Chapter 9 Polynomials Unit Plan

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Education 352
Professor Schilling
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A. TEXTBOOK/ COURSE INFORMATION

NAME OF COURSE/ GRADE LEVEL: Algebra 1 Eighth Grade

DESCRIPTION OF COURSE: This course is designated for 8th grade students with advanced math skills. Algebra 1 discusses topics such as solving linear equations and inequalities, solving quadratic equations by factoring, polynomial expressions, graphing linear equations and inequalities in the variables, and solving systems of two linear equations.

NAME OF CHAPTER/UNIT: Chapter 9 Polynomials and Factoring

DESCRIPTION OF CHAPTER/UNIT: In this chapter, students will learn how to add and subtract polynomials, factor trinomials of different types, and multiply binomials. By the end of this unit, students should have gained more knowledge about polynomials, applications, and how to solve them.

TITLE OF TEXTBOOK: Prentice Hall Mathematics Algebra 1

NAME(S) OF AUTHOR(S)/ EDITORS: Allan E. Bellman, Sadie Chavis Bragg, Randall I. Charles, William G. Handlin Sr., Dan Kennedy

NAME OF PUBLISHING COMPANY: Pearson Prentice Hall

COPYRIGHT DATE: 2004

READING LEVEL OF TEXTBOOK: Eighth Grade reading Level
B. PHILOSOPHY OF READING IN THR CONTENT

STANDARDS:
A1.1.4 Use the laws of exponents for rational exponents.

A1.6.1 Add and subtract polynomials.

A1.6.2 Multiply and divide monomials.

A1.6.4 Multiply polynomials.

A1.6.6 Find a common monomial factor in a polynomial.

A1.6.7 Factor the difference of two squares and other quadratics.

A1.8.2 Solve quadratic equations by factoring.
IMPORTANCE:
This unit is important to study because it is laying down the basic math concepts that students will need to succeed in any other math course. Solving polynomials and factoring is an essential skill that is needed in any high school or college level math course and is even used in some science classes. Understanding factoring can help any student understand the importance of polynomials and their application in the real world. More importantly, students will also get a sense of the many applications of mathematics in everyday life.

PHILOSOPHY:
My philosophy about reading in mathematics is that it is necessary to understand the concepts, definitions, and theorems behind mathematics. I feel that mathematics is difficult to read because you are essentially learning a whole new language. “Sine” is said just like the English word “sign” but both have two totally different meanings. You have to know the word for every symbol and its symbolic meaning. Reading the chapter and teaching yourself is a common tool used in mathematics especially in higher education. Being able to go through a section and read not only the words but the signs, symbols, and numbers are essential to understanding mathematics and applying your knowledge to solve problems.

I personally struggled in my high school geometry class when the concept of proofs came into the class curriculum. I remember coming home to my mother, who was a high school math teacher, and complaining to her about not getting the purpose or concept behind a proof. She would sit down next to me talking me through every step and asking me how I could justify each one. She had me reading all the theorems, postulates, and definitions in the back of the book until I could find the right one that justified my next step. It was not until that class that I realized the importance behind reading in mathematics. I did not understand the theorems that I was reading resulting in me not understanding “why” or “how” I could do each step in my proof.
C. Readability Tests

Textbook: Prentice Hall Mathematics Algebra 1

Sample Passage 1:
To understand a set of data, you need to organize and summarize the data using a measure of central tendency. Mean, median, and mode are all measures of central tendency. You must decide which measure of central tendency best describes a set of data. Below is a review of mean, median, and mode, and where you would use each as the measure of central tendency.

Mean = \( \frac{\text{sum of the data items}}{\text{total number of data items}} \)

Use the mean to describe the middle of a set of data that does not have an outlier. An outlier is a data value.

Sentences: 6.4
Syllables: 156

Sample Passage 2:
Saving for College: For years, college costs have risen steadily. Although general inflation in our economy averages 3.0% to 3.5%, the rate of increase in college costs is about 5% a year. While many prospective students expect to benefit from financial aid, they also must prepare to pay some portion of the costs themselves.

To help with these preparations, Congress has authorized special college-saver plans, called “529 Plans” because they are described in section 529 of the Internal Revenue Code. The plans allow the gains (interest from savings accounts or dividends from stocks) on college savings to grow without...

Sentences: 4.6
Syllables: 171

Sample Passage 3:
Pricing Products: Carlos and Anna have created a new electronic game that they think will be a big hit. But they can’t decide how much to sell it for. They have manufactured 2500 to start out, at a cost to them of $18 for each game, but they doubt they can sell all of them right away.

They have completed a market study. By interviewing potential buyers, they have learned that if they set a price of $40, they should be able to sell 1000 games during the first six months. They have also discovered that for every $5 they...

Sentences: 5.5
Syllables: 146

Average Sentences: 5.5
Average Syllables: 157.6
I was surprised by the Fry readability test. I do not feel like this textbook has a 10th grade reading level. Algebra 1, for the average student, is usually taken as a 9th grader. I think that with math textbooks the Fry readability test is not as accurate. Many of the symbols have many syllables connected to that symbol. For instance, “/” is said as “divided by” which has 4 syllables. I think the symbols in mathematics might skew the ending number of syllables in 100 word sample. This will make the reading level a little bit higher than the actual reading level.
D. Trade Books

Annotated List of Trade Book for Mathematics


This book is a mathematical folktale taking place in India. A greedy raja takes all of the rice when there is a shortage in the village. Rani, a girl that lives in the village, makes a deal with the raja and asks him one grain of rice, doubled each day for 30 days. Rani’s business deal ends up saving the village and she becomes a hero.

I would use this book as an attention grabber. This book helps bring culture into the classroom as well as the importance of mathematics. The lesson in this book is to treasure and understand the importance of mathematics in everyday life. After I would read this book out loud, I would ask the students to share what they thought of the story. I would also ask them to share a story of when math came in handy in their own lives. Then I would have them get into groups of three or four and actually compute how much rice Rani got by the end of the thirty days.


In *Sir Cumference and the First Round Table*, Cindy Neuschwander writes about King Arthur and his knights. When King Arthur and his knight get together around their rectangle table, the knights constantly are shouting across the table to be heard. One of the knights, Sir Cumference, saw the problem this table was creating and decided to come up with a more feasible table. This book discusses different strategies to solve this table problem. Eventually Sir Cumference decides on a round table.

I would use this book as a read aloud in my classroom. This book would be a great introduction to any chapter that involves geometry. My ideal time to use this book is when students have some knowledge about circles. I would read this book and then create a small activity to introduce pi. I would pass around various sizes of circles and pieces of string. Have the students measure the circumference and diameter and approximate the ratio between these two numbers. It should be approximately be 3.14. This would be a great read aloud to introduce this activity.
This book gives fun and interesting math tales about various aspects of mathematics. Certain types of areas include: decimals, squares, Fibonacci Sequence, Pi, and the number line. Each tale gives a fun and interesting tale that incorporates history and the many mathematical discoveries.

I could use this book in many ways in the classroom. It covers so many basic mathematical concepts that it could be used as a read aloud or attention grabber in the classroom. I could also read one of these tales as a time filler to give the students more knowledge about another aspect of mathematics. For instance, many students graduate not knowing what the Fibonacci sequence is. If I had time one day I could read the tale to the students and then go into a discussion about the sequence (1, 1, 2,3,5,8,…..) . There are so many fascinating and fun aspects of mathematics that are not covered in core areas. This book would give me an interesting introduction to many of these aspects.


In the *How Much is a Million?*, David Swartz uses physical objects to show that many people have no idea how much one million actually is. He uses concrete examples to help readers conceptualize the number one million. For example, it would take a goldfish bowl large enough to hold a whale to hold one million goldfish.

I would use this book as a read aloud. This would be a great book to begin a lesson about number computation. This would be a fun activity that helps students get a get a real sense of what the value of a number actually looks like. I would read this book to them and then have them get into groups. I would then have them come up with examples from the book that represents the number one billion. For instance, it would take 100 goldfish bowls large enough to hold a whale to hold one billion goldfish.


In the *Grapes of Math*, Gregory Tang uses clever rhymes to help create fun, interactive story problems. He uses helpful hints and strategies that help the reader to create and compute faster answers. This book covers pattern recognition, grouping, and multi-step thinking.

I would read this book as a read aloud in my classroom when starting the concept of word problems. Word problems are a hard concept to grasp. The hardest thing about word problems is reading and decoding the mathematical language. I would use this book as a transition tool. I would read it out loud and then split the class up into groups giving each one a problem from the book. These problems should not be difficult, but it would switch their minds from mathematical computation to reasoning.
E. Lesson Plan to activate prior knowledge of unit’s subject

MANCHESTER COLLEGE
Department of Education

LESSON PLAN by: Michelle Miller
Lesson: Adding and Subtracting Polynomials
Length: 45 minutes for lesson, plus 5 minutes for homework.
Grade: 8th Grade Algebra

Academic Standard:
A1.1.4 Use the laws of exponents for rational exponents.
A1.6.1 Add and subtract polynomials.

