General Information

Lesson Parts & Duration

Total Duration: 1 to 1 ½ hours

- Activity: Backwards Numerical Evaluation

Subject(s)

- Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols (5.OA.A.1).

Objective

- Students will be able to apply previous knowledge about the order of operations (PEMDAS).
- Students will be able to evaluate numerical expressions with parentheses, brackets, and braces.
- Students will be able to come up with their own examples of numerical expressions using these symbols.

Materials

- blank paper (as much as needed per student)
- pencil & crayons/colored pencils
- whiteboard & markers
- **Optional:** printable "Exit Slip" (page 5)
- **Optional:** printable "Break Up Your Day" brain/movement break ideas (page 6)

Instructional Setting

- Students should be seated with or near another student for partner work.

Throughout this lesson, you will find:

- ***Scripted Text*** indicates things that need to be said directly. Bullets starting with a **"T"** followed by *italicized type* indicate scripted text
- **Clarifiers** within scripted text are in orange
- **Teacher Directions** indicate things you should be doing
- **Side notes** provide helpful hints, ELL strategies, differentiation and information
- **Break Up Your Day** (Brain/Movement Breaks) are in green boxes (at the end)

Remember!

Quality over quantity. All components do not have to be accomplished; lessons may be ended at any time and resumed later.

Instructional Plan: 60-90 minutes

Introduction

- ***T*** *Today we will talk about numerical expressions and how we can read them correctly.*
- ***T*** *You know how when we learn to read, we learn that each punctuation mark gives our text different meaning.*
- ***T*** *These punctuation marks tell someone what needs to be done, like when a reader sees a comma, they know they must pause or end punctuation like a period tells a reader to take a longer pause.*
- ***T*** *Similarly, in math, we use symbols as well; for example, a plus sign and a minus sign.*
- ***T*** *But you may already know that there are some other symbols as well.*
- ***T*** *Can anyone think of an example of another mathematical symbol?*
- ***T*** *Turn and tell a partner sitting next to you all of the mathematical symbols that you know.*

Provide about 30 seconds for students to discuss. Monitor to ensure student conversations are on topic.

- ***T*** *Who would like to share their answers with the class?* **Call on several students.**
- ***T*** *Addition sign, subtraction sign, multiplication sign, division sign, fraction line, percentage, decimal point, exponents.*
- ***T*** *All these are symbols that mean that we need to calculate something.*
- ***T*** *We also use symbols like parentheses, brackets, and braces to help us separate our expression into different groupings.*
- ***T*** *There is also a particular order to solve when using these symbols.*
- ***T*** *When using the order of operations we first solve the parentheses ( ), then the brackets [ ], and last the braces { }.* Draw these on the board for students to use as a reference later.

Backwards Activity

- ***T*** *Now it is time to see how we can apply that knowledge and solve a backwards problem.*
- ***T*** *It will be something like Jeopardy – I will give you an answer and then you will have to come up with the numerical expression that needs to be solved to get that answer.*
- ***T*** *However, there are some rules for this game.*
- ***T*** *First, there is no one single correct numerical expression that will yield the answer.*
- ***T*** *Does this mean we will have multiple ways to solve the problem?* **Wait for a whole class answer.** Answer: Yes
- ***T*** *Second, you need to have at least 5 numbers in the numerical expression, otherwise it would be too easy.*
- ***T*** *So, if I gave you the answer of 18 an example of a correct answer might be 5 + 4 x 6 – 5 x 2.* Write example on board for students to model their answers after.

