Performance Based Learning and Assessment Task # 1

How do I Choose the Most Cost Efficient Scooter Rental Plan for My Family?

I. ASSESSMENT TASK OVERVIEW & PURPOSE:

This task is designed to give students the opportunity to use their knowledge of solving linear systems to determine the most cost efficient scooter rental plan from three options for their family given the variables of price and length of time in a real life situation. Students will have to graphically represent their solutions on graph paper or as a print out from a computer program, show the solutions algebraically and create data tables. Students will have to solve a system of linear equations to choose the most cost efficient plan for their families for an unknown amount of time.

II. UNIT AUTHOR:

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III. COURSE:

Algebra I

IV. CONTENT STRAND:

Expressions and Operations

A.1 THE STUDENT WILL REPRESENT VERBAL QUANTITATIVE SITUATIONS ALGEBRAICALLY AND EVALUATE THESE EXPRESSIONS FOR GIVEN REPLACEMENT VALUES OF THE VARIABLES.

Equations and Inequalities

A.4 THE STUDENT WILL SOLVE MULTISTEP LINEAR AND QUADRATIC EQUATIONS IN TWO VARIABLES, INCLUDING

- a) solving literal equations (formulas) for a given variable;
- justifying steps used in simplifying expressions and solving equations, using field properties and axioms of equality that are valid for the set of real numbers and its subsets;
- c) solving quadratic equations algebraically and graphically;
- d) solving multistep linear equations algebraically and graphically;
- e) solving systems of two linear equations in two variables algebraically and graphically; and
- f) solving real-world problems involving equations and systems of equations.

Graphing calculators will be used both as a primary tool in solving problems and to verify algebraic solutions.

V. OBJECTIVES:

- Students will use their knowledge of linear systems to determine the most cost efficient scooter rental plan for their families.
- Students will use graph paper or a computer program to graph their linear systems.
- Students will show their solutions algebraically.
- Students will create data tables.

VI. REFERENCE/RESOURCE MATERIALS:

Students will use the Algebra I text book available in the classroom. Teacher will provide graph paper, rulers, TI-84 Plus calculators, colored pencils and access to computers for use of GeoGebra, Geometer's Sketch Pad, Desmos, MS Word, MS Excel and Google Docs. Students will also have access to their teacher for guidance.

VII. PRIMARY ASSESSMENT STRATEGIES:

Students will be assessed on the accuracy of their equations, the graph of their equations, their table of values, their algebraic solutions and the explanation for their choice.

VIII. EVALUATION CRTERIA:

Self assessments and teacher assessments are attached to this document as well as a benchmark of what students are expected to produce.

IX. INSTRUCTIONAL TIME:

This activity should take one 45-minute period.

How do I Choose the Most Cost Efficient Scooter Rental Plan for My Family?

Strand (Expressions and Operations, Equations and Inequalities)

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NCTM Standards - Algebra

Algebra:

Students will:

- interpret representations of functions of two variables
- write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency—mentally or with paper and pencil in simple cases and using technology in all cases;
- judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.

Connections:

Students will:

- Organize their mathematical thinking through discussion with peers
- Communicate their thinking clearly to teacher and peers
- Analyze and evaluate the mathematical thinking and strategies of their partners
- Use the language of mathematics to express mathematical ideas precisely
- Recognize and apply mathematics in contexts outside of mathematics
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole

Representation:

Students will:

- Create and use representations to record and communicate mathematical ideas.
- Select, apply, and translate among mathematical representations.
- Use representations to model and interpret physical and mathematical phenomena.
- draw reasonable conclusions about a situation being modeled.
- model and solve contextualized problems using various representations, such as graphs, tables, and equations.

Additional Objectives for Student Learning:

Not applicable

Mathematical Objectives

The goal of this activity is to allow students to demonstrate their knowledge of verbal expressions, their ability to solve linear systems and their ability to translate their results into reasonable conclusions given a real life situation.

Materials/Resources

- Students will use the Algebra I text book available in the classroom. Teacher will provide graph paper, rulers, TI-84 Plus calculators and access to computers for use of GeoGebra, Geometer's Sketch Pad, Desmos, MS Word, MS Excel and Google Docs.
- Students will also have access to their teacher for guidance.