Performance Objectives: Given 20 problems on page 459, students will add and subtract polynomials using laws of exponents with 80% accuracy.

Assessment: Give the students a set of problems from the textbook with instructions to apply their knowledge of polynomials. After completion, the problem set will be graded on accuracy of adding and subtracting polynomials.

Advance Preparation by Teacher:
1) Bring a ball for introduction

Procedure:
Introduction: Ask for a volunteer. Then have the volunteer stand approximately fifteen to twenty feet away. Throw the ball up in the air across to the student volunteer while making a parabolic shape in the air. Ask the students “What shape is the ball making as it goes in the air?” Most students will say either an arc or a horseshoe. Draw this shape on the board. Then tell the students that this is a very common graph seen in upper math courses called a parabola. Then tell the students “A polynomial is the equation that represents this shape. With a polynomial equation you can interpret the path of this ball, when it will land, and where it will be at a certain time.” Reiterate to the students that this is something done in higher math classes but what the students will learn in this chapter will help them solve these types of problems in the future. Ask the students what other objects make this parabolic shape. Answers might include: rainbow, football, and a paper airplane. Tell the students that this is the type of equation that we will be dealing with in this unit. (Bloom: Knowledge, Analysis, Gardner: Kinesthetic, Spatial, Fisher: Chapter 3 Demonstrations)

Step by Step Plan:
1) Have the student volunteer sit down and ask everyone open to page 456 sections 9-1 in their Algebra 1 textbook.
2) Have a student read the definitions of a monomial and the degree of a monomial (Gardner: Verbal)
3) Put \(x^2y\) on the board.
4) Demonstrate using the definition of the degree of a monomial and show that \( x \) will have degree 2 and \( y \) will have degree one.
5) Now put the examples: \( 5x^3 \) and \( 8y^2z^3 \) on the board and have two students go up to the board and write down the degree of each monomial (Gardner: Kinesthetic, Bloom: Knowledge). (Answer: \( x \) has degree 3, \( y \) has degree 2, and \( z \) has degree 3)
6) Have another student read the definition of a polynomial. (Gardner: Verbal)
7) Write the example: \( 5+7x^3+2x^2+5x \)
8) Show the students that when writing polynomials you should combine like terms using rules of exponents and then write the terms in order. Largest degree first and smallest degree last.
9) Using the example on board, it should be simplified as \( 7x^3+7x^2+5 \)
10) Now write two examples on the board having the students do these examples at their seats while you walk around checking their progress. Examples are: \( 3x^4+x^3+x^4 \) and \( 4+2x^2+3x^5 \). (Gardner: intrapersonal)
11) The answers should be \( 4x^4+x^3 \) and \( 3x^5+2x^2+4 \).
12) Ask the students “What are the rules for adding exponents?” (Bloom: Comprehension)
13) Then give the example: \( (4x^3-3x)+(5x^2+4x) \). Tell the students that again they will add the terms using the rules of exponents and then collect like terms and then write the terms in order.
14) The answer will be \( 4x^3+5x^2+x \).
15) Finally put the example: \( (2x^2+x^3)-(x^2-x) \) on the board.
16) The important part of this example is the subtraction sign. Students need to realize that with a subtraction symbol the group of terms being subtracted will have the opposite sign.
17) After changing the signs, the example will then be \( 2x^2+x^3-x^2+x \). So the final answer should be \( x^3+x^2+x \).
18) Have the children pair up. Say “Using the knowledge you just learned today work with your partner on problems 24 and 32 on page 459” (Gardner: Interpersonal, Bloom: Application)
19) Go around the room making sure the students understand adding and subtracting polynomials.
20) Ask the students if they have any more questions. If not, assign 1-39 odd.

**Closure:** Ask the students to raise their hand and share one thing they learned today. Have 2-3 students answer. Also tell the students that tomorrow we will be learning how to multiply polynomials. Tell them to read the next section and come to class prepared to ask questions. (Bloom: Comprehension)

**Adaptations/ Enrichments:**
A student with math giftedness- Have the student do 15-39 odd and 40, 41,43,45,47,49, and 53. These problems are more difficult and ask higher level questions. Ask the higher level blooms questions to this student. Have this student work with a student that might benefit from peer tutoring. Have this student come
up to the board and do a problem. Have them explain their reasoning and thought process.

**Self Reflection:** Did all the students meet the objective? If not, why? Will I need to re-teach them? Was there enough time for the students to grasp the concept? What could I have done differently to improve this lesson?

**Citations:**
Lesson Plan by Michelle Miller

Lesson: Multiplying and Factoring
Length: 50 minutes
Age or Grade Intended: 8th grade algebra

Academic Standard:  
A1.6.2 Multiply and divide monomials  
A1.6.6 Find a common monomial factor in a polynomial

Performance Objective: Given 7 problems on page 463, students will multiply monomials with 80% accuracy.
Given 7 problems on page 463, students will find a common monomial factor in a polynomial with 80% accuracy.

Assessment: Give the students a set of problems from the textbook with instructions to apply their knowledge of polynomials. After completion, the problem set will be graded on accuracy of multiplying and factoring monomials.

Advanced Preparation by Teacher:  
1) Have vocabulary worksheet ready.  
2) Have overhead ready.

Procedure:

Introduction: As the students are entering the classroom have an overhead on the projector for the students to work on. See attached overhead assignment. As the students work on the assigned problems, take attendance. After attendance, collect previous night’s homework to grade. Let the students have 5 minutes to work on the overhead assignment. Once the time is up, call on three volunteers to go up to the board and put the first three problems and the answers on the chalkboard. These problems review the previous day’s lesson. Tell the students that they should be grading this assignment at their seats. For the last question, talk to your students and come up with new parabolic shape examples and see how polynomials could be applied to each scenario. Examples would consist of: shooting a basketball in the air and building a bridge. This shows the students the applications of what they are learning. (Gardner: Kinesthetic, Mathematical, Bloom: Knowledge, Application, Synthesis)

Step-by-Step:  
1) Collect the overhead assignment.
2) Pass out the vocabulary worksheet.
3) Explain to the students that throughout this chapter they will be responsible for filling out this worksheet and it will be handed in and graded before the test. Explain that the +, -, and – columns represent their comfort for each vocabulary word. Then they will also write the definition and an example for each word.
4) Do number one together, which was in the last section, so they have a good understanding of how to complete this chart. Unfortunately, there are no new vocabulary words in this section, but they do have some rows to fill in from section 9-1.
5) Have the students open their book to page 462 Section 9-2 and have them get out their notes.
6) Put -4x(5x^2-2x) on the board. Restate the exponent rules and show how to simplify and distribute. The answer is -20x^3+8x^2. The students should be at their seats actively taking notes. (Gardner: Visual)
7) Put two more examples on the board and call two volunteers to come up to the board and simplify them. The examples should be 4b(5b^2+b) and 2x^2(5x^2-7x^2). (Bloom: Application, Gardner: Kinesthetic)
8) Have the other students work on the examples at their seat. (Gardner: Intrapersonal)
9) Put a monomial on the board and list the factor. Example: 4x^3 = 2*2*x*x*x
10) Put example 6x^3-12x^2 and list out the factors. 6x^3 = 2*3*x*x*x and 12x^2 = 2*2*3*x*x. (Bloom: Application, Gardner: Interpersonal)
11) Show that these have the common factors, 2, 3, x, and x so the greatest common factor (GCF) is 6x^2
12) Put two examples on the board and have the students work with groups of four and find the GCF. Examples: 5x^5+10x^3 and 3x^2-18. (Bloom: Application, Gardner: Interpersonal)
13) Make sure you go around the classroom and monitor their progress.
14) Make sure you ask the students “Is there any questions that you have about what we have learned to far?” (Bloom: Comprehension)
15) Now show the students how to factor out the GCF in their examples. With the previous example 6x^3-12x^2 we showed that 6x^2 is the GCF. When you factor out the GCF, the answer is 6x^2 (x-2).
16) Still in the groups, have the students work on the two examples they previously were working on and factor out the GCF. (Bloom: Interpersonal)
17) Go around the room and monitor their progress.
18) Ask the students if there is any more questions. If not assign problems 1-23 odd and 27,29.

Closure: Ask the students share some things they learned today. Have 2 or 3 students answer. Make sure you review the exponent rules for multiplying exponents. Ask the students for these general rules. Before the bell rings, tell the students that tomorrow their homework will be collected and we will be starting on section 9-3. Tell the students to not only work on their homework but also look over the next section which is over foiling polynomials and come prepared to class to ask any questions they might have.
Adaptations/Enrichments:

A girl with ADHD- Have her work with another student that will keep her on task. Stand close to her desk while giving directions. Make sure she knows what the directions are. Have her as the volunteer that goes up to the board.

