Reading in the Content Area:

A Polynomial Unit Plan

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TESTBOOK INFORMATION

NAME OF COURSE/GRADE LEVEL: Algebra 1, 8th Grade

DESCRIPTION OF COURSE: Algebra 1 covers many topics including equations, inequalities, solving and applying proportions, graphs and functions, linear equations and their graphs, systems of equations, polynomials, and quadratic equations. The course involves much group work as well as individual work time and homework each night. Students are expected to come to class prepared each day to learn and to give their best effort the entire class period.

NAME OF CHAPTER/UNIT: Chapter 9: Polynomials and Factoring

DESCRIPTION of CHAPTER/UNIT: This unit is on polynomials and factoring. Students will spend approximately 2 weeks on this unit while learning about methods like foiling in addition to things like factoring the difference of two squares and other quadratics. Each lesson plan contains a different instructional strategy and/or a different modification. Answers keys to both the lessons and the unit test are included in this unit.

TITLE OF TEXTBOOK: Algebra 1

NAME(S) OF AUTHOR(S)/EDITOR(S): Dan Kennedy, Randall I. Charles, Sadie Bragg

NAME OF PUBLISHING COMPANY: Prentice Hall Mathematics

COPYRIGHT DATE: 2004

READING LEVEL OF TESTBOOK: 9th Grade

B. PHILOSOPHY OF READING IN THE CONTENT

STANDARDS

- A1.6.1 Add and subtract polynomials.
- A1.6.2 Multiply and divide monomials. (Core Standard)
- A1.6.3 Find powers and roots of monomials (only when the answer has an integer exponent). (Core Standard)
- A1.6.4 Multiply polynomials. (Core Standard)
- A1.6.5 Divide polynomials by monomials. (Core Standard)
- A1.6.6 Find a common monomial factor in a polynomial. (Core Standard)
- A1.6.7 Factor the difference of two squares and other quadratics. (Core Standard)
- A1.6.8 Understand and describe the relationships among the solutions of an equation, the zeros of a function, the x-intercepts of a graph, and the factors of a polynomial expression. (Core Standard)

**IMPORTANCE**

Students in Algebra 1 need to study polynomials because polynomials is a core standard for the Indiana Department of Education. Polynomials are the basic formulas students will need to know for Algebra 2 as well as any higher level math classes students take in high school. For instance, when students enter pre-calculus, they will be expected to know about polynomials because they are the basis for graphing data. Polynomials are one of the basic math skills students need to be successful when they go into high school classes and beyond.

**PHILOSOPHY**

Reading is important in Algebra 1 because students need to be able to think critically when they read the problem. A lot of Algebra 1 is based on problem solving. However, if students are unable to read into the problem and figure out what information they need and what information they don’t need then they will be unable to work. Algebra 1 does a lot of work with real-life applications and reading is our world each and every day.

In addition, students need to be able to put two parts of a problem together in order to figure out the best way to go about the problem. That may mean that the students have to read information from different sources to figure out the best way to find an answer. Being able to evaluate those sources and decide if one solution is better than another is an important skill for students to have. For example, if students were to read each others’ writings about how they got answers to solve a certain group problem, they need to be able to evaluate those answers and try to understand what their classmates did and why. Students who can do this kind of reading will be able to help not only each other problem solve but will better understand the concepts in Algebra 1 by themselves.
Fry Readability Test

Three 100-word samples from the textbook

“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. Use the mean to describe the middle of a set of data that does not have an outlier. An outlier is a data value that is much higher or lower than the other data values...” (page 118)

Sentences: 5 and 9/10  Syllables: 153

“Suppose you combine ingots of 25% copper alloy and 50% copper alloy to create 40 kg of 45% copper alloy. How many kilograms of each do you need? When starting a business, people want to know the break-even point, the point at which their income equals their expenses. The graph at the right shows the break-even point for one business. Notice that the values of y on the red line represent dollars spent on expenses, and the values of y on the blue line represent dollars received as income. So y is used to represent both...” (page 363)

Sentences: 5 and ½  Syllables: 137

“Fractions like 5/9,7/12,and ½ are rational numbers. A ratio of two polynomials is a rational expression. Here are some examples of rational expressions. Of course, the value of the expression in the denominator cannot be zero, since division by zero is undefined. For the rest of this chapter, assume that the values of the variables that make the denominator zero are excluded from the domain. Like rational numbers, a rational expression is in simplest form if the numerator and denominator have no common factors except 1. For example, \( \frac{(x+5)}{10z} \) is in simplest form since neither 10 nor z...” (page 652)

Sentences: 6 and 4/5  Syllables: 168

Totals:  Sentences: 18.2  Syllables: 453
Average:  Sentences: 6.06  Syllables: 151
The Fry Readability Graph says the text is written at a 9th grade level.

The graph puts the textbook at a ninth grade level. In general, I agree with the textbook. Although my eighth graders are using the textbook, Algebra I was originally meant to be a 9th grade class. The text told me what I already suspected. I believe that the eighth graders can handle the text because if they are taking the class in middle school then they are supposed to be ready for high school level material, like a ninth grade math book. I also have tenth and eleventh grade students at my high school who are reading using this book in their Algebra I class. For those students who are above the ninth grade level I think this book is also appropriate because they are not working at grade level and may need a book that is a little bit easier for them to understand, like a book written at the ninth grade level. The words and sentences in the textbook contain some difficult vocabulary terms, like polynomials or measures of central tendency, and it uses these vocabulary terms a lot. A student needs to be able to understand what these words mean and the math classes at the middle school level help get students ready to read and understand these words in high school, or eighth grade if that is when they are ready to take Algebra. However, the sentences are not too long that a 14 or 15 year old student would stop understanding them or get confused by all the words. Therefore, I that this book Algebra I book was written for students at the ninth grade level and that it is appropriate for Algebra I students.
Tradebooks


A boy wakes up with a cat on his head and he does not know what to do to get it off. The cat explains that he will get off if the boy can beat him at a few games of chance. The boy plays along guessing at all the games they play. However, the boy only guesses about the outcomes of the events and ends up losing each time. Finally, though, he figures out how probability, odds, and outcomes play when it comes to games of chance and he beats the cat in time to remove it from his head before his soccer game.


In the story, a boy named Pythagoras travels with his dad to Alexandria to meet a builder named Neferheperhersekeper. The builder introduces Pythagoras to the concept of right angles and allows the boy to follow and watch him as he builds. By the end of the story, the Pythagoras has noticed that all right angles follow a precise formula and so the special number pattern came to be known as the Pythagorean theorem.


Robert is having dreams of a magical land where numbers play tricks and a mean man called the number devil is in charge. The two compete against one another to solve a series of problems and, when Robert tries to take the easy way out or calls math boring, the number devil loses his temper. In the end, Robert must find the usefulness in math and beat the number devil in order to stop having the dreams about the magical land of number tricks.


Fourteen-year-old Ravi, loves math. So it is not surprise when the local police force calls upon him to come out to their crime scenes to solve the cases with math. The stories are similar to *Encyclopedia Brown* cases except in these stories only high schools math is involved, except for one case that has some calculus in it, but with Ravi’s help the reader is able to solve them all.


Jeremy and Sam’s school decide to take cancel math from the school day for all the classes in the district. While most students are excited, Sam is upset and he signs up to debate against the Director of Education. in his argument, Sam talks about how many is
found in all things, such as in music, cartoons, or bicycles. Jeremy shares his thoughts too on ideas like chaos theory and cash prizes for new prime numbers. In the end, the Director of Education, and even the students, admit that math has a place in the school day and should continue to be taught.


Tess loves math, until she started middle school algebra. The concept of variables throws Tess of her game and now everything in the eighth grade seems like a variable including boys, parents, and friends. In the story, there are many mysteries with plenty of variables for Tess to confront including a suicide, a stolen history test, and a cheating scandal. Tess does make it through it all however and passes Algebra class and once again falls in love with math.


Tess is back with her new love for math despite Algebra and variables. On her way to school one day she sees a series of numbers spray painted onto a building. Tess knows it is a math puzzle so she solves it to reveal a secret code about an fire that happened and Tess believes the message is about a fire that happened at school. Despite maybe getting in trouble Tess writes back to find out more information. She does solve the mystery but she also gets caught and must deal with the punishment.


The story of Sir Cumference and the Dragon of Pi is about a boy named Radius who must use math to rescue his dad because his dad drank a potion that turned him into a dragon. Radius in on a quest to find the magic number which change his dad back into his normal self. The magic number turns out to be pi, or 3.14, and Radius finds it by figuring out that it is the same magic number for all circles.


The story begins with King Arthur getting his knights together around a table that is too long and narrow. Everyone must shout to be heard, although this is better than the triangular table that was too pointy for everyone to sit at. So King Arthur calls a knight, named Sir Cumference, and his wife, named Lady Dî of Ameter, and their son, Radius, to help solve the problem. The solution, of course, happens to be a round table where everyone is equal distance from each other and no one has to shout to be heard or hit by point corners.

Sir Cumference is back and this time Per is off to visit his aunt and uncle Lady Di of Ameter and Sir Cumference. Soon Per and her cousin Radius become involved with a mystery that involves inner and outer edges and a giant sea serpent. The kids must go to the Isle of Immeter and use geometric formulas to beat the sea serpent and bring back peace to the land.
Unit Lesson #1
Anticipatory Activity

Lesson Plan by Daniel Haffner
Length: 60-65 minutes
Age or Grade Level Intended: Algebra 1
Academic Standard(s): A1.6.1 Add and subtract polynomials.

Performance Objective(s):
Given ten problems, the student will solve the addition problems with polynomials with 80% accuracy.

Given ten problems, the student will solve the subtraction problems with polynomials with 80% accuracy.

Assessment:
Given a polynomial of any size, the students will know how to group the like terms and be able to add and/or subtract the coefficients to get the correct answer. The students will be given a worksheet to complete with 10 problems. The students will do the worksheet in class and what doesn’t get done will be homework. The teacher will check the answers the next day to figure out if students mastered the standard with 80% accuracy or not.

Advance Preparation by Teacher:
The teacher will have a set of algebra tiles for each pair or group of students and one for himself. The student will need a pencil to do the worksheet. The teacher will need an overhead projector and overhead pen or a chalkboard and chalk to write equations on.

Procedure:
Introduction

1. Remind students that they have just finished up a chapter on exponents and exponential function. Ask students to name three things they learned about exponent and/or exponential function. (Bloom’s: knowledge)
2. Tell students that today they will be learning a very important skill today. The skill is probably the most important thing they have learned in math for a long time and that the skill that will be learning will form the basic foundation for the rest of the semester. Tell students that today they are going to be learning about polynomials.
3. Project the following websites/pictures of the artwork. Explain to students that the visual displays were made using polynomials. The art was made with very advanced math but it was using math, particularly polynomials. Ask for students impressions of the artwork. Ask students what it looks like to them, what it reminds them of, what they think it could be, etc. (Bloom’s: knowledge; Gardner’s: visual-spatial, interpersonal, verbal-linguistic)
1. http://www.bugman123.com/Fractals/PolynomialRoots-large.jpg

4. Tell students that they are going to be spending the next week or so learning about polynomials and how polynomials affect everyday math and everyday life.

**Step by step**

1. Remind students about the algebra tiles they have used before and have students explain what each one represents. The large square represents an area of $x^2$, the rectangle represents an area of $x$, and the small square, or unit square, represents an area of one. (Gardner’s Logical-Mathematical, Visual-Spatial)

2. To check that students understand how algebra tiles work, create several equations with algebra tiles for them and explain what each tile represents (red is negative, blue is positive, large squares are $x^2$ terms and rectangles are $x$ terms and small squares are the unit terms) Ex: $3x^2 + 2x - 4$ and $x^2 - 2x + 6$ (Bloom’s: Knowledge, Comprehension. Gardner’s Logical-Mathematical, Visual-Spatial)

3. Let a student create an equation if he or she seems to have mastered using the Algebra tiles. (Bloom’s: Knowledge, Comprehension. Gardner’s Logical-Mathematical, Visual-Spatial, Bodily-kinesthetic) Divide the class into small groups. Give each group a set of algebra tiles. (Gardner’s: Interpersonal)

4. Place a large square, a rectangle, and a unit square on the overhead projector and label them, respectively, $x^2$, $x$, and 1.

5. Write the following addition problem on the chalkboard: $(x^2 + 2x + 3) + (-x^2 - x + 2)$ (Gardner’s: visual-spatial, logical-mathematical)

6. On the overhead projector, model the expression $x^2 + 2x + 3$ as shown below. (Gardner’s: visual-spatial, logical-mathematical)

   ![Diagram 1]

7. Directly underneath the first expression on the overhead projector, model the expression $-x^2 - x + 2$ as shown below. (Gardner’s: visual-spatial, logical-mathematical)

   ![Diagram 2]
8. Using the overhead transparency marker, circle or place an "X" on top of the tiles that "cancel" out (the positive and negative large square and one of the positive rectangles and the negative rectangle). Explain to the students that the sum of these tiles is zero before removing the tiles from the overhead. (Gardner’s: visual-spatial, logical-mathematical, verbal-linguistic, bodily-kinesthetic)

9. Ask students to write the resulting algebraic expression on their own paper. Check to see that students had the correct solution of \( x + 5 \). Discuss the solution with the class. (Gardner’s: visual-spatial, logical-mathematical, interpersonal)

10. Write the following subtraction problem on the chalkboard:

\[
\frac{3x^2 - 2x + 1}{-4x^2 + x - 5}
\]

11. Ask students to work in their groups to model the problem with algebra tiles at their desks. Remind students that since this is a subtraction problem, the sign of the terms in the second row will change. (Bloom’s: comprehension, application; Gardner’s: Interpersonal, Logical-Mathematical, bodily-kinesthetic)

12. Offer help to groups as needed. Check to see that groups model the problem correctly.

13. Instruct students to work with their group members to "cancel" tiles whose sum is zero by removing them from the model. Students should remove three positive and three negative large square tiles. Ask students to write the solution of the problem on their own paper. [-\( x^2 - 3x + 6 \)] (Gardner’s: visual-spatial, logical-mathematical, interpersonal, bodily-kinesthetic)

14. Once all groups finish the problem, ask them to share their answers with the class. Discuss the answers and offer possible reasons for incorrect answers. (Bloom’s: comprehension; Gardner’s: interpersonal, verbal-linguistic)

15. Write the following addition problem on the chalkboard:

\[
\alpha^2 + 6\alpha - 5
+ 3\alpha^2 - 2\alpha + 6
\]

16. Instruct groups to choose tiles to represent the terms used in the expressions and make a note of the choice on a sheet of paper. Tell groups to model the expressions at their desks, cancel tiles whose sum is zero, and write the solution to the problem. (Gardner’s: visual-spatial, logical-mathematical, interpersonal, bodily-kinesthetic)
17. Ask a representative from one of the groups to model their group’s work for the class using the overhead projector and tiles. Discuss the solution and ask groups to share any alternative problem-solving approaches. (Bloom’s: comprehension; Gardner’s: visual-spatial, logical-mathematical, interpersonal, bodily-kinesthetic)

18. Relate algebra tiles to the manipulation of expressions on paper by relating the grouping of algebra tiles to the addition of like terms.

19. Provide groups with a list of practice problems to work on as an in-class assignment. (Bloom’s: application; Gardner’s: visual-spatial, logical-mathematical, interpersonal, bodily-kinesthetic)

20. Emphasize the importance of combining only like terms. Explain that even though like terms must have identical variables, they may have any real number coefficient.

21. Discuss solutions as a class. (Bloom’s: knowledge, comprehension; Gardner’s: interpersonal, bodily-kinesthetic)

22. Hand out the worksheet and allow, if there is time, allow students to work on it.

Conclusion

1. Discuss the following questions with the class as a review: (Bloom’s: knowledge, comprehension, application, analysis)
2. How are the like terms combined?
3. Is it possible to combine un-like terms?
4. Can you describe the “like terms” in the set of algebra tiles?
5. What happens when you “combine” the large square with a small square?
6. Remind students that polynomials are one of the most important and basic functions in mathematics.
7. Tell students if they did not complete the worksheet in class then it is homework.
8. Tell students that tomorrow they will be learning more about adding and subtracting polynomials as well as learning important vocabulary for the unit.

Adaptations/Enrichment:

Self-Reflection:

- Did the students understand everything I was asking them to do?
- Were the questions too hard or easy?
- Did I have enough time to explain everything or was it too rushed/long of a time?
- Did the students pass the assessment part? If they did not pass, why?
- Did the activity activate background knowledge?
Adding and Subtracting Polynomials

Directions: Solve each of the polynomial equations. Show your work.

1. \((x^2 + 2x + 1) + (2x^2 + 4x + 8)\)

2. \((x^2 + 6x - 3) + (3x^2 + x + 2)\)

3. \((2x^2 - 5x + 3) - (2x^2 + 6)\)

4. \((12x^2 + 7 - 12) - (3x^2 - 2x - 20)\)

5. \((-x^2 + 2x - 1) + (x^2 - 2x - 6)\)
6. \((2x^2 + 3x + 6) - (x^2 - 5x + 2)\)

7. \((9x^2 + 2x + 21) + (x^2 + 2x - 7)\)

8. \((5x^2 + 10x + 15) - (6x^2 - 2x - 30)\)

9. \((6x^2 + 7x + 14) + (2x^2 - 4x + 8)\)

10. \((6x^2 + 7x + 14) + (2x^2 - 4x + 8)\)
Adding and Subtracting Polynomials

Directions: Solve each of the polynomial equations. Show your work.

1. \((x^2 + 2x + 1) + (2x^2 + 4x + 8)\)

\[3x^2 + 6x + 9\]

2. \((x^2 + 6x - 3) + (3x^2 + x + 2)\)

\[4x^2 + 7x - 1\]

3. \((2x^2 - 5x + 3) - (2x^2 + 6)\)

\[-4x + 9\]

4. \((12x^2 + 7 - 12) - (3x^2 - 2x - 20)\)

\[9x^2 + 2x - 25\]

5. \((-x^2 + 2x - 1) + (x^2 - 2x - 6)\)

\[-7\]
7. \((2x^2 + 3x + 6) - (x^2 - 5x + 2)\) = \(x^2 + 8x + 4\)

8. \((9x^2 + 2x + 21) + (x^2 + 2x - 7)\) = \(10x^2 + 4x + 14\)

9. \((5x^2 + 10x + 15) - (6x^2 - 2x - 30)\) = \(-x^2 + 12x + 45\)

10. \((6x^2 + 7x + 14) + (2x^2 - 4x + 8)\) = \(8x^2 + 3x + 22\)
Unit Lesson #2
Vocabulary Lesson

Lesson Plan by Daniel Haffner

Lesson: Chapter 9 Multiply and Factoring Monomials with Polynomials.
Length: 60 minutes
Age or Grade Level Intended: Algebra 1

Academic Standard(s):
A 1.6.2 Multiply and divide monomials.
A 1.6.6 Find a common monomial factor in a polynomial.

Performance Objective(s):
Given a set of monomial multiplication problems, the students will solve at the problem correctly 4 out of 5 times.
Given a set of monomial division problems, the students will solve at the problem correctly 4 out of 5 times.
Given a set of polynomials, the students will find the common monomial factor 4 out of 5 times correctly

Assessment:
The students will be given ten problems to complete in class or as homework. The teacher will grade the homework. Mastery is 80% of the problems completed correctly.

Advance Preparation by Teacher:
- computer with internet access
- TV hooked up to computer
- Copies of the worksheet for each student
- Chalkboard/chalk
- 4x6 note cards, 10 for each student
- Paperclips for each student

Procedure:
Introduction:
1. Remind students how they talked about adding and subtracting polynomials. Ask students what they remember about finding like terms. (Bloom’s: Knowledge)
2. Tell students that you have had some questions about why things like polynomials and monomials are important. Tell students that polynomials are used in computer programs that movie companies use to make the special effects.
3. Ask students if any of them have ever seen the movie *The Matrix*. Explain to students that *The Matrix* movie series is about a man named Neo who tries to save the world from machines taking over. Everyone lives in a fake computerized world and occasionally humans will morph into the bad guy, Agent Smith. The morphing scenes that take place in movies like *The Matrix* rely on polynomials to create the special effects.
4. Show students the video clip at http://www.youtube.com/watch?v=XZB5kdvnVXk&feature=related (Gardner’s: Visual-Spatial)

5. Share with students that today they will be learning about multiplying and dividing polynomials, the basis formulas and process that movie graphic artists use to create special effects with morphing shapes.

**Step by Step**

1. Tell students that in order to learn about polynomials, they need to learn some vocabulary first. Give each student 10, 4 x 6 index cards. Have students fold the card twice (to get four squares). In the top left square have students right the vocabulary word. In the top right section the student’s write the definition in their own words. In the bottom left part, the students draw a picture or an example for the word. In the bottom right corner, the student’s use the word in a sentence. (Gardner’s: Intrapersonal, Logical-Mathematical, Visual-Spatial, Verbal-Linguistic)
   
   a. Binomial
   b. Degree of monomial
   c. Degree of polynomial
   d. Factoring by group
   e. Monomial
   f. Perfect square
   g. Trinomial
   h. Polynomial
   i. Standard form of a polynomial
   j. FOIL

2. Go over the definitions for each word. Call on students to give their own definitions, pictures, and sentences for each word. Have student’s paperclip their index cards together and save them to study for the test.

3. Transition with the students to the day’s lesson. On the board write $(2x)(4x)$, and see if any of the students can do it without you explaining how to. To solve $2 * 4 * x * x = 8x^2$ (visual-spatial, logical-mathematical)

4. Write $(5x)(5x^2 + x)$ again ask the students if they could solve this one. Solution: $(5 * 5 * x * x * x) + (5 * x * x) = 25x^3 + 5x^2$

5. Write on the board this problems, and have the student work in pairs $(2x)(15x+2)$, $(5x^2)(3x^4 + 3x^2)$, $(10y)(10y^3 + 5)$ (Bloom’s: Knowledge, Comprehension, Application; Gardner’s: Interpersonal, Verbal-linguistic, Logical-Mathematical)

6. Go through the ones that they seem to have trouble with. Solutions $(2x)(15x + 2) = 30x^2 + 2x$, $(5x^2)(3x^4 + 3x^2) = 15x^6 + 15x^4$, $(10y)(10y^3 + 5) = 100y^4 + 50y$

7. Now put an x on top with the 20 to get $\frac{20x}{10}$ now ask the students what do they get. Answer: 2x

8. Now put an x on bottom $\frac{20x}{10x}$ the students should get 2x.

9. Now write $\frac{8x^2}{2x}$ ask the students what they would get. Answer: 4x
10. Now have the students try these with a partner. \( \frac{4x^2}{x}, \frac{16x^6}{4x}, \frac{9x}{3x^2}, \frac{15y^3}{5y} \) (Bloom’s: Knowledge, Comprehension, Application; Gardner’s: Interpersonal, Verbal-linguistic, Logical-Mathematical)

11. Go around and see if everyone understands it. Then solve the problems on the board with them. Answers \( \frac{4x^2}{x} = 4x, \frac{16x^6}{4x} = 4x^5, \frac{9x}{3x^2} = \frac{3}{x}, \frac{15y^3}{5y} = 3y^2 \)

12. Now on the board write \( 3x^3 - 15x \) now have the students find the greatest common factor (GCF) of the two terms. Ask students what number is the GCF was and have students defend their answer as to why it was the GCF. \( 3x^3 = 3 \times x \times x \times x \) and \( 15x = 3 \times 5 \times x \), so the GCF of the two terms is \( 3x \). Now factor the \( 3x \) out in front of the polynomial, with what was left when finding the GCF. \( 3x(x^2 - 5) \). (Bloom’s: Evaluation; Gardner’s: Logical-Mathematical)

13. Now on the board write \( (5x^2 - 5x) \) now to factor start by finding the GDF, which is \( 5x \). Now write answer which is \( 5x(x-1) \) and remind the students that \( 5x \times 1 \) gives them back \( 5x \)

14. Now have the students work with their partner again and try factoring: \( (5x^2 + x), (15x^2 - 5), (4x^2 - 8x) \)

1. Walk around and see if all are working and understanding how to factor, and then go through the problems. Answers are: \( x(5x + 1), 5(3x^2 - 1), 4x(x - 2) \) (Gardner’s: Verbal-Linguistic, Visual-Spatial, Logical-Mathematical; Bloom’s Knowledge, Comprehension, Application)

15. Give them their worksheet which is homework if they do not get it done in class.

Closing

1. Last 10 min of class ask the students what the definitions are for the following words and they may not look at their notes or book. (Bloom’s: Knowledge, comprehension)
   - Binomial
   - Degree of monomial
   - Degree of polynomial
   - Factoring by group
   - Monomial
   - Perfect square
   - Trinomial
   - Polynomial
   - Standard form of a polynomial
   - FOIL

2. Write on the board \( (x^2 + 2) \times (x^2 + 2) \), have the students try to multiply the two polynomials by on their own. Let them work on it and see if they get it. (Bloom’s: Knowledge, Comprehension, Application; Gardner’s: Intrapersonal, Logical-Mathematical)

3. Give a hint, if needed. HINT: multiply each term of the first polynomial by every term in the second polynomial. Solution: \( x^4 + 4x^2 + 4 \)

4. Remind students that the vocabulary words they reviewed will be on the test so they need to know the words and that the problem they just completed is what they will be working on tomorrow.
Adaptations

Reflections
- Did I get the student’s interested in the lesson?
- Do the students really know the vocabulary terms?
- Do the student’s know how to multiply monomials?
- Did students understand the examples with the algebra tiles?
- Did I explain enough of the lesson or should I do more examples?
- What did not go smoothly?
- What did the students enjoy about the lesson?
- What would make the lesson go better next time?
Multiply Polynomials
Multiplying and Dividing Monomials

Name________________________________________  Date________________

Directions: Solve each of the following problems. **SHOW ALL WORK**

1. \((3x^2)(2x)\)
2. \((2x)(6x)\)
3. \((7x^4)(10x)\)
4. \((6x)(2x^{25})\)
5. \((x)(4x)\)
6. \(\frac{12x}{4}\)
7. \(\frac{6x^4}{2x^2}\)
8. \(\frac{8x^3}{4x}\)
9. \(\frac{6x^2}{3x^3}\)
10. \(\frac{2y^3}{6y^2}\)
11. \(x^3 + 2x^2\)
12. \(12x^2 + 16\)
13. \(15x^3 - 10x\)
14. \(8x - 16x^2\)
15. \(6x + 9x^3\)
Multiply Polynomials
Multiplying and Dividing Monomials

Directions: Solve each of the following problems. **SHOW ALL WORK**

1. \((3x^2)(2x)\)\\
   \[6x^3\]

2. \((2x)(6x)\)\\
   \[12x^2\]

3. \((7x^4)(10x)\)\\
   \[70x^5\]

4. \((6x)(2x^{25})\)\\
   \[12x^{26}\]

5. \((x)(4x)\)\\
   \[4x^2\]

6. \[\frac{12x}{4}\]\\
   \[3x\]

7. \[\frac{6x^4}{2x^2}\]\\
   \[3x^2\]

8. \[\frac{8x^3}{4x}\]\\
   \[2x^2\]

9. \[\frac{6x^2}{3x^3}\]

10. \[\frac{2y^3}{6y^2}\]

11. \[x^3 + 2x^2\]

12. \[12x^2 + 16\]

13. \[15x^3 - 10x\]

14. \[8x - 16x^2\]

15. \[6x + 9x^3\]

**Note:** The solutions are provided for verification.
Unit Lesson #3
Includes a Read-Aloud, Modified for ADHD

Lesson Plan by Daniel Haffner
Lesson: Chapter 9 Multiply Polynomials.
Length: 60 minutes
Age or Grade Level Intended: Algebra 1

Academic Standard(s): Algebra 1.6.4 Multiply polynomials.

