WAMC Lab Template

Math Concept(s): Understanding Rational Exponents By Counting Methods
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Attach the following documents:

- Lab Instructions

To warm up, students will be asked to count to 10. Most students will count to 10 by adding ones.

Wait several seconds, and some students will count by twos, fives and tens (TEN).

I will then give each student about 10 slips of paper. For each student, each slip of paper will have the same number (either a 2, 3 or 4). One of the numbers will be cut up into pieces corresponding to its value: one 2 will be cut in half, one 3 will be cut into thirds, etc.

Now I will ask the class if one can count to 10 by threes. The answer is yes! You can count by threes, but to land on the number 10, one must use a fraction of the three, so there are 3 and 1/3 steps to 10 if counting by threes. I will write on the board…

1+1+1+1+1+1+1+1+1+1 = 10 = 1*10
2+2+2+2+2 = 10 = 2*5
3+3+3+(1/3)(3) = 10 = 3*(3+1/3)

Then I will ask the students to count to 20… More examples:
4+4+4+4+4=20=5*4
8+8+(1/2)8=20=(2+1/2)*8

Then I will ask the students to count to 5 using 10's. Students will be confused. Hopefully someone says 5 is half of ten… so to count to 5 by using tens, you need to use half a 10.

(1/2)*10 = 5

I will change the format at this time: I will ask students to count by 2's to 16, but not by adding. Someone will ask what that means, but I won't say anything. I'll give them a minute or two to think about it. Hopefully, a student comes up with the idea that 16 can be reached by multiplying 2's

$2*2*2*2=16=2^4$

Exponents are a form of counting by multiplication, not by adding. Therefore, the traditional means of grouping numbers to form higher numbers doesn't work when it comes to multiplication. For the students with twos, I will ask them to set up what 2^4 looks like… what does it mean to have 2 sets of 2 sets of 2 sets of 2? Hopefully, they will eventually come up with the following:

Then I'll ask the groups with 3's to count to 27 and the 4's to count to 16 (3 sets of 3 sets of 3, and four sets of 4).

So, back to addition and fractions. Counting by 4's, 20 is 4+4+4+4+4, and counting by 10's, 5 is ½ of 10. ½ of 10 should only make sense when grouping by addition. But how does it work when using multiplication (and specifically, exponents). In other words, what does $16^{3/4}$ look like? What is ¾ of 16 when multiplying? Let's take a look…

Or maybe it looks like this…

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The same goes for $27^{2/3}$. 2/3 of 27 is 9 is you are counting by multiplication.

Exit Ticket Problems

1. What is .

2. What is the explicit form of a function that multiplies the input by 10 and adds 8 to the product to form the final product?

3. If $g(x)=x^2+4$, what is g(3)?

Example Quiz Problems

1. If f(3) = 5, what is the..
    a. Function's Name?
    b. The Input?
    c. The Output?
2. If f(x) = 3x-5, what is f(10) equal to?
3. How can we express a function that takes an input, multiplies it by 1/2 , then subtracts 5 from the result? (in case you didn't know, subtracting x from y can be written as y – x)

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

Lab Plan

Lab Title: Root of the Problem

Prerequisite skills: Numeracy, Problem Solving

Lab objective: Students will learn function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

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

Lab Plan

Lab Title: Human Vending Machine

Prerequisite skills: Numeracy, Problem Solving,

Lab objective:

Standards: *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*
Mathematics K–12 Learning Standards: F-IF.1 Understand the concept of a function and use function notation

Standards for Mathematical Practice:

- Standard Number 2 for High School: High school students seek to make sense of quantities and their relationships in problem situations. They abstract a given situation and represent it symbolically, manipulate the representing symbols, and pause as needed during the manipulation process to probe into the referents for the symbols involved. Students use quantitative reasoning to create coherent representations of the problem at hand; consider the units involved; attend to the meaning of quantities, not just how to compute them; and know and flexibly use different properties of operations and objects.

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

- 12 Sheets of Paper – Four with Food, four with numbers, four with functions

Set-Up Required:

- Make the sheets of paper
- Print the worksheets

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Student Leader will have the task of arranging the students in proper order.
- Notetakers will write additional notes for classmates and absent students

Cooperative Learning:

- Students will be interacting with each other when evaluating others' functions.

Expectations:

- Students will have a baseline understanding of function notation and how to evaluate a function.

Timeline:

- The entire lesson, including lab and assignment, should take an entire block period of 120 minutes. This is the first lesson in the unit (2 weeks, approximately).

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- UPC
- Computer Applications
- Search Engines
- Data Queries

Career Applications

- Computer Applications
- Engineering
- Science