Self-Reflection:
Did all the students meet the objective? If not, why? Will I need to re-teach them? Was there enough time for the students to grasp the concept? What could I have done differently to improve this lesson?

Citations:

Section 9-1 review
Simplify and put in standard form:

1) \((x^3+5x)-(8x^2-5x^3)\)
2) \(y^2-y+y^6-y^2\)
3) \((x^5-x^7-x^2)+(x^4-2x^5)\)

Short Answer: Yesterday, I gave the example of a ball being thrown in the air to represent a parabolic shape. Come up with a different example of a parabolic shape.
Section 9-1 review

Simplify and put in standard form:

1) \((x^3+5x)-(8x^2-5x^3) = (6x^3-8x^2+5x)\)
2) \(y^2-y+y^6-y^2 = y^6-y\)
3) \((x^5-x^7-x^2)+(x^4-2x^5) = -x^7-x^5+x^4-x^2\)

Short Answer: Yesterday, I gave the example of a ball being thrown in the air to represent a parabolic shape. Come up with a different example of a parabolic shape.

Answers in Lesson Plan
<table>
<thead>
<tr>
<th>Word</th>
<th>+</th>
<th>~</th>
<th>-</th>
<th>Example</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Degree of Monomial</td>
<td></td>
<td></td>
<td></td>
<td>$7x^2y^3 = \text{degree 5}$</td>
<td>Sum of the exponents of its variables</td>
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<tr>
<td>2) Standard Form</td>
<td></td>
<td></td>
<td></td>
<td>$3x^4 + 5x^3 - 7x + 1$</td>
<td>Degrees of the monomial terms decrease from L to R</td>
</tr>
<tr>
<td>3) Polynomial</td>
<td></td>
<td></td>
<td></td>
<td>$x^2 + x$</td>
<td>Is a monomial or the sum or difference of 2 or more monomials</td>
</tr>
<tr>
<td>4) F.O.I.L</td>
<td></td>
<td></td>
<td></td>
<td>First outer Inner Last</td>
<td>Applying distributive property to two binomial</td>
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<td></td>
<td></td>
<td></td>
<td>$(x+1)(x+1) = x^2 + 2x + 1$</td>
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<tr>
<td>5) Square of a Binomial</td>
<td></td>
<td></td>
<td></td>
<td>$(x+1)^2 = (x+1)(x+1)$</td>
<td>Method for squaring a binomial</td>
</tr>
<tr>
<td>6) Perfect Square</td>
<td></td>
<td></td>
<td></td>
<td>$x^2 + 2x + 1$</td>
<td>A trinomial of the form $a^2 + 2ab + b^2$</td>
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<tr>
<td>7) Factor By Grouping</td>
<td></td>
<td></td>
<td></td>
<td>$y^3 + 3y^2 + 4y + 12$</td>
<td>You can use this method if two groups of terms have same factor</td>
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<td></td>
<td>$y^2(y+3) + 4(y+3)$</td>
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<tr>
<td>8) Binomial</td>
<td></td>
<td></td>
<td></td>
<td>$7x + 4$</td>
<td>A polynomial with 2 terms</td>
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<tr>
<td>9) Trinomial</td>
<td></td>
<td></td>
<td></td>
<td>$3x^2 + 2x + 1$</td>
<td>A polynomial with 3 terms</td>
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<tr>
<td>10) Monomial</td>
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<td></td>
<td>$4x^2$</td>
<td>Expression that a number, variable, or product of a number and one or more variables</td>
</tr>
</tbody>
</table>
Name: ______________________

Vocab Worksheet

<table>
<thead>
<tr>
<th>Word</th>
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<th>Example</th>
<th>Definition</th>
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<tbody>
<tr>
<td>1) Degree of Monomial</td>
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<td>2) Standard Form</td>
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<td>3) Polynomial</td>
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<td>4) F.O.I.L</td>
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<tr>
<td>10) Monomial</td>
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Lesson Plan modified for ADD

MANCHESTER COLLEGE
Department of Education

Lesson Plan by Michelle Miller

Lesson: Multiplying Binomials (Modified for a student with ADD)
Length: 50 minutes
Age or Grade Intended: 8th grade algebra

Academic Standards:
A1.6.4 Multiply polynomials.

Performance Objectives: Given 11 problems on page 469, students will multiply polynomials using the distributive property and FOIL method with 80% accuracy.

Assessment: Give the students a set of problems from the textbook with instructions to apply their knowledge of polynomials. After completion, the problem set will be graded on accuracy of multiplying polynomials.

Advance Preparation by Teacher:
1) Have article ready
2) Have handout copied

Procedure:

Introduction: Have the students come into the classroom and sit down. Begin class by reading out loud the attached article. This article gives some examples about how important mathematics is in everyday life. After reading the article, have the students get together in groups of 4 and plan how they could use mathematics in their own lives. After 5 minutes, have the students get together as a class and discuss some of the examples. Next, explain that in this lesson you will be showing the students a common application of multiplying polynomials. Tell the students that what they learned previously about multiplying monomials will come in handy in today’s lesson. (Bloom: Application, Synthesis Gardner: Auditory, Interpersonal)

Step by Step Plan:
1) Take attendance.
2) Collect homework from previous lesson.
3) Hand out the attached handout. Tell them that they will be using this handout for notes and practice.
4) Since they have already learned the distributive property. Go through the distributive property method for multiplying polynomials.
5) Have the students try the next example by themselves. (Gardner: Intrapersonal, Mathematical Bloom: Application)
6) Go over the FOIL method on the handout.
7) After the example ask the students to reiterate what FOIL stands for. (Bloom: Comprehension)
9) Have the students try the next example by themselves. (Gardner: Intrapersonal, Mathematical Bloom: Application)
10) Go over the real life application example using polynomials. (Gardner: Visual)
11) Have the students get into groups of 4 and come up with their own example similar to the example you just went over. (Bloom: Knowledge, Gardner: Interpersonal)
12) Make sure the students solve their own examples in their groups. (Gardner: Mathematical)
13) Ask the students if they have any questions.
14) Assign problems 1-21 odd on page 469.

**Closure:** Ask the students share some things they learned today. Have the students on a piece of paper write what FOIL stands for. Have the students turn in this slip before they leave. (First, Outer, Inner, Last) Before the bell rings, tell the students that tomorrow their homework will be collected and we will be starting on section 9-4. Tell the students to not only work on their homework but also look over the next section which is over multiplying special cases and come prepared to class to ask any questions they might have.

**Adaptations/Enrichments:**

A boy with ADHD- In group work, have the student work with other students that will keep him on task. Make sure he knows what the directions are. Have the student pick up the homework and pass out the handout. Ask him to erase the board before the lesson. Use positive reinforcement when he is staying on task.

**Self-Reflection:**

Did all the students understand the distributive and FOIL property? If not, why? Will I need to re-teach them? Was there enough time for the students to grasp the concept? Did the students understand the real life application of mathematics? What could I have done differently to improve this lesson?

**Citations:**


Mathematics in Daily Life

By: iCoachMath

Waxing eloquently on the basic importance of Mathematics in human life, Roger Bacon (1214-1294), an English Franciscan friar, philosopher, scientist and scholar of the 13th century, once stated: "Neglect of mathematics works injury to all knowledge, since he who is ignorant of it cannot know the other sciences or the things of the world." And the ingenuity of his statement is there before us to see, in this Internet era.

However, mathematics, in itself, has all the ingredients that make it a universal language shared by all human beings irrespective of culture, religion, or gender. Pi is always 3.14159 regardless of where we are. Similarly, the elemental mathematical processes (like addition, subtraction, etc.) never get changed due to a change in the location or for any other reason whatsoever. These all say about the close intertwining of mathematics in our daily life.

At a time when even a common man is being increasingly dependent upon the application of science and technology in the day-to-day activities of life, the role of mathematics has undoubtedly been redefined. Right from getting up in early hours of the day to the ringing of an alarm, to wait for the counts of whistles of the cooker, to exchange currency at a ticket outlet while availing a public conveyance, almost every next moment we do the simple calculations at the back of our mind. Of course, these are all done pretty unconsciously without a thought being spared for the use of mathematics on all such occasions.

Reading time on a watch, rounding a date on a calendar, checking up the mileage of your car, halting at the filling station, attending to a roll call at school, getting scores in the class exams, scoring in a game, betting on a horse race, preparing a recipe in the kitchen, - the list is just endless if one goes on to note down the situations when our computational skill, or more specifically, simple mathematics comes to play a role. It scares us to certain extent to think of a life without any knowledge of calculation or computation, or in other words mathematics. In many a case, lack of a formal education hardly affects gaining a relative mastery in these computational skills which are so essential in our daily life.

At a psychological level, exposure to mathematics helps in developing an analytic mind and assists in better organization of ideas and accurate expression of thoughts. At a more general level, far away from dealing with the higher mathematical concepts, the importance of mathematics for a common man is underpinned whenever he visits banks, shopping malls, railways, post offices, insurance companies, or deals with transport, business transactions, imports and exports, trade and commerce, and the ilk. Even when we think of role of mathematics in our recreational activities, we surprisingly have a list that runs quite long: video games, computer games, puzzles, riddles, and so on.

It ensues from the above discussion that a modern life style seems completely handicapped and at times, highly improbable, in the absence of mathematics. For, unless we are well versed in the language of numbers, we would find it difficult to reach at
important decisions and perform everyday tasks. Be it to shop wisely, or buy the right insurance, or refashion a home within a budget, knowledge of mathematics holds the key, and hence, barely necessary.
Methods for Multiplying Polynomials

Distributive Property:
1. \((2x+3)(x+4)\)
   \[
   = 2x(x+4) + 3(x+4) \\
   = 2x^2+8x+3x+12 \\
   = 2x^2+11x+12
   \]

You Try!
2. \((6h-7)(2h+3)\)

First Outer Inner Last (FOIL):

1. \((2x+3)(x+4)\)
   \[
   = 2x(x)+2x(4)+3(x)+3(4) \\
   = 2x^2+8x+3x+12 \\
   = 2x^2+11x+12
   \]

You Try!
2. \((3x+4)(2x+5)\)

Real Life Application: Pretend you want to plant grass in your yard surrounding a shed. Let this diagram display your yard and the shed.

Area of outer square: \((3x+1)(2x+5)\)
Area of shed: \((x+2)(x)\)
Area of grass area:
area of outer square- area of shed
\[
(3x+1)(2x+5)-(x+2)(x) \\
= 6x^2+15x+2x+5 -x^2+2x \\
=5x^2+15x+5
\]
Lesson Plan by Michelle Miller

Lesson: Multiplying Special Cases (modified for dyscalculia)
Length: 50 minutes
Age or Grade Intended: 8th grade algebra

Academic Standards:
A1.6.4 Multiply polynomials.

Performance Objectives: Given 10 problems on page 477, students will multiply polynomials using mathematical rules with 80% accuracy.

Assessment: Give the students a set of problems from the textbook with instructions to apply their knowledge of polynomials. After completion, the problem set will be graded on accuracy of multiplying polynomials.

Advance Preparation by Teacher:
1. Have PowerPoint ready on the board.
2. Have introduction ready on the board.

Procedure:

Introduction: Have the students walk into the classroom and sit down in their seats. On the board write, “Get into groups of 3 or 4. Pretend you have a black Labrador dog which has the gene (DY) and another black Labrador dog that has the gene (DY). You want to breed them. What is the probability you will have a yellow Labrador puppy? ” While they work in groups take the attendance and collect previous night’s homework. After about 5 minutes, have a representative from each group go up to the board and write their answer along with how they figured it out. Some students may not have an answer or may have the incorrect answer. Ask the students with an answer to defend their reasoning. Tell the students that they will be using their previous knowledge about multiplying polynomials to solve this sort of a problem in today’s lesson. (Bloom: Evaluation and Application, Gardner: Interpersonal, Mathematical)

Step by Step Plan:
1. Put the PowerPoint on the board.
2. Make sure that the mimeo board is on.
3. Slide 1: Have the students write in their notes this math rule.
4. Slide 2: Demonstrate how to use the squaring a binomial rule on an example. Have the students at their seats try it on their own. (Gardner: Intrapersonal)
5. Slide 4, 5, and 6 go into the example that was given at the beginning of class. Read each slide to the class and show the students how a Punnett square works. Ask the students: “So what is the probability using a Punnett square that two black labs with the gene (DY) will have a yellow lab?” The answer is ¼. (Bloom: Comprehension)
6. Slide 7: Show the students how to do metal math. Explain the example on the PowerPoint. While you do the example make sure you ask some of the basic multiplication facts in the problem. (Bloom: Knowledge)
7. Slide 8: Have them get with a partner, not with a student near them, and try these two examples with a partner. Go around the room and answer any questions. (Bloom: Application, Gardner: Kinesthetic, Mathematical)
8. Slide 9: Have the students go back to their seats and write down the final rule. Explain the example on the PowerPoint. Have them get with a partner next to their seats and work on the practice problem. (Gardner: Interpersonal)
9. Slide 10: Ask the students if there are any questions about this section.
10. Assign problems 1-20 odds.

**Closure:** Ask the students write an exit slip. Have them write a brief paragraph sharing something they learned today. Ask the students to share any concepts that they did not understand or “get” fully. Collect the paragraphs. Before the bell rings, tell the students that tomorrow their homework will be collected and we will be starting on section 9-5. Tell the students to not only work on their homework but also look over the next section which is over factoring quadratics and come prepared to class to ask any questions they might have.

**Adaptations/Enrichments:**

A boy with a dyscalculia learning disability- At the introduction, have the LD student work with a student that has patience and good teaching skills. If he doesn’t understand something, this student can help explain the problem and the concepts being used. The PowerPoint is a great tool to use with a LD student. This is a very visual tool that helps him read what the teacher is saying. If the student has trouble reading math, make sure that either a teacher or another student reads the Labrador example on the PowerPoint. Give the student graph paper to write on for the homework assignment.

**Self-Reflection:**
Did all the students understand the lesson? If not, why? Will I need to re-teach them? Was there enough time for the students to grasp multiplying polynomials? What were some of the comments that the students wrote in their paragraph? What could I have done differently to improve this lesson?

**Citations:**
I. Lesson plan modified for Gifted and Talented

MANCHESTER COLLEGE
Department of Education

Lesson Plan by Michelle Miller

Lesson: Factoring Quadratics (modified for gifted and talented)
Length: 50 minutes
Age or Grade Intended: 8th grade algebra

Academic Standards:
A1.8.2 Solve quadratic equations by factoring.

Performance Objectives: Given 15 problems on page 483, students will solve quadratics using the factoring method with 80% accuracy.

Assessment: Give the students a set of problems from the textbook with instructions to solve the quadratics using the factoring method. After completion, the problem set will be graded on accuracy of factoring.

Advance Preparation by Teacher:
1) Have handout ready.
2) Have overhead ready.
3) Have a ball ready.

Procedure:

Introduction: As the students are entering the classroom, have an overhead on the projector for the students to work on that reviews the previous lesson about using differences of two square and squaring a binomial theorem. See attached overhead assignment. As the students work on the assigned problems, take attendance. After attendance, collect previous night’s homework to grade. Let the students have 5 minutes to work on the overhead assignment. Once the time is up, call on four volunteers to go up to the board and put the four problems and the answers on the chalkboard. Tell the students that they should be grading this assignment at their seats. After you go over the problems, ask the students to get into groups of 4 and try to come up with strategies to factor $x^2 + 7x + 12$. Essentially, you are asking the students to work backwards. The previous two lessons consisted of simplifying the factors, but this lesson you are given the equation and need to compute the factors. Tell the students to think about how this type of problem is put together. Give the students about 5 minutes. Many students will have trouble with this task. Tell the students that this is what they will be learning today.
(Bloom: Analysis, Knowledge, Gardner: Interpersonal, Kinesthetic)

Step by Step:
1. Hand out the handout that is attached.
2. Start with the first problem that was presented to the students \( x^2 + 7x + 12 \) on the worksheet.
3. Do the problem on the handout and show how to factor the problem. The factors go in column one and the sum of the factors are in column two. (Gardner: Visual)
4. Explain that the factors’ sums need to sum up to the middle number.
5. Ask the students if there are any questions.
6. Have the students do problem two on their own. (Gardner: Mathematical)
7. Ask a student to come up and demonstrate this problem on the board.
8. Ask the students: Can anyone tell me the steps when factoring a problem of this type? (Bloom: Comprehension)
9. Do problem number 3. Point out that the there is a negative number in the middle.
10. Ask the students what the factors are for 42. (Bloom: Knowledge)
11. Have the students do number 4 by themselves. (Gardner: Intrapersonal).
12. Have another student come up to the board and demonstrate the problem, steps, and solutions.
13. Go over number 5.
14. Tell the students to pay close attention to the operation in front of every number.
15. Have the students do problem 6 with a partner. (Bloom: Application, Gardner: Interpersonal)
16. Ask a student to come up to the board and demonstrate the process for solving problem 6.
17. Ask the students if there are any questions?
18. If not, assign 1-29 odd.

**Closure:** Get a small ball. Toss the ball to a student and ask the student to share some thing he or she learned today. Have 2 or 3 students answer. Before the bell rings, tell the students that tomorrow their homework will be collected and we will be starting on section 9-6. Tell the students to not only work on their homework, but also look over the next section which is over factoring quadratics in the form \( ax^2 + bx + c \) and come prepared to class to ask any questions they might have.