Performance Objective(s):
Given a set of 10 problems, the student will solve the multiplication problems with polynomials with 80% accuracy.

Assessment:
The students will be given 10 problems to do. The teacher will check the assignment when the students hand it in to see if the students got at least 80% of the problems correct.

Advance Preparation by Teacher:
- Chalkboard and Chalk
- Computer with internet access and tv hooked up to it
- Copies of the worksheet for each student
- Copies of the handout “Why Learn to Factor” for each student

Procedure:

Introduction

1. Ask students what they remember about polynomials from the last two days. Have two different students share one thing from each day. (Bloom’s: knowledge)
2. Tell students that in the past, you have gotten some questions about why they have to learn about factoring and if it has anything to do with real life.
3. Handout copies of “Why Learn to Factor” to each student. Ask for a student to volunteer to read as Katie, ask the volunteer to do their best voice impression of a whining or complaining student as they read. Allow the student volunteer to read Katie’s part. Read Dr. Ian’s response. Continue this way throughout the article. Stop sometimes to talk with students about what Dr. Ian is saying and about how it applies to life. Ask students to summarize certain points of Dr. Ian’s after each letter.
4. When finished, tell students that for the rest of unit, you do not expect to hear why they must learn about factoring. Students who do ask will be told to go back and reread the article.
5. Remind students that today they are going to be learning about multiplying monomials and today they are going to be learning about multiplying polynomials, two of Katie’s complaints to Dr. Ian.
6. Show students the video clip: The Ballad of FOIL Man.
   http://www.youtube.com/watch?v=FVel7PluUO0
7. Tell students that they will be learning to FOIL like FOIL Man as they build on what they learn yesterday about multiplying monomials. (Gardner’s: Musical-Rhythmic, Visual-Spatial, Logical-Mathematical)

**Step by Step**

1. On the board write FOIL, Say the F stands for First, O stands for Outside, I stands for Inside, and L stands for Last.
2. On the board write \((2x^2 + 2) \cdot (x + 1)\), F-First means multiply the first terms of each polynomial together, which is \((2x^2 \cdot x)\). then Outside means to multiply the farthest terms of the two polynomials, which is \((2x^2 \cdot 1)\). Inside means to multiply the closest terms of the two polynomials, which is\((2 \cdot x)\). Last means to multiply the last term of each polynomial, which is\((2 \cdot 1)\). (Gardner’s: Verbal-Linguistic, Visual-Spatial, Logical-Mathematical)
3. Then take all the FOIL parts and add them together to get \((2x^2 \cdot x) + (2x^2 \cdot 1) + (2 \cdot x) + (2 \cdot 1)\), start to solve by order of operations. To get \((2x^3 + 2x^2 + 2x + 2)\)
4. Finish by telling the class to add all the like terms. (There are none so it is a test) :)
5. New problem on the board\((2x + 5) \cdot (5x + 1)\), Go through FOIL again to get\((2x \cdot 5x) + (2x \cdot 1) + (5 \cdot 5x) + (5 \cdot 1)\), so with multiplying in the quantities you get \(10x^2 + 2x + 25x + 5\). Now ask the students to add like terms. (there are some this time) so final answer is \(10x^2 + 27x + 5\). (Gardner’s: Verbal-Linguistic, Visual-Spatial, Logical-Mathematical; Bloom’s Knowledge, Comprehension, Application)
6. Now write \((3x + 2) \cdot (x^3 + 4)\), have the students try it by themselves for a few minutes, (walk around and see if most understand FOIL) If not teach it like the previous two problems but with a little more attention on the ones who did not get it. If they understand it then go step by step with the problem and asking the students what each step is: Answer should be \((3x^4 + 2x^3 + 12x + 8)\) (Gardner’s: Verbal-Linguistic, Visual-Spatial, Logical-Mathematical, Bloom’s Knowledge, Comprehension, Application)
   a. if they did not understand then do \((x^2 + 2) \cdot (x^2 + 4)\) ask them to work on it for a few minutes. And then ask students what to do to show work and step by step of FOIL. Answer \((x^4 + 6x^2 + 8)\)
7. Now give the students 20 minutes to work on the worksheet and if not done in class it will be homework.

**Closing**

a. Ask a student to explain the steps of foiling. (Bloom’s: Knowledge)
b. Write the problem \((3x + 2) \cdot (x^3 + 4)\) on the board and as a class solve the problem together. Ask students to justify their answer for each step of the problem. (Bloom’s: Knowledge, Application, Evaluation)
c. Tell students that tomorrow they are going to be learning more about multiplying polynomials and how things change, or stay the same, for special cases.
Adaptations

ADHD: Provide note-taking handout to student with examples already written down on the paper so the student can focus on what is being said in class and on solving the problem and not writing it out. Student will only be given five homework problems, when those are complete the student will be allowed to get up, get a drink if needed and get the remaining five problems from the teacher’s desk. Student’s article will contain highlighted sections of important information. The student will have more room on their paper (large-lined paper) to complete the work in which will help the student since they generally have poor handwriting.

Reflections

- Did I get the student’s interested in the lesson?
- Do the students remember how to do monomials from the previous lesson?
- Do the student’s know how to FOIL?
- What would make the lesson go better next time?
- Do the students remember the vocabulary terms?
- Should I give more or less time for working in class?
- Did I do too many examples or not enough?
- Would the activity go better if I let students work on the homework in pairs?
Multiply Polynomials

Name________________________________________  Date________________

Directions: Use FOIL to solve each of the following problems. SHOW ALL WORK

3. \((x + 4)\) * \((x + 2)\)

4. \((x + 7)\) * \((x + 3)\)

5. \((x^2 + 3)\) * \((x + 9)\)

6. \((x + 9)\) * \((x^2 + 3)\)

7. \((x + 6)\) * \((x^2 + 6)\)

8. \((x^2 + 2)\) * \((x^2 + 2)\)

9. \((x + 7)\) * \((x^5 + 2)\)

10. \((y^3 + 6)\) * \((y^2 + 2)\)

11. \((x - 2)\) * \((x - 3)\)

12. \((a^2 - 12)\) * \((a^2 + 2)\)
Multiply Polynomials

Name_________________________ KEY __________________________ Date________________

Directions: Use FOIL to solve each of the following problems. **SHOW ALL WORK**

1. \((x + 4) \times (x + 2)\) 
   \[x^2 + 6x + 8\]

2. \((x + 7) \times (x + 3)\) 
   \[x^2 + 10x + 21\]

3. \((x^2 + 3) \times (x + 9)\) 
   \[x^3 + 9x^2 + 3x + 27\]

4. \((x + 9) \times (x^2 + 3)\) 
   \[x^3 + 9x^2 + 3x + 27\]

5. \((x + 6) \times (x^2 + 6)\) 
   \[x^3 + 6x^2 + 6x + 36\]

6. \((x^2 + 2) \times (x^2 + 2)\) 
   \[x^4 + 4x^2 + 4\]

7. \((x + 7) \times (x^5 + 2)\) 
   \[x^6 + 7x^5 + 2x + 8\]

8. \((y^3 + 6) \times (y^2 + 2)\) 
   \[y^5 + 2y^3 + 6x^2 + 12\]

9. \((x - 2) \times (x - 3)\) 
   \[x^2 - 5x + 6\]

10. \((a^2 - 12) \times (a^2 + 2)\) 
    \[a^4 - 10x^2 - 24\]
Why Learn to Factor? – A Series of Correspondents

Hello!

I am currently in Algebra 2. The thing is, factoring expressions and special products are killing my brain cells... I want to be a fashion designer someday so will I really be needing factoring?

Sincerely,

The Mathematically Challenged Katie

Hi Katie!

For fun, you might want to conduct a random survey of adults that you run into, and ask how many of them ended up doing what they thought they'd be doing at your age. Just a thought.

If you suspect that you'll probably never have to factor an equation once you're out of school, you're right. But you're not being taught factoring so you can use it on a daily basis. You're being taught factoring - and a lot of other mathematical techniques - so that you can develop certain habits of thought, which will make you better at _anything_ you might end up doing, whether it's fashion design, rocket science, or managing the local McDonald's.

Which habits of thought? The most important one, I think, is the habit of looking for ways to turn difficult tasks into easy ones by changing descriptions. That's all that's going on with factoring, really.

