Math 1/Algebra 1
Factoring: Find the GCF

Mathematics Learning Objectives:
- The students will be able to find the greatest common factor of binomial expressions as well as trinomial expressions by using the “tree” method and prime factorization.

Language Objectives:
- The students will be able to define and determine the prime factorization of numbers and expressions.
- The students will be able to define a factor.
- The students will be able to define a greatest common factor.
- The students will be able to determine the greatest common factor of a binomial and trinomial.

Essential Question:
- How do you find the GCF of an expression?

Common Core State Mathematics Standards:
- A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

Common Core State Mathematical Practice Standards:
- Standard 1: make sense of problems & persevere in solving them
    - I will have the student breakdown every expression into its most basic components over and over again until they are able to see an expression and immediately know to breakdown the problem into its most basic parts.
- Standard 5: use appropriate tools strategically
    - using PENCIL and paper to write out all details of breaking a number and/or expression into its most basic parts.
- Standard 7: look for & make use of structure
    - I will have students use the “tree” method or another method for breaking down expressions into its most simplest parts in order to determine the GCF of an expression.

Materials:
- Pencils (30)
- Paper (30)
- Warm up Handouts (30)
- Group Handout (30)
- In class Assessment Handout (30)
- Dry Erase Board (preferably 5’x12’)
- Dry Erase Markers (1-3)

Notes to the reader:
This lesson plan is intended for Math 1/Algebra 1 students with NO knowledge of factoring. However, I am assuming that the students know how to add, subtract, multiply and divide two, or three, variables and numbers as well. In addition, I assume that the student would know how to multiply two binomials together, what prime and composite numbers are. This is mainly an introductory lesson for factoring as well as strengthen assumed previous knowledge.

Time 90 minutes

Time	What is the teacher doing?	What are students doing?
0-5	Introduction: • Introduce yourself. • Introduce the lesson. • Discuss the purpose of this lesson. Handout: • Handout two sheets of paper/student. • Handout one pencil/student. • Handout the warm-up exercises and give them 10 minutes to work on them. • This is an INDIVIDUAL assignment. • Be sure to check students' work as they work. • This is to help assess the pre-assumptions. • Go over the solutions. The need to go into detail may vary depending on class' overall grasp of the previous material.	Introduction: • Students will introduce themselves. Handout: • Students should be receiving a pencil, paper, and the warm-up handout. • Students should be working on the handout, INDIVIDUALLY. • If they finish early, have them check over their work. Possible Questions: • Is this for a grade? • I don't remember how to do any of these, can you show me how?
6-30	Lesson • Go through the lesson notes with the class. • Answer any questions students may have. • Check throughout that the students are understanding.	Lesson • Students should be paying attention and/or note taking. Possible Questions: • Is there more than one way to do this? • What if you cant find the GCF? • Is there always a GCF? • What if you had 5,6,7,…, or 10 parts to an expression?
31-70	Practice Problems Worksheet • Pass out the worksheet. • Have the students work in pairs. • Walk around and answer any questions students may have. • Do NOT give any answers out. • Ask them questions that will help them lead to the answer. • Have students explain their thought process to you.	Practice Problems Worksheet • Students should be working in groups of two. • If they finish early, they should check their work. Possible Questions: • Is there more than one answer to each problem? • Is there an easier method to find the GCF?
71-90	Review • Arrive to the conclusion that we can find the GCF of binomial or trinomial expressions	Review • Students should be paying attention and/or note taking.

	by using the tree method or prime factorization and that this all leads to factoring an expression which just the opposite of distribution which you can demonstrate by $x^2 - 2x$ • Go over the answers. • Discuss all of the solutions. • Have a couple of students present their solutions to question 4 and 6.	• Students should make sure their answers and thought process line up with the correct answers/solutions.