**Adaptations/Enrichments:**

A boy that is gifted and talented in mathematics- In the introduction, this boy might be able to figure out the method to factor \( x^2 + 7x + 12 \). If the student does figure it out, have them come up to the board and demonstrate how they came up with the strategy. Ask the gifted and talented student the question “What is an application of factoring quadratics in everyday life?” to the gifted and talented student. You could ask this question at the end or during the lesson. When you put them into groups you can pair him with a student that is struggling. To the side, ask the gifted and talented student to help you by teaching the struggling students/student. Finally, assign the student a different set of problems. Assign him 17,19,25,29, 31, 33, 35, 37, 43, 45, 47, 49, 55, 57, 59. These problems are a little harder but cause the student to think and apply what he knows.
Self-Reflection:
Did all the students understand factoring quadratics? If not, why? Will I need to re-teach them? Was there enough time for the students to grasp the concept? Could I have done differently to improve this lesson?

Citations:

OVERHEAD:

\((c+1)^2\)

\((x+4)^2\)

\((x+4)(x-4)\)

\((a-8)(a+8)\)
OVERHEAD Key:

$(c+1)^2 = c^2 + 2c + 1$

$(x+4)^2 = x^2 + 8x + 16$

$(x+4)(x-4) = x^2 - 16$

$(a-8)(a+8) = a^2 - 64$
1. $x^2 + 7x + 12$

<table>
<thead>
<tr>
<th>Factors of 12</th>
<th>Sum of Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 12</td>
<td>13</td>
</tr>
<tr>
<td>2 and 6</td>
<td>8</td>
</tr>
<tr>
<td>3 and 4</td>
<td>7</td>
</tr>
</tbody>
</table>

$x^2 + 7x + 12 = (x+3)(x+4)$

2. $x^2 + 7x + 10$ (YOU TRY!)

<table>
<thead>
<tr>
<th>Factors of 10</th>
<th>Sum of Factors</th>
</tr>
</thead>
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</table>

3. $x^2 - 17x + 42$ (NOTICE IT IS NEGATIVE 17)

<table>
<thead>
<tr>
<th>Factors of 12</th>
<th>Sum of Factors</th>
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<tbody>
<tr>
<td>-1 and -42</td>
<td>-43</td>
</tr>
<tr>
<td>-2 and -21</td>
<td>-23</td>
</tr>
<tr>
<td>-3 and -14</td>
<td>-17</td>
</tr>
</tbody>
</table>

$x^2 - 17x + 42 = (x-3)(x-14)$ check by F.O.I.L

4. $x^2 - 10k + 25$ (NOW YOU TRY!)

<table>
<thead>
<tr>
<th>Factors of 12</th>
<th>Sum of Factors</th>
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<td></td>
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</tbody>
</table>
5. \( x^2 + 6x - 27 \)

<table>
<thead>
<tr>
<th>Factors of -27</th>
<th>Sum of Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and -27</td>
<td>-26</td>
</tr>
<tr>
<td>27 and -1</td>
<td>26</td>
</tr>
<tr>
<td>3 and -9</td>
<td>-6</td>
</tr>
<tr>
<td>9 and -3</td>
<td>6</td>
</tr>
</tbody>
</table>

\[ x^2 + 6x - 27 = (x-3)(x+9) = x^2 + 9x - 3x - 27 = x^2 + 6x - 27 \]

6. \( x^2 - 3x - 18 \) (YOU TRY!)

<table>
<thead>
<tr>
<th>Factors of -18</th>
<th>Sum of Factors</th>
</tr>
</thead>
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</table>
Lesson Plan by Michelle Miller

Lesson: Factoring Quadratics (modified for a student with anxiety disorder)
Length: 50 minutes
Age or Grade Intended: 8th grade algebra

Academic Standards:
A1.8.2 Solve quadratic equations by factoring.

Performance Objectives: Given 14 problems on page 487, students will solve quadratics using the factoring method with 80% accuracy.

Assessment: Give the students a set of problems from the textbook with instructions to solve the quadratics using the factoring method. After completion, the problem set will be graded on accuracy of factoring.

Advance Preparation by Teacher:
1) Have handout ready.
2) Admit writing prompt written on the board.

Procedure:

Introduction: As the students enter the classroom have the students sit down and begin writing their admit slip. This should be written on the board, “What did you learn from yesterday’s lesson? What problems arise if you factor a quadratic in the form ax^2 + bx + c? In other words, what problems does the “a” create? Make sure they know what you expect in regards of quality writing. You expect a paragraph with complete sentences, and correct grammar and punctuation. Give the students about 5 to write on these assigned questions. After they complete their writing to learn strategy, discuss their answers. Some students might struggle realizing what problems the “a” creates. Tell the students that this type of problem is what we will be covering today in class. (Bloom: Synthesis, Comprehension, Gardner: Linguistic)

Step by Step:
1. Pass out the handout to the students.
2. Go through number 1. Tell the students that column 1 represents the factors of “a”. Column 3 represents the factors of “c”. Column b represents the combinations of the sums of columns 1 and 2. The number in column 2 that matches “b” is the correct position of the factors. Ask the students for help with the factors. (Bloom: Knowledge)
3. Have the students work on number 2 by themselves. Go around the room and monitor their progress. Have one student go up to the board and write their steps and correct answer. (Gardner: Kinesthetic, Intrapersonal, Bloom: Application)

4. Go through number 3. Tell the students that this example has a negative c. Ask the students for help with the factors. (Bloom: Knowledge)

5. Have the students get with a partner and work on number 4. Have one of the students go up to the board and write down their steps and solution. Go over the student’s work. (Gardner: Interpersonal)

6. Go over problem 5. Show that something can be factored. This makes the equation simpler. Ask the students what could be factored out. (Bloom: Knowledge)

7. Have the students get together with a different partner and work on problem 6. Have a different student go up to the board and write down their steps and solution. Go over the students work. (Gardner: Mathematical, Interpersonal)

8. Ask the students if there are any questions. If not, assign 1-27 odds.

**Closure:** Ask the students to write down the steps for factoring this type of an equation. Give the student about two minutes to write down the steps. The answers should include:

1. See if something can be factored out.
2. Find factors of “a”.
3. Find factors of “c”.
4. Find the sum combinations of “a” and “c”.

Once they are done, ask the student to share the steps they came up with. Tell the students to not only work on their homework, but also look over the next section which is over factoring special cases and come prepared to class to ask any questions they might have. (Bloom: Comprehension)

**Adaptations/Enrichments:**

A girl with anxiety disorder- Encourage her to complete the problems that are on the handout. Allow her extra time when working with her partner or on the homework. Give her extra support and encouragement throughout the lesson. Do not have her be one of the students that go up to the board. Board work may stress her out. Have a schedule written on the board so there are no surprises.

1. Writing Prompt
2. Handout
3. Homework

**Self-Reflection:**
Did all the students understand factoring quadratics of the type ax² +bx+c? If not, why? Will I need to re-teach them? Was there enough time for the students to grasp the concept? Could I have done differently to improve this lesson?

**Citations:**
FACTORIZING OF THE TYPE $AX^2+BX+C$

1. $6n^2+23n+7$

<table>
<thead>
<tr>
<th>Product of A</th>
<th>Sum of products of B</th>
<th>Products of C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*6</td>
<td>1<em>7 + 1</em>6 = 13</td>
<td>1*7</td>
</tr>
<tr>
<td></td>
<td>1<em>1 + 7</em>6 = 43</td>
<td>7*1</td>
</tr>
<tr>
<td>2*3</td>
<td>2<em>7 + 1</em>3 = 17</td>
<td>1*7</td>
</tr>
<tr>
<td></td>
<td>2<em>1 + 7</em>3 = 23</td>
<td>7*1</td>
</tr>
</tbody>
</table>

$6n^2+23n+7 = (2n+7)(3n+1)$

2. $2y^2+5y+2$

<table>
<thead>
<tr>
<th>Product of A</th>
<th>Sum of products of B</th>
<th>Products of C</th>
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$2y^2+5y+2 = $

3. $7x^2-26x-8$

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<thead>
<tr>
<th>Products of A</th>
<th>Sum of products of B</th>
<th>Product of C</th>
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<tbody>
<tr>
<td>1*7</td>
<td>1*-8 + 1*7 = -1</td>
<td>1*-8</td>
</tr>
<tr>
<td></td>
<td>1<em>1 - 8</em>7 = -55</td>
<td>-8*1</td>
</tr>
<tr>
<td></td>
<td>1*-4 + 2*7 = 10</td>
<td>2*-4</td>
</tr>
<tr>
<td></td>
<td>1<em>2 - 4</em>7 = -26</td>
<td>-4*2</td>
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$7x^2-26x-8 = (x-4)(7x+2)$

4. $5d^2-14d-3$

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<tr>
<th>Products of A</th>
<th>Sum of products of B</th>
<th>Product of C</th>
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$5d^2-14d-3 =$
5. $20x^2+80x+35=5(4x^2+16x+7)$

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<tr>
<th>Product of A</th>
<th>Sum of products of B</th>
<th>Product of C</th>
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<tbody>
<tr>
<td>1*4</td>
<td>1<em>7+1</em>4= 11</td>
<td>1*7</td>
</tr>
<tr>
<td></td>
<td>1<em>1+7</em>4 = 29</td>
<td>7*1</td>
</tr>
<tr>
<td>2*2</td>
<td>2<em>7+1</em>2=16</td>
<td>1*7</td>
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</table>

$4x^2+16x+7 = (2x+1)(2x+7)$
$20x^2+80x+35 = 5(2x+1)(2x+7)$

6. $2v^2-12v+10$

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<tr>
<th>Product of A</th>
<th>Sum of products of B</th>
<th>Product of C</th>
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$2v^2-12v+10=$
Lesson Plan by Michelle Miller

Lesson: Factoring Quadratics (modified for a student with autism)
Length: 50 minutes
Age or Grade Intended: 8th grade algebra

Academic Standards:
A1.8.2 Solve quadratic equations by factoring.