For example, if I give you an equation like \( f(x) = x^2 - 8x + 15 \) and ask you to draw a graph of the function, you could start plugging in values of \( x \), and plotting the resulting points on a graph. How many points would you have to plot? Maybe a few (if you get lucky in choosing your values of \( x \)), maybe a lot (if you're not so lucky). In any case, it's very straightforward, but also very tedious and time-consuming.

On the other hand, if you factor the equation to get \( f(x) = (x - 3)(x - 5) \) then you can see immediately where the graph crosses the x-axis (at \( x=3 \) and \( x=5 \)), so you can draw two points with no effort at all; and if you recognize that this must be the equation of a parabola, and if you remember that a parabola is symmetric, then you know that the highest or lowest point must be halfway between the two points you just drew. So with very little effort, you can sketch the graph.

Now, how often are you going to do this? Probably if you needed to graph an equation like this, you'd just run a computer program to do it for you.
But look at it this way. When you were very young, you spent hours and hours playing with all kinds of toys, e.g., blocks that you would pound through holes with the same shapes. Were you preparing to pound blocks through holes on a daily basis as an adult? Or were you developing a fairly general set of problem-solving skills that you would someday use on problems that you couldn't even begin to imagine at that age?

Same thing with math.

- Doctor Ian

Hello again!

Another question: You explained about how factoring affects our life. But that is just factoring in general. But our teacher even asked us to study about all the rules of factoring. Specifically Rule # 1, which is Common Monomial Factoring which is what we should check first in an equation.

Let me get to my point: How does Common Monomial Factoring affect or how is it connected to our real life? The hardest type of factoring for me is Perfect Square Trinomial Factoring. How does that affect or get used in our real life?

You did tell me that some techniques in math our teacher taught to us so that we can develop certain habits. Why do we need to develop these habits? The computer can do the thinking for us too! Well... Thanks for the reply!

-Katie

Hi Kaite,

Suppose you're running a factory. There are a number of workers who do certain tasks, many of them requiring a particular tool (e.g., a certain kind of file). Each guy, when he needs a tool, leaves what he's doing and walks over to the place where they keep the tools, checks out the tool, walks back to where he's working, uses the tool, walks back to the place where they keep the tools, and checks it back in. This can happen several times a day.

If you're familiar with factoring common monomials, you might think about this: Is it easier to compute \(3 \times 19 + 12 \times 19 + 2 \times 19 + 5 \times 19\) or \((3 + 12 + 2 + 5) \times 19\)?

It's obvious that it's easier to compute the latter, because it requires fewer steps. So you might consider, can the underlying idea be applied to what's happening in the factory? In fact, it can: You could have each worker check out the tools that he needs one time, at the beginning of the shift, and check them back in one time, at the end of the shift. It's really the same kind of
reasoning, except one deals with mathematical expressions, and the other deals with manufacturing processes.

Do you need to have studied monomial factoring in order to come up with this solution? Not necessarily. But if you've spent several years in math classes, learning to look for ways to eliminate wasted operations, you're much, much more likely to think to look for a solution in the first place, which is the first step to finding one.

“The hardest type of factoring for me is Perfect Square Trinomial Factoring. How does that affect or used in our real life?” Well, it's really just another variation on the same idea.

“You did tell me that some techniques in math our teacher taught to us so that we can develop certain habits. Why do we need to develop these habits? The computer can do the thinking for us too!”

I've spent a large part of my career working in artificial intelligence, and I can tell you that if you think computers are going to be able to do your thinking for you anytime soon, you need to reconsider that notion. But let me ask you this: If computers do your thinking for you, why shouldn't someone who's thinking of hiring you for a job just buy a computer?

Michelle, there is no question that you can live a 'real' life without ever using any of the information that you're learning in your math classes. You can grow up, get a job that bores you (because all the thinking that it requires is being done by other people, leaving you to simply carry out their increasingly detailed orders), use the money from the job to pay for food, shelter, and clothing, and spend what's left (if anything _is_ left) on diversions (alcohol, video games, movies, clubs) to help you forget how much you hate your boring job... Millions of people do this, and if you want to join them, you're free to do that. (Or, you might be perfectly happy with a job that never requires you to think in order to deal with a situation that wasn't covered during your training. Millions of people do that, too.)

But before you make that decision, you should take the time to talk to some people who have jobs that require creative thought: scientists, engineers, architects, designers, computer programmers, and so on. If you do, what you'll find is that many of these people _love_ what they do, and would probably do it for free (that is, if they weren't already being paid high salaries).

As the guy in the commercial says, having a job that you love is like being on vacation every day, and getting paid for it. For the most part, the more math you learn, the more options you have, and the greater control you can exercise over your own life.

- Doctor Ian

Unit Lesson #4
Modified for Learning Disabilities

Lesson Plan by Daniel Haffner
Lesson: Multiplying Special Case Polynomials
Length: 50 min.
Age or Grade Level Intended: Algebra 1

Academic Standard(s): A.1.6.4 Multiplying Polynomials

Performance Objective(s):
Given a set of problems, the student will multiply the special case polynomial problems 8 out of 10 times correctly.

Assessment:
The students will be given a worksheet to complete. The worksheet will be graded. Mastery is getting 8 out of the 10 problems correct.

Advance Preparation by Teacher:
- Access to youtube: http://www.youtube.com/watch?v=kMP0vclKlDA
- Copies of the worksheet for each student
- Pencils
- Chalkboard, chalk

Procedure:
Introduction:
1. Remind students how they learned about Foiling yesterday. Ask a student to explain to the class what foiling is. (Bloom’s: knowledge)
2. Remind students that they learned yesterday how polynomials are used in the movies. Tell students that there are other uses for polynomials including video games. Tell students that today you are going to show them a video clip of how polynomials can be used to design video games.
3. Play the youtube clip: http://www.youtube.com/watch?v=kMP0vclKlDA. (Gardner’s: Visual-Spatial, Logical-Mathematical)
4. Tell students that today they are going to be learning more about multiplying polynomials and have the procedures can change for polynomial special cases, using the same information they learned yesterday about foiling.

Step by Step

1. On the board write \((a+b)(a+b)\) and have the students solve the problem like FOIL Man would do. They should get: \(a^2 + 2ab + b^2\). Ask the students if they can up with a pattern that will help them solve more problems like \((a+b)(a+b)\)? first they need to realizes that the problems is just squaring a binomial. \((a+b)(a+b)=(a + b)^2\). (Bloom’s: Comprehension, Application; Gardner’s: Visual-Spatial, Logical-Mathematical)
2. Now have them rewrite \((x+4)(x+4)\) as a square. Answer: \((x + 4)^2\)

3. Now teach them the 3 steps of solving the square of a binomial
   a. Square the first term. (1st term of answer)
   b. Multiply the two terms then double. (2nd term of answer)
   c. Square the last term. (3rd term of answer)

4. Now work through each step with them on \((x + 4)^2\)
   a. Square the first term. So \(x\) becomes \(x^2\)
   b. Multiply the two terms then double. So \(x\) and 4 multiplied is 4x and double it is \(2 \times 4 \times x = 8x\)
   c. Square the last term so 4 becomes \(4^2 = 16\)

5. So putting all three steps together \((x + 4)^2\) becomes \(x^2 + 8x + 16\)

6. Now have the students try \((x + 7)^2, (4x + 7)^2\). (Bloom’s: Application; Gardner’s: Visual-Spatial, Logical-Mathematical, Verbal-Linguistic)

7. Now work through each step with them on \((x - 4)^2\)
   a. Square the first term. So \(x\) becomes \(x^2\)
   b. Multiply the two terms then double. So \(x\) and -4 multiplied is -4x and double it is \(2 \times (−4) \times x = −8x\)
   c. Square the last term so 4 becomes \((-4)^2 = 16\)

8. So putting the steps together you get \(x^2 − 8x + 16\)

9. Tell the student it does not matter if you have a subtraction sign or addition sign the same steps works for both.

10. Now write \((x+6)(x-6)\) on the board. Now ask them what they would do when trying to find the difference of squares. (Bloom’s: Application; Gardner’s: Visual-Spatial, Logical-Mathematical, Verbal-Linguistic)

11. Have them use foil if they need to see how it turns out at the end. Answer: \(x^2 − 36\)

12. Tell them when they see a problem that is multiplying the differences of squares they can use two steps.
   a. Multiply the two first terms.
   b. Multiply the two last terms.

13. Explain that when multiplying the difference of squares the middle term cancels out because one will be the negative of the other.

14. Have the students try \((x+4)(x-4 ),(x+2)(x-2).\) (Bloom’s: Application; Gardner’s: Visual-Spatial, Logical-Mathematical, Verbal-Linguistic)

15. Hand out the worksheet and allow students time to work. What is not done will be homework.

**Closing**

1. Ask the students how to solve the square of a binomial? Ask students to defend their answers by giving proof of how they got it. Make sure they get all three steps. (Bloom’s: Analysis, Synthesis, Evaluation)

2. Then ask the students how to solve the difference of squares? Ask students to defend their answers by giving proof of how they got it. Make sure they get both steps. (Bloom’s: Analysis, Synthesis, Evaluation)
3. Then ask the students why there is only two terms in the answer in the difference of squares? Have them defend their answers. (Bloom’s: Analysis, Synthesis, Evaluation)

4. Tell students that tomorrow they will begin studying the difference of two squares and other quadratics. Tell students that they will need to remember the last four days of lessons because factoring the differences of squares and quadratics is a big lesson that will take multiple days to cover.

