Go Ahead, Make My . . . Number

Order of Operations

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Published by *K20 Center*

Grade Level	6th – 7th Grade	**Time Frame**	2-3 class period(s)
Subject	Mathematics	**Duration**	90 minutes
Course	Middle School Mathematics		

Essential Question

Why does order of operations matter in mathematics?

Summary

This lesson uses mathematical manipulatives to engage students in learning how to use the order of operations for finding solutions to simple expressions. Students will explore concepts by playing three games to work with order of operations and to help develop computational fluency.

Snapshot

Engage

Students engage in the game Four 4's where they are asked to use four 4's and any operations they wish to obtain a whole number between 0 and 20.

Explore

Students use dice as a manipulative to explore and better understand order of operations and build computational fluency.

Explain

Students trade problems with a partner to check for accuracy and clarify misconceptions.

Extend

Students extend their learning by playing the game Target Number, which is similar to Four 4's but with more variation.

Evaluate

Students use the I Think/We Think strategy to make sense of the order of operations while watching a short clip of “Ma and Pa Kettle.”

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

N 201: Perform one-operation computation with whole numbers and decimals

Oklahoma Academic Standards Mathematics (5th Grade)

5.A.2.1: Generate equivalent numerical expressions and solve problems using number sense involving whole numbers by applying the commutative property, associative property, distributive property, and order of operations (excluding exponents).

Oklahoma Academic Standards Mathematics (5th Grade)

6.A.2.1: Generate equivalent expressions and evaluate expressions involving positive rational numbers by applying the commutative, associative, and distributive properties and order of operations to model and solve mathematical problems.

Oklahoma Academic Standards Mathematics (5th Grade)

7.A.4.1: Use properties of operations (associative, commutative, and distributive) to generate equivalent numerical and algebraic expressions containing rational numbers, grouping symbols and whole number exponents.

Attachments

- I Think, We Think - Go Ahead, Make My Number--Spanish.docx
- I Think, We Think - Go Ahead, Make My Number--Spanish.pdf
- I Think, We Think--Go Ahead, Make My . . . Number.docx
- I Think, We Think--Go Ahead, Make My . . . Number.pdf
- Operation and Number Cards--Go Ahead, Make My . . . Number.docx
- Operation and Number Cards--Go Ahead, Make My . . . Number.pdf
- Parenthesis Cards--Go Ahead, Make My . . . Number.docx
- Parenthesis Cards--Go Ahead, Make My . . . Number.pdf
- Presentation Slides -- Go Ahead, Make My . . . Number.pptx

Materials

- Parentheses Cards, printed and each parenthesis cut out individually (attached, 1 per pair of students)
- I Think, We Think Handout (attached, 1 per student)
- Operations and Number Cards (attached, optional instead of dice)
- Random polyhedral dice (4 per pair of students)
- Operations dice (3 per pair of students)
- Pencils and paper

30 minutes

Engage

Display **slide 3** and ask a student to pick a whole number between 0 and 20. Write the number on the board. Let students know they will work with their neighbor on this task.

Explain to students that their goal is to use the four 4s and any operations they wish (addition, subtraction, multiplication, division) to make the number on the board.

Walk through an example or two on the board to show what is expected. If the number is 15, students could take 4·4–4/4. This would give them 16–1 = 15. Another example would be that if the number is 0, students could use 4+4–4–4=0.

Four 4's were used in each example, and the chosen number was obtained.

Play a few rounds of this game to get students in the mindset of arranging the number 4 in different ways to get the target number.

Guidance

Some students might ask if they can use radicals, exponents, parentheses, etc. These can all be permissible, but the exact rules that you employ are up to your discretion. If your students have already become familiar with the Order of Operations, they should be encouraged to practice putting parenthesis in the correct location. Also, some numbers are more challenging to get to than others. If you notice students getting frustrated, feel free to pause and work out the solution as a whole class.

Display **slide 4**. Once a few student pairs find a solution, ask one or two representatives to come to the board to write out their solutions.

Move to **slide 5** and go over the Order of Operations. You will next add parentheses or brackets around students' operations. Compare the answers to what they would be if they followed the Order of Operations rules so that they can begin seeing how the order of operations works.

For example, if a student comes to the board and writes out 4+4/4+4=1, (4+4) and (4+4) to make this equation true. Explain that without the parentheses, if you used order of operations, you'd have to divide 4/4 first to get 1. Then 4+1+4 would be 9. Adding brackets or parentheses enables us to prioritize certain operations over others. The operation enclosed in parentheses takes precedence in the order of operations.

Go over the essential question and learning objective for this lesson on **slide 6** and **slide 7**.

40 minutes

Explore

Explore/Explain Spiral

This lesson's Explore phase will consist of three rounds. Each round will be followed by an Explain phase. In other words, you'll have students play one round of the game and then follow it with one round of explaining (described below).

