

Unit: Tools of Algebra

Big Idea: The order in which we multiply in an expression affects the outcome.

Literacy Strategy: Anticipation Guide

Lesson: Order of Operations

Idaho Content Standard #1: Number and Operation

Learning Objectives:

Students will be able to solve basic problems using $*$, $/$, $+$ and $-$, without a calculator.

Students will be able to solve problems using grouping symbols and exponents.

Students will understand the difference between **simplify** and **evaluate**.

Lesson Context: This will be a beginning of the year assessment/review of order of operation concepts. Before this lesson I will review variables and algebraic expressions. After this lesson I will review the real number line.

Instructional materials: Algebra 1 Text Book page 9 and 10.
Anticipation Guide Handout

Procedures:

Engage/Introduction: (5 min)

Show them pictures of different animals in the area/United States. Have the students name them.

EX/ Robin. Discuss how different parts of the world have a different common name for the same organism. Discuss how scientists solve this problem... scientific names.

Mathematicians must also have a common language or order of operations.

Explore/Learning Activities: (40 Min)

Tell them to read the directions carefully and begin without using your text books and without talking to your neighbor. Give them the Anticipation Guide.

Step 1: Put down T/F. No talking. Do not solve the problem.

Step 2: Use the book to scratch-out and change answers. Write down the place on page 8 or 9 that made them change their mind. NO TALKING! NO PARTNERS!

Step 3: Compare their answers **with a partner**. Change any answers but note the place in the text that caused them to change their mind.

Step 4: Solve #3-10 of the Anticipation Guide. NO PARTNERS!

Step 5: Compare answers **with a partner** and change answers if needed.

Step 6: Go over answers as a class. **Group discussion.**

Step 7: Use group discussion on problems where they use grouping symbols to make a given math problem true. Example: $3^2 + 9 / 9 = 2$ *Where should the parenthesis go?

Closure: (5 min)

Journal Entry: Why is it important to have order of operations?

Explain the difference between simplify and evaluate?

LIMSST Project Literacy Lesson Reflection Form

Name: _____

401

Date lesson was taught: 8-26-2010

Lesson Title/Topic Area(s): Order of Operations

Anticipation Guide

Literacy Emphasis:

(Please discuss the literacy strategy(s) you embedded in this lesson. How do the strategies support student thinking and meaning making? Be specific and use as much detail as possible.)

Anticipation Guide

By having the students answer the true/false questions before notes or reading the examples, they must show their prior knowledge at the beginning of the assignment. They read the text to see if their answers are correct and then list specific areas of the text that made them change their answer if they do so. They use this information to actually solve the algebraic expressions later in the class period.

Student Response to the Lesson:

(Describe the nature of student engagement in the math/science content presented in the lesson. How effective was the strategy at supporting student reasoning? Describe evidence that the students were making sense of the content presented.)

The students worked hard trying to figure out the T/F and then they were reading the pages in the math book to see if they actually were correct. By having them discuss their answers with a small group, they could be assured their answer was correct and argue their point if there was a disagreement. They love to argue "why" they have the correct answer. They had to support their reasoning to get others to change their minds. I was able to see their work and know if they were making sense of the material and it was interesting to hear them explain their thinking... right or wrong... during the discussions.

Lesson Reflection:

(What worked well with this lesson? What challenges did you encounter in this lesson? How would you change certain aspects of the lesson or the questions that you asked? How does this influence future lesson planning?)

I think the students were able to think about the order of operations rules they learned in the past, and confirm or change their thinking "on their own" rather than copying the rules down in their notebooks.

Next year I will cut the number of problems from 10 to 8. My learning objective will still be able to be achieved and time will be saved for more discussion, guided practice etc.

I will have them add the order of operation rules in their notebooks at the end of the hour next year and give them a homework assignment on this lesson.

I ended up taking two days on this section this year. I was not completely sure they had enough practice to get the rules to "sink in." I have never used an anticipation guide before. I liked how the guide enabled me to see and hear how the students are thinking.

I also think I could make this a note taking activity. I would like for the students to have this information available in their notebooks or journals. I allow them to use their journals to fix missed test question for half credit. I could project these same questions for them to copy in their notebook and do the activity the exact same way.

Elements of effective instruction: (Describe how the lesson addresses each of the following. If not applicable, explain.)

1. Describe how the lesson fosters intrinsic motivation to learn.

By relating how scientists and mathematicians need a common language, the students will understand the importance of having everyone follow the same mathematical rules. I'm not this makes them want to learn the rules but they do understand the reasoning behind having rules.

