				
2					7				
3					8				
4					9				
5					10				

Container Number ___________________

Shake	Peas Removed				Shake	Peas Removed			
	T1	T2	T3	Ave		T1	T2	T3	Ave
1					6				
2					7				
3					8				
4					9				
5					10				



Write some conclusions based on the data:

Write a supportive statement for the idea that "using the 5700 half-life of Carbon 14 to date fossils is not the most effective measuring tool but it works well for ancient human civilization.

Rubric and/or Assessment Tool

Item	Points
Raw Data table for 3 containers	/ 10
Average Data for 3 containers	/ 10
Graph Labeled • Title • Axis • Best fit line • Lines identified by container	/ 10
Writes statement using data to support	/ 10
Total	**/ 40**

Areas to address before reassessment: