M&Ms

When you are finished with this investigation, you will answer questions about domain and range, and describe the relationship between the variables and the pattern of change shown in the table and graph.

Materials: One bag of M&Ms, 1 partner, 1 paper plate, and marsupial repellent.

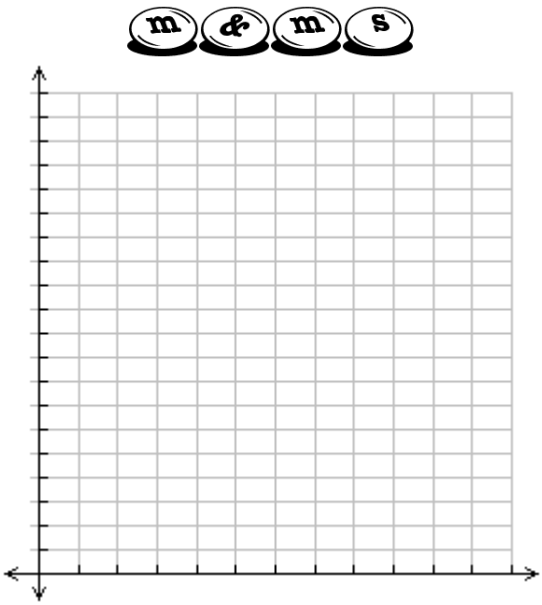
1. Count total number of M&Ms in your bag. This is your starting amount (M&Ms for 0 drops).
2. Divide your plate into two even sections. One for you and one for your partner.
3. Choose one person who will go first.
4. The person who goes first pours the M&Ms onto the paper plate so that they fall randomly over the plate.
5. The person who went first gets to eat the M&M's with the logo up that landed on his/her section.
6. Count all the remaining M&Ms on the whole plate, record it in a table like this:

Drop #	0	1	2	3	4	5	6	7	8
M&Ms remaining									

7. Now it's the other person's turn. The person who didn't go first grabs up all the remaining M&Ms and dumps them back onto the plate. It is his/her turn to eat the ones with the logo up that falls into his/her section.
8. Count all the remaining M&Ms, record it in your table. (Extend your table as needed.)
9. Repeat this process, switching turns, until your M&Ms are all gone.

10. Which is the independent variable and which is the dependent variable?

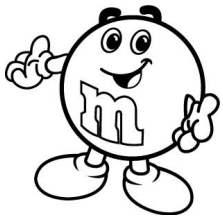
11. Graph the relationship between *Drop #* and *M&Ms remaining*. (Think about where the independent and dependent variable must go)



12. Draw a line or curve that you think best follows the data. (On graph)

13. Describe the relationship between the variables.

    "As the…



14. Using your calculator, plot the data from your experiment listed in the table above in an appropriate window.

15. Plot the rule $y = 100*(.8)^x$. How well does this model your data?

16. Adjust the numbers in the rule $y = 100*(.8)^x$ until you have a good fit for your data. What is the rule you found to model your data?

17. Rewrite your rule in function notation with letters for variables that make sense to you. (Be sure to define your variables.)

18. Show that you know function notation by writing an expression like "$C(4)$" and tell what it means and its value.

19. What is the domain and range of this situation?

20. Do you think the situation is discrete or continuous? Defend your choice.

21. How would changing the shaded region affect the equation? What if the shaded region was smaller? Larger?

How'd you do on your "I Can…" statements for this activity?

I can create a scatter plot on paper.
I can create a scatter plot with technology
I can draw a line of best fit when appropriate.
I can identify the independent and dependent variables in a situation.
I can describe the relationship between two variables when given a set of data.
I can understand and use correct function notation.
I can find the domain and range of a function.
I can determine whether a situation is discrete or continuous.

WAMC Lab Template
Math Concept(s): Writing Equations from data in Exponential form.
Source / Text: **CORD Algebra 1**
Developed by: Lexie Pettersen and Chad Burns E-Mail: lexie.pettersen@hotmail.com
ccburns90@hotmail.com Date: Summer In-Service 2013

Attach the following documents:
Lab Instructions: See attached

Student Handout(s): See attached

Rubric and/or Assessment Tool: See attached Summative assessment that will be given to students after the lab and after another day of practice with exponential decay functions. We will be using formative assessment throughout the entire lab by asking scaffolding questions throughout the lab to help students recognize this familiar function. We will also make sure to ask questions that will allow the students to extend their understanding of this function, function notation, and graphing.

Short Description (Be sure to include where in your instruction this lab takes place):
When students are finished with this investigation, they will be able to answer questions about domain and range, and describe the relationship between the variables and the pattern of change shown in the table and graph. The instructions for this lab are located on the worksheet students will be given to collect their data, graph it, and then calculate the regression equation.