  5 + 4 x 6 – 5 x 2.
  24 10
  5 + 24 – 10 = 18
- ***T*** *So, how many numbers do you need in your expression?* **Wait for a whole class answer.** Answer: 5
- ***T*** *Another rule is you need to show two different numerical expressions that yield the same answer, but have different numbers and different placement of the symbols, if you choose to add symbols.*

  [5 + (4 x 6)] – 5 x 2.
  24
  5 + 24 = 29
  29 – 5 x 2
  29 – 10 =
- ***T*** *You will earn 5 points per correct numerical expression.*
- ***T*** *So, if both of your numerical expressions are correct, you can earn a total of 10 points.*
- ***T*** *Then, you can also earn 2 bonus points if you are able to create an expression that includes two out of the three symbols – parentheses, brackets, and braces. How many symbols do you need in your numerical expression to earn 2 extra points?* **Wait for a whole class answer.** Answer: 2

- ***T*** *To sum it up, you need two different expressions and at least 5 numbers in each numerical expression.*
- ***T*** *To earn additional bonus points you need to use at least 2 out of the 3 types of symbols (parentheses, brackets, and braces in each).*
- ***T*** *After you work on these problems, you and your partner will exchange your paper with another group and check their work.*
- ***T*** *The other group will be awarding you with points for each correct expression and bonus points if 2 symbols are included in your numerical expression.*
- ***T*** *If the partners you have switched with made a mistake, discuss it with them and identify the issue.*
- ***T*** *We will also look at a few examples together on the board to make sure that we all understand the procedure.*
- ***T*** *After we are done with the activity, we will continue by thinking about how numerical expressions with parentheses, brackets, and braces can be used in real life. Any questions before we start?*

Rules:
1.) Must have 5 numbers
2.) Must write 2 different expressions per answer.

Scoring Points
- 5 Points for each correct numerical expression containing 5 numbers
- 2 Bonus Points if correctly used 2 symbols (parentheses, brackets, & braces)

Give each student a piece of paper.

- ***T*** *I will write the answers on the board. Remember, you have to go backwards and make up your numerical expressions from there.*
- ***T*** *The first answer is 72.*
- ***T*** *The second one is 44.*
- ***T*** *The third one is -28.*
- ***T*** *The fourth one is 177.*
- ***T*** *And the fifth one is 99.5.*
- ***T*** *Get your pencils ready and go!*

Differentiation:
Pair struggling students with a partner. If the whole class appears to be solid on the concept, you may want them to complete this task independently.

Allow enough time to complete this task. Monitor students and provide assistance as needed.

- ***T*** *Now exchange your papers with another group and look thoroughly through their solutions.*
- ***T*** *If something is unclear, do not hesitate to ask them.*

Note:
If some students are finished earlier than others, give them a couple more answers to work on: 243 and 13.

Allow enough time to complete this task. Monitor students and provide assistance as needed.

- ***T*** *Now I would like us to take the opportunity to share our many solutions for each answer.*
- ***T*** *This will help you to clearly see that there is always more than one way to solve a problem!*
- ***T*** *Who would like to share?* Call on a few students and write down their numerical expressions. Ideally, have the students walk the whole class through their solutions on the whiteboard. This will take some time for all 5 answers and their numerical expressions.

Real Life Application

- ***T*** *We practiced using a lot of numbers that we cannot connect with our real-life experiences.*
- ***T*** *But let's stop for a moment and think, what are some occasions where we have to add, subtract, multiply and divide several numbers at once?*
- ***T*** *I may need to group these numbers in my numerical expression using imaginary parentheses, brackets, and braces.*
- ***T*** *Let me give you an example of what I mean.*

- ***T*** *I am going to the grocery store and I need to buy the following items: 4 bananas and each one weighs 120 grams; 2 apples and each one weighs 80 grams, and 3 boxes of strawberries with 500 grams in each. I want to buy all these things twice and separate them – one time for me and one time for my brother.*
- ***T*** *How many* ***kilograms*** *will that be in total?* Write example on the whiteboard.
- ***T*** *How can I write this using a numerical expression with grouping symbols?* Call on a few students to give their guesses. Write their ideas on the board. The correct answer: 2[(4 x 120) + (2 x 80) + (3 x 500)]/ 1,000 = 2[480 + 160 + 1500]/1,000 = 2x2,140/1,000 = 4,280/1,000 = 4.28 KG
- ***T*** *I would like you to come up with a similar scenario and support it with a numerical expression with parentheses, brackets, and braces.*
- ***T*** *I will leave my example on the board to help you as you create a similar scenario and support it with a numerical expression using parentheses, brackets, and braces.*

Give time to complete this task. Monitor students and provide assistance as needed.