Warm-up Handout

Name: ___________________________ Class: ______________ Date: ____________

1. $2 \cdot 10 = ?$
2. $x + 1 = ?$
3. $x - 2x = ?$
4. $3x + 7x = ?$
5. $-x(6x) = ?$
6. $x^2(x^4 + 1) = ?$
7. $(x + 1)^2 = ?$

Warm-up Handout (SOLUTIONS)

Name: ___________________________ Class: ______________ Date: ____________

1. $2 \cdot 10 = \boxed{20}$

2. $x + 1 = \boxed{x + 1} = \boxed{1 + x}$

3. $x - 2x = x + (-2x) = \boxed{-x}$

4. $3x + 7x = \boxed{10x}$

5. $-x(6x) = [(-1) \cdot (6)] \cdot [x \cdot x] = [-6] \cdot [x^2] = \boxed{-6x^2}$

6. $x^2(x^4 + 1) = (x^2)(x^2) + (x^2)(1) = \boxed{x^4 + x^2} = \boxed{x^2 + x^4}$

7. $(x + 1)^2 = \boxed{x^2 + 2x + 1}$

   Method 1: $By\ FOIL\ METHOD$: $First: x \cdot x = x^2$
   $Outer: x \cdot 1 = x$
   $Inner: 1 \cdot x = x$
   $Last: 1 \cdot 1 = 1$
   $\Rightarrow x^2 + x + x + 1 = \boxed{x^2 + 2x + 1}$

   Method 2: $(x + 1)^2 = (x + 1) \cdot (x + 1) = x(x + 1) + 1(x + 1) = x^2 + x + x + 1 = \boxed{x^2 + 2x + 1}$

Lesson Notes

- What is a prime number? A number that is only divisible by itself and 1.
  Ex: $2 = 2 \cdot 1$
  Ex: $3 = 3 \cdot 1$
  Ex: $7 = 7 \cdot 1$

- What is a composite number? A number that is divisible by other factors and not just itself and .
  Ex: $4 = 2 \cdot 2 = 2 \cdot 2 \cdot 1$
  Ex: $10 = 5 \cdot 2 = 5 \cdot 2 \cdot 1$
  Ex: $20 = 5 \cdot 4 = 5 \cdot 2 \cdot 2 \cdot 1$

- Prime Factorization- writing a number as its most basic parts, i.e. its prime numbers.
  Ex: $4 = 2 \cdot 2 = 2 \cdot 2 \cdot 1$
  Ex: $10 = 5 \cdot 2 = 5 \cdot 2 \cdot 1$
  Ex: $20 = 5 \cdot 4 = 5 \cdot 2 \cdot 2 \cdot 1$

- Notice that is the same as breaking down a composite number! But now it has a name, prime factorization.

- We can do this to variables as well!
  Ex: $x^2 = x \cdot x$
  Ex: $x^3 = x^2 \cdot x = x \cdot x \cdot x$
  Ex: $x^2y^2 = x \cdot x \cdot y \cdot y$
  Ex: $a^2b^2cd^5 = a \cdot a \cdot b \cdot b \cdot c \cdot y \cdot y$

- It helps to use the "tree" method for breaking down a number.
  Ex: 32
  $\swarrow \quad \searrow$
  $8 \cdot 4$
  $\swarrow\searrow \quad \swarrow\searrow$
  $4 \cdot 2 \quad 2 \cdot 2$
  $\swarrow\searrow$
  $2 \cdot 2$ Thus, $32 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$

- Note, that it doesn't matter how you begin your tree because the prime factorization will be the same at the end. You can demonstrate this by using the previous example. Also, you can explain the below examples differently if you feel the students are not grasping the idea.
  Ex: 32
  $\swarrow \quad \searrow$
  $2 \cdot 16$
  $\swarrow\searrow \quad \swarrow\searrow$
  $1 \cdot 2 \quad 2 \cdot 8$
  $\swarrow\searrow \quad \swarrow\searrow$
  $2 \cdot 4$
  $\swarrow\searrow$
  $2 \cdot 2$ Thus, $32 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$

Ex: 120

$\swarrow \quad \searrow$

$20 \cdot 10$

$\swarrow\searrow \quad \swarrow\searrow$

$10 \cdot 2 \quad 5 \cdot 2$

$\swarrow\searrow$

$5 \cdot 2$ Thus, $120 = 5 \cdot 5 \cdot 2 \cdot 2 \cdot 2$

Ex: 924

$\swarrow \quad \searrow$

$77 \cdot 12$

$\swarrow \; \searrow \quad \swarrow\searrow$

$11 \cdot 7 \quad 6 \cdot 2$

$\swarrow\searrow$

$3 \cdot 2$ Thus, $924 = 11 \cdot 7 \cdot 3 \cdot 2 \cdot 2$

- The same method can be applied to variables as well.

Ex: $x^2 \quad y^2$

$\swarrow\searrow \quad \swarrow\searrow$

$\mathrm{x} \cdot x \quad y \cdot y$

Thus, $x^2y^2 = x \cdot x \cdot y \cdot y$

Ex: $a^2 \quad b \quad c^2$

$\swarrow\searrow \quad \downarrow \quad \swarrow\searrow$

$\mathrm{a} \cdot a \quad b \quad c \cdot c$

Thus, $a^2b^2 = \mathrm{a} \cdot a \cdot b \cdot c \cdot c$

Ex: $r^2 \quad s^6$

$\swarrow\searrow \quad \swarrow \; \searrow$

$\mathrm{r} \cdot r \quad s^4 \cdot \quad s^2$

$\swarrow\searrow \quad \swarrow\searrow$

$s^3 \cdot s^1 \quad s^1 \cdot s^1$

$\swarrow \searrow$

$s^2 \cdot s^1$

$\swarrow\searrow$

$s^1 \cdot s^1$

Thus, $r^2s^6 = \mathrm{r} \cdot r \cdot s^1 \cdot s^1 \cdot s^1 \cdot s^1 \cdot s^1 \cdot s^1$

- Note that these can be done several different ways.

- How does this apply to factorizing expressions? Its helps us find the GCF so that we can factor an equation which then leads us to being able to determine the zeros of an equation, which I will demonstrate later.

- GCF- greatest common factor that an variables or numbers share.

- Explain a few examples using the "balloon" method which is explained below. This should help give a visualization for students who are having difficulty grasping this idea of GCF.

Ex: Use the “balloon” method.

For example, what is the GCF of 12 and 24?

Lay out the the factors of 12, in a line, under 12 but written on balloons and the same for 24 next to the 12 layout like so:

12	24
1	1
2	2
2	2
3	2
	3

Then pop the numbers they have in common (which in this document are the underlined numbers):

12	24
$\underline{1}$	$\underline{1}$
$\underline{2}$	$\underline{2}$
$\underline{2}$	$\underline{2}$
$\underline{3}$	2
	$\underline{3}$

So the $GCF = 1 \cdot 2 \cdot 2 \cdot 3 = \boxed{12}$

Ex: Use the “balloon” method.

For example, what is the GCF of 16 and 40?

Lay out the the factors of 16, in a line, under 40 but written on balloons and the same for 40 next to the 16 layout like so:

16	40
1	1
2	2
2	2
2	2
2	5

Then pop the numbers they have in common (which in this document are the underlined numbers):

16	40
$\underline{1}$	$\underline{1}$
$\underline{2}$	$\underline{2}$
$\underline{2}$	$\underline{2}$
$\underline{2}$	$\underline{2}$
2	5

So the $GCF = 1 \cdot 2 \cdot 2 \cdot 2 = \boxed{8}$

- If the students are not grasping GCF, by your judgment, do a few of the examples below with the balloon method instead of the methods already used in the solution.