Lab Plan
Lab Title: **M&M**

Prerequisite skills:
Have seen and worked with exponential growth functions. They should be familiar with the graph of an exponential growth function as well as be able to connect the equation of the function to the correct exponential growth graph. Students should also be familiar with how to find an exponential regression equation on their graphing calculators as well as understand the value of the variables used in the exponential equation.

Lab objective:
This lab would be used to introduce the graph and equation of an exponential decay function.

Standards:
CCSS-M:

- **Create Equations that describe numbers or relationships A-CED (Domain)**
  - 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- **Construct and compare linear, quadratic, and exponential models and solve problems. F-LE (Domain)**
  - 1. Distinguish between situations that can be modeled with linear functions and with exponential functions.
    - c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

Standards for Mathematical Practice:

- 4. Model with mathematics.

State Standards addressed (2008 Washington State Mathematics Standards):

- **A1.7.A** Sketch the graph for an exponential function of the form $y = ab^x$ 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.
- **A1.3A** Determine whether a relationship is a function and identify the domain, range, roots, and independent and dependent variables.

Reading:

- Follow a set of given instructions.

Writing:

- Communicate using words the relationship between two variables; the independent and dependent variable.

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☐ Global Awareness ☒ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy
☐ Health/Safety Literacy ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION
Creativity and Innovation
☒ Think Creatively
☒ Work Creatively with Others
☐ Implement Innovations
Critical Thinking and Problem Solving
☒ Reason Effectively
☐ Use Systems Thinking
☐ Make Judgments and Decisions
☒ Solve Problems
Communication and Collaboration
☒ Communicate Clearly
☒ Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS
Information Literacy
☒ Access and Evaluate Information
☐ Use and manage Information
Media Literacy
☐ Analyze Media
☐ Create Media Products
Information, Communications and Technology (ICT Literacy)
☒ Apply Technology Effectively

LIFE & CAREER SKILLS
Flexibility and Adaptability
☒ Adapt to Change
☐ Be Flexible
Initiative and Self-Direction
☒ Manage Goals and Time
☒ Work Independently
☐ Be Self-Directed Learners
Social and Cross-Cultural
☒ Interact Effectively with Others
☒ Work Effectively in Diverse Teams

Productivity and Accountability
☒ Manage Projects
☒ Produce Results
Leadership and Responsibility
☒ Guide and Lead Others
☒ Be Responsible to Others

Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Plates, M&M's, Marker, Calculator, Pencil, Worksheet

Set-Up Required:

- Color half of the paper plate for about 15 paper plates. Have a few plates colored with varying shaded areas to make the connection with the b value for the students. Put the correct equations on the back of the different shaded plates.

Lab Organization Strategies:

Grouping/Leadership/Presentation Opportunities:

- Students will be working in groups of two by their choosing or if the teacher wants to group certain students together they can make groups themselves.

Cooperative Learning:

- Students will be working together to collect data, graph points, find a regression equation of their data, find domain and range, and then talk about what they learned about exponential decay functions. They will be sharing their discoveries with their peers as well as the teacher when they are asked scaffolding questions.

Expectations:

- All students will be "playing the M&M game" as well as graphing points, finding regression equation, and we will expect the students to be able to explain the meaning of the a and b values in the context of the function.

Timeline:

- 50 min period.

Post Lab Follow-Up/conclusions:

Discuss real world application of learning from lab

- Connecting to science in regards to carbon dating.

Career Applications

- Scientist, anthropologist.

Optional or Extension Activities

- After the students have “played the game” we will have them experiment with the exponential equations by shading different regions of the paper plates and having them come up with the correct equation. We will expect them to communicate how they came up with their a and b values depending on the region we are referring to.

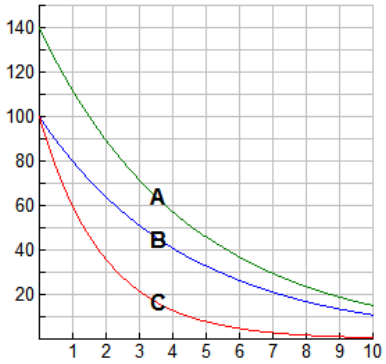
Checkup, Algebra
"Represent and Analyze Exponential Functions"

Name _____

1. Use words to describe this pattern: 800, 400, 200, 100, 50, 25, …

   "Start at ____ and multiply by _____."

2. Match each function rule to the correct curve shown in the graph.



   ____ $f(x) = 140 \cdot (0.8)^x$

   ____ $g(x) = 100 \cdot (0.8)^x$

   ____ $h(x) = 100 \cdot (0.6)^x$

3. Write an exponential function rule for this data.

x	0	1	2	3	4	5	6
y	6	18	54	162	486	1458	4374

   Function rule: _____

4. Write an exponential function rule for this data.

x	0	1	2	3	4	5	6
y	300	180	108	64.8	38.88	23.328	13.997

   Function rule: _____