- ***T*** *After you are done with your scenario and the corresponding numerical expression, I will collect your papers.* Collect papers and use them as exit slips for this segment. Give them to the teacher to review.
- ***T*** *Eyes on me in 5...4...3...2...1...0. Thank you!*
- ***T*** *We are done with this lesson, so let us get up and move around a little bit!*

Make sure to "Break Up Your Day!"

Now is a great time to take a break and get students re-energized.

See our list of engaging movement and brain break ideas to get your students moving and ready to refocus! (see page 6)

Name: _____Date: _____

Exit Slip:
Order of Operations: Real Life Application
PEMDAS

Directions: Create a scenario that involves use of at least 2 of the 3 symbols, parentheses, brackets, and braces. Then show the corresponding numerical expression.

Example: *I am going to the grocery store and I need to buy the following items: 4 bananas and each one weighs 120 grams; 2 apples and each one weighs 80 grams, and 3 boxes of strawberries with 500 grams in each. I want to buy all these things twice and separate them – one time for me and one time for my brother. How many* ***kilograms*** *will that be in total?*

Numerical Expression: 2[(4 x 120) + (2 x 80) + (3 x 500)]/ 1,000 = 2[480 + 160 + 1500]/1,000 = 2x2,140/1,000 = 4,280/1,000 = 4.28 KG

Name: _____Date: _____

Exit Slip:
Order of Operations: Real Life Application
PEMDAS

Directions: Create a scenario that involves use of at least 2 of the 3 symbols, parentheses, brackets, and braces. Then show the corresponding numerical expression.

Example: *I am going to the grocery store and I need to buy the following items: 4 bananas and each one weighs 120 grams; 2 apples and each one weighs 80 grams, and 3 boxes of strawberries with 500 grams in each. I want to buy all these things twice and separate them – one time for me and one time for my brother. How many* ***kilograms*** *will that be in total?*

Numerical Expression: 2[(4 x 120) + (2 x 80) + (3 x 500)]/ 1,000 = 2[480 + 160 + 1500]/1,000 = 2x2,140/1,000 = 4,280/1,000 = 4.28 KG

Make sure to "Break Up Your Day!"

These can be used in the middle of a lesson or at the end of your lesson.

Here are a few engaging movement and brain break ideas to get your students moving and ready to refocus!

Break Up Your Day: Math Outside!

- Students take scratch paper/pencil and find multiplication problems outside.
- Students write multiplication problems they see on the playground. (examples: 3 basketball courts times 6 students equals 18 basketball players, four hopscotches times 5 students equals 20 students playing hopscotch.)

Break Up Your Day: Thumbs Up!

- Student is called on (use name cards or equity cards if available) to state a rounding observation from within the classroom using numbers from 1 to 500.
- Other students signify whether they understand and agree with the observation. (Example: "There are approximately 100 pencils in the classroom because each student has 3 pencils and there are 32 students. 3 times 32 is 96 and 96 rounds to 100.)
- Tally how many students agree with the rounding statements.
- The statement with the most votes or Thumbs Up is the "Round Up Captain"!

Break Up Your Day: Body Stretches!

10 minutes
FORMATION: Standing at desks

- Have students begin the day with a series of simple activities lasting 30 seconds or more: jumping jacks, knee lifts, flap arms like a bird, hopping, scissors (feet apart then cross in front, feet apart then cross in back)…
- Follow each activity with a basic stretching movement:
- Reach for the sky runner's stretch
- Butterfly stretch (sit with bottom of feet together)
- Knee to chest, rotate ankles, scratch your back

Hold stretches for 10 - 30 seconds. Repeat a different simple activity followed by a new basic stretch as many times as desired.