2. Describe how the lesson elicits students' prior knowledge.

By having the students answer the true/false questions before notes or reading the examples, they must show their prior knowledge at the beginning of the assignment.

3. Describe how the lesson intellectually engages the students in making meaning of the targeted math/science content.

They read the text to see if their answers are correct and then list specific areas of the text that made them change their answer if they do so. Then they use this information to actually solve the algebraic expressions later in the class period.

4. Describe how students:

- *Science:* Use evidence to support and/or critique claims.
- *Math:* Explain and justify their reasoning.

They do this by listing the areas in the text that justify their changed answers. They also justify their reasoning to a partner and to the class through discussion.

5. Describe how the students engage in making sense of the material covered in the lesson.

They discuss their answers in pairs after completing the true/false and the evaluate portions of the assignment. We also discuss the problems in the guide as a class. They also write in their journals.

Student Work:

Include samples of student work from the lesson (include and clearly label examples of high, medium, and low quality). *Remove student names before submitting.*

Reflection:

Relationship to Previous Instruction:

(Have you taught this lesson/topic prior to the LIMSST project? If so, how did your teaching of this lesson differ from what you taught before? How did students' reactions to this lesson differ?)

I have taught this topic for past 15 years. In the past, I listed the rules, showed examples, and gave them the assignment. I questioned them as group during lecture but never in partners and have them find the rules in the text. The students were engaged the whole class hour and were surprised when it was time to go. I think the students enjoyed the lesson.

Anticipation Guide: Order of Operations Name: _____

Before reading in your text book: Decide whether the statements below are T or F. Do not leave any blank. Turn your paper over when you finish writing T or F.

During or after reading pages 9 and 10 in your text book: Cross out and change any responses you now believe to be incorrect. Use the space under the each question to note the location of text you have found information to support your thinking (change). Be ready to prove your interpretation.

_____ 1. If a numerical expression is evaluated, a variable is seldom in the solution.

_____ 2. If a numerical expression is simplified, a variable is seldom in the solution.

_____ 3. $2 + 3 * 4$ Addition is the first step in correctly solving this numerical expression.

_____ 4. $2^3 + 4^2 / 8$ Two to the third power is the first step in solving this numerical expression.

_____ 5. $6 / 3 + 2 * 5$ Addition is the second step in solving this numerical expression.

_____ 6. $(10^2 - 4 * 8) / (8 + 9)$ Division is the fifth step in solving this numerical expression.

_____ 7. $3 + 100 / 5 (6 + 2^2)$ Multiplying by 5 is the third step in solving this numerical expression.

_____ 8. $9 + [4 - (10 - 9)^2]^3$ Simplifying 9 squared is the first step in solving this numerical expression.

_____ 9. $5 + (24 / 3) * 7^1$ Simplifying 7 to the first power is the first step in solving this numerical expression.

_____ 10. $(8^2 - 4) / (5 * 6)$ Subtraction is the second step in solving this numerical expression.

Name: _____

1-2 Quiz

Order of Operations

15

(5 points each)

1. If a numerical expression is evaluated, a variable is seldom in the solution. T/F

2. Evaluate $2 + 3 * 4$

3. Evaluate $3 + 100 / 5 (6 + 2^2)$

Revised
for next year

Anticipation Guide: Order of Operations Name: _____

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B. During or after reading pages 9 and 10 in your text book: Cross out and change any responses you now believe to be incorrect. Use the space under the each question to note the location of text you have found information to support your thinking (change). Be ready to prove your interpretation.

C. Solve the numerical expressions #3-8.

True/False
Answers

- _____ 1. If a numerical expression is evaluated, a variable is usually in the solution.
- _____ 2. If a numerical expression is simplified, a variable can be in the solution.
- _____ 3. $2 + 3 * 4$ Addition is the first step in correctly solving this numerical expression.
- _____ 4. $2^3 + 4^2 / 8$ Two to the third power is the first step in solving this numerical expression.
- _____ 5. $6 / 3 + 2 * 5$ Addition is the second step in solving this numerical expression.
- _____ 6. $(10^2 - 4 * 8) / (8 + 9)$ Division is the fifth step in solving this numerical expression.
- _____ 7. $3 + 100 / 5 (6 + 2^2)$ Multiplying by 5 is the third step in solving this numerical expression.
- _____ 8. $9 + [4 - (10 - 9)^2]^3$ Simplifying 9 squared is the first step in solving this numerical expression.