Performance Objectives: Given 10 problems on a worksheet, students will solve perfect square quadratics using the factoring method with 80% accuracy.

Assessment: Give the students a set of problems on a worksheet with instructions to solve the perfect squares using the factoring method. After completion, the problem set will be graded on accuracy of factoring.

Advance Preparation by Teacher:
1. Have worksheet ready.
2. Put numbers 1, 2, 3, 4, 5, 6, 7, 8, 9 on pieces of paper.
3. Copy handout.
4. Have ball ready.

Procedure:

Introduction: As the students enter the room, have the students take a seat. Take the attendance. Have this problem on the board for the students to work on. “The area of this square is \( x^2 + 6x + 9 \). What are the lengths of the sides?” Tell the students to work on this problem. Give them about 5 minutes. Ask the students to share their work and reasoning. The answer should be \((x+3)\). Tell the students that these last couple of days we have been working on factoring quadratics. Today we will be talking about factoring special cases of quadratics. This type of question is called a perfect square. This type of equation is what we will be discussing today. (Bloom: Analysis, Gardner: Mathematical)

Step By Step:
1. Ask a student to read the definition on page 490. (Bloom: Auditory)
2. Give each student the handout.
3. Hand out the numbers to the students.
4. Explain that a quadratic is in this form \(ax^2+2ab+ab\).
5. Put the equation \(x^2+10x+25\) on the board. Have \(a=\) and \(b=\) on the board.
6. Ask what is the square root of 25? Ask the students what “a” and “b” are equal to in this example? The answer is \(a= 1\) and \(b =5\) (Bloom: Knowledge, Comprehension).
7. Have the students with numbers 1 and 5 come up to the board and magnet the pieces of paper next to \(a=\) and \(b=\). (Gardner: Visual)
8. Now have a student factor the equation using the handout. Have a student come up to the board and demonstrate how to factor the equation. (Gardner: Kinesthetic, Intrapersonal Bloom: Application)
9. Now put the equation \(9x^2+12x+4\) on the board. Have the students work on what “a” and “b” equal. Have the students with the numbers 3 and 2 go up to the board. Have them magnet their piece of paper. Then have the students factor the perfect square. Have a student come up to the board and demonstrate how to factor it. (Bloom: Application, Gardner: Mathematical)
10. Now draw a square on the board and say that the area of this square is \(4t^2+36t+81\). What is the length of each side? Have the students figure out what “a” and “b” equal. The students with 2 and 9 should put their paper on the board. Have the students factor the equation. Show how \((2t+9)\) is the length of each side of the square.
11. Ask the students if there are any questions. If not, hand out the worksheet.

**Closure:** Get a ball. Ask the students to share something they learned today. Toss the ball around the room to about 5 students. Tell the students to not only work on their homework, but also look over the next section which is over difference of two squares and come prepared to class to ask any questions they might have. (Bloom: Knowledge)

**Adaptations/Enrichments:**
A girl with autism- The \(a=\) and \(b=\) on the board is a great visual on the board for her. The handout is also a great visual. Put a schedule on the board to help her with transitions throughout the lesson. Create a learning environment comfortable for the student. Make sure her peers understand her disability. Have a peer work with her on the homework. This will help her with her social skills.

**Self-Reflection:**
Did all the students understand factoring perfect squares? If not, why? Will I need to re-teach them? Was there enough time for the students to grasp the concept? Could I have done differently to improve this lesson?

**Citations:**
PERFECT SQUARE TRINOMIALS

\[ a^2 + 2ab + b^2 = (a+b)(a+b) = (a+b)^2 \]

\[ a^2 - 2ab + b^2 = (a-b)(a-b) = (a-b)^2 \]
Factor each expression.

1. \( c^2 + 10 + 25 \)

2. \( k^2 - 16k + 64 \)

3. \( m^2 - 24m + 144 \)

4. \( t^2 - 14t + 49 \)

5. \( x^2 - 2x + 1 \)

6. \( h^2 + 12h + 36 \)

Find the length of each square.

7. \( 4m^2 + 20m + 25 \)

8. \( 49d^2 + 28d + 4 \)

9. \( 25g^2 - 40g + 16 \)
Factor each expression.

1. \( c^2 + 10 + 25 = (c+5)(c+5) \)

2. \( k^2 - 16k + 64 = (k-8)(k+8) \)

3. \( m^2 - 24m + 144 = (m-12)(m-12) \)

4. \( t^2 - 14t + 49 = (t-7)(t-7) \)

5. \( x^2 - 2x + 1 = (x-1)(x-1) \)

6. \( h^2 + 12h + 36 = (h+6)(h+6) \)

Find the length of each square’s side.

7. \( (2m+5)(2m+5) \) so \( (2m+5) \) is the length of the side

8. \( (7d+2)(7d+2) \) so \( (7d+2) \) is the length of the side

9. \( (5g-4)(5g-4) \) so \( (5g-4) \) is the length of the side
Lesson Plan by Michelle Miller

Lesson: Factoring Quadratics (modified for a student with mild mental retardation)
Length: 50 minutes
Age or Grade Intended: 8th grade algebra

Academic Standards:
A1.6.7 Factor the difference of two square and other quadratics

Performance Objectives: Given 13 problems on page 493, students will solve the difference of two squares using the factoring method with 80% accuracy.

Assessment: Give the students a set of problems from the textbook with instructions to factor the difference of two squares. After completion, the problem set will be graded on accuracy of factoring.

Advance Preparation by Teacher:
1. Have PowerPoint ready.
2. Have white boards, dry erase markers, and erasers ready.

Procedure:

Introduction:
Have the students come in and take a seat. The PowerPoint should be on the board.

Slide 1: Tell the students that these last couple of days we have been working with factoring various quadratics. Today we will continue this by talking about differences of two squares. Ask the students to name types of factoring methods. Answers should include perfect square quadratics, factoring special cases, and FOIL.

Slide 2: Ask the students take out a piece of paper and write the writing prompt written on slide 2 that predicts what class is going to be about today. You are essentially asking them to use their prior math knowledge to interpret the words “difference of two squares”.

Ask the students to share what they think the form of difference of two squares is. Tell the students that if their questions are not answered throughout this lesson that you will answer them after the lesson is over. (Bloom: Analysis, Gardner: Linguistic)

Step by Step Plan:
1. One row at a time, let the students get up and get a white board, marker, and eraser from the back table.
2. Slide 3: Tell the students to write this rule in their notebooks. Tell the students to write this definition on their white board for future reference. Have the students hold up their white boards to demonstrate they have done this. (Gardner: Linguistic)

Slide 4: Have a student come up to the board and write what “a” is equal to. Have another student right what “b” is equal to using the rule shown on the previous slide and on their white boards. Show how to use the rule in this case. Ask the students what the square root of 64 is. The students should also be doing this example at their desks on their white boards. (Bloom: Comprehension, Knowledge)

Slide 5: Now give another example. Show that this has a 4 in front of the $a^2$. Ask two students what “a” and “b” equals. Go through the example with the students. Again the students should be using their white board to complete this problem with you. Have the students hold up their white boards to show their work. (Gardner: Visual, Auditory)

Slide 6: Now have the students do this problem on their own at their desks. Have one student to come up to the board and complete the problem. At the end, the students should hold up their white boards and show the completed problem. Make sure every student has completed this problem (Bloom: Application, Gardner Intrapersonal)

Slide 7: Ask the students what the common factor is in this equation. Show on the board how to factor the 10 out. Show how this problem is factored the usual method like the previous problems.

Slide 8: Now have the students work in pairs on this problem on their white boards. Ask the student what the common factor is. Have a student come up to the board and write the factors. Have another student come up to the board and complete the problem. Have the other students raise their white boards to show the completed problem. Scan the white boards to make sure they have the correct answer. (Bloom: Knowledge, Gardner: Mathematical, Interpersonal)

2. Ask the students to share any questions that pertain to the lesson that was not answered.

3. Assign 11-35 odds, on page 493.

**Closure:** Ask the students on a scrap piece of paper to write down the step to factor difference of two squares. Give them 5 minutes. The answer should include:
1. Factor out common factor if there is one
2. Find what “a” equals and “b” equals.
3. Use the rule to find the factors.

