# Performance Based Learning and Assessment Task #2

## *Green Cravings*

**I. ASSESSSMENT TASK OVERVIEW & PURPOSE:**

The task is to provide students will the opportunity to take a real world situation and create a mathematical model. Students will create algebraic equations from their data and solve for the unknown variable

**II. UNIT AUTHOR:**

Arthur Madeoy, Frederick County Middle School, Frederick County, VA

**III. COURSE:**

Algebra I

**IV. CONTENT STRAND:**

- Expressions and Operations
- Equations and Inequalities

**V. OBJECTIVES:**

The learner will create a representation of data, represent a quantitative situation algebraically, and solve an algebraic equation for the unknown variable.

**VI. REFERENCE/RESOURCE MATERIALS:**

Skittles,TI-84 Calculator, and a poster sized sheet of paper.

**VII. PRIMARY ASSESSMENT STRATEGIES:**

- Create a valid representation to solve for the unknown
- Convert to an algebraic equation if not already in that representation
- Solve the algebraic equation for the unknown variable

**VIII. EVALUATION CRITERIA:**

See attached rubric and data sheet.

**IX. INSTRUCTIONAL TIME:**

This task should take two 50 minute class periods.

# Green Cravings

**Strand**

- Expressions and Operations
- Equations and Inequalities

**Mathematical Objective(s)**

The learner will create a representation of data, represent a quantitative situation algebraically, and solve an algebraic equation for the unknown variable.

**Related SOL**

A.1 The student will represent verbal quantitative situations algebraically and evaluate these expressions for given replacement values of the variables.

A.4 The student will solve multistep linear and quadratic equations in two variables, including
d) solving multistep linear equations algebraically and graphically

**NCTM Standards**

- Understand relations and functions and select, convert flexibly among, and use various representations for them
- Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships
- Use symbolic algebra to represent and explain mathematical relationships
- Draw reasonable conclusions about a situation being modeled

**Additional Objectives for Student Learning (include if relevant; may not be math-related):**

Learn there are various ways to represent mathematics.

**Materials/Resources**

Skittles,TI-84 Calculator, and a poster sized sheet of paper.

**Assumption of Prior Knowledge**

- Graphing
- Creating tables

- Creating algebraic equations from data
- Solving multi-step equations
    - ✓ Students may struggle with solving a multi-step equation. Most will struggle with which operation to undo first. Before the exercise, students will review the concepts involved in solving multi-step equations.

## Introduction: Setting Up the Mathematical Task

Students will be given a bag of skittles. They will determine how many Skittles are in the bag and how many green. Students will determine how many bags of Skittles will be needed to have the same amount of Skittles as their bag except with all of the Skittles being green.

They will then repeat this exercise with a partner utilizing both of their bags of Skittles.

Students and groups may represent the data in any method they wish. Once they have done this they will then convert their representation to algebraic equation. Once completed they will then create a poster board showing their method of thinking and how they originally represented the data.

## Student Exploration

**Individual Work**

Part 1 of the task involved working independently. Students will need to use only their mathematical knowledge and background to complete the task.

**Small Group Work**

Students will work together in pairs. Students should communicate with each other in discussing the best mathematical strategies for solving the problem.

**Student/Teacher Interactions**

Students should be communicating about the task. They should be asking themselves and their group how they can represent the data given. Students should use representations of their thinking as a problem solving strategy. The teacher will go around the room and ensure that the students are following procedure and using questioning to guide students in their exploration.

**Monitoring Student Responses**

Individual and group responses will be monitored. Any response that is not clear will prompt the students for clarification.

## Assessment List and Benchmarks

## The following Rubric will be used for the Final Draft

Using the descriptions of each category on page 2 to determine the appropriate point value