Adaptations

Learning Disability: Student will be given a copy of the notes to follow along with in class. Student will have graph paper to complete homework problems on (so that all of the numbers, symbols, and equations line up correctly). Student will be allowed to use algebra tiles to work out the problems for the homework.

Reflections

- Did I get the student’s interested in the lesson?
- Do the students remember how to do multiply polynomials from the previous lesson?
- Were my adaptations effective?
- Did I give too many examples or not enough examples?
- Do the student’s remember the vocabulary terms? Are they studying the vocabulary terms?
- Do the student’s remember how to FOIL?
- What would make the lesson go better next time?
Multiply Polynomials

Directions: Use FOIL to solve each of the following problems. **SHOW ALL WORK**

1. \((x-1)(x-1)\)

2. \((x+5)(x+5)\)

3. \((x^2 - 4)(x^2 + 4)\)

4. \((x^2 + 4)(x^2 + 4)\)

5. \((x^3 + 7)(x^3 + 7)\)

6. \((x^2 - 9)(x^2 + 9)\)

7. \((x^4 + 8)(x^4 - 8)\)

8. \((x - 4)(x + 4)\)

9. \((x^2 + 3)(x^2 - 3)\)

10. \((x^5 - 12)(x^5 - 12)\)
Multiply Polynomials

Directions: Use FOIL to solve each of the following problems. **SHOW ALL WORK**

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

2. \((x + 5)(x + 5)\)
   
   \(x^2 + 10x + 25\)

3. \((x^2 - 4)(x^2 + 4)\)
   
   \(x^4 - 16\)

4. \((x^2 + 4)(x^2 + 4)\)
   
   \(x^4 + 8x^2 + 16\)

5. \((x^3 + 7)(x^3 + 7)\)
   
   \(x^6 + 14x^3 + 49\)

6. \((x^2 - 9)(x^2 + 9)\)
   
   \(x^4 - 81\)

7. \((x^4 + 8)(x^4 - 8)\)
   
   \(x^8 - 64\)

8. \((x - 4)(x + 4)\)
   
   \(x^2 - 16\)

9. \((x^2 + 3)(x^2 - 3)\)
   
   \(x^4 - 9\)

10. \((x^5 - 12)(x^5 - 12)\)
    
    \(x^{10} - 24x^5 + 144\)
Unit Lesson #5
Modified for Gifted and Talented

Lesson Plan by Daniel Haffner
Lesson: Factoring Trinomials
Length: 50 min.
Age or Grade Level Intended: Algebra 1

Academic Standard(s): A1.6.7 Factor the difference of two squares and other quadratics

Performance Objective(s): Given 10 problems, the students will factor the difference of two squares with 80% accuracy.

Assessment: The students will be given 10 problems. The teacher will check to see that the student got at least 8 out of the 10 problems correct.

Advance Preparation by Teacher:
- Deck of cards (have all face cards -Jacks, Queens, and Kings - tens, and nines, and one joker, and other random cards to have the total of cards equal the number of students in the class).
- Chalkboard, chalk
- Copies of the worksheet for each student

Procedure:
Introduction:
1. Ask students to give three examples from what they learned yesterday. (Bloom’s: knowledge). Tell students that they will be expanding on their knowledge of multiplying polynomials today.
2. First, ask the students if they can tell you what is the standard form of a trinomial?
   Answer: $ax^2 + bx + c$ where a, b and c are real numbers. (Bloom’s: knowledge). Tell students that for now we are only going to concentrate on trinomials, where $a=1$ and that an example of factoring would be turning 1 trinomial into 2 binomials.
3. On the board write $x^2$ on the left and x in the middle, and put constant on the right.
4. Pass out or let the students draw a card from the deck so that everyone has a card.
5. Have all the students who got a face card or an ace go to the right side of the board and the people who got nines and tens to move to the middle of the board and the joker goes to the left. There should be: 1 joker ($x^2$) term, 8 nines and tens (x)term, and 12 king queen and jacks (constant ) term. (Bloom’s: knowledge, comprehension; Gardner’s: Bodily-Kinesthetic, interpersonal, visual-spatial)
6. For the other students who did not move to the board, they get to work with you, to help move the students who formed the trinomial, have to turn them into 2 binomials.
7. The students at the desk first need to find out how many people are on the constant side of the board. Tell all the students that the first thing they need to do is find all the factors to the constant term. The students at the desk work together and tell everyone all the answers. Then find all the factors of that number. Answer: (1 and 12), (2 and 6), (3 and 4)
8. Now tell everyone that the next step would be to find the factor sum that equals the number of x terms there are. People at the desk should say, 6 and 2. 6+2=8
9. Now ask the students what times what give you $x^2$. answer is $x\times x$
10. Now tell them that use the: what times what give you $x^2$ for the first term of each polynomial, and then the second term of each polynomial would be the factors who sum is the number of x terms there were in the trinomial. Have the students at the desk go to the board and write the two polynomials. Answer: $(x+2)(x+6)$ (Bloom’s: knowledge, comprehension; Gardner’s: Bodily-Kinesthetic, interpersonal, visual-spatial)

Step by Step

1. Now have them go back to their seats and have them try $x^2 + 7x + 10$, and $x^2 + 21x + 20$ in pairs. (Bloom’s: knowledge, comprehension; Gardner’s: intrapersonal, logical-mathematical, visual-spatial)
2. When most are finished go through each with them to make sure they fully understand.
3. $x^2 + 7x + 10 = (x + 5)(x + 2)$, and $x^2 + 21x + 20 = (x + 1)(x + 20)$. Make sure the sum of the factors is correct.
4. Now give them $x^2 − 17x + 42$. Ask the students what would be the rules for this type of problem? Ask students to defend their answer. Answer: find the negative factors of 42. That sum up to -17. (Bloom’s: comprehension, application, evaluation; Gardner’s: verbal-linguistic, logical-mathematical, visual-spatial)
5. Negative factors of 42 would be (-1 and -42), (-2 and -21), and (-3 and -14) and the sum that adds up to -17 is -3 and -14. So factoring $x^2 − 17x + 42$ give $(x − 3)(x − 14)$.
6. Now have the students explain/defend their answers. They can work in pairs again. (Bloom’s: knowledge, comprehension. evaluation; Gardner’s: interpersonal, logical-mathematical, visual-spatial)
7. Then go through the answers with them to make sure they get the correct answer. $x^2 − 10x + 25 = (x − 5)(x − 5)$ and $x^2 − 11x + 18 = (x − 2)(x − 9)$.
8. Now give them the worksheet and have them work on it for the rest of class and if they do not finish it then it is homework.

Closing

1. Ask the students what is the steps to factor a trinomial when every term is positive?
   a. Find the factors of the constant term and then find the sum of the factors that match x term and then find what times what gives you the first term of the trinomial (Bloom’s: knowledge, comprehension; Gardner’s: interpersonal, logical-mathematical, verbal-linguistic)
2. Now ask the students what are the steps to factor a trinomial when the x term is negative?
   a. Find the negative factors of the constant terms and then find the sum of the factors who’s the same as the middle term (x), and then find what times what give you the term of the first in the trinomial. (Bloom’s: knowledge, comprehension; Gardner’s: interpersonal, logical-mathematical, verbal-linguistic)
3. Now tell the students that tomorrow they will be learning to factor trinomials with a negative c term, and factoring with trinomials with two variables.

Adaptations

Enrichment – Have the student visit the website http://www.mathcats.com/crafts/stringart.html to look at examples of string art created using polynomials. The student will write about what is happening with the slope of the lines from the beginning to the end of the animation. Then the student will print out one of the string art patterns and make their own string art pattern using colored pencils. The student could also make up their own story problem that uses polynomials and quadratics in a real life situation or using the deck of cards from the activity at the beginning of class and present the problem to the class. Have the students compare Pascal’s triangle to the factoring of difference of two squares and other quadratic equations.