Assumption of Prior Knowledge

- Students should know how to graph lines and how to solve multi-step equations.
- Students should understand the meaning of the results of an equation given the context of a real life situation.
- Students should be able to create equations based on real-life situations..
- Students may have a problem understanding that they are not choosing just one value for the number of weeks of vacation, but must look at the range of weeks possible. The teacher may have to help with the explanation.

Introduction: Setting up the Mathematical Task

The teacher will ask a few questions with time for student responses at the end of each question. "How many of you have ever ridden a scooter?" "How many of you have been on a jet ski?" "How many of you have been to a tropical island?"





("Untitled Photograph of a scooter", n.d.) ("scoot-scooters-3-537x389.jpeg", n.d.)





("JetSki3-150x150.jpg", n.d.)

("2girls1_fs-150x150.jpg ", n.d.)

Students will be placed into groups of two to three by the teacher or by their own choosing. Students will be told about the scenario and that they must choose the most cost efficient plan for their family. The scenario can be changed for differentiation. Students must graph their linear equations, create a table and solve equations algebraically in order to come up with the best decision. Students will demonstrate their ability to solve linear systems and draw conclusions from their solutions.

Student Exploration

Students will work in groups for the entirety of the project, with the help of the teacher when necessary. Students will determine most cost efficient plans themselves, but all must include how they used their calculations, graph and table to determine their decision.

Student/Teacher Actions

- Students will be talking, calculating, creating tables and drawing their graphs. To draw the graphs they can use graph
 paper or a computer. This could be a good use of a program like GeoGebra or Desmos. The teacher will be circulating
 and giving help and advice where it is needed. Students might not understand that the vacation period is a variable
 and choose only one period. The teacher may need to point out that we are looking at multiple periods of time and
 the conclusions must reflect all possibilities. This could be a good time to discuss input/output and
 independent/dependent variables.
- At the end of the project each group will present their design to the class, explaining their decisions and calculations.
 They should include what part of the project was the most difficult, what was something new that they learned, and what they might do differently.

Assessment List and Benchmarks

Students will complete a graph, a table, all algebraic solutions and an explanation for their choices and what they may have done differently. Students will self assess their work using the same rubric as the teacher.

What is the Best Scooter Rental Plan for My Family

Students are to work in groups of two or three.

You and your family will be taking a long vacation (from 1 to 4 weeks) to a tropical island. The island is so small that the residents don't use cars, but large enough that they do use other forms of transportation. There are three scooter rental companies on the island. All three companies have weekly rentals.

- Scooters Galore charges \$50 up front and \$15 per week.
- Speedy's charges \$20 up front and \$25 per week.
- Fun Times Rentals charges \$35 up front and \$20 per week.

You must come up with a detailed reason for choosing which company to rent scooters from on the island.

- Show your family a table with the costs broken down.
- Show your family a graph of the costs.
- Show your family algebraically how to find the best deal.
- After coming up with your choice and convincing your family to go with that company, you receive a coupon in the mail from Fun Times rentals with a special offer. The offer is for the use of a jet ski for a day at no charge. The usual daily rental for the jet ski is \$15. Does this change your decision?
- Explain in full detail why this does or does not change your initial decision, what was difficult for you in this task, what you learned, and what you might do differently.

Performance Assessment Task "Scooter Rental" Self Assessment

Names_			
Date		 	

Element	Possible Points	Self	Teacher	Score
Equation for Scooters Galore.	3			
Equation for Speedy's.	3			
Equation for Fun Times Rentals.	3			
Graph for Scooters Galore.	3			
Graph for Speedy's.	3			
Graph for Fun Times Rentals.	3			
Table for Scooters Galore.	3			
Table for Speedy's.	3			
Table for Fun Times Rentals.	3			
Algebraic Solution and Work	6			
Decision and Explanation	6			

Performance Assessment Task "Scooter Rental"

