Are You Smarter Than a Calculator?

Order of Operations

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Grade Level	6th – 7th Grade	**Time Frame**	95 minutes
Subject	Mathematics	**Duration**	2–3 class periods
Course	Middle School Mathematics		

Essential Question

How do I use a non-scientific calculator to evaluate numerical expressions?

Summary

In this lesson, students compare methods to evaluate numerical expressions with and without the use of a non-scientific calculator. Students begin by discussing the pros and cons of modern technology. They then explore the limitations of a non-scientific calculator when using one to evaluate numerical expressions. Students develop a method for solving these expressions using the calculator and complete an escape room-themed activity using the methods they discovered. To conclude the lesson, students solve an expression and evaluate the work of their peers in a Commit and Toss activity.

Snapshot

Engage

Students debate and discuss the pros and cons of technology.

Explore

Students investigate and discover the limitations of non-scientific calculators when evaluating numerical expressions.

Explain

Students share methods they discovered for successfully evaluating numerical expressions using a non-scientific calculator.

Extend

Students use their chosen methods for evaluating numerical expressions with the correct order of operations to complete an escape room activity.

Evaluate

Students evaluate an expression then review their peer's work during a Commit and Toss activity.

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 (7th 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.
7.A.4.2: Evaluate numerical expressions using calculators and other technologies and justify solutions using order of operations and grouping symbols.

Attachments

- Evaluate and SCORE—Are You Smarter Than a Calculator - Spanish.docx
- Evaluate and SCORE—Are You Smarter Than a Calculator - Spanish.pdf
- Evaluate and SCORE—Are You Smarter Than a Calculator.docx
- Evaluate and SCORE—Are You Smarter Than a Calculator.pdf
- Lesson Slides—Are You Smarter Than a Calculator.pptx
- Strategy Harvest—Are You Smarter Than a Calculator - Spanish.docx
- Strategy Harvest—Are You Smarter Than a Calculator - Spanish.pdf
- Strategy Harvest—Are You Smarter Than a Calculator.docx
- Strategy Harvest—Are You Smarter Than a Calculator.pdf
- The Inventor's Escape Room Teacher Guide—Are You Smarter Than a Calculator.docx
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- The Inventor's Escape Room—Are You Smarter Than a Calculator.pdf

Materials

- Lesson Slides (attached)
- Evaluate and SCORE handout (attached; one per student)
- Strategy Harvest handout (attached; one per student)
- The Inventor’s Escape Room handout (attached; one per student)
- The Inventor’s Escape Room Teacher Guide document (attached)
- TI-108 or 4-function calculator (one per student)
- Laptops, Chromebooks, or other internet accessible devices

10 minutes

Engage

Teacher's Note: Preparation

Access the Inventor's Escape Room activity and make a copy of the link. Post the link in a location where students can access it during the Extend portion of the lesson. Play the escape room yourself prior to the lesson so you are prepared to answer any student questions about the activity.

Use the attached **Lesson Slides** to guide the lesson. Display **slide 3** and invite students to think about the statement, "Technology is good." Ask students to silently decide if they strongly agree with the statement, strongly disagree with the statement, or if their level of agreement is somewhere in between.

Move to **slide 4** and show students how to Fold the Line. Designate one side of the classroom as the "strongly agree" side and the opposite side as the "strongly disagree" side. Have students stand closer to one end of the room or the other in the position that best represents their opinion, forming a line. Prompt students to discuss their opinions with nearby classmates who share similar opinions to their own. This discussion should help them clarify their stances.

After students discuss, have them "fold the line." Have the student who is furthest on the "strongly agree" side walk toward the opposite end of the line and face the student who is furthest on the "strongly disagree" side. The rest of those in line should follow the leader, pairing up with the next classmate in line. When students stop moving, each one should be standing across from the classmate opposite them in line.

Display **slide 5** and have students present their opinions to their new partner and discuss their stances. Begin the two-minute timer on the slide and allow students time to share. When time is up, have students return to their seats.

Facilitate a whole class discussion on the activity. Address the following questions:

- What are some points your partner made that you hadn't thought about?
- After this activity, how as your opinion or response to the question changed?

Transition to **slide 6** and **slide 7** to review the essential question and lesson objectives.

25 minutes

Explore

Display **slide 8**. Divide students into pairs and have them choose which one of them is Student A and which is Student B. Give each student one copy of the **Evaluate and SCORE** handout. Distribute one TI-108 calculator to each pair of students.

Teacher's Note: Calculator and Handout

Because the TI-108 is not a scientific calculator, it does not perform functions with regard to the order of operations. Instead, the calculator computes using the order of the functions entered. The calculator can be used when students struggle with multiplication or division facts, but they must know the order of operations and input numbers into the calculator one step at a time, using scratch paper to keep track of their progress.

The handouts and examples intentionally use both x and · (dot) for multiplication and both ÷ and the fraction bar for division. The use of the different symbols is intended to remind students that they can see these functions represented in a variety of ways, and they need to be comfortable with all forms of representation.