Ex: 36 and 420 $\Rightarrow 36 = 1 \cdot 2 \cdot 2 \cdot 3 \cdot 3$

$\Rightarrow 420 = 1 \cdot 2 \cdot 2 \cdot 3 \cdot 5 \cdot 7$

$\Rightarrow GCF = 1 \cdot 2 \cdot 2 \cdot 3 = \boxed{12}$

Ex: 18 and 20 $\Rightarrow 18 = 1 \cdot 3 \cdot 6 = 1 \cdot 2 \cdot 9$

$\Rightarrow 20 = 1 \cdot 2 \cdot 2 \cdot 5$

$\Rightarrow GCF = 1 \cdot 2 = \boxed{2}$

Ex: $6a^2b^2 + 8a^2b^2c \Rightarrow 6a^2b^2 = 3 \cdot 2 \cdot \mathrm{a} \cdot a \cdot b \cdot b$
$\Rightarrow 8a^2b^2c = 2 \cdot 2 \cdot 2 \cdot \mathrm{a} \cdot a \cdot b \cdot b \cdot c$
$\Rightarrow GCF = 2 \cdot \mathrm{a} \cdot a \cdot b \cdot b = \boxed{2a^2b^2}$

- Note that $2a^2b^2$ is a common term in both expressions of $6a^2b^2 + 8a^2b^2c$ by showing $6a^2b^2 = 3(2a^2b^2) + 4c(2a^2b^2) = (2a^2b^2)(3 + 4c)$

Ex: $8c^4d^2e - 12c^3d^4e^2 \Rightarrow 8c^4d^2e = 2 \cdot 2 \cdot 2 \cdot \mathrm{c} \cdot c \cdot c \cdot c \cdot d \cdot d \cdot e$
$\Rightarrow 12c^3d^4e^2 = 3 \cdot 2 \cdot 2 \cdot \mathrm{c} \cdot c \cdot c \cdot d \cdot d \cdot d \cdot d \cdot e \cdot e$
$\Rightarrow GCF = 2 \cdot 2 \cdot \mathrm{c} \cdot c \cdot c \cdot d \cdot d \cdot d \cdot d \cdot e = \boxed{84c^3d^2e}$

- How does the GCF help with factoring? It helps us break everything into small parts!
Ex: $4x^2 + 4y^2 \Rightarrow 4x^2 = 1 \cdot 2 \cdot 2 \cdot x \cdot x$
$\Rightarrow 4y^2 = 1 \cdot 2 \cdot 2 \cdot y \cdot y$
$\Rightarrow GCF = 1 \cdot 2 \cdot 2$
$\Rightarrow 4x^2 + 4y^2 = \boxed{4(x^2 + y^2)}$

Ex: $x^2y^2 + x^2 \Rightarrow x^2y^2 = x \cdot x \cdot y \cdot y$
$\Rightarrow x^2 = x \cdot x$
$\Rightarrow GCF = x^2$
$\Rightarrow \frac{x^2y^2+x^2}{x^2} = y^2 + 1$
$\Rightarrow x^2y^2 + x^2 = \boxed{x^2(y^2 + 1)}$

- So we find the GCF of each part and then divide it out to factor out the expression completely.

- Lets do a few more examples!
Ex: $x^2(3x + 1) - 3(3x + 1) \Rightarrow x^2(3x + 1) = x \cdot x \cdot (3x + 1)$
$\Rightarrow 3(3x + 1) = 3 \cdot (3x + 1)$
$\Rightarrow GCF = 3x + 1$
$\Rightarrow \frac{x^2(3x+1)-3(3x+1)}{(3x+1)} = x^2 - 3$
$\Rightarrow x^2(3x + 1) - 3(3x + 1) = \boxed{(3x + 1)(x^2 - 3)}$
- Side note: explain that when you take out the GCF you have "leftovers" and you must put the "leftovers" in container i.e. the parentheses. For example, in the above example $x^2 - 3$ are the "leftovers" and by putting them in a container to go means you put them in parentheses.