Reflections

- Did I get the student’s interested in the lesson?
- Do the students remember information from the previous lesson?
- Are they studying their vocabulary cards on their own or do they not understand the mathematical terms I use?
- Was the lesson too long or too short?
- Were my adaptations effective?
- What would make the lesson go better next time?
Factoring Polynomials

Name______________________________________  Date________________

Directions: Use FOIL to solve each of the following problems. **SHOW ALL WORK**

1. $x^2 + 13x - 30$

2. $x^2 - 15x + 36$

3. $x^2 + 4x + 3$

4. $x^2 + 6x + 8$

5. $x^2 - 16x + 28$

6. $x^2 + 21x + 38$

7. $x^2 - 3x + 2$

8. $x^2 - 9x + 8$

9. $x^2 - 18x + 45$

10. $x^2 + 19x + 18$
Name_________ KEY __________

Worksheet
Factoring Trinomials

1. $x^2 + 13x - 30$
   $(x - 2)(x + 15)$

2. $x^2 - 15x + 36$
   $(x - 3)(x - 12)$

3. $x^2 + 4x + 3$
   $(x + 1)(x + 3)$

4. $x^2 + 6x + 8$
   $(x + 4)(x + 2)$

5. $x^2 - 16x + 28$
   $(x - 14)(x - 2)$

6. $x^2 + 21x + 38$
   $(x + 19)(x + 2)$

7. $x^2 - 3x + 2$
   $(x - 2)(x - 1)$

8. $x^2 - 9x + 8$
   $(x - 8)(x - 1)$

9. $x^2 - 18x + 45$
   $(x + 19)(x + 2)$

10. $x^2 + 19x + 18$
    $(x + 18)(x + 1)$
Gifted and Talented

In this unit, I will use the website http://www.fcpsteach.org/gt_renzulli/default.cfm as an idea board for creating activities that challenge my gifted students. I like the idea of using a board where the students have choices about the activities they can complete and it would be something that would be easy to adapt to this unit on polynomials. I do not want to just give the students more homework problems because that doesn’t seem fair to the students. The students probably already know how to do the work so to give them more homework problems doesn’t really make sense. I could present the chart of options to the students at the beginning of the unit and allow them to work through the activities at their own pace. Each square of the chart would be for a student with a different type of learning intelligence or learning style. For example, I could do an activity about genetics, figuring out the different colors for a dog breed like Labradors, and how polynomials could affect breeders. This way, a student who is interested in nature or mathematics would still be learning about polynomials but in a way that interests them.

In this lesson, I had the students go to a website that was about the patterns of string art. Polynomials are used to make string art and I could extend this lesson into other earlier lessons when polynomials were first introduced. I would have the student research different types of art that polynomials can be used to make. Then I would have the student compare and contrast those types of art work and write a paragraph or two explaining their favorite artwork and why. Then I would have the student imitate that artwork by making their own with colored pencils. The student would not be using polynomials to create the artwork, because expensive computer programs are needed for that, but they would be copying it and making it their own with colored pencils. This would meet the needs of students who were visual-spatial learners, logical-mathematical learners, and intrapersonal learners.

Finally, I could have students do research how polynomials were used in past and present movies like Ghost Busters or the Matix. The student could research how the same polynomials are still being used but how things have changed as computer programs get better and designers come up with formulas that look more realistic. I would have the student create a comparison chart that would allow the student to write about the similarities and differences between the movies, polynomial formulas, and graphic techniques that were used. The student could present their report to the class and show video clips of different transformations. The students would enjoy seeing the graphics of movies that morphed or changed from the 1980s and 1990s because they look so different to movie characters that morph today.
Unit Lesson #6
Modified for Behavior Disorders, Includes Writing to Learn Strategy

Lesson Plan by Daniel Haffner
Length: 50 min.
Age or Grade Level Intended: Algebra 1

Academic Standard(s): A1.6.7 Factor the difference of two squares and other quadratics

Performance Objective(s): Given a 10 problems, the students will be able to factor trinomials with negative c values with 80% accuracy.

Assessment: The students will be given 10 problems. The teacher will check to see that the student got at least 8 out of the 10 problems correct.

Advance Preparation by Teacher:
- Chalkboard, chalk
- Copies of the worksheet for each student
- Algebra tiles for every person or pair, depending on how many you have
- Paper and pencils for each student

Procedure:

Introduction:
1. Remind the students about what they learned with factoring in the previous days. Have a five different students name something they learned from day one, day two, and so on. (Bloom’s: knowledge)
2. Have a set of algebra tiles for every person or pair, depending on how many you have.
3. Review the basic uses of algebra tiles by modeling a polynomial expression. Remind students that the large square represents an area of $x^2$, the rectangle represents an area of $x$, and the small square, or unit square, represents an area of one.
4. Model the polynomial $2x^2 + 3x – 5$ at the overhead projector using the overhead algebra tiles as shown below. (Gardner’s: Visual-Spatial, Logical-Mathematical)

```
+ + + + + + + + +
```

3. Review polynomial multiplication by modeling the problem $(x + 2)(x – 3) = x^2 – x – 6$ using overhead algebra tiles as shown below.

```
+ + + + + + + + +
```
4. Now tell the students that we will be working with trinomials of the form $ax^2 + bx + c$, but this time we will be using a negative $c$ value. So have them try using the tiles backwards to factor the trinomial $x^2 + 6x - 27$.

(Gardner’s: Visual-Spatial, Logical Mathematical)

5. Ask the students to think of a procedure that will help solve this type of factoring?

(Bloom’s: Comprehension)

**Step by Step**

1. Ask one of the students to write the procedure on the board if one of them figured out, if not tell them and write it on the board. (Bloom’s: knowledge, Gardner’s: Logical-mathematical)
   
a. Find the factors of $-c$
   
b. Find the sum of all the factors
   
c. Find the sum of the factors that is $=b$
   
d. Then put in the form of $(x-\_)(x+\_)$

2. Now have students get into pairs and try $x^2 + 8x - 20, x^2 + 3x + 10$ (Gardner’s: interpersonal, logical-mathematical).

3. Once most pairs figure them out write out the solution on the board. Answers: $x^2 + 8x - 20 = (x - 2)(x + 10), x^2 + 3x + 10 = (x - 2)(x + 5)$

4. Show the students how to model for each step and have the students write down the following steps on their own paper:
   
a. The problem from the board is:
   
b. What am I thinking? (what is the key word, what is the rule, and what is the first step?)
   
c. Solve it with mathematics
   
d. Solve it with words.

5. Model for the students how to use the four writing steps in the problem $x^2 + 8x - 20, x^2 + 3x + 10$.


Have students use the writing method from step 4 to solve their problem. Have students share their writings with the person sitting next to them.

7. Go through it with them, so write the factors of -18 which are: 1 and -18, 18 and -1, 6 and -3, 3 and -6. Have students share their writings with the class.

8. Now of those factors, ask which one sums up to -3? Ask students to defend their answer. Answer 3 and -6. (Bloom’s: evaluation)
9. Now tell students that we have all the information we need to solve, so write $x^2 - 3x - 18 = (x - 6)(x + 3)$. Again, have students go through the writing process to solve the problem and have them share their answers with a partner before going through the questions as a whole class.

10. Now have them work in pairs to try $x^2 - 3x - 40$, and $x^2 - x - 56$. Have students explain their thinking out loud or in writing. (Bloom’s: evaluation, Gardner’s: interpersonal)

11. Answers are: $x^2 - 3x - 40 = (x - 8)(x + 5)$, and $x^2 - x - 56 = (x - 8)(x + 7)$, have students demonstrate their answers and thinking for the rest of the class to hear. Allow students to justify their answers or ask questions about how their classmates got an answer. (Bloom’s: knowledge, comprehension, application, evaluation; Gardner’s: visual-spatial, verbal-linguistic, interpersonal, logical-mathematical)

12. Give the students their worksheet and say that it is homework if they do not get it done in the rest of the class. Tell students that they will need to use the writing steps they learned in class today and apply them to homework problem 1 and homework problem 10.

**Closing**

1. With the last 5 minutes, select one of the homework problems and work through it together. Have a different student walk through each step of the problem until finished. (Bloom’s: knowledge, comprehension, application; Gardner’s: visual-spatial, verbal-linguistic, interpersonal, logical-mathematical)

2. Tell the students what they learned today will be important for tomorrow. However, tomorrow $a$ will not equal 1 in the standard form and this will be important to solve the problems.

**Adaptations**

Behavior Disorders – The student’s partner will be carefully selected for him or her so that the student does not partner with someone who easily upsets them. The student will be provided with a checklist for the math class so that they can monitor their own activities in math such as the bell work, lesson time, and homework time. The student will be allowed to complete five problems and then take a short break to either get a drink or complete an easy logic problem. The student will then complete the last five problems on the homework. This will help the student not get as frustrated in class. The student will also sit by the teacher so that the teacher can monitor the student’s behavior, cue the student on when appropriate, and use proximity control to help the student behave and stay on task.

**Reflections**

- Did I get the student’s interested in the lesson?
- Do the students remember information from the previous lesson?
- Are they studying their vocabulary cards?
- Was the lesson too long or too short?
- Were my adaptations effective?
- What would make the lesson go better next time?
Factoring Polynomials

Name________________________________________  Date________________

Directions: Use FOIL to solve each of the following problems. **SHOW ALL WORK**

1. \(x^2 - 2x - 24\)  
2. \(x^2 + 3x - 18\)  
3. \(x^2 - 2x - 8\)  
4. \(x^2 + 16x - 17\)  
5. \(x^2 + 6x - 40\)  
6. \(x^2 - 8x - 9\)  
7. \(x^2 + 3x - 4\)  
8. \(x^2 + x - 20\)  
9. \(x^2 - 14x - 32\)  
10. \(x^2 - 13x - 30\)
1. $x^2 - 2x - 24$  
   $(x - 9)(x + 1)$
   \((x - 6)(x + 4)\)

2. $x^2 + 3x - 18$  
   $(x - 4)(x + 1)$
   \((x - 3)(x + 6)\)

3. $x^2 - 2x - 8$  
   $(x - 4)(x + 5)$
   \((x - 4)(x + 2)\)

4. $x^2 + 16x - 17$  
   $(x - 16)(x + 2)$
   \((x - 1)(x + 17)\)

5. $x^2 + 6x - 40$  
   $(x - 15)(x + 2)$
   \((x - 4)(x + 10)\)

6. $x^2 - 8x - 9$
Unit Lesson #7  
Modified for Autism

Lesson Plan by Daniel Haffner  
Lesson: Factoring Trinomials  
Length: 50 min.  
Age or Grade Level Intended: Algebra 1

Academic Standard(s): A1.6.7 Factor the difference of two squares and other quadratics

Performance Objective(s): Given a 10 problems, the students will factor trinomials with a value not equal to 0 with 80% accuracy.

