General Materials and Supplies:

Laptop, Projector, Power Cord   *It's All in the Translation* Cards   *They Knew Calculus When They Left* Article

Patty Paper   *Follow the Path* Handout   Sets of Arrow Templates

Chart Paper   Markers

Focused Strategies for Middle-Grades Mathematics Vocabulary Development Article on CD

Slide	Tasks/Activity	Personal Notes
	(slide 1) **Module 3** This module focuses on algebraic translations and geometric transformations.	

	(slide 2) **Equation Talk**
	 Have participants look at each equation listed. Without calling out answers ask them to give a "thumbs up" in front of their chests when they have a solution. Challenge participants to find alternate solution strategies.
	 After everyone has a thumb up, ask for volunteers to give solution strategies (so they must explain how they got their answer).
	
	 $\Rightarrow x + 7 = 28$
	     o 7 more than some number is 28, so that number must be 21
	     o 28-7 is 21
	 $\Rightarrow x - 4 = 16$
	     o Some number decreased by 4 is 16, so that number must be 20
	     o 16 + 4 = 20
	 $\Rightarrow \dfrac{x}{5} + 4 = 6$
	     o I need to add 2 to 4 to reach 6, so some number divided by 5 is two, and that number must be 10
	     o 6-4=2 and 2x5=10
	 $\Rightarrow 2x - 3 = 17$
	     o 20 minus 3 is 17, so some number multiplied by 2 is 20, the number is 10	

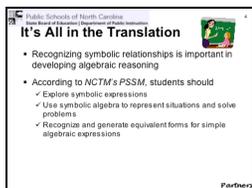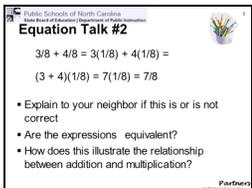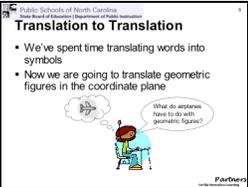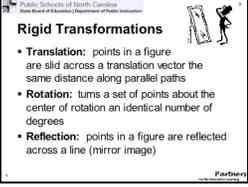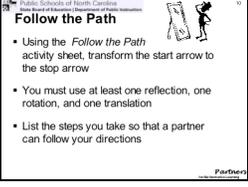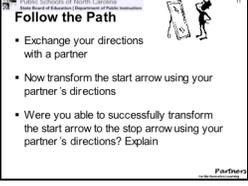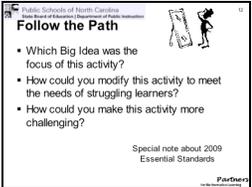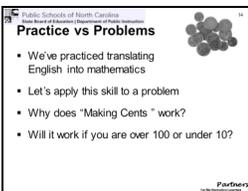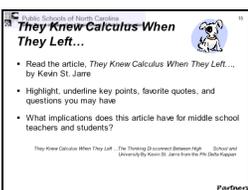|		
	o 17+3=20, 20/2=10 Encourage participants not to begin with teaching algorithms for solving equations, but instead use student reasoning that build on the understanding of what these equations mean. • What do I add to 7 to get to 28? • What plus 4 is 6? What divided by 5 is 2? *In what ways do Number (Equation) Talks encourage students to think flexibly about number and operation relationships?* Answers will vary. Allowing the student's reasoning to justify the answer empowers the student to utilize and look for number and operation relationships.	
It's All in the Translation slide	(slide 3) **It's All in the Translation** Let's talk about translating words into algebraic symbols. *Recognizing symbolic relationships is important in developing algebraic reasoning.* *According to NCTM's PSSM, students should* • *Explore symbolic expressions* • *Use symbolic algebra to represent situations and solve problems* • *Recognize and generate equivalent forms for simple algebraic expressions.*	

(slide 4) **It's All in the Translation** Distribute sets of *It's All in the Translation* cards (Module Three, Handout One) to each group of four. To demonstrate ways to differentiate this activity, fix the sets so that each group is working with a different number and/or set of cards. Group 1: Entire set of cards Group 2: Expressions only Group 3: Equations and inequalities only Group 4: Half the deck with a mixture of expressions, equations, and inequalities - In your group, read the directions for playing *It's All in the Translation*. - Encourage participants to play at least one round of the game. - Have groups share their experiences playing the game with the large group.	
(slide 5) **It's All in the Translation** *How would you use this activity in your classroom?* - Meaningful practice - Review - Assessment *How could you modify this activity to meet the needs of struggling learners?* - Use half of the deck - Use only the expression cards or only the equation cards *How could you make this activity more challenging?* - Use the entire deck of cards - Have students solve the equations to earn points *Which Big Idea was the focus of this activity?* A variety of representations (including tables, charts, graphs, number lines, expressions, equations, and inequalities) can be used to illustrate mathematical relationships, to model mathematical situations, or to describe and generalize patterns *How does this relate to the Essential Standards?* Answers will vary.	

