

FAME Lesson Plan Form

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Course Name: General Math

Grade: 8

Unit Title: Algebra, Integers, and Equation Solving

Purpose of the Unit: Model real-world situations through writing and evaluating numerical and algebraic expressions using a variety of strategies to predict, find, and check results.

Lesson Title: Order of Operations

Purpose of the Lesson: Use the order of operations to evaluate numerical expressions.

Grade level: 6-8

Subject and Strand: 8th grade Math/Number Sense

State Standards/Focal Points: MA.8.1.6.5/Number and Operations and Algebra (Grade 7)

Process Standards: Problem Solving, Communication, Reasoning & Proof, Connections, and Representation

Student objectives (What students will be able to do when they complete this lesson):

The students will be able to evaluate a numerical expression with more than one operation by following the rules for the order of operations.

How lesson will be introduced:

What ideas justify the statement: "Mathematics is a language"? When you hear the word language what do you think about? Language is a way that we are able to communicate to one another. The order of operations is the language of mathematics because it lets us know how numbers and operations fit together. Therefore the order of operations exists so that everyone solves the same problem the same way.

Use the word sort activity to incorporate a reading strategy (**Vocabulary Instruction**) within the lesson. The directions for the activity are: sort the words, categorize or group them, and be able to defend your answer. Make sure the students understand the terminology being used. The words are a review of vocabulary that has been used within previous grades.

Procedures to be followed in teaching lesson:

- 1) Introduction to the lesson including the word sort activity.
- 2) While the groups are completing the word sort activity walk around and listen to the discussions and ask some questions to get an idea of their thinking.
- 3) Have the students present their setup. (**Reasoning & Proof, Communication**)
- 4) Have the students work in groups and calculate ten problems without calculators using their reasoning from the word sort activity.
- 5) Once they have finished they will receive a calculator that uses the order of operations and calculate the problems again. Allow them time to discover the differences between their answers.
- 6) Have the groups present the differences found to the class. (**Communication, Connections**)
- 7) Present the mnemonic device, such as “PEMDAS – Please Excuse My Dear Aunt Sally”, be sure that students use it correctly. These are the ranks of operations. Parentheses outrank exponents, which outrank multiplication and division, which outrank addition and subtraction. Multiplication and division are the same rank as are addition and subtraction. The same ranks operate from left to right or which ever comes first.
- 8) Show the following visual to help clarify the misunderstanding of the rank/priority.

PEMDAS

P

E

MD

AS

- 9) Explain some of the other misunderstandings.
 - a. The role of the fraction bar is commonly misunderstood. The fraction bar acts like a grouping symbol. It has the effect of placing parentheses or brackets around the numerator and around the denominator.
 - b. Parentheses next to one another means multiplication, the number on the outside of parentheses means multiple, and a dot means multiplication. Show examples on the board.
 - c. When you have multiple sets of parentheses, you work from the inside out. Complete one step at a time and show your work.

- 10) Have the students work on the even numbered problems within the McDougal Littell Middle School Math 3 textbook. Lesson 2.1 pages 12-13 numbers 2-36.
- 11) Give them the Number Puzzles Activity from the McDougal Littell Course 3 Special Activities Book for homework. Review the directions and the first exercise with them. (**Problem Solving, Reasoning and Proof**)
- 12) Use the McDougal Littell Sunshine State Standards Support Book page 2 Order of Operations for a quiz grade.
- 13) Revisit problem 10 in the group exercises. Have the students write a verbal model and an equation to calculate the total cost (TC) for a family of (a) adults and (c) children to see a movie. (**Visual & Symbolic Representation, Problem Solving, and Connections** to the next lesson which is Variables and Expressions.)

Instructional materials to be used:

McDougal Littell Middle School Math 3 textbook, Sunshine State Standards Support Book, and Special Activities Book.

Graphing calculator

Interwrite board

TI Smart View software

Paper and pencils

Assessment tools to be used & how students will be assessed:

The word sort activity, the group problems, and the discussions will be used for the informal assessment.

The formal assessment will include the following:

Even numbered problems within lesson 2.1 pages 12-13 numbers 2-36

Homework – Number Puzzles Activity

Quiz - Order of Operations within the Sunshine State Standards Support Book

How assessment results will be reported:

Informal assessment will count towards the student's participation grade.

The formal assessments will be graded and put in their folders and grade book.