- Now we can use the GCF to aid in grouping
Ex: $ax + 2x - 2a - 4 = (ax + 2x) - (2a + 4) = x(a + 2) - 2(a + 2) = (a + 2)(x - 2)$

- Arrive to the conclusion that we can find the GCF of binomial or trinomial expressions by using the tree method or prime factorization.

Practice Problems Handout

Name: ________________________ Class: ____________ Date: __________

1. **Determine GCF(1, 4)**

2. **Determine GCF(80, 100)**

3. **Determine GCF(12, 120)**

4. **Determine GCF($8x^2, 10x$)**

5. **Determine GCF($c^3,\ c^2, -c$)**

6. **Determine GCF($18c^3, -63c^2, -9c$)**

7. **Determine GCF($4xy, 8x^2y, -24x^4y^5$)**

Practice Problems Handout (SOLUTIONS)

Name: ___________________________ Class: ______________ Date: ____________

Part 1: Find the GCF of:

1. Find the GCF of 1 and 4 $\Longrightarrow GCF = 1 = \boxed{1}$
2. Find the GCF of 99 and 999 $\Longrightarrow GCF = 1 \cdot 3 \cdot 3 = \boxed{9}$
3. Find the GCF of 12 and 120 $\Longrightarrow GCF = 1 \cdot 2 \cdot 2 \cdot 3 = \boxed{12}$
4. $8x^2 + 10x = 2x(4x + 5) \Longrightarrow GCF = \boxed{2x}$
5. $c^3 + c^2 - c = c(c^2 + c^1 - c^0) = c(c^2 + c^1 - 1) \Longrightarrow GCF = \boxed{c}$
6. $18c^3 - 63c^2 - 9c = 9c(2c^2 - 7c - 1) \Longrightarrow GCF = \boxed{9c}$
7. $4xy + 8x^2y - 24x^4y^5 = 4xy(1 + 2x - 6x^3y^4) \Longrightarrow GCF = \boxed{4xy}$

Reflection

The topic for my micro teaching project was factoring. Specifically, I chose to do my micro teaching lesson plan on finding the greatest common factor. I enjoyed this topic because it was very helpful for when I was a high school student learning how to factor. Unfortunately, my sophomore high school teacher did a poor job teaching the concept of factoring. Fortunately, through a lot of hard work I become efficient in the area of factoring and thought it would be fun to teach how I learned it myself. My students consisted of a family of six in which I taught five of them. There were two elementary school students, Justice and Tobias, one middle school student, Anika, one high school student, Silas, and a mother, Shannon. I chose this family to see the effects of my teaching on a wide range of students.

First I began the lesson with a pre-assessment to gain a better understanding about my students and where they stand with the assumptions I made. My assumptions were "This lesson plan is intended for Math 1/Algebra 1 students with NO knowledge of factoring. However, I am assuming that the students know how to add, subtract, multiply and divide two, or three, variables and numbers as well. In addition, I assume that the student would know how to multiply two binomials together, what prime and composite numbers are. This is mainly an introductory lesson for factoring as well as strengthen assumed previous knowledge." My assumptions were very wrong. Only four out of the five were able to answer question three, 2x10=?. Only one student could answer question two and three, which were asking for the definitions of a binomial and trinomial. And only one student, Shannon, could answer any of the other questions. No one was able to demonstrate knowledge of multiplying two variables, e.g. x times x. So, my new assumptions are that students could add, subtract, multiply, and divide numbers. Technically, my lesson plan was designed for students whom did have my first stated assumptions. I think, after my lesson, that this lesson plan is better suited for sophomore students. I assumed, at first, that 8th and 9th grade students could find the greatest common factor. Due to my wrong assumptions, I had to spend ten unplanned minutes going over the warm-up assignment. My students mentioned that they have never really have worked on the concepts that were covered in my pre-assessment. Next time, I will choose more age appropriate students to get better results.