# *Green Cravings*

| | | | Earned Assessment | |
|---|---|---|---|---|
| **Number** | **Element** | **Point Value** | **Self** | **Teacher** |
| **1** | Mathematics task is inquiry based | 2 | **2** | |
| **2** | Mathematics task is connected to the real world | 2 | 2 | |
| **3** | Mathematics task is open ended | 2 | 2 | |
| **4** | Mathematics task requires higher order thinking skills | 2 | 2 | |
| **5** | Mathematics task includes one or more performance tasks | 2 | 2 | |
| **6** | Mathematics task identifies one or more work habits | 2 | 2 | |
| **7** | Mathematics tasks are based on the SOL's | 2 | 2 | |
| **8** | The assessment list identifies all essential mathematics | 2 | 2 | |
| **9** | The assessment list identifies all performance components | 2 | 2 | |
| **10** | The assessment list includes work habits | 2 | 2 | |
| **11** | The assessment list acts as a student check list | 2 | 2 | |
| **12** | The assessment list allows for student self-assessment | 2 | 2 | |
| **13** | The assessment list allows for teacher assessment | 2 | 2 | |
| **14** | There are two mathematics tasks | 2 | 2 | |
| **15** | There are two assessment lists | 2 | 2 | |
| **16** | There are two benchmarks. | 2 | 2 | |
| **17** | The project package is well organized | 2 | 2 | |
| **18** | The project package is neat | 2 | 2 | |
| **19** | The project package is complete | 2 | 2 | |
| **20** | All recommended changes were made | 2 | 2 | |

**Rubric for Final**

| # | Element | 0 | 1 | 2 |
|---|---|---|---|---|
| **1** | Mathematics task is inquiry based | Not inquiry based | Somewhat inquiry based | Inquiry based |
| **2** | Mathematics task is connected to the real world | No connection to real world experiences | Connection to in-school | Connection to out-of-school |
| **3** | Mathematics task is open ended | Fully teacher directed closed task | Teacher structured but open ended task | Many entry points and multiple solutions |
| **4** | Mathematics task requires higher order thinking skills | Memorization and skill practice | Show and explain | Analysis, synthesis |
| **5** | Mathematics task includes one or more performance tasks | No performance tasks | NA | Includes one or more |
| **6** | Mathematics task identifies one or more work habits | No work habits identified | Some are identified | All work habits are identified |
| **7** | Mathematics tasks are based on the SOL's | No SOL identified | Uses unrelated SOL | Uses appropriate SOL |
| **8** | The assessment list identifies all essential mathematics | No essential elements are identified | Some are identified | All are identified |
| **9** | The assessment list identifies all performance components | None are identified | Some are identified | All are identified |
| **10** | The assessment list includes work habits | No work habits included | Some appropriate work habits included | All appropriate work habits included |
| **11** | The assessment list acts as a student check list | Fails to act as a checklist | Check list is difficult to use | Acts as a check list |
| **12** | The assessment list allows for student self-assessment | Fails to allow for self-assessment | Self-assessment difficult to perform | Allows for self-assessment |
| **13** | The assessment list allows for teacher assessment | Fails to allow for teacher assessment | Teacher assessment difficult to perform | Allows for teacher assessment |
| **14** | There are two mathematics tasks | No tasks | One task | Two tasks |
| **15** | There are two assessment lists | No lists | One list | Two lists |
| **16** | There are two benchmarks. | No benchmarks | One bench marks | Two benchmarks |
| **17** | The project package is well organized | No evidence of organization | Not fully organized | Well organized |
| **18** | The project package is neat | Lacks neatness | Needs improvement | Neat |
| **19** | The project package is complete | Incomplete in more than one area | Incomplete in one area | Complete |
| **20** | Recommended changes were addressed | No recommended changes were addressed | Some recommended changes were addressed | All recommended changes were addressed |

Algebra I Name(s)_____

"Green Cravings"

Mr. Madeoy wants to bring Skittles to share with his class of ___ students. He enjoys the green Skittles the best and thinks everyone else should also have only green ones.

**Part I - Individual Work**

Using the paper provided accomplish the following:
Determine how many fun size Skittles bags you would need to have exactly the same number of Skittles in your bag except all of the Skittles need to be green. Assume all bags have the same number of skittles.

Your work should show the following:

1. Representation of the data - Show at least 1 mathematical representation. Examples of representations can include algebraic, graphical, chart and tables, numeric, etc.

2. Mathematical Reasoning - Your representations should be able to help you in solving the task. You need to show the solution and explain how your representation allowed you to get the solution.

**Part II - Partner Work**

Using the paper provided accomplish the following:
Determine how many fun size Skittles bags you would need so that the entire class has a bag of only green Skittles. Things to consider: Since not every bag has the same number of Skittles, how will you determine how many Skittles each bag will have for each student?

Your work should show the following:

1. Show at least 2 mathematical representations. Examples of representations can include algebraic, graphical, chart and tables, numeric, etc.

2. Mathematical Reasoning - Your representations should be able to help you in solving the task. You need to show the solution and explain how your representation allowed you to get the solution.

