

# 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 write an equivalent expression for perfect squares. Students should understand that when squaring a binomial a middle term is present. Questions include: When is there a “middle term” when multiplying a binomial by a binomial? When squaring a binomial, how do you get the “middle term”?

### CONTEXT

*What should students know to engage in the lesson?*

Students should know the definition of a monomial, a binomial, a trinomial, a polynomial, and a perfect square.

Students should understand how to use the distributive property to write equivalent expressions.

### ASSOCIATED STUDENT DIFFICULTIES

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

When given a square of a binomial, students may only want to square the two terms in the binomial. They often forget that there will be a middle term since the entire binomial is squared, not just each term in it. When given a square of a binomial, students might multiply the two terms of the binomial to get the “middle term” and not double it.

### PLANNING FOR DIFFERENTIATION

*Describe how the lesson design incorporates a plan for differentiation.*

- Directions on using the applet are in writing on the exploration as well as illustrated on the exploration.
- 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.
- Questions on the exploration get more advanced and more abstract the further the students progress.
- 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.

This resource was designed by Education Development Center, Inc. in collaboration with the Development Team Members of RSU#11 & RSU#54. This work is licensed under the Creative Commons Attribution-Non Commercial-Share Alike 3.0 License. This resource is designed to support the use of OER in K-12 education.



## 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-assessment deal with multiplying monomials and binomials. Questions 2 and 5 are the questions to be analyzed the most, since they are dealing with perfect squares. One of the biggest misconceptions is that there is no “middle term” when squaring a binomial.

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

While working on the exploration, the teacher monitors 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 understanding by looking at student explanations as well as talking to the students.

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.

## MATERIALS & RESOURCES

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

- Pre-assessment/probe: Equivalent Expressions
- 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.)
- Distributive Property Matrix Applet: [http://maine.edc.org/file.php/1/ParticipantResources/DistribPropMatrix4\\_Bean\\_L.html](http://maine.edc.org/file.php/1/ParticipantResources/DistribPropMatrix4_Bean_L.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 since it will be the first time they have used them as well as the first time the teacher used them. The results of the probe might take longer than expected in order for the students to fully understand why the clickers are used and the information that can be gathered by using them.

<b>LESSON DESCRIPTION</b>	
<b>PREPARATION</b>	<p><i>What resources will you need? What type of preparation is needed before you can begin the lesson?</i></p> <ul style="list-style-type: none"> <li>- Distributive Property Matrix (4) applet, clickers, interactive whiteboard, projector, laptops, probe, exploration, pencil</li> <li>- 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.</li> </ul>

	<b>LESSON</b>	<b>QUESTIONS FOR LEARNERS</b>	<b>NOTES / REFLECTIONS</b>
<b>INTRODUCTION</b>	<p>Steps of the lesson: learning activities (and time allocation)</p> <ul style="list-style-type: none"> <li>- Students complete the probe for the pre-assessment (10 min).</li> <li>- Students use the clickers to get class results on each question from the probe. Teacher explains the significance of the results (10 min).</li> <li>- Teacher picks out the questions from the probe that have the most discrepancy (5 min).</li> </ul>	<p>What is the significance of the information gathered by using the pre-assessment?</p> <p>If using clickers or similar assessment tool: What do the percents represent and mean to the class?</p> <p>How can we use the information from the pre-assessment?</p>	<p>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 not likely miss and these two questions are the ones that the exploration focuses on.</p>

This resource was designed by Education Development Center, Inc. in collaboration with the Development Team Members of RSU#11 & RSU#54. This work is licensed under the Creative Commons Attribution-Non Commercial-Share Alike 3.0 License. This resource is designed to support the use of OER in K-12 education.



	LESSON	QUESTIONS FOR LEARNERS	NOTES / REFLECTIONS
<b>CORE INSTRUCTION</b>	<ul style="list-style-type: none"> <li>- Students answer the first few questions from the exploration (5 min).</li> <li>- Class discussion on the first few questions from the exploration (5 min).</li> <li>- Students use the applet to answer the questions from the exploration (10 min).</li> <li>- Class discussion on the second part of the exploration (5 min).</li> <li>- Students continue to use the applet to answer the questions from the exploration (15 min).</li> <li>- Class discussion on the final part of the exploration to come to a generalization (10 min).</li> </ul>	<p>What did you notice about the equivalent expressions for perfect squares?</p> <p>Will there always be a “middle term?”</p> <p>Why or why not?</p> <p>What do you notice about the “middle term?”</p>	<p>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.</p>
<b>CLOSURE</b>	<ul style="list-style-type: none"> <li>- Students complete the post-assessment (10 min).</li> <li>- Teacher and students go over the solutions to the post-assessment, concentrating on the few questions that were most commonly missed (10 min).</li> <li>- Final wrap up over lesson (10 min).</li> </ul>	<p>How are perfect squares similar to differences of squares?</p> <p>How are they different?</p> <p>Does it matter what the two monomials are in the binomial as to the way that you find equivalent expressions with a perfect square?</p>	<p>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.</p>

