

Rich Mathematical Task – Algebra II – *Algae Attack*

Task Overview/Description/Purpose:
<ul style="list-style-type: none"> In this task, students will explore a situation about algae growth in a lake to examine exponential growth. This task is designed to be used to introduce a unit on exponential equations as it is geared towards understanding how exponential growth behaves. It could also be used as an assessment at the end of the unit to see if students create an equation to model situation rather than just using a pattern.

Standards Alignment: Strand – <i>Number and Number Sense</i>
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<p>Primary SOL: All.7 The student will investigate and analyze linear, quadratic, absolute value, square root, cube root, rational, polynomial, exponential, and logarithmic function families algebraically and graphically. Key concepts include g) connections between and among multiple representations of functions using verbal descriptions, tables, equations, and graphs.</p> <p>Related SOL (within or across grade levels/courses): A.7, MA.1</p>

<p>Learning Intention(s):</p> <ul style="list-style-type: none"> Content - I am learning to use the behavior of exponential functions to solve a practical problem. Language - I am learning to justify my solutions to a problem in writing using my mathematics vocabulary. Social - I am learning to discuss with my peers my ideas about solving a problem.
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<p>Success Criteria (Evidence of Student Learning):</p> <ul style="list-style-type: none"> I can use the patterns of exponential functions to analyze and solve practical problems. I can describe the characteristics of an exponential function within the parameters of a practical problem.
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Mathematics Process Goals	
Problem Solving	<ul style="list-style-type: none"> Students will apply mathematical concepts and skills and the relationships among them and choose an appropriate strategy to solve a problem.
Communication and Reasoning	<ul style="list-style-type: none"> Students will explain their reasoning using mathematical vocabulary. Students will provide work to show how they used their strategy to reach their solution.
Connections and Representations	<ul style="list-style-type: none"> Students will provide one or more representations of the situation: drawing, table, graph, and/or equation.

Task Pre-Planning

<p>Approximate Length/Time Frame: 40 – 60 minutes</p>
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<p>Grouping of Students:</p> <p>If using this as an introductory task, provide some individual think time for students to read the task and come up with their ideas. Then put students into pairs or small groups to work through their ideas for solving the task.</p> <p>If using this task as a summative assessment, you might choose to have students work independently or in a partner/small group with a group work reflection.</p>

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Task Pre-Planning	
Materials and Technology: <ul style="list-style-type: none">• Graphing utility• White board• Markers• Graph paper• Pattern Blocks (if available)	Vocabulary: <ul style="list-style-type: none">• Exponential function• Base• Domain• Range
Anticipate Responses: See the Planning for Mathematical Discourse Chart (columns 1-3).	

Task Implementation (Before)
Task Launch <ul style="list-style-type: none">• Work with your English colleagues to use reading strategies that will be familiar to your students.• Although this task could be used as an introduction to exponential functions, they should have a basic understanding of exponential and a working understanding of domain and range.• Present this task as a problem for students to solve in any manner that makes sense to them.• Make sure students have access to a variety of materials.• Allow students to pursue different strategies, and do not lead them to using a system of equations unless that is what they think of doing on their own.
Task Implementation (During)
Directions for Supporting Implementation of the Task <ul style="list-style-type: none">• Monitor – Teacher will listen and observe students as they work on task and ask assessing or advancing questions (see chart on next page).• Select – Teacher will decide which strategies or thinking that will be highlighted (after student task implementation) that will advance mathematical ideas and support student learning.• Sequence – Teacher will decide the order in which student ideas will be highlighted (after student task implementation).• Connect – Teacher will consider ways to facilitate connections between different student responses.
Suggestions For Additional Student Support: May include, among others: <ul style="list-style-type: none">• Possible use of sentences frames to support student thinking• Provide highlighters to assist students in interacting with text• Provide oral instructions• Allow students to provide oral explanations• Possible problem solving strategies questions for non-starters:<ul style="list-style-type: none">○ Can you draw a picture to represent the situation?○ Can you try writing out the pattern you think this situation follows?
Task Implementation (After)
Connecting Student Responses (From Anticipating Student Response Chart) and Closure of the Task: <ul style="list-style-type: none">• Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion.

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- Connect different students' responses and connect the responses to the key mathematical ideas to bring closure to the task. Discuss similarities and differences between two strategies before adding additional strategies.
- Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion.
- Draw out any pertinent vocabulary, if possible, during the closure discussion and post the word wall cards.

Teacher Reflection About Student Learning:

- What strategies did students use and did they fit with what you expected them to do?
- What were the reoccurring student misconceptions?
- How will the evidence provided through student work inform further instruction?
- Does vocabulary need further development?
- Are students able to explain their work verbally (oral or written)?