Before the bell rings, tell the students that tomorrow their homework will be collected and we will be starting on section 9-5. Tell the students to not only work on their
homework but also look over the next section which is over factoring by grouping and come prepared to class to ask any questions they might have.

Adaptations/Enrichments:
A boy with mild mental retardation- The PowerPoint is a great visual aid for the student to understand the steps for factoring. Give the student an outline of the lesson and a print out of the PowerPoint. The white boards are also a great way for him to get the general concepts while still being apart of the class and having fun. Give the student graph paper for homework. Only assign 11-21 odds. These problems are simpler and could be done by following the examples from the PowerPoint.

Self-Reflection:
Did all the students understand the lesson? If not, why? Will I need to re-teach them? Was there enough time for the students to grasp difference of two squares? Did the students understand the PowerPoint? What could I have done differently to improve this lesson?

Citations:

Lesson Plan by Michelle Miller

Lesson: Factoring by Grouping (modified for a student with a hearing impairment)
Length: 50 minutes
Age or Grade Intended: 8th grade algebra

Academic Standards:
A1.8.2 Solve quadratic equations by factoring.

Performance Objective:
Given 10 problems on page 499, students will solve quadratic equations using the factoring by grouping method with 80% accuracy.

Assessment: Give the students a set of problems from the textbook with instructions to use the factoring by grouping method to solve quadratic equations. After completion, the problem set will be graded on accuracy of factoring.

Advance Preparation by Teacher:
1. Have graphic organizer ready.
2. Have 1, 2, 3, 4 on pieces of paper. There should be enough for each student to have one number.

Procedure:

Introduction:
Have the students come in and take a seat. Have these few problems on the board as the students enter the room:
1. $x^2 - 4$
2. $x^2 - 2x + 1$
3. $49y^2 - 4$

Have the students do these few problems on the board. While the students are doing this activity take attendance and collect last night’s homework. Have three students go up to the board and complete these three problems.

Answers:
1. $(x+2)(x-2)$
2. $(x-1)(x-1)$
3. $(7y-2)(7y+2)$
Tell the student that these past few lessons we have been dealing with factoring and using various methods of factoring. Today, we will be discussing the last method of factoring before the test. This method is called the factoring by grouping method. Tell the students that factoring can be applied to many things. One application is trying to find dimensions of a rectangular prism. Ask the students what a rectangular prism would look like? The answer is a 3 dimensional rectangular figure. Imagine a cardboard box; this is an example of a rectangular prism. This is the type of problems we will be dealing with today.

(Gardner: Mathematical, Bloom: Synthesis)

**Step By Step:**

1. Give each student a number. Every student should either have a 1, 2, 3, or 4.

2. Have a student pass out the graphic organizer paper.

3. Now have the students get out their textbook and look on page 497. There is a chart in the center of the page. Each student will read their step. So 1’s will read step 1, 2’s read step 2, 3’s read step 3, and 4’s read step 4. Make sure every one is using the example 48x²+46x+5. (Gardner: Linguistic)

4. Give the students five minutes to look over their step. Tell the students that they should fill out their own square on the graphic organizer along with an example demonstrating the step in that box.

5. Now put the class into groups of 4 where there is a 1, 2, 3, 4 in each group. (Gardner: Kinesthetic)

6. Have the students share each of the steps and what you are supposed to do in each step. Tell the class that if one of their peers is teaching a step, you should be writing what the step is and the example. At the end of the group work, every student should have their graphic organizer filled in with the step and an example in each box.

7. Ask the students what are the four steps for factoring by grouping? (Find the product of ac, find the two factors of ac that have sum b, Rewrite the trinomial using the sum, factor by grouping) (Bloom: Comprehension)

8. Now write this in the board 24q² + 25q - 25. Ask the students in their groups to factor this equation using the grouping methods. (Gardner Interpersonal Bloom: Application)

9. Once they’re are done ask the following questions:
   - What is the product of ac?
   - What are the two factors that have sum of b?
   (Bloom: Knowledge)

10. Have one student come up to the board and write the final two steps.
11. Now ask the students to solve this word problem using the factoring by grouping method: The volume of the rectangular prism is length * width* height. The volume is $80x^3 + 224x^2 + 60x$. Factor to find possible expressions for the length, width, and height of the prism. Tell the students that they can work in their groups. (Bloom: Application, Gardner Mathematical)

12. Have one student come up and put step 1. One student put up step 2. One student put up step 3 and one student put up step 4. The answer to this problem should be $4x(10x+3)(2x+5)$

13. Ask the students if there are any questions over the section

14. If not, assign problems 1- 19 odds on page 499

**Closure:** Ask the students on a scrap piece of paper to write down the 4 steps to the factoring by grouping method. Also ask the students to give one example of a rectangular prism. Have the students turn this slip in.

Before the bell rings, tell the students that tomorrow their homework will be collected. Tell the students that tomorrow we will be reviewing for a test for the following day. Come prepared to come to class with questions over chapter 9.

**Adaptations/Enrichments:**
A boy with a hearing impairment- Make sure the student sit in front of the room. If the student has trouble hearing during group work, have the student and his group go out in the hallway to work on problems. It will be quieter. The graphic organizer is a great tool for the student to understand the four steps and has an example to follow to understand the concept. Make sure the directions for the practice problems are on the board are written out so the student understands the introduction task. Repeat the information and questions and verify that they do in fact understand. Making copies of the questions will help the student get involved with the lesson. Use any tools that are available such as a microphone or hearing aids.

**Self-Reflection:**
Did all the students understand the lesson? If not, why? Will I need to re-teach them? Did the students like the white board technique? Did the students stay on task with the white boards or where they distracted? Was there enough time for the students to grasp the grouping method? Did the students work well in groups? What could I have done differently to improve this lesson?

**Citations:**
Please be neat and complete with all your answers. Show all work. No books or notes are allowed. You may use a calculator. Good Luck!

1. Write what F.O.I.L stands for. (8 points)

F=

O=

I=

L=

2. A monomial is __________. (2 points)
   a) a number
   b) a variable
   c) a number and a variable
   d) a number, a variable, or a product of a number and one or more variables

3. A polynomial is __________. (2 points)
   a) a monomial or the sum or difference of two or more monomials
   b) the sum of two or more monomials with degree less than 2
   c) the sum or difference of two or more monomials less than 3
   d) a monomial

4. Find GCF of each polynomial (2 points each)

   a) $36v+24$

   b) $6a^2-8a$

   c) $9x^3-6x+12$
5. Simplify into standard form. (2 points each)
   a) \(2x^2(9+x)\)
   b) \(-5c^3(9c^2-8c-5)\)
   c) \((17n^4+2n^3)-(10n^4+n^3)\)

6. Use FOIL to simplify. (2 points each)
   a) \((x^2+2)(x+5)\)
   b) \((a-8)(a-9)\)
   c) \((w-12)^2\)

7. Factor each equation. Classify each equation and as either a Perfect Square, Differences of Two Squares, or Neither. (4 points each)
   a) \(x^2+7x+12\)
   b) \(x^2-8x+16\)
   c) \(6n^2+23n+7\)
   d) \(x^2-64\)
8. A friend of yours says that he has a square room that is represented by the equation 
$$4m^2+20m +25.$$ He or she can’t figure out the lengths of the sides. What solutions would 
you tell your friend to help him or her figure out the lengths of one of the sides? In other 
words, what should your friend do to solve this equation? (2 points)

b) What are the lengths of the sides of the room? (2 points)

9. What are the four steps when you use the factoring by grouping method? (8 points)

10. Factor by grouping. Be sure to show all the steps. (4 points each)

a) $$2m^3+6m^2+3m+9$$

b) $$6n^3 +3n^2+2n+1$$

11. Throughout this unit, we discussed practical ways mathematics can be applied to 
concepts in the real world. In a short paragraph, do you think that mathematics plays a 
vital role in your life? Why or why not? If it does, give a short example of how you use 
mathematics is your life. (4 points)
Chapter 9 Test  
8th Grade  

Name:____________________________                                              Date: __________

Please be neat and complete with all your answers. Show all work. No books or notes are allowed. You may use a calculator. Good Luck!