Tell students that they must work together to evaluate each numerical expression on the handout. Tell students that for the first three questions, Student A must evaluate the expressions by hand, and Student B must evaluate the expressions with the calculator. For the final three questions, partners will switch roles. Have students record their work and answers on the handout.

Display **slide 9** and encourage partners to work together to answer the reflective questions on the back of the handout using the SCORE Reflection format. Students will answer the following reflective questions on the back of their handouts:

- **Strategy:** Describe the method you developed for using the calculator on the problems above.
- **Celebration:** What do you like about the method you came up with?
- **Obstacles:** What do you dislike about the method you came up with?
- **Refinement:** If you were to use this method in the future, what would you do differently?
- **Extra information:** Note any thoughts, feelings, or details that seem important related to this method.

20 minutes

Explain

Lead students in a whole class discussion about the answers they arrived at on the front of their handouts. Use prompting questions to lead the discussion such as, “Why did you get different answers for the same problem?" “How do you know which answer is correct?” “Did you find a way to use the calculator wisely?” If necessary, use slide 9 to facilitate the discussion.

Have students remain in pairs and distribute one copy of the attached **Strategy Harvest** handout to each pair. Display **slide 10** and review the instructions for the Strategy Harvest activity. Ask each pair of students to find another pair and share the method they developed for accurately evaluating expressions with the calculator. Instruct students to listen to the other group’s method and compare it to their own.

Start the three-minute timer on the slide and have students begin the discussion. Once time is up, have students find another pair and repeat the process. Have students share with two or three other pairs, then bring the class together and have pairs share some of the interesting methods they learned from other groups.

After students share their methods, have them take out their notebooks or pieces of paper and transition through **slides 11–22** to demonstrate how to properly solve these types of problems using the calculator. **Slides 11–19** allow you to walk through each step in the correct order and display the appropriate calculator buttons for each step. **Slides 20–21** present the entire expression and all the steps necessary to solve it. Expression three is an opportunity for students to work on their own and confirm or modify their approach. **Slide 22** has no steps displayed.

Equation Answers

The answers for the expressions on slides 11–22 are listed below.

- Expression #1: 54
- Expression #2: 5
- Expression #3: 5
- Expression #4: 23

Encourage students to record each answer they get with the calculator on paper so they can track their progress. This method will prevent students from having to start over from the beginning if they press the wrong button.

Teacher's Note: Calculator Skills

Some students may not like using the calculator to solve these problems, but calculator usage is an important skill to practice. Encourage every student to use the calculator on these exercises to familiarize themselves with the methods.

30 minutes

Extend

Teacher's Note: The Inventor's Escape Room Teacher Guide

The attached **Inventor's Escape Room Teacher Guide** document is designed to assist you with evaluating student work. The document provides both the results for each lock and the final code for the escape room activity.

Display **slide 23** and pass out one copy of attached **The Inventor's Escape Room** handout to each student.

Have students navigate to the Inventor's Escape Room. Tell students that the online escape room will guide them through the expressions on their worksheet. As they solve each expression, they'll receive the piece of a secret code. Inform students that they must show their work in the space provided on their worksheets.

Teacher's Note: Time Crunch and Showing Work

If you have a limited amount of class time for this portion of the lesson, consider assigning the escape room activity as independent practice outside of class.

Students may be confused about how to show their work on paper when using a calculator. Consider having them record the buttons they press in the order they press them. Tell students that each time they press "Enter" they can start a new line in their work.

15 minutes

Evaluate

Display **slide 24** and introduce students to the Commit and Toss strategy. Have students evaluate the expression on the slide on a piece of paper, showing all of their work. Remind them **not** to write their names on the papers.

Teacher's Note: Anonymity

It is important that this activity is done anonymously. Anonymity reduces the risk of embarrassment over being wrong and allows students to demonstrate their current knowledge.

Move to **slide 25**. Have students crumple up their responses and toss them across the room or into a box or empty trash can. Have each student select a crumpled paper (not their own) and check their classmate's work against their own response. Encourage them to evaluate which steps were done correctly and what mistakes were made.

Engage the class in a discussion about the correct answer to the expression, what students noticed about their peers' work, and what common mistakes were made.

Resources

K20 Center. (n.d.). Commit and toss. Strategies. https://learn.k20center.ou.edu/strategy/119

K20 Center. (n.d.). Fold the line. Strategies. https://learn.k20center.ou.edu/strategy/171

K20 Center. (n.d.). SCORE reflection. Strategies. https://learn.k20center.ou.edu/strategy/3694

K20 Center. (n.d.). Strategy harvest. Strategies. https://learn.k20center.ou.edu/strategy/135

K20 Center. (n.d.). *The inventor's escape room* [Video game]. https://k20center.itch.io/escape-room

K20 Center. (2021, September 21). *K20 Center 2 minute timer* [Video]. YouTube. https://www.youtube.com/watch?v=HcEEAnwOt2c

K20 Center. (2021, September 21). *K20 Center 3 minute timer* [Video]. YouTube. https://www.youtube.com/watch?v=ilSP02KPau0