Students will continue working with their partners on this exploration. Display instructions on **slide 8**.

Ask students to take out a sheet of paper to record their work. Distribute four random polyhedral dice, a set of parentheses cards (printed and individually cut from the lesson attachments), and three operational dice to each pair. Do not distribute red dice. These will be used later in the Extend activity.

Explain to students that they will take turns rolling dice and creating expressions for their partner to solve. Ask students to determine which partner is Student 1 or Student 2.

Directions for Student 1:

1. Roll one random polyhedral die.
2. Roll an operation die, placing it to the right of the first polyhedral die.
3. Roll another polyhedral dice and place it to the right of the operation die.
4. Continue this process until all four dice have been rolled.
5. If students wish, they can insert the parentheses anywhere in the expression.

Student 1 will work to solve the problem they have created.

Optional Facilitation with Cards Instead of Dice:

If you don’t have easy access to any of the dice used for this lesson, you can use the operation and number cards instead. Print, cut, and laminate (optional) at least 1 page of operations and 2 pages of number cards for each student pair. Students will shuffle the operation cards separate from the number cards and draw four of each type. Parentheses cards can be drawn and added as much as desired.

30 minutes

Explain

Move to **slide 9.** Ask student 2 to look at the solution and check for accuracy.

If there are mistakes, ask both students to work together to figure out where they are and help one another clarify misconceptions that they might have had about how the expression could be solved. To help keep this process positive, ask students to use I Notice/I Wonder language. So, instead of saying something like, "*That's wrong; do this!*" encourage them to say instead, "*I notice you did ____; I wonder what would happen if you had tried____*."

Once each pair of students has completed a round and is happy with their solution, have each pair share with the class what dice they rolled and how they solved it. If the class is large, have each pair join with another pair and share what dice they rolled and how they solved it.

Once students have agreed that the solution is accurate, have them go back to the Explore activity. Display **slide 10** and switch roles. Student 2 will now solve the equation, and Student 1 will check their work.

Continue this process for three or four rounds, or until you feel that students are grasping the concept.

40 minutes

Extend

To extend their understanding of the order of operations, ask students to play a game called *Target Number*. This game is similar to the Four 4's game. Students will try to combine operations to hit a target number.

Have students remain with their partner to play the game. They will keep all the dice and parentheses they already have, and you will distribute one additional red die to each pair. Explain to students that this red die represents their target number.

An Extra Challenge

If you have additional dice left over, feel free to add more operations and more numbers for an extra challenge—especially if you feel that students could use an extra push in their learning.

Display **slide 11** and instruct students to roll the red target number die and set it to the side.

Next, have students roll their remaining dice. The goal for students is to rearrange the numbers and use operations in any form to get as close to the target number as possible. Students can also use their parentheses if they choose to do so. Play at least three or four rounds of *Target Number*. Feel free to play longer if you think students need more practice.

40 minutes

Evaluate

To evaluate students' understanding of the order of operations, show a short video of Ma and Pa Kettle. As students watch, their goal is to determine what Ma and Pa Kettle are doing and determine if they are correct in their thinking.

Embedded video
https://youtube.com/watch?v=jSrPlf4GBHc

https://www.youtube.com/watch?v=jSrPlf4GBHc&t=9s

Display **slide 12** and pass out a copy of the **I Think/We Think** handout to each student. Or ask students to make their own I Think/We Think chart by drawing a line down the middle of a sheet of paper and labeling the left side "I Think" and the right side "We Think."

Explain to students that they will watch a Ma and Pa Kettle clip (on **slide 13)** twice. After the clip is shown once, ask students to write down individually on the "I Think" side of their papers, what they think is happening in the clip without talking to their partner. You can prompt students with the following questions:

- What did you notice in the clip?
- What did Ma and Pa Kettle do?
- Why do you think they did this?

The clip of Ma and Pa Kettle is linked here.

Once students finish writing, show the clip one more time. Ask students to pay attention to Ma and Pa Kettle's reasoning. After the clip plays through a second time, have students work with their partner to complete the "We Think" portion of their evaluation. Here, students can talk freely to their partner about what they think is happening.

Solicit some responses from the class.

Ask students to turn in their "I Think/We Think" reflections before they leave class.

Resources

- Boaler, J. (2018). The four 4's. https://www.youcubed.org/tasks/the-four-4s/
- K20 Center. (n.d.). I notice, I wonder. Strategies. https://learn.k20center.ou.edu/strategy/180
- K20 Center. (n.d.). I think/we think. Strategies. https://learn.k20center.ou.edu/strategy/141
- Petrovic, Walter D. (2014, January 17). *High Math by Ma and Pa Kettle.* [Video]. YouTube. https://www.youtube.com/watch?v=jSrPlf4GBHc