(slide 6) **Equation Talk**

3/8+4/8=3(1/8)+4(1/8)=(3+4)(1/8)=7(1/8)=7/8
Explain to your neighbor if this is or is not correct.
It is.
Are the expressions equivalent?
Yes they are.
How does this illustrate the relationship between addition and multiplication?
These equivalencies rely on the distributive property of multiplication with addition.
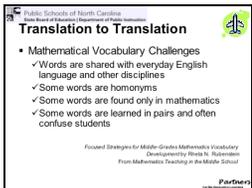
(slide 7) **Translation to Translation**
Mathematical Vocabulary Challenges
- *Words are shared with everyday English language and other disciplines (Table)*
- *Some words are homonyms (Plane and Plain)*
- *Some words are found only in mathematics (Integer)*
- *Some words are learned in pairs and often confuse students (Factors and Multiples)*

Ask participants to make lists of words that meet the above criteria.

Place chart paper around the room, one for each category above. After participants have had ample time to make lists, have them go around the room and write their responses on the chart paper.

Pass out the article and assign sections to read: *Focused Strategies for Middle-Grades Mathematics Vocabulary Development* by Rheta N. Rubenstein From *Mathematics Teaching in the Middle School.* Remind participants to take notes on notebook paper.

(slide 8 image)	(slide 8) **Translation to Translation** This is a transition slide into the next activity. *We just spent time translating words into symbols, now we are going to translate geometric figures in the coordinate plane.*	
(slide 9 image)	(slide 9) **Rigid Transformations** Briefly review the transformations (translations, rotations, and reflections).	
(slide 10 image)	(slide 10) **Follow the Path** • Using the *Follow the Path* handout (Module Three, Handout Two), ask participants to transform the *start* arrow to the *stop* arrow. Provide participants with patty paper and a template of the arrow. • Remind participants that they are required to use at least one reflection, one rotation, and one translation. • Participants are to record the transformations used. Tell participants that they are to write directions so that another participant can follow.	
(slide 11 image)	(slide 11) **Follow the Path** • Ask participants to exchange their directions with a partner. • Participants will now transform the *start* arrow using the directions from their partner. • *Were you able to successfully transform the start arrow to the stop arrow using your partner's directions? Explain.*	

(slide 12) **Follow the Path**	

(slide 12) **Follow the Path**
Which Big Idea was the focus of this activity?
Two dimensional figures are viewed in the rectangular coordinate plane and transformations of two dimensional figures within the plane may produce figures that are similar and/or congruent to the original figure

How could you modify this activity to meet the needs of struggling learners?
•   Provide directions for the transformations

How could you make this activity more challenging?
•   Change the requirements (i.e. at least two rotations, etc.)

After discussing this activity have participants look at the third handout (Module 3, Handout 3). When this professional development was written the grade 6 Essential Standards including reflections, rotations, and translations. These expectations were later modified.
Since the 2009 Standard Course of Study is not scheduled to be adopted by the State Board until fall 2009, Handout 3 was created to match the changed expectations.
Be certain to check the final adopted version.
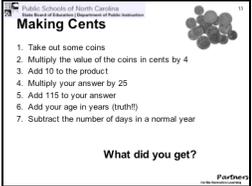
(slide 13) **Making Cents**
Lead the participants through the bullets on the slide.
1.   *Take out some coins*
2.   *Multiply the value of the coins in cents by 4*
3.   *Add 10 to the product*
4.   *Multiply your answer by 25*
5.   *Add 115 to your answer*
6.   *Add your age in years (truth)*
7.   *Subtract the number of days in a normal year*

What did you get?

Participants will see that the resulting number contains their age in the last 2 digit places, following the value of the coins in cents.
For example, 45 cents and an age of 39 should result in the four-digit number 4539.

	(slide 14) **Practice versus Problems** *We've practiced translating English into mathematics.* *Let's apply this skill to a problem* *Why does "Making Cents" work?* As participants work on this problem, flip back to the previous slide so that they can see the steps. One explanation is… Using C to represent some value of coins (in cents) and A to represent an age, the steps of "Making Sense" can be written with the expression (4C+10)25+115+A-365. Simplified to 100C+250+115+A-365 or 100C+A. So the value of the change is "shifted up" two places, so that when the age is added it appears in the tens and ones places. *Will it work if you are over 100 or under 10?* If time allows, and a participant has an answer, let the group decide if they agree with the solution.	
	(slide 15) *They Knew Calculus When They Left…* Have participants to read the St. Jarre article. Ask them to highlight or underline key points, favorite quotes, and questions they may have. *What implications does this article have for middle school teachers and students?* • Teachers have to provide problems that have more than one right answer. • Teachers need to except, encourage multiple strategies to solving problems. • Teachers have to let students struggle.	

	• Teachers have to ask good questions and provide students with time to think about the answer.	
(slide image) They Knew Calculus When They Left…	(slides 16) ***They Knew Calculus When They Left…*** *"[Universities] only want students who have been taught how to learn and think. Students who, when faced with problems in a new context can self-correct their own thinking, adapt, and succeed."* Ask for a volunteer to read the quote on the slide.	
(slide image) Reflection	(slide 17) **Reflection** Ask participants to reflect upon the following question and how they would explain their response to that question to parents or principals. They might talk in their table groups, making notes for themselves. *How can the activities in the PARTNERS Professional Development encourage student thinking?*	
	(slides 18-21) **Credits for project and closing slides**	