Performance Based Learning and Assessment Task

Movie Projector Cost

I. ASSESSSMENT TASK OVERVIEW & PURPOSE:
The students will solve multistep equations and inequalities to determine the minimum amount needed to break even.

II. UNIT AUTHOR:
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III. COURSE:
Algebra 1

IV. CONTENT STRAND:
Patterns, Functions, and Algebra
Computation and Estimation

V. OBJECTIVES:

- The learner will be able to translate a real world situation into mathematical expressions, equations, and inequalities.
- The learner will be able to solve multistep linear equations.
- The learner will be able to solve multistep linear inequalities.
- The learner will be able to apply their solutions found to a real world situation and ensure their answer makes sense.

VI. REFERENCE/RESOURCE MATERIALS:
Graphing calculators to ensure accuracy of computations
Task form

VII. PRIMARY ASSESSMENT STRATEGIES:
Students will be assessed on the equations and inequalities written based off the task given. They will also be assessed on the accuracy of their solution and computational skills to get to the solution.

VIII. EVALUATION CRITERIA:
Students will be evaluated using the attached rubric.

IX. INSTRUCTIONAL TIME:
This task should take two instructional periods (approximately 2 hours).

Movie Projector Cost

Strand
Patterns, Functions, and Algebra

Computation and Estimation

Mathematical Objective(s)
The student will write and solve equations and inequalities based on a real-world situation.
The student will interpret their solution and determine meaning based on the real-world situation.

Related SOL
- A.1 (translating verbal situations into algebraic expressions, inequalities, or equations)
- A.4d and f (solving multistep linear equations in real-world contexts)
- A.5a and c (solving multistep linear inequalities in real-world contexts)

NCTM Standards
- Judge the reasonableness of numerical computations and their results
- 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
- Draw reasonable conclusions about a situation being modeled
- Solve problems that arise in mathematics and in other contexts
- Apply and adapt a variety of strategies to solve problems
- Monitor and reflect on the process of mathematical problem solving
- Organize and consolidate their mathematical thinking through communication
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others
- Analyze and evaluate mathematical thinking and strategies of others
- Recognize and apply mathematics in contexts outside of mathematics

Additional Objectives for Student Learning:
None

Materials/Resources
Attached handouts and rubrics
Graphing calculators

Assumption of Prior Knowledge
- The students need to know how to write equations, expressions, and inequalities based on verbal expressions.
- The students need to know how to solve linear equations.
- The students need to know how to solve linear inequalities.
- The students need to know how to judge the reasonableness of their solutions and apply it to given real-world situations.
- The students may possibly know the current cost of tickets at a movie theater, but need to consider the cost given to them in the task.

Introduction: Setting Up the Mathematical Task

The teacher will ask the students if they enjoy going to the movies and to explain why or why not. Hopefully, a student will mention the cost of the movie theater. The teacher will then explain that today's task involves investigating prices of movie tickets and explaining their high costs.

Student Exploration

Throughout the whole problem, students will work in pairs or groups of 3 or 4. It is up to the individual teacher. Although students will discuss mathematical processes in their groups, they will produce individual results. The teacher will circulate throughout the room to answer individual student questions as needed.

Student/Teacher Actions:

- The students will work together through the task sheet. They may struggle coming up with different equations, expressions, and inequalities due to the high number of variables and their diversity. The teacher will help the student by reminding them to define the variables and take each section one at a time since the questions build on each other.
- After the project is complete, students will assess themselves and their group, as well as determine their grade for the project. Students will be asked to analyze what they have learned as well as the difficulty of the task.

Monitoring Student Responses

The teacher will hand out the task with the questions. As students need assistance, the teacher will help break down problems into smaller chunks. If a group finishes early, that group may research the cost of food that is sold at the theater and compare it to the price at which it is being sold. They can discuss and come up with ways the food cost could help offset some of the projector costs.

Assessment List and Benchmarks

While completing the task, the students will complete the attached task sheet. Students will also self-assess using the rubric attached. At the end of the activity, they will discuss what they have learned and how they have contributed to the group's learning. They will also decide what was easy and difficult about the task, as well as how it could be improved in the future.

Movie Projector Cost Task

The cost to go see a movie at Movie Tavern is $10.75 for an adult and $8.75 for a child. It costs $40,000 to buy a digital film projector. A full movie theater can hold 250 people, where every child and adult has their own seat. If the ratio of adults to children in the theater on average is 3 to 7, how many movies need to be shown to a full theater to break even?

1. Create a table showing the total amount of money for the ratio of 3 adults to 7 children for 5 different amounts of adults and children. (Ex: cost of 3 adults and 7 children, cost of 6 adults and 14 children, etc.)