The overall lesson seemed to have went better. I first showed the students how to breakdown numbers into their most basic factor, do the same for variables, then a combination of numbers and variables. I added more examples each to ensure the students were understanding the concepts. The students seemed to be

grasping the idea, which was shown when I would call on a student, randomly, to tell me what my next step would be in the examples that I provided. However, once I got to the point in my lesson in which I would show the students how to determine the great common factor of an expression I thought the students would understand the concept better by my "ballon" method because they seemed bored. This was definitely evident since I saw one of the elementary school students yawn two feet in front of me. So I deemed it a good time to unleash my visual presentation of finding the greatest common factor. I wanted the students to determine GCF(12, 24). I picked a student to write down the factors of each number by the tree method. I picked Anika to do 12 and Silas to 24. Then I wrote down the prime factors of each number on a column of balloons. One column for each number that we were factoring. Hence, one column for 12 and one column for 24. Then I popped each ballon they numbers had in common. After, I listed out only the common factors and multiplied them. Thus, they were shown how to find the greatest common factor. They seemed to enjoy this a bit more and were more interactive after. So, the lesson seemed to go well, but it went longer than I had planned since I added examples.

After the lesson, I gave the students a post-assessment to determine if they had learned anything at all. They definitely answered a lot more than they did in the warm-up. They all at least answered five out of the seven questions. Everyone, but Shannon, were unable to determine the greatest common factor of 99 and 999. I realized that 999 was a too big of a number without a calculator. Honestly, I was surprised surprised that Justice and Tobias, given their very young age, were able to attempt most of the problems. As for the rest of my students, the only mistakes they made were basic addition and subtraction. They used the tree method I taught them for all of their problems which was exciting for me to see. After implementing this lesson, I realized I should have worded my questions as 'determine GCF(1,4), GCF(8x^2,10x),' and so fourth. Writing the questions as "find the GCF of 8x^2+10x" was very confusing because a couple of the students asked how they were supposed to solve the problem. So I decided to reword the problems and take away problems two, and those after question seven because their was not enough time for them and they focused more on 'factoring' and not determining the greatest common factor.

When I designed this plan, I thought that it could be taught to anyone of any age group. I got a bit over zealous and picked students whom I knew were much too young for my lesson plan. The only one that actually showed any knowledge gain is Shannon, which may not be actual knowledge gain but recollecting her previous knowledge from which she was in high school. So I deem my micro teaching lesson as partially unsuccessful. I

had no idea how much information can go into teaching students how to determine the greatest common factor of expressions. I honestly thought that my lesson was going to go to fast. On the contrary, it went past 90 minutes. Keep in mind that my students are use to working at a different pace since they are homeschooled and younger than what my lesson plan was created for. However, each student showed that they knew what is and how to determine the greatest common factor. So, it seemed as though the students did in fact learn something. I, however, found that I made the lesson too difficult and needed to be shortened. I should spend more time on going through the post-assessment and add more examples. Perhaps this concept would better work if it was broken into two days instead of one. In other words, determine the greatest common factor of numbers on day one and spend day two determining the greatest common factor of expressions.

Discussion prompts:

Rubric #1: Planning for Mathematics Understanding

Describe the central mathematical focus of your lesson.

The main focus of my lesson was how to find the greatest common factor. I used prime factorization to breakdown a number down by the "tree" method. Finding the greatest common factor helps out greatly for students when it comes to factoring. I also used a "balloon" method to tie in prime factorization and the tree method to finding the greatest common factor.

Describe how the standards and learning objectives address conceptual understanding, procedural fluency, and mathematical reasoning/problem-solving skills.