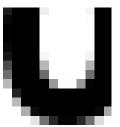
Names_	
Date	

Assessment Rubric

	3 points	2 points	1 point	0 points
Equation for	Equation is	Equation is	Equation is	No Equation is
Scooters Galore.	correct.	mostly correct.	present, but not	present.
			correct.	
Equation for	Equation is	Equation is	Equation is	Equation is
Speedy's.	correct.	mostly correct.	present, but not	present.
			correct.	
Equation for Fun	Equation is	Equation is	Equation is	No Equation is
Times Rentals	correct.	mostly correct.	present, but not	present.
			correct.	
Graph for	Graph of the line	Graph of the line	Graph of the line	No Graph of the
Scooters Galore.	is correct.	is mostly correct.	is present, but	line is present.
			not correct.	
Graph for	Graph of the line	Graph of the line	Graph of the line	No Graph of the
Speedy's.	is correct.	is mostly correct.	is present, but	line is present.
			not correct.	
Graph for Fun	Graph of the line	Graph of the line	Graph of the line	No Graph of the
Times Rentals.	is correct.	is mostly correct.	is present, but	line is present.
			not correct.	
Table for	Table of values is	Table of values is	Table of values is	No Table of
Scooters Galore.	correct.	mostly correct.	present, but not	values is present.
			correct.	
Table for	Table of values is	Table of values is	Table of values is	No Table of
Speedy's.	correct.	mostly correct.	present, but not	values is present.
			correct.	
Table for Fun	Table of values is	Table of values is	Table of values is	No Table of
Times Rentals.	correct.	mostly correct.	present, but not	values is present.
	6		correct.	0
Al	6 points	4 points	2 points	0 points
Algebraic	All Work and	Most Work is	Some Work is	No Work is
Solution and	Algebraic	shown and	shown and	shown and No
Work	Solution is	Algebraic	Algebraic	Algebraic
	correct.	Solution is	Solution is	Solution is
		mostly correct.	present, but not	present.
Desision and	Desision and	Desision and	correct.	No Docicion and
Decision and	Decision and	Decision and	Decision and	No Decision and
Explanation	Explanation are	Explanation are	Explanation are	Explanation are
	complete	mostly complete.	present, but not	present.
			complete.	

Benchmark

Company	Cost for 1 Week	Cost for 2 Weeks	Cost for 3 Weeks	Cost for 4 Weeks
Scooters Galore	\$65	\$80	\$95	\$110
Speedy's	\$45	\$70	\$95	\$120
Fun Time Rentals	\$55	\$75	\$95	\$115



$$y = 15x + 50$$
 $20x + 35 = 15x + 50$ $25x + 20 = 15x + 50$ $25x + 20 = 20x + 35$
 $y = 20x + 35$ -35 -20 -20 -20 -20 -20
 $y = 25x + 20$ -20 -20 -20 -20
 $20x = 15x + 15$ $25x = 15x + 30$ $25x = 20x + 15$
 $-15x$ $-15x$ $-15x$ $-20x$ $-20x$
 $-20x$ $-20x$ $-20x$
 $-2x$ $-2x$

All have the same cost at week three.

For my family vacation to the tropical island I would make the following decision based on time. If the vacation is one or two weeks long the best choice is Speedy's. Speedy's cost less for the first two weeks. If the vacation is three weeks long, I would choose the one with the best brochure, because they all cost the same amount. If the vacation is four weeks long, I would choose Scooters Galore, because they are the least expensive. After receiving the coupon from Fun Times Rentals, I would choose to go with them, because the free one day rental for the jet ski saves me more than going with the least expensive company for any of the vacation length options and I like to jet ski. We learned that there are multiple ways to solve the problem. A student's decision on which way to solve the problem depends on how the student best sees the solution.

[Untitled photograph of a scooter]. (n.d.). Retrieved July 15, 2014 from http://blog.motorcycle.com/2009/08/20/manufacturers/qlink/new-qlink-scooters-for-fast-coffee-breaks/

[scoot-scooters-3-537x389.jpeg]. (n.d.). Retrieved July 15, 2014 from http://inhabitat.com/scoot-launches-electric-scooter-sharing-program-in-san-francisco/

[JetSki3-150x150.jpg]. (n.d.). Retrieved July 15, 2014 from http://onthebeach.ws/about-beach-rentals-fort-lauderdale/rent-a-jet-ski-on-fort-lauderdale-beach/jet-ski-mimi/

[2girls1_fs-150x150.jpg]. (n.d.). Retrieved July 15, 2014 from http://onthebeach.ws/about-beach-rentals-fort-lauderdale/rent-a-jet-ski-on-fort-lauderdale-beach/