1. Write what F.O.I.L stands for. (8 points)

F=
O=
I=
L=

2. A monomial is __________. (2 points)
   a) a number
   b) a variable
   c) a number and a variable
   d) a number, a variable, or a product of a number and one or more variables

3. A polynomial is __________. (2 points)
   a) a monomial or the sum or difference of two or more monomials
   b) the sum of two or more monomials with degree less than 2
   c) the sum or difference of two or more monomials less than 3
   d) a monomial

4. Find GCF of each polynomial (2 points each)
   a) 36v+24
   b) 6a^2-8a
5. Simplify into standard form. (2 points each)
   a) $2x^2(9+x)$
   b) $(17n^4+2n^3)-(10n^4+n^3)$

6. Use FOIL to simplify. (2 points each)
   a) $(x^2+2)(x+5)$
   b) $(w-12)^2$

7. Factor each equation. Classify each equation and as either a Perfect Square, Differences of Two Squares, or Neither. (4 points each)
   a) $x^2+7x+12$
   b) $6n^3+23n+7$
   c) $x^2-64$

8. What are the four steps when you use the factoring by grouping method? (8 points)

9. Throughout this unit, we discussed practical ways mathematics can be applied to concepts in the real world. In a short paragraph, do you think that mathematics plays a vital roll in your life? Why or why not? If it does, give a short example of how you use mathematics is your life. (6 points)
Please be neat and complete with all your answers. Show all work. No books or notes are allowed. You may use a calculator. Good Luck!

1. Write what F.O.I.L stands for. (8 points)

F= First
O= Outer
I= Inner
L= Last

2. A monomial is ____d______. (2 points)
   a) a number
   b) a variable
   c) a number and a variable
   d) a number, a variable, or a product of a number and one or more variables

3. A polynomial is _____a______. (2 points)
   a) a monomial or the sum or difference of two or more monomials
   b) the sum of two or more monomials with degree less than 2
   c) the sum or difference of two or more monomials less than 3
   d) a monomial

4. Find GCF of each polynomial (2 points each)
   a) $36v+24 = 12(3v+2)$

   b) $6a^2-8a= 2a(3a-4)$

   c) $9x^3-6x+12= 3(3x^3-2x+4)$
5. Simplify into standard form. (2 points each)
   a) \(2x^2(9+x) = 18x^2+2x^3\)

   b) \(-5c^3(9c^2-8c-5) = -45c^5+40c^4+25c^3\)

   c) \((17n^4+2n^3)-(10n^4+n^3) = 7n^4+n^3\)

6. Use FOIL to simplify. (2 points each)
   a) \((x^2+2)(x+5)= x^3+5x^2+2x+10\)

   b) \((a-8)(a-9)= a^2-17a+72\)

   c) \((w-12)^2= w^2-24w+144\)

7. Factor each equation. Classify each equation and as either a Perfect Square, Differences of Two Squares, or Neither. (4 points each)
   a) \(x^2+7x+12 = (x+3)(x+4)\) Neither

   b) \(x^2-8x+16= (x-4)(x-4)\) Difference of two squares

   c) \(6n^2+23n+7= (2n+7)(3n+1)\) Neither

   d) \(x^2-64= (x+8)(x-8)\) Perfect square
8. A friend of yours says that he has a square room that is represented by the equation $4m^2+20m+25$. He or she can’t figure out the lengths of the sides. What solutions would you tell your friend to help him or her figure out the lengths of one of the sides? In other words, what should your friend do to solve this equation? (2 points)

Factor the equation and the factor is the length of the side.

$b) \text{What are the lengths of the sides of the room? (2 points)}$

$(2m+5)(2m+5) \text{ so the length is } (2m+5)$

9. What are the four steps when you use the factoring by grouping method? (8 points)
1. Find the product of ac
2. Find the two factors of ac that sum up to b
3. Rewrite trinomial using sum
4. Factor by grouping

10. Factor by grouping. Be sure to show all the steps. (4 points each)

$a) \ 2m^3+6m^2+3m+9 = 2m^2(m+3) + 3(m+3)$

$b) \ 6n^3+3n^2+2n+1 = 3n^2(2n+1)+(2n+1)$

11. Throughout this unit, we discussed practical ways mathematics can be applied to concepts in the real world. In a short paragraph, do you think that mathematics plays a vital role in your life? Why or why not? If it does, give a short example of how you use mathematics is your life. (4 points)
Answers may vary.
Name: ____________________________ Date: __________

Please be neat and complete with all your answers. Show all work. No books or notes are allowed. You may use a calculator. Good Luck!

1. Write what F.O.I.L stands for. (8 points)

F = First

O = Outer

I = Inner

L = Last

2. A monomial is ___d_______ . ( 2 points )
   a) a number
   b) a variable
   c) a number and a variable
   d) a number, a variable, or a product of a number and one or more variables

3. A polynomial is ____a_______. ( 2 points)
   a) a monomial or the sum or difference of two or more monomials
   b) the sum of two or more monomials with degree less than 2
   c) the sum or difference of two or more monomials less than 3
   d) a monomial

4. Find GCF of each polynomial (2 points each)
   a) 36v+24 = 12(3v+2)

   b) 6a^2-8a= 2a(3a-4)
5. Simplify into standard form. (2 points each)
   a) \(2x^2(9+x) = 18x^2 + 2x^3\)

   b) \((17n^4 + 2n^3) - (10n^4 + n^3) = 7n^4 + n^3\)

6. Use FOIL to simplify. (2 points each)
   a) \((x^2 + 2)(x + 5) = x^3 + 5x^2 + 2x + 10\)

   b) \((w - 12)^2 = w^2 - 24w + 144\)

7. Factor each equation. Classify each equation and as either a Perfect Square, Differences of Two Squares, or Neither. (4 points each)
   a) \(x^2 + 7x + 12 = (x + 3)(x + 4)\) Neither

   b) \(6n^2 + 23n + 7 = (2n + 7)(3n + 1)\) Neither

   c) \(x^2 - 64 = (x + 8)(x - 8)\) perfect square

8. What are the four steps when you use the factoring by grouping method? (8 points)
   1. Find the product of \(ac\)
   2. Find the two factors of \(ac\) that sum up to \(b\)
   3. Rewrite trinomial using sum
   4. Factor by grouping

9. Throughout this unit, we discussed practical ways mathematics can be applied to concepts in the real world. In a short paragraph, do you think that mathematics plays a vital roll in your life? Why or why not? If it does, give a short example of how you use mathematics in your life. (6 points)
   Answers may vary.
**Modifications for Chapter 9 Test**

This test is the modified version of the chapter 9 unit test for a learning disability student. I took a few problems away from the original test. The first few questions are the same because they are knowledge based questions. I took away the amount of problems on each question. I also took away the word problem and the factoring by grouping problems. This creates a test that isn’t as intimidating for the student and makes it possible for the student to complete the test in the time allotted. The questions still address all the standards in this unit and the necessary tasks for the student to understand to pass the course. The majority of the questions on the test are knowledge, comprehension, and application Bloom level questions.

Other modifications that I would implement would be to allow a special education teacher or aid to read the test to the student. All the questions involve some reading, so having someone read the questions to the student would help. With someone reading the test, I would ask the student to take the test in another classroom where it was quiet with minimal number of distractions. I would also allow this student to have and extra 15 minutes to complete the exam. These are the modifications on my chapter 9 unit test.
REFLECTION PAPER

One of the many things I learned throughout the development of this unit was the importance of reading in mathematics. Reading in mathematics is extremely different than reading a novel in an English class. The words and symbols are a whole new language. In order to understand mathematics, a student needs to first understand its language. Students need to be able to read a math textbook outside of class in order to understand the content or a lesson. I will have trouble covering everything in the textbook. Many times students will go home to do homework and not understand a certain problem. The students need to learn that many times the answer is the textbook. I also want my students to read the section before the class period. This will cause them to come to class already knowing the material or the students will have questions already in mind. Reading in mathematics is extremely important in upper level math classes. This will make high school students to take responsibility for their education and prepare them for higher education.

Throughout this unit and class, I learned many techniques that will enhance my classroom for my students, as well as my exceptional learners. I learned that visuals are very helpful and useful in the classroom. This will help students of many learning types. Creating new and interesting ways to teach certain lessons will also help engage your students. Allow them to get out of their seats and work with their peers is always a great technique. Have a great “hook” to really grasp the attention of your students. Depending on the exceptionality, many things can be implemented into the classroom. Make sure you are aware of all the students’ learning disabilities or impairments. Become
knowledgeable of the exceptionalities and what is recommended for modifications in the classroom.

In this class, our textbook talks about many modifications and enrichments that can be done throughout a classroom to engage the students. Personally, I feel that chapter three will be the most useful tool when teaching my future students. This chapter is about the high incidence disabilities such as speech, learning, intellectual, and emotional disabilities. These are many of the disabilities that are found most frequently in a classroom. Not only does this chapter describe many of these disabilities, but it also gives modifications and adaptations that can be made in the classroom. Out of these four high incidence disabilities, I find that the student with an emotional disability would be the most intimidating when making accommodations. Before taking this class, I wouldn’t know how to handle or adapt the classroom for a student with an emotional disability. I know that in the future, I will definitely look back through this textbook for new ideas and modifications that I could use to enhance my classroom environment.

This class and project prepared me for some of the challenges I will face in my student teaching. I was able to get a grasp on how to write a lesson plan, as well as, write an engaging lesson. I know how to make the modifications and adaptations needed in my classroom. This unit showed me more importantly how hard of a job a teacher really is. I understand that a great teacher is one that will put forth the effort to create an environment and lesson that enhances the learning process.