2. Write an equation(s) to determine how many adults and children will be in a theater of 250 people. Be sure to define your variables.

3. Write an expression to determine the total cost of movie tickets for the adults and children.

4. Solve your equation(s) from number 2 and use the expression from number 3 to determine the total amount being paid to the movie theater for one movie.

5. Write an inequality to determine how many movies to show to begin to make a profit off the digital projector.

6. Solve your inequality in number 5 to determine the minimum amount of movies needed to be shown to begin making profit.

7. What are some other ways movie theaters make profits to endure some of the costs they have?

8. Based on this information, do you think the movie theaters are charging enough? If you were a movie theater owner, what would you do to help offset the costs of these projectors? Use your data and prior knowledge as reasoning to support your answer.

9. Consider the amount of people it takes to run a single movie. Research the amount of people it takes to run 5-8 movies at a movie theater. Also, research the hourly pay for these workers. Determine the cost for a typical night in a movie theater to just have a movie showing with the necessary workers.

10. Using the same information, consider some movie theaters being open on holidays such as Christmas. The workers need to be compensated extra for working on this holiday, but there may not need to be as many. If a worker makes 1.5 times his/her hourly pay on holidays, how much more will this add to the total cost to open the theater on holidays? Do you think this is worth it?

Movie Projector Cost Task Rubric

			Earned Assessment	
Number	**Element**	**Point Value**	**Self-Graded**	**Teacher Grade**
1	Created a table using the ratio of adults to children for 5 different amounts of children and adults	2		
2	Wrote an equation to determine how many children and adults would make a full theater	2		
3	Wrote an expression to determine total cost of movie tickets	2		
4	Determined the total amount being paid to the movie theater for one movie	2		
5	Wrote an inequality to determine how many movies need to be played to begin to make a profit	2		
6	Determined the minimum amount of movies needed to make a profit	2		
7	Decided other ways a movie theater may make profit besides ticket sales	2		
8	Analysis of ways movie theaters make profit and how the student would change things if they were the owner	4		
9	Algebraic solutions and showed how arrived at the solutions	4		
10	Researched and considered workers and their salary and determined the total cost to show 5-8 movies in a theater.	4		
	Totals	26		

What I did to contribute to the project:	
What my group mates did to contribute to the project:	
What was easy about this task:	**What was hard about this task:**
What I learned during this task:	**Ways to improve this task:**

#	Element	0	1	2
1	Created a table using the ratio of adults to children for 5 different amounts of children and adults	Did not create a table	Created a table and either did not use the appropriate ratio or did not include 5 different amount of children and adults	Created a table with 5 different amounts of children and adults using the appropriate ratio
2	Wrote an equation to determine how many children and adults would be a fully movie theater	Did not write an equation	Wrote an incorrect equation	Wrote a correct equation with variables defined
3	Wrote an expression to determine total cost of movie tickets	Did not write an expression	Wrote an incorrect expression	Wrote a correct expression with variables defined
4	Determined the total amount being paid to the movie theater for one movie	Did not determine the total amount being paid to the movie theater	Determined an incorrect total amount being paid to the movie theater	Determined the correct amount being paid to the movie theater
5	Wrote an inequality to determine how many movies to be played to begin to make a profit	Did not write an inequality	Wrote an incorrect inequality	Wrote a correct inequality with the variables defined
6	Determined the minimum amount of movies needed to make a profit	Did not determine the amount of movies needed to make a profit	Determined an amount other than the minimum to make a profit	Determined the minimum amount of movies need to make a profit
7	Decided other ways a movie theater may make profit besides ticket sales	Did not give examples of other ways movie theaters make profits	Gave unreasonable examples of ways movie theaters make profits	Gave appropriate, realistic examples of ways movie theaters make profits
8	Analysis of ways movie theaters make profit and how the student would change things if they were the owner	**0** Student didn't analyze the situation to determine changes to be made	**2** Student proposed changes, but did not support using the data from task	**4** Student proposed changes using the supporting arguments and knowledge from the task
9	Algebraic solutions and work	**0** No work was shown nor final answer to the task	**2** Some of the calculations were shown, but incorrect solutions	**4** All of the calculations shown as well as correct solutions
10	Researched and considered workers and their salary and determined the total cost to show 5-8 movies in a theater.	**0** Did not research or compute salary and total cost to run 5-8 movies	**2** Researched and considered workers salary, but did not determine the total cost to show 5-8 movies	**4** Researched and considered workers salary and determined the total cost to show 5-8 movies