OER In Mathematics Professional Development Project

Lesson Plan

Topic of the lesson:

Using the Distributive Property to Find Equivalent Expressions

Standard(s)/Learning Result(s):

8 ALGEBRA: Symbols and Expressions

Students create, evaluate, and manipulate expressions.

c. Apply the properties of the real number system, including the distributive and associative laws, to create equivalent expressions.

Goal(s) of the Lesson:

What do you want the students to know and be able to do? What overarching questions do you want them to be able to answer?

Students should be able to use the distributive property to re-write an expression. Sometimes students will apply the distributive property to simplify or evaluate expressions. The distributive property can also be used to simplify mental calculations. For example, if given 12 * 99 students could apply the distributive property by multiplying 12 * 100 to get 1200 then subtract 1 set of 12 to get 1188 [12(99) = 12(100-1)]

Context

What should students know to engage in the lesson?

Students should have experience with identity and equality properties and have an understanding of order of operations.

Associated Student Difficulties

Describe known misconceptions (overgeneralizations, common errors, and misunderstandings) associated with the content in this lesson?

Students often totally ignore the parenthesis in an expression. Ex. 2 (3+5) is seen as 2(3) then add 5 to get 11 rather than 2 times 8 which is 16.
Students will sometimes see these two expressions as the same thing ignoring the addition sign→ 2(3+x) and 2(3x). If they misapply the idea of the distributive property they may think that the solution to both of these is 6+2x. Also, students sometimes are able to evaluate 3(x+2) but don't know how to apply the distributive property to (x+2)3.

Planning for Differentiation

Describe how the lesson design incorporates a plan for differentiation.

- Directions on using the applet are in writing on the exploration, illustrated on the exploration, and provided as a screen-cast that can be played.
- Teacher continually walks around the room to help those who need the directions for using the applet read out loud or explained in more detail.
- Students can write explanations with words or use illustrations or a combination of both.
- Students can work in pairs as long as each student writes or illustrates own explanation.

Pre/Post Assessment

Review what you want students to know and be able to do. How will you determine what they know and don't know? How will you determine that they have met the target? (Describe the pre/post assessment)

The questions on the pre and post-assessments deal with applications of the distributive property. They include expressions with integers only, integers and variables, and variables alone. They include items that contain typical student errors and misconceptions. The assessments also include examples with visual representations.

Pre-Assessment: After the students answer the questions on the probe they will be asked to analyze the results to determine which concepts have a bigger discrepancy in results in the data collected from the class. These will be the target questions to work more closely on.

While working on the exploration, the teacher will monitor the students for understanding by going over the results of certain parts of the exploration before the students answer the next section. The teacher will also continually move around the classroom to check for understanding by looking at student explanations as well as asking students targeted questions.

Post-Assessment: After the students answer the questions on the post-assessment after doing the exploration, the results of the most commonly missed questions determined from the pre-assessment will be discussed again in more detail. (Students will also be asked to explain their thinking using the applets. These explanations will be recorded in screen casts.)

Materials & Resources

Describe any tools and resources that are needed to support the lesson.

- Pre-assessment/probe: Equivalent Expressions-Distributive Property.
- Exploration handout
- Pencil

Technology Tools / Applets

What technology tools, applets, and/or resources you will use for this lesson?

- Interactive whiteboard (if possible) and projector
- Laptops
- Clickers or other rapid-response formative assessment strategy (Moodle quiz, Google Form, etc.)
- Equivalent Expressions - Distributive Property (3) Applet: http://maine.edc.org/file.php/1/tools/EquivExprDistribProp3.html
- Students will work at seats individually on their laptops to answer the questions on the exploration or they may consult with another student. The class will be pulled back together every few questions to make sure the students are on the right track and to discuss their findings up to that point to help answer the remaining questions. Students will be asked to explain their understanding orally to the class as well as go to the interactive whiteboard to illustrate and explain their solutions.

What management strategies will you utilize during the lesson?

- Pre-load applet on the teacher computer(s)
- Prepare technology-based assessment method in advance
- Prepare for using paper assessments if needed
- Have students load the applet in 2-4 groups (not all at once)
- If necessary, align the interactive whiteboard and projector before class begins

Teacher Notes: The lesson should take approximately one hour to complete, depending on the students ability to answer the questions on the probe as well as to use the clickers or online assessment tool.

Lesson Description

Preparation

What resources will you need? What type of preparation is needed before you can begin the lesson?

- Equivalent Expressions - Distributive Property (3) applet, clickers, interactive whiteboard, projector, laptops, probe, student exploration sheet, pencil
- The students need to each have a probe to answer the questions, their own laptop to work on the exploration, and an understanding of what the probe is used for as well as how the results will be used.

	Lesson	Questions for Learners	Notes / Reflections
Introduction	Steps of the lesson: learning activities (and time allocation) - Students complete the probe for the pre-assessment (10 min). - Students use the clickers to get class results on each question from the probe. Teacher explains the significance of the results (10 min). - Teacher picks out the questions from the probe that have the most discrepancy (5 min).	What is the significance of the information gathered by using the pre-assessment? If using clickers or similar assessment tool: What do the percents represent and mean to the class? How can we use the information from the pre-assessment?	The students took a little longer than I originally thought answering the questions to the probe. I could have given the probe to them the day before (and collected it) so we could have started class directly with the clickers. However, the students worked well on the probe and they really enjoyed using the clickers. They were able to distinguish which questions from the probe were the ones we should most focus on as a class since they understood what the percentages meant. Questions 2 and 5 were the most obvious questions where the class was split on the solutions. These were exactly the ones I thought they would most likely miss and these two questions are the ones that the exploration focuses on.

	Lesson	Questions for Learners	Notes / Reflections
Core Instruction	- Students answer the first few questions from the exploration (5 min). - Class discussion on the first few questions from the exploration (5 min). - Students use the applet to answer the questions from the exploration (10 min). - Class discussion on the second part of the exploration (5 min). - Students continue to use the applet to answer the questions from the exploration (15 min). - Class discussion on the final part of the exploration to come to a generalization (10 min).	What did you notice about the equivalent expressions for perfect squares? Will there always be a "middle term?" Why or why not? What do you notice about the "middle term"?	The students were able to answer the questions on the exploration without much assistance from me. The directions and illustrations were clear enough for the directions to be understood. Most of the students worked alone on the exploration. However a few students did choose to discuss it briefly with the person sitting next to them or even to help another student sitting relatively close to them. The students did a fantastic job explaining the concepts to the class and illustrating the concept of the multiplication matrix on the interactive whiteboard.
Closure	- Students complete the post-assessment (10 min). - Teacher and students go over the solutions to the post-assessment, concentrating on the few questions that were most commonly missed (10 min). - Final wrap up over lesson (10 min).	How are perfect squares similar to differences of squares? How are they different? Does it matter what the two monomials are in the binomial as to the way that you find equivalent expressions with a perfect square?	The post assessment probe did not take quite as long to answer since the students had the material fresh in their minds and understood it a little better. The students were once again able to verbalize their understanding of the concept very well. They were able to distinguish between perfect squares and difference of squares. The results of questions 2 and 5 were overwhelming. Almost all of the students were able to understand and explain that squaring a binomial would give you a "middle term". I was so extremely proud of the class for their hard work and observations.