WORD SORT for Order of Operations

ADDITION	BRACKETS []	CURLY-BRACES { }
DIVISION	EVALUATE	EXPONENTS
FRACTION BAR	GROUPING SYMBOLS	MULTIPLICATION
NUMERICAL EXPRESSION	ORDER OF OPERATIONS	PARENTHESES ()
SIMPLIFY	SUBTRACTION	VALUE

Cut these ahead of time and put them in an envelope for the students to use. Tell them to sort the words, categorize or group them, but they must be able to defend why they did it.

Problems to complete within their groups:

Evaluate the expression.

1) $5 + 16 \times 3 \div 6$

2) $(14 + 8) \div 2$

3) $\frac{9 \times 9}{6 \div 2}$

4) $3 [(11 - 1) \div 5]$

5) $\frac{45 + 19}{2 \times 8}$

6) $16 - 6 + 2 \times 4$

What is the value of the expression?

7) $54 \div 3 - 3 \times 2$

8) $6^2 + 48 \div (5 - 3)^3$

- 9) Mary bought 2 shirts for \$8 each and 3 pairs of pants for \$11 each. She paid with a \$50 bill. Which expression shows how much change she received?

- a) $50 - 2 \times 8 + 3 \times 11$
- b) $2 \times 8 + 3 \times 11 - 50$
- c) $50 - (2 \times 8 + 3 \times 11)$
- d) $50 - 5(8 + 11)$

- 10) A family of 2 adults and 5 children are planning to go to a movie. The cost of an adult ticket is \$8.50. The cost of a children's ticket is \$5.00. How much money will it cost for the family to see the movie?

Number Puzzles Activity from McDougal Littell Course 3 Special Activities Book

Use any combination of the operations +, -, ×, or ÷, and any combination of the grouping symbols (), [], or fraction bars to write an expression that equals the number given. The first exercise shows one possible equation.

- 1) Use six 2s to equal 14. $\underline{2 \times (2 + 2 + 2 + 2) - 2}$
- 2) Use four 3s to equal 7. _____
- 3) Use six 2s to equal 13. _____
- 4) Use four 4s to equal 3. _____
- 5) Use four 5s to equal 2. _____
- 6) Use four 8s to equal 1. _____
- 7) Use five 6s to equal 3. _____
- 8) Use four 7s to equal 14. _____

Order of Operations

Support for GLE MA.A.3.3.2.8.4

EXAMPLE Use the order of operations to evaluate the expression $6 \times 3 + 12 \div (4 - 2)$.

Solution

$$6 \times 3 + 12 \div (4 - 2) = 6 \times 3 + 12 \div 2$$

$$= 18 + 12 \div 2$$

$$= 18 + 6$$

$$= 24$$

Evaluate inside parentheses:
 $(4 - 2) = 2$.

Perform multiplication and division from left to right:
 $6 \times 3 = 18$.

Perform division:
 $12 \div 2 = 6$.

Perform addition:
 $18 + 6 = 24$.

Exercises

Evaluate the expression.

1. $24 \div 3 \times 2 + 10$ 2. $2(6 + 4) - 15 \div 3$ 3. $(3 \times 10) \div (4 + 1)$

4. Evaluate $(8 + 2 \times 5 + 3) \div (9 \div 3)$. Explain how you found the answer.

5. In what order should the operations be performed in the expression $6 \times (5 - 2) + 12 \div 4$?

- (A) $\times, -, +, \div$ (B) $\times, +, +, -$ (C) $-, \times, \div, +$ (D) $-, +, \times, \div$

6. Which expression has a value of 30?

- (F) $24 + 6 \div 2 \times 3 - 1$ (H) $(24 + 6) \div 2 \times 3 - 1$
(G) $24 + 6 \div (2 \times 3) - 1$ (I) $24 + 6 \div 2 \times (3 - 1)$

7. Which expression can be used to find the total cost of 3 picture frames that cost \$4 each and 2 picture frames that cost \$8 each?

- (A) $3 \times 4 + 2 \times 8$ (B) $3 + 4 \times 2 + 8$ (C) $5(4 + 8)$ (D) $12(3 + 2)$

8. Ruth and Carl play table tennis. They play one game that lasts 12 minutes, and 4 more games that last 7 minutes each. For how many minutes do they play table tennis?

9. For a special event, chairs are set up in the school gymnasium in 2 sections. One section has 14 rows of 10 chairs per row and the other section has 12 rows of 8 chairs per row. How many chairs are set up for the event? Write an expression that describes the situation. Then evaluate your expression to find the answer.

