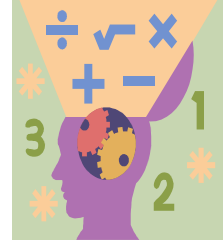# Algebra/Geometry Institute Summer 2007

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Order of Operations

I. Teaching Objective(s)
The student will be able to find the value of expressions using the order of operations.

II. Instructional Activities
- The teacher will start class by connecting to prior knowledge of things that come in order.
- Ask students what do people do at a traffic signal? (They stop on red, prepare to stop on yellow, and go on green.)
- Ask students what would happen if there was no rule about what the colors mean? (There would be more collisions at busy intersections.)
- Ask students if everyone decided to stop on yellow, go on red, and prepare to stop on green would that work? (Yes)
- Encourage students to list other situations where rules and order are important such as in courtrooms, legislatures, and games.
- Tell students we will now learn about the order of operations.
- Explain to students that the order of operations has to be done through a certain order just as the traffic light.
- Explain the rules to students.
- Do all operations in parenthesis first.
- Work exponents.
- Multiply and divide in order from left to right.
- Add and subtract in order from left to right.
- Tell students to help us remember these rules we will create a mnemonic device for remembering the order of operations.
- Have students write **PEMDAS.**
- Explain to the students what rule goes with each letter.

  P = Work parenthesis first
  E = Work exponents
  M= Multiply
        (Multiply and Divide in order from left to right)
  D = Divide
  A = Add

           (Add and Subtract in order from left to right)

S = Subtract

- Use the phrase **Please Excuse My Dear Aunt Sally** as your mnemonic device.
- Encourage students to create their own mnemonic device for remembering the order of operations.
- Try various sample problem allowing students to verbally evaluate the expression.

Example:

- ✓ Use the expression $3 + 2 \times 5 \times 4$
- ✓ Ask students what would you do first? Why? (Multiply 2 and 5; it's the first multiplication from the left)
- ✓ Ask students what would you do next? (Multiply 10 and 4)
- ✓ What is the last step? (Add 3 and 40)
- ✓ What is the final value? (43)

- Explain to students how important it is to follow the rules.
- Tell students we will work several problems containing an exponent.

Example:

- ➤ Use the expression $(10 - 8)^4 \times 3$
- ➤ Ask students what would you do first? Why? (Work parenthesis. $10 - 8 = 2$)
- ➤ Ask students what would be the next step? (Work exponent $2^4 = 16$)
- ➤ What's the next step? Why? (Multiply 16 and 3)
- ➤ What is the final value? (48)

- Have students work 4 numerical expressions independently. Answers

	Answers
1) $2 \times (4^2 - 5)$	22
2) $5 \times 3^2 - 10$	35
3) $3^3 - 2^4 + 30$	41
4) $12 \times (60 - 2^5)$	336

- Allow students time to complete given numerical expressions.
- Draw names from the popsicle stick jar for students to show how they solved the numerical expression.
- Praise students for a job well done.
- Ask students to name some key words that were used today.
- Allow students time to brainstorm for terms.

- Once students have had time to express themselves, explain to the students the key terms that they will need to know.
- **Order of operations** – the order in which one calculates numbers.
- **Numerical expressions** – contains only numbers and operation symbols.
- Explain all terms to students fully, and answer all questions by students.
- Tell students they all did a good job!

Cooperative Learning

- Tell students taped under their desk is a colored card.
- Have students group according to their color card.
- Tell each group they will work to create a numerical expression with only one answer and be prepared to defend it.
- Explain to each group that they will explain their answer using the **PEMDAS** formula and describe how they arrived at their answer.
- Have students also devise a numerical expression to exchange with other groups.
- Remind students that each group must have a numerical expression, with at least three different operations.
- Allow students 10-15 min to create, exchange, and evaluate their numerical expressions.
- Check student's results, and allow time for questions and feedback.

III. Materials and Resources
Paper
Pencils
Colored cards
Popsicle sticks (names)
Middle Grades Math Tools for Success, Prentice Hall 2001

IV. Assessment
➢ The teacher will observe the students to assess their understanding of the order of operations.
➢ The students will also make a journal entry describing the process they took to evaluate their numerical expression.