Module 1 for Fundamentals of Algebra Whole Numbers Arithmetic Operations

**Diversity in Mathematics Objectives**

1. Prior to this lesson, it is highly recommended that instructor become acquainted with student interests via surveys (questions on hobbies, study habits, positive learning experiences, what they value most, what activities help them study/learn better).
2. Culturally responsive mathematics promotes student achievement by developing contexts that interest them and results in creating meaning. Allow student choice on country and subtopic selection.
3. Contextualize: Challenge students to work on higher-level tasks that incorporate adding and dividing in a context that will require them to be critical of possible social injustices or examine the effect of factors on wages.
4. Scaffold the lesson with historical context that provides information on cultural mathematical history and provides insight concerning global community.
5. Allow flexibility in classroom group activities, permitting students to form their groups or work individually if desired (respecting diverse learning styles). Provide options for all to share insight.
6. Design assessments/assignments that account for diverse learning styles and approaches (visual/written/verbal components)
7. Encourage students to explore strengths that fortify their application of math skills and embrace a growth mindset.

**Learning Objectives**

Student Learning Objective (University of Cincinnati)
*“Simplify numerical expressions using the order of operations, evaluate algebraic expressions for given values of variables; estimate the result of computations, and check answers for reasonableness.”*

Unit Objectives

* Apply arithmetic concepts for whole numbers by combining numbers and determining averages
* Investigate various wages associated to class related positions, gender, countries/locations (be prepared to compare currencies as well).
* Reflect on disparities and consider age/class/gender and other factors that may affect wages.

**Introduction (6-7 minutes)**

* Prior to conducting the lesson, “Recycle” mathematics: Have students address the first question in Activity handout – Part 1A.
* Instructor question prompts:

How can you use those “operations”, and what words communicate these “symbols”?

**Explicit Instruction/Teaching Modeling (20 minutes)**

* Explicit symbol/vocabulary translation work (Activity handout – Part 1B)

Have students figure out vocabulary association with operation symbols: … addition symbols, subtraction symbols, etc.

Think-pair-share opportunity (or individual) to list words associated with these symbols; follow up with whole-class discussion on these outcomes. Instructor completes any missing words critical for translation.)

Then write the following words on the board for Addition, subtraction, multiplication and division so that students practice translating words to symbols:

Addition: Result is sum. Key words are add, sum, total, increase, more than.

Examples: 5 added to x, 5 plus x, x increased by 5, 5 more than x …. are all x + 5 or 5+ x.

Subtraction: Result is difference. Key words are subtract, take away, decrease by, less (and less than), subtract from. CAUTION: order matters

Examples: Subtract 5 from x, 5 less than x, 5 subtracted from x, x less 5, difference of x and 5 , x take away 5, decrease x by 5 … are all x – 5.

Multiplication: Result is product (items multiplied are factors). Key words are multiply, times, product, double, triple.

Examples: Multiply x by 5, the product of 5 and x, 5 times x …. are all x5 or 5x. Double x is 2x, triple 5 is 3(5).

Division: Result is quotient. Long division symbols – inside have dividend, outside have divisor. Fraction form has numerator, dividend on top and divisor denominator below. Key words: divide, divided by, share equally, per, quotient.

Examples: Divide x by 5, x divided by 5, divide x equally among 5 people, the quotient of x and 5 … are all x/5. (Show multiple symbols.)

FYI: Some useful game websites on arithmetic operations:

<http://arithmetic.zetamac.com/>

<http://mental-math-trainer.com/>

* On the Activity handout, and have students reflect on the questions related to measurements in Peru (and Europe) and the cultural norm of approximating an ingredient. Give them a few minutes and then follow-up with class as a whole.

Context: Cooking (Activity handout – Part 1C)

Different cultures share recipes different ways. Verbal, written, visual…

This is an example of a Peruvian recipe for Ceviche.

Now ask students to (3) double the original recipe. (Pairs or individual work)

Then (4) Have students divide the original recipe by 2.

**Guided Practice/Interactive Modeling (25 minutes)**

* Refer Activity handout Part 1C, section 5. Give examples below and then have students create more basic examples to explain the properties.
Interactive Discussion
	+ Addition:
		- Possible steps for adding numbers like 756 and 39 (using carrying and digits).
		- Properties: adding 500 + 0 or 0 + 500 (addition property of 0 and commutative property of addition).

Adding x + 6x + 4x possibilities (x + 6x) + 4x versus x + (6x + 4x) (associative property of addition). Purpose of properties?

* + Subtraction:
		- Subtract digits starting in ones place, then tens place, and so on.
		- Show vertical subtraction and solicit feedback on visual difference between this and horizontal subtraction (use 756 – 32 as an example, then 756 - 39).
	+ Multiplication :
		- Ask how to deal with 250 + 250 + 250 + 250 for example.
		- Ask regarding steps used to double the original recipe Activity handout Part 1C.
		- Properties of multiplication ( 5 \* 0, multiplication property of 0; 5 \* 1, multiplication property of 1; 2 \* 250 vs 250\*2 commutative property of multiplication and 2\*3 \*10 as (2 \* 3) \* 10 vs. 2 \* (3\*10). Associative property of multiplication.
	+ Refer to different methods of long division that exist in other continents/countries
		- <http://www.showme.com/sh/?h=pVPM0ES>
		- Use their work to determine steps in dividing 500 by 2.
		- Now model an example like the quotient of 576 and 3 and have students try a few more problems (work with setup, multiplication and subtraction sidebar work and layout of long division.
		- Division properties of 0 and 1 (5/1, then 0/5 and 5/0).
		- Introduce determining an average.
* FYI: Possibly give a preview of future work with decimals 28.3495 grams in an ounce and .035274 ounces in one gram.
* Optional: For our whole number work APPROXIMATE and say that 28 grams are in an ounce to determine how to find out how many ounces of fish are required in Activity handout Part 1C.

**Activity/Assessment (20 minutes and at home portion)**

Refer to Activity handout

* Part 1B: Have students verbally share words associated with symbols (activity part 1b -- +, -, x, / ) Practice translation from words to arithmetic and algebraic expressions. Check sheets to see student responses.
* Have each student identify arithmetic and algebraic properties in part 1C table.
* Part 1D: Instructor will walk through the data and question for the first item, then students will work in pairs through the remaining questions. Remind students that item 5 should be unique for each student (individual work). If time permits, have some students go to the board and write down their response to item 5. This may be collected (part 1D) as a homework activity for the next class

**Review and Closing (2-3 minutes)**

* Recap symbols for operations and corresponding words that allow us to translate English to math language.
* Ask students to describe one of the properties discussed and its importance.
* Allow students to ask questions and/or write a question they wish to discuss further during the following session.
* Possible Online blogs – reflection on learning about different units, wage inequity in the US and wages/currency in other countries. Reflection on any mistakes they made with the words/symbols translation and what steps they can take to correct this in the future. (By introducing cultural evolution of symbols and counting, and using context of cultural food measurements, we allow students to consider creation of math and identifying with different possibilities – math identity creation.)