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Planning for Mathematical Discourse

Mathematical Task: Algae Attack

Content Standard(s): All.7g

Anticipated Student Response/Strategy <i>Provide examples of possible correct student responses along with examples of student errors/misconceptions</i>	Assessing Questions – Teacher Stays to Hear Response <i>Teacher questioning that allows student to explain and clarify thinking</i>	Advancing Questions - Teacher Poses Question and Walks Away <i>Teacher questioning that moves thinking forward</i>	List of Students Providing Response <i>Who? Which students used this strategy?</i>	Discussion Order - sequencing student responses <ul style="list-style-type: none"> • <i>Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion</i> • <i>Connect different students' responses and connect the responses to the key mathematical ideas</i> • <i>Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion</i>
Anticipated Student Response: Student is unable to start part a.	<ul style="list-style-type: none"> • What values do we know? • Do you have to know the initial amount of algae to answer the question? 	<ul style="list-style-type: none"> • If the lake was 10,000 or 100,000 square meters, would it change the time it takes for the lake to be completely covered? • How could you use the knowledge that the lake is completely covered on April 30th? 		
Anticipated Student Response: Student creates a table for part c. (Note: When used as an introductory task, this is the most likely method a student might use)	<ul style="list-style-type: none"> • How did you know where to start your table? • Can you explain to me how you solved the task? • What evidence do you have to support your claim? 	<ul style="list-style-type: none"> • How is your solution the same/different as _____? • Can you solve the task in a different way? 		
Anticipated Student Response: Student creates an equation for part c.	<ul style="list-style-type: none"> • How did you define x? • How did you define y? • What does 0.5% represent? • Can you explain to me how you solved the task? 	<ul style="list-style-type: none"> • Think of another situation with an initial amount. What day does that occur? • How is your solution the same/different as _____? 		

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Student Misconception: The student uses 0.5% to represent day 1 instead of day 0.	<ul style="list-style-type: none"> • What evidence do you have to support your claim? 	<ul style="list-style-type: none"> • Can you solve the task in a different way? • What solution method would be most efficient? 		

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NAME _____

DATE _____

Algae Attack

On April 1, a fast growing species of algae is accidentally introduced into a lake. It starts to grow and cover the surface of the lake in such a way that the area covered by the algae doubles every day. If it continues to grow, the lake will be totally covered, endangering the wildlife dependent on the lake. At the rate it is growing, this will happen on April 30.

- a. When will the algae cover half of the lake? Explain how you arrived at your answer.

- b. On April 26, a student who walks by the lake every day warns that the lake will be completely covered soon. Her friend just laughs. Why might her friend be skeptical of the warning?

- c. On April 29, biologists arrive at the lake and remove almost all of the algae. They are not able to remove all of the algae, and estimate that 0.5% of the surface is still covered with algae. Considering the pattern of growth, have the biologists solved the problem of algae growth covering the lake? Create a mathematical representation of the situation and justify your answer.

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Rich Mathematical Task Rubric

	Advanced	Proficient	Developing	Emerging
Mathematical Understanding	<p>Proficient Plus:</p> <ul style="list-style-type: none"> Uses relationships among mathematical concepts or makes mathematical generalizations 	<ul style="list-style-type: none"> Demonstrates an understanding of concepts and skills associated with task Applies mathematical concepts and skills which lead to a valid and correct solution 	<ul style="list-style-type: none"> Demonstrates a partial understanding of concepts and skills associated with task Applies mathematical concepts and skills which lead to an incomplete or incorrect solution 	<ul style="list-style-type: none"> Demonstrates no understanding of concepts and skills associated with task Applies limited mathematical concepts and skills in an attempt to find a solution or provides no solution
Problem Solving	<p>Proficient Plus:</p> <ul style="list-style-type: none"> Problem solving strategy is well developed or efficient 	<ul style="list-style-type: none"> Problem solving strategy displays an understanding of the underlying mathematical concept Produces a solution relevant to the problem and confirms the reasonableness of the solution 	<ul style="list-style-type: none"> Problem solving strategy displays a limited understanding of the underlying mathematical concept Produces a solution relevant to the problem but does not confirm the reasonableness of the solution 	<ul style="list-style-type: none"> A problem solving strategy is not evident Does not produce a solution that is relevant to the problem
Communication and Reasoning	<p>Proficient Plus:</p> <ul style="list-style-type: none"> Reasoning or justification is comprehensive Consistently uses precise mathematical language to communicate thinking 	<ul style="list-style-type: none"> Demonstrates reasoning and/or justifies solution steps Supports arguments and claims with evidence Uses mathematical language to communicate thinking 	<ul style="list-style-type: none"> Reasoning or justification of solution steps is limited or contains misconceptions Provides limited or inconsistent evidence to support arguments and claims Uses limited mathematical language to partially communicate thinking 	<ul style="list-style-type: none"> Provides no correct reasoning or justification Does not provide evidence to support arguments and claims Uses no mathematical language to communicate thinking
Representations and Connections	<p>Proficient Plus:</p> <ul style="list-style-type: none"> Uses representations to analyze relationships and extend thinking Uses mathematical connections to extend the solution to other mathematics or to deepen understanding 	<ul style="list-style-type: none"> Uses a representation or multiple representations, with accurate labels, to explore and model the problem Makes a mathematical connection that is relevant to the context of the problem 	<ul style="list-style-type: none"> Uses an incomplete or limited representation to model the problem Makes a partial mathematical connection or the connection is not relevant to the context of the problem 	<ul style="list-style-type: none"> Uses no representation or uses a representation that does not model the problem Makes no mathematical connections