The common core objective that my lesson plan was fulfilling was, "A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression." It is a very broad standard, so this standard addresses many things. First, it takes an expression and gives it in another form. For example, $36 = 1 \cdot 2 \cdot 2 \cdot 3 \cdot 3$. In this case, we are able to see an ordinary number but then see it in another form, which leads to prime factorization. This standard also allowed us to do the same for $6a^2b^2 = 3 \cdot 2 \cdot \mathrm{a} \cdot a \cdot b \cdot b$ and $x^2y^2 + x^2 = x^2(y^2 + 1)$. This standard leads into breaking down expressions and finding commonalities. This could also lead to students finding the zeros of an expression such as $x^2y^2 + x^2 = x^2(y^2 + 1) \Rightarrow 0 = x^2(y^2 + 1) \Rightarrow x = 0, y = \pm 1$. By using this standard, I was able to show students that the first thing they should do when they see expressions, like the above mentioned, to begin by using the tree method with prime factorization. I showed every example using these methods, and my students showed that they understood the procedure because they used the same for the post-assessment that I gave them. I gave them many different situations in which they had to use mathematical reasoning to determine the greatest common factor of each situation.

Briefly describe what you might teach next in order to help students make connections between concepts/procedures.

I think the next lesson would be introducing the idea of factoring. First, I will give them a pre-assessment of the material learned in this lesson and then go through more examples such as $x^2(3x + 1) - 3(3x + 1) = (3x + 1)(x^2 - 3)$. I think this lesson would be a good bridge to factoring expressions.

Rubric #3: Using Knowledge of Students to Inform Teaching

Describe students' prior academic learning and prerequisite skills related to the central focus. What do you expect students to already know?

My original assumptions were, "This lesson plan is intended for Math 1/Algebra 1 students with NO knowledge of factoring. However, I am assuming that the students know how to add, subtract, multiply and divide two, or three, variables and numbers as well. In addition, I assume that the student would know how to multiply two binomials together, what prime and composite numbers are. This is mainly an introductory lesson for factoring as well as strengthen assumed previous knowledge." However, those assumptions are for freshman and/or sophomore high school students. When I delivered my lesson, I found that my assumptions were incorrect. I assumed that my students would be able to arithmetic such as multiplying variables together. However, my high school student was a little far behind in mathematics. Not making the correct assumptions made teaching my lesson a bit more difficult.

Based on what you learned about the students you worked with, how do you think your lesson connected to students' everyday experiences, culture, backgrounds, or interests?

I think it connected very well. Most of my students were really young, so using my "balloon" method made the lesson a lot more fun for my students. They all enjoyed popping balloons because they were popping a bunch of them before the lesson even started, so this method definitely caught their attention.

Rubric #7: Engaging Students in Learning

Explain how your instruction engaged student in developing conceptual understanding, procedural fluency, and mathematical reasoning/problem-solving skills.

I broke down each problem using the same method, the tree method. I was consistent in using this method so that it would be ingrained into my students' head. Also, I constantly asked my students if everything was making sense. In addition, I would have each student complete an example to demonstrate to the other students. I think by doing so many examples helped ensure that the students would develop conceptual understanding.

Describe how your instruction linked students' prior academic learning (from Rubric #3 above) and personal, cultural, and/or community assets with new learning (see "assets" in the edTPA handbook pp. 49-50).

I used the students' prior knowledge to aid in developing new ideas. For example, during the pre-assessment, I noticed that the students had difficulty with expressions involving variables but not problem when it came to just numbers. So, I began the lesson by using just numbers. Actually, I used solely numbers for most of my examples to show the students how to breakdown numbers using the tree method over and over. I thought repetition using numbers would help bridge finding the greatest common factor of expressions involving variables. This was definitely imperative when I was using my "balloon" method. Although this method was a bit messy, this type of hands on instruction helped use the students' prior knowledge to my advantage. It was easy to convey the idea of determining the greatest common factor using visuals such as the balloon. By writing the numbers on the balloons, then popping the common balloons, then writing the commonalities, and then multiplying them seemed to really help the students understand the concept of finding the greatest common factor. Also, having the students be related made it easier for them to ask for help from their siblings. Their mother, Shannon, was a great help because she knew how to word my ideas in manners that her children, my students, would understand.