**Part III - Algebraic Interpretation**

Using your data from part I and part II, create algebraic representations of your solution then solve your equation for the unknown variable.
(note: If you used algebraic representations in Part I and Part II then you can skip this step)

**Part IV - Poster Board Gallery Walk**

Take your data from part II and draw at least 2 mathematics representations used onto the poster board. Remember, the mathematics representations are algebraic, graphical, chart and tables, numeric, etc. For example, if you calculated average then show that is what you did or if you created a chart to represent the data then that is what you need to show on the poster board. The poster board should be neat, organized, and presentable. Your poster boards will be on display for others to view. We will then discuss the activity.

Rubric For Activity

"Green Cravings"

| Parts | Goals | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|
| Part I Individual Work | Representation of Data | No evidence | Has at least 1 representation but is unrelated to problem being solved | Has at least 1 representation related to the problem but has minor errors | Has at least 1 representation of the data and is without errors |
| Part I Individual Work | Mathematical Reasoning | No evidence | Uses mostly trial and error to find the solution instead of using their representation of the data | Shows connection between their representation and the solution but has minor errors | Shows connection between their representation and the solution without errors |
| Part II Partner Work | Representation of Data | No evidence | Has at least 2 representations but is unrelated to problem being solved | Has at least 2 representations related to the problem but has minor errors | Has at least 2 representations of the data and is without errors |
| Part II Partner Work | Mathematical Reasoning | No evidence | Uses mostly trial and error to find the solution instead of using their representation of the data | Shows connections between their representations and the solution but has minor errors | Shows connections between their representations and the solution without errors |
| Part III Algebraic Interpretation | Represents Data Algebraically | No evidence | Algebraic representation is unrelated to data or other types of representations created | Algebraic representation follows the data but has error in syntax | Algebraic representation is correct |
| Part III Algebraic Interpretation | Solves Algebraic Equation for Unknown Variable | No evidence | Attempts to solve algebraic equation using methods that do not follow make sense mathematically | Attempts to solve algebraic equation correctly but makes an error in computation | Algebraic equation is solved correctly |

| | | | | | |
|---|---|---|---|---|---|
| Part IV<br>Poster Board | Poster Board | No Evidence | Poster board was created but shows no mathematical representations | Poster board was created but only shows 1 mathematical representation | Poster board shows 2 mathematical representations |
| Part IV<br>Poster Board | Follows Procedure and Presentable | No Evidence | Did not follow procedures and/or work is not neat, organized and presentable | Followed procedure and work is neat, organized, and presentable but has minor errors | Followed procedure and work is neat, organized, and presentable |

# Benchmark

## Part 1

Bag has 16 skittles.

4 green skittles

| # Bags | # Green Skittles | Total Green Skittles |
|---|---|---|
| 1 | 4 | 4 |
| 2 | 4 | 8 |
| 3 | 4 | 12 |
| 4 | 4 | 16 |

Since there are 16 skittles then 16 green ones are needed.

Each bag has 4 green.

Therefore, 4 bags will be needed.

# Part II

## Benchmark

Partner I - 16 skittles | 4 green

Partner II - 20 skittles | 6 green

Avg. $\frac{16+20}{2} = 18$ | $\frac{4+6}{2} = 5$

There are 20 students in class. If each bag is to have 18 green then we need 360 green skittles.

Using Avg.

| # Bags | # green | Total green |
|---|---|---|
| 1 | 5 | 5 |
| 2 | 5 | 10 |
| 3 | 5 | 15 |
| (4) | 5 | 20 |
| 5 | 5 | |

We would need 4 bags to get one bag of green skittles.

| # Bags | # green | Total green |
|---|---|---|
| 1 | 5 | 5 |
| 2 | 5 | 10 |
| 3 | 5 | 15 |
| 4 | 5 | 20 |
| 5 | 5 | 25 |
| 6 | 5 | 30 |
| 7 | 5 | 35 |
| 8 | 5 | 40 |
| 9 | 5 | 45 |

$\frac{360}{45} = 8$

9 bags give 45 green

so $8 \times 9 = 72$.

72 bag needed.

#green  #Sto.  #skittles

$5X = 20 \times 18$  $5X = 360$  $X = 72$ bags

Benchmark

Part III

# green each bag = 5

# skittle each bag = 18

# students = 20

X = # bags

$5X = 18 \cdot 20$

$\frac{5}{5}X = \frac{360}{5}$

$X = 72$