

WAMC Lab Template

Math Concept(s): Linear and Exponential functions

Source / Text: Algebra 1 Cord

Developed by: Dani Andrews E-Mail: andredj@puyallup.k12.wa.us

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Attach the following documents:

Lab Instructions

(Included in student handout)

Student Handout(s)

(Attached at bottom)

Rubric and/or Assessment Tool

(Attached at bottom)

Indicate “SPECIFIC” relationship to Science, Technology, or Engineering

Exponential Growth or decay compared with linear growth or decay in a science lab can have huge effects on research and development. For example, most bacteria has exponential growth and it is important to know what that means compared to a linear growth when developing antibiotics and vaccines.

Short Description (Be sure to include where in your instruction this lab takes place):

In partners students complete two types of drop trials. First students drop M7M's and take away 5 M&M's every drop. They record and repeat this process until they have no M&M's left. This represents the linear function. Trial 2 consists of students dropping the M&M's and then taking away the “heads up” M&M's. They record and repeat this process until they have no M&M's left. This represents the exponential function. Students graph their data and respond to exit ticket questions comparing the two types of functions.

Lab Plan

Lab Title: M&M Lab

Prerequisite skills: Linear functions (modeling and identifying)

Basic knowledge of exponential functions

Lab objective:

Students will be able to identify and model similarities and differences in exponential and linear functions.

Standards:

Mathematics K–12 Learning Standards:

- [CCSS.Math.Content.HSF.LE.A.1](https://www.coreknowledge.org/standards/mathematics/high-school/HSF.LE.A.1)

Distinguish between situations that can be modeled with linear functions and with exponential functions.

Standards for Mathematical Practice:

- [CCSS.Math.Practice.MP6](https://www.coreknowledge.org/standards/mathematics/practice/MP6) Attend to precision.
- [CCSS.Math.Practice.MP1](https://www.coreknowledge.org/standards/mathematics/practice/MP1) Make sense of problems and persevere in solving them.

- [CCSS.Math.Practice.MP4](#) Model with mathematics.

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- [CCSS.ELA-Literacy.W.9-10.1](#)

Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

Leadership/21st Century Skills:

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

- | | | |
|---|--|---|
| <input type="checkbox"/> Global Awareness | <input checked="" type="checkbox"/> Financial/Economic/Business/Entrepreneurial Literacy | <input type="checkbox"/> Civic Literacy |
| <input type="checkbox"/> Health/Safety Literacy | <input type="checkbox"/> 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

- 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

Math Council

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

Materials

- M&M's (about 100 per group)
- Cup for M&M's to be distributed in (1 per partner pair)
- Paper Plate (1 per partner pair)
- Graphic organizer for table and graphs
- Exit ticket for student reflection

Set-Up Required:

- Copy Lab handout
- Have materials laid out for students

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Critical thinking and problem solving
- Communication and Collaboration
- Information Literacy
- Initiative and self-direction
- Social and Cross-Cultural
- Productivity and accountability

Cooperative Learning:

- Students will work with a partner

Expectations:

- Students will complete all of lab effectively and communicate findings effectively

Timeline:

- 55 minutes

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Analyzing data, probability and statics

Career Applications

- Financial advising, research development, probability and statics

Optional or Extension Activities

- Cut paper plate in half and see if decay is slower or faster
- Cut the paper plate into thirds or fourths and compare decay rates

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Directions:

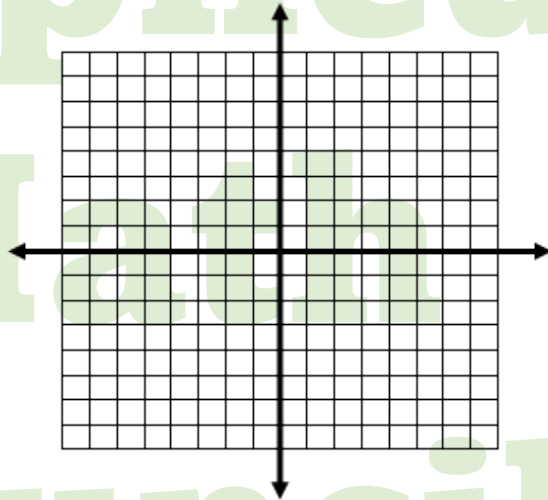
1. In partners, collect materials.
2. Count number of initial amount of M&M's you and your partner have, record this number at zero drops. Drop cup of M&M's on paper plate, take away 5, record how many you have left in first table. (Repeat this process until you no longer have M&M's... you might need to go into negatives).
3. On the next table, record initial amount of M&M's at zero drops. Drop cup of M&M's on paper plate, take away any M&M's that are **heads up** (showing the "m" side). Record this number. (Repeat this process until you run out of M&M's).
4. Graph Data
5. Complete exit ticket

Trial 1 (take away five)

X= number of drops

Y=amount left

X Y

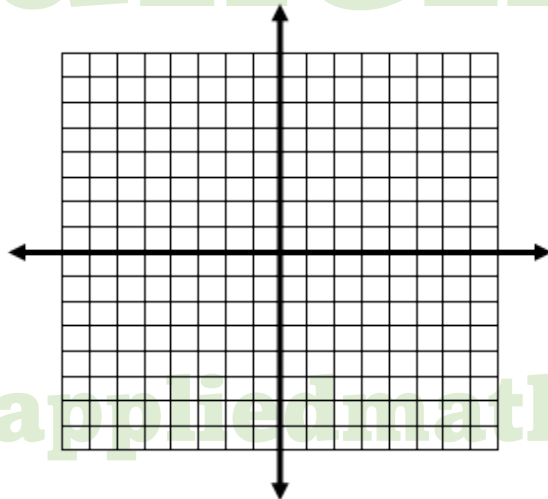


Trial 2 (take away heads up)

X= number of drops

Y=amount left

X Y



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Rubric for Lab 1

Math – M&M Lab

CATEGORY	4	3	2	1
Mathematical Concepts	Explanation shows complete understanding of the mathematical concepts used to solve the problem(s).	Explanation shows substantial understanding of the mathematical concepts used to solve the problem(s).	Explanation shows some understanding of the mathematical concepts needed to solve the problem(s).	Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s) OR is not written.
Mathematical Reasoning	Uses complex and refined mathematical reasoning.	Uses effective mathematical reasoning	Some evidence of mathematical reasoning.	Little evidence of mathematical reasoning.
Mathematical Errors	90-100% of the steps and solutions have no mathematical errors.	Almost all (85-89%) of the steps and solutions have no mathematical errors.	Most (75-84%) of the steps and solutions have no mathematical errors.	More than 75% of the steps and solutions have mathematical errors.
Use of Manipulatives	Student always listens and follows directions and only uses manipulatives as instructed.	Student typically listens and follows directions and uses manipulatives as instructed most of the time.	Student sometimes listens and follows directions and uses manipulatives appropriately when reminded.	Student rarely listens and often "plays" with the manipulatives instead of using them as instructed.
Working with Others	Student was an engaged partner, listening to suggestions of others and working cooperatively throughout lesson.	Student was an engaged partner but had trouble listening to others and/or working cooperatively.	Student cooperated with others, but needed prompting to stay on-task.	Student did not work effectively with others.
Completion	All problems are completed.	All but one of the problems are completed.	All but two of the problems are completed.	Several of the problems are not completed.
Explanation	Explanation is detailed and clear.	Explanation is clear.	Explanation is a little difficult to understand, but includes critical components.	Explanation is difficult to understand and is missing several components OR was not included.