

WAMC Lab Template

Math Concept(s): Polynomial Arithmetic

Source / Text:

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Attach the following documents:

- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

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

This lab will be for students who have identified Computer Sciences as their CTE domain. This lab will allow students to demonstrate their understanding of polynomial arithmetic in the analogous context of optimizing the length of inputs for coding. This lab will span an entire unit, with pre-assigned groups completing it as the unit progresses, and new learning is acquired.

Lab Plan

Lab Title: Optimize the Code!

Prerequisite skills: Integer arithmetic, knowledge of linear functions.

Lab objective: In this lab, students will learn to write equivalent polynomials, to meet various criteria, which will familiarize students with polynomial arithmetic and factoring.

Intro demonstration: Groups of students are given sets of different sized cups: Four small, two medium, one large. Teacher verbally lists start state for each round, listing each cup one at a time (i.e. for round one, the teacher says “one small plus one small”). Students are given goal state to accomplish. Once class agrees on goal, algebraic description is derived as a group. Teacher should emphasize that the cups themselves aren’t changing, just their number. When students attempt to combine cups of different size during round 4, teacher adds a rule that cups of different size cannot be combined.

Round	Start	Goal	Algebraic Description
1	Two Small	One Stack	Two Small
2	Three Small	Two Stacks	Three Small
3	Three Small	Minimum Stacks	Three Small
4	One Small, One Medium	One Stack	One Small Plus One Medium
5	One Small, One Medium	Minimum Stacks	One Small Plus One Medium
6	Four Small, Two Medium	Four Stacks	Four Small Plus Two Medium
7	Four Small, Two Medium	Minimum Stacks	Four Small Plus Two Medium

8	Four Small, Two Medium, One Large	Two Stacks	Four Small Plus Two Medium Plus One Large
9	Four Small, Two Medium, One Large	Minimum Stacks	Four Small Plus Two Medium Plus One Large

Activity concludes with discussion comparing Start Description (one at a time) and Optimized Description.

Standards: *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*

Mathematics K–12 Learning Standards:

- HSA.SSE.A.1.a : Interpret parts of an expression, such as terms, ... and coefficients.
- HSA.SSE.B.3 : Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
- HSA.APR.A.1 : Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

Standards for Mathematical Practice:

- Reason abstractly and quantitatively.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

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

- RI.8.4 : Determine the meaning of words and phrases as they are used in a text, including...technical meanings; analyze the impact of specific word choices on meaning...

K-12 Science Standards

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Technology

- 5.d. Students ... use algorithmic thinking to develop a sequence of stems to create and test automated solutions.

Engineering

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Leadership/21st Century Skills:

<https://wa-appliedmath.org/>

21st Century Interdisciplinary themes (Check those that apply to the above activity.) <input type="checkbox"/> Global Awareness <input 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 <u>Creativity and Innovation</u> <input checked="" type="checkbox"/> Think Creatively <input checked="" type="checkbox"/> Work Creatively with Others <input checked="" type="checkbox"/> Implement Innovations <u>Critical Thinking and Problem Solving</u> <input checked="" type="checkbox"/> Reason Effectively <input type="checkbox"/> Use Systems Thinking <input type="checkbox"/> Make Judgments and Decisions <input checked="" type="checkbox"/> Solve Problems <u>Communication and Collaboration</u> <input type="checkbox"/> Communicate Clearly <input checked="" type="checkbox"/> Collaborate with Others	INFORMATION, MEDIA & TECHNOLOGY SKILLS <u>Information Literacy</u> <input type="checkbox"/> Access and Evaluate Information <input type="checkbox"/> Use and manage Information <u>Media Literacy</u> <input type="checkbox"/> Analyze Media <input type="checkbox"/> Create Media Products <u>Information, Communications and Technology (ICT Literacy)</u> <input type="checkbox"/> Apply Technology Effectively	LIFE & CAREER SKILLS <u>Flexibility and Adaptability</u> <input type="checkbox"/> Adapt to Change <input type="checkbox"/> Be Flexible <u>Initiative and Self-Direction</u> <input checked="" type="checkbox"/> Manage Goals and Time <input type="checkbox"/> Work Independently <input checked="" type="checkbox"/> Be Self-Directed Learners <u>Social and Cross-Cultural</u> <input checked="" type="checkbox"/> Interact Effectively with Others <input checked="" type="checkbox"/> Work Effectively in Diverse Teams	Productivity and Accountability <input checked="" type="checkbox"/> Manage Projects <input checked="" type="checkbox"/> Produce Results <u>Leadership and Responsibility</u> <input checked="" type="checkbox"/> Guide and Lead Others <input checked="" type="checkbox"/> Be Responsible to Others

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

Materials

- (for first day demonstration) Cups of different three different sizes (32 small, 16 medium, 8 large, for 8 groups).

Set-Up Required:

- Each group gets one set of different sized cups.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Cooperative Learning: Students will work in groups to implement new learning in creating equivalent algebraic expressions.

Expectations:

- Students will complete this lab over the course of the unit, which will be due at the end of the unit.

Timeline:

- 2 Weeks

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Students will learn how to optimize algebraic expressions based on given parameters, with a connection explicitly made in reference to coding.

Career Applications

- Computer science, other STEM fields which require working with any programming languages.

Optional or Extension Activities

- Researching simple programming languages and learning about actual examples of how code uses polynomials, and optimizes lines of code.

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