Assessment: The students will be given 10 problems. The teacher will check to see that the student got at least 8 out of the 10 problems correct.

Advance Preparation by Teacher:  
- Chalkboard, chalk (different color chalk)  
- Copies of the worksheet for each student  
- “I have, you have” factor cards cut out and enough for each student to have 2 of each  
  o “I have” cards have a trinomial on them for students to answer  
  o “Who has” cards have a question that has an answer to one of the “I have” cards.

Procedure

Introduction:
1. Remind students that they have recently been learning how to factor trinomials. Tell the students that they will be learning how to factor trinomials again, but this time it will not equal 1.  
2. Tell students that before they learn about that type of factoring, they will be playing a game of “I have, you have” factors.  
3. Tell the students that they will each get four cards, two “I have” cards and two “who has” cards.  
   a. The “I have” cards will need to factor the trinomial on their card. They will then need to put their names on the back of the card with their work.  
   b. Once students finish working out the problem they will also have a card that has a question asking who has ____? card (the answer to their problem). Students will need to find the person who answers their two question cards and give that person his or her card “I have” cards. (Gardner’s: Interpersonal, Logical-Mathematical)  
4. Students will check the work on both of the cards that they received.

Step by Step:
1. Have students sit back down and then write on the board $6x^2 + 23n + 7$  
2. Now ask the students how they think the problem should be factored. Get different ideas from students and ask students to justify their answers or explain their thinking. Remind students that they should be trying to get the answer so no idea is wrong at this point. (Bloom’s: Knowledge, Evaluation)  
3. Remind students that the standard form of a trinomial is $ax^2 + bx + c$  
4. Have students copy down what you write on the board.  
5. Divide the board up into 4 sections with each letter of FOIL at the top of a section.  
   a. Under the F section, tell the students that they need to find all the factors of $a$.  
   b. Under the L section, tell the students that they need to find all the factors of $c$. 

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c. Now students should be left with the O and U sections as empty. Tell students that they will need to take one of the factors of a and put in the O section. Tell students that they now need to take one of the factors from c and put it in the I section. The factors should be taken from the same row (so if a student takes a factor of a from row one, then they should take a factor of c from row one).

d. Multiply the two numbers in each of the sections and then take the sum of the two sections. When the sum is equal to b, use the two numbers in O for the outer of each binomial, and the two numbers in I for the inner.

Example:

<table>
<thead>
<tr>
<th>F</th>
<th>O</th>
<th>I</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7*1</td>
<td></td>
<td>1*7</td>
</tr>
<tr>
<td>1*6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1*3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3*1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2x+7)</td>
<td>*</td>
<td>(3x+1)</td>
<td></td>
</tr>
</tbody>
</table>

Make sure the x terms product is equal to the a and the product of the constant is equal to the c.

(Gardner’s: Logical-Mathematical, Visual-Spatial)

6. Now have the students try \(7x^2 - 26x - 8\), by themselves. Answer: \((1x+4)(7x+2)\). As a class, work through it together calling on a different student to explain each step of the problem. (Bloom’s: knowledge, comprehension)

7. Now have them get with a partner and try \(20x^2 + 80x + 35\). Let students work in partners for a minute or two, and then give them a hint to make the problem easier.

a. Hint: factor out a monomial or GCF of all terms in the trinomial. It will reduce the number of factors you have to search for.

8. Ask students why factoring out a monomial or GCF of all terms in the trinomial makes the problem easier. Have students explain their thinking. (Bloom’s: analysis, Gardner’s: interpersonal)

9. As a class, work through it together calling on a different student to explain each step of the problem. (Bloom’s: knowledge, comprehension; Gardner’s: verbal-linguistic) Answer: \(5(2x+1)(2x+7)\)

10. Let students work on the homework. Now give them their worksheet and have them work on it for the rest of class. If they do not finish it then it is homework.

Closing

1. Take the last 5 min of class and review with the students the steps of all types of factoring they have learned.
   a. Standard form is when \(a=0\) and when \(a\) does not equal 0 (like today’s lesson)
   b. Bring back the term FOIL and discuss with students what good is it now that they learned factoring. (Bloom’s: knowledge, comprehension; Gardner’s: verbal-linguistic, interpersonal)

2. Ask the students what type of factoring they like best and have them justify their answers or explain their thinking (Bloom’s: knowledge, application, evaluation; Gardner’s: verbal-linguistic, interpersonal)

3. Ask the students if they are any special case factoring problems? (such as squaring a binomial, difference of squares)? (Bloom’s: knowledge, application; Gardner’s: verbal-linguistic, interpersonal, logical-mathematical).

4. Tell students that tomorrow, they will be learning more about factoring the difference of two squares and other quadratics.
Adaptations
Autism – Provide student with a script for checking to see if a classmate has his or her card during the game. For example, the student’s script could be:

Student: Do you have the answer _________?
If yes: I will give you my card.
If no: Ok. I will keep looking.

--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Student: I have the answer __________
If the student does has your answer – Yes, that matches my card. Thank you.
If the student does not have your answer – No, that does not match my card. Sorry.

Provide student with a schedule for how the class will run so the student can follow along and see the routine for the day. Allow student to work by him or herself to solve the problems in class if they want to. Allow student to work in the back of the room if the noise from other students working starts to upset him or her. Provide student with a handout of the notes to follow along with.

Reflections
- Did I get the student’s interested in the lesson?
- Do the students remember information from the previous lesson?
- Was the lesson too long or too short?
- Were my adaptations effective?
- What would make the lesson go better next time?
<table>
<thead>
<tr>
<th>I have</th>
<th>Who has</th>
<th>I have</th>
<th>Who has</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x^2 - 18x + 81$</td>
<td>$(x - 10)(x + 1)$?</td>
<td>$x^2 - 9x - 10$</td>
<td>$(x + 12)(x - 3)$?</td>
</tr>
<tr>
<td>$x^2 - 9x - 36$</td>
<td>$(x + 7)(x + 7)$?</td>
<td>$x^2 + 14x + 49$</td>
<td>$(x + 2)(x - 6)$?</td>
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<tr>
<td>$x^2 - 4x - 12$</td>
<td>$(x + 11)(x - 3)$?</td>
<td>$x^2 + 8x - 33$</td>
<td>$(x + 8)(x + 4)$?</td>
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<tr>
<td>$x^2 + 12x + 32$</td>
<td>$(x - 15)(x - 4)$?</td>
<td>$x^2 - 19x + 60$</td>
<td>$(x - 6)(x + 6)$?</td>
</tr>
<tr>
<td>$x^2 - 36$</td>
<td>$(x + 2)(x + 7)$?</td>
<td>$x^2 + 9x + 14$</td>
<td>$(x + 9)(x - 5)$?</td>
</tr>
<tr>
<td>$x^2 + 4x - 45$</td>
<td>$(x + 1)(x + 1)$?</td>
<td>$x^2 + 2x + 1$</td>
<td>$(x + 9)(x + 9)$?</td>
</tr>
<tr>
<td>I have $x^2 + 18x + 81$.</td>
<td>Who has $(x + 6)(x - 10)$?</td>
<td>I have $x^2 - 4x - 60$.</td>
<td>Who has $(x - 6)(x - 6)$?</td>
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<td>Who has $(x - 15)(x + 4)$?</td>
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<td>Who has $(x + 1)(x + 10)$?</td>
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<tr>
<td>I have $x^2 + 11x + 10$.</td>
<td>Who has $(x - 9)(x - 3)$?</td>
<td>I have $x^2 - 12x + 27$.</td>
<td>Who has $(x - 6)(x + 4)$?</td>
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<td>I have $x^2 - 2x - 24$.</td>
<td>Who has $(x - 8)(x - 4)$?</td>
<td>I have $x^2 - 12x + 32$.</td>
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<td>I have $x^2 + 19x + 60$.</td>
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<tr>
<td>I have $x^2 + 10x + 21$.</td>
<td>Who has $(x - 8)(x - 3)$?</td>
<td>I have $x^2 - 11x + 24$.</td>
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<td>I have $x^2 + 15x + 54.$</td>
<td>$(x - 8)(x - 7)$</td>
</tr>
<tr>
<td>I have $x^2 - 15x + 56.$</td>
<td>$(x + 8)(x + 5)$</td>
<td>I have $x^2 + 13x + 40.$</td>
<td>$(x - 6)(x - 10)$</td>
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<tr>
<td>I have $x^2 - 16x + 60.$</td>
<td>$(x + 6)(x + 5)$</td>
<td>I have $x^2 + 11x + 30.$</td>
<td>$(x - 12)(x + 3)$</td>
</tr>
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<td>I have $x^2 - 9x - 36.$</td>
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<td>$(x - 9)(x + 3)$</td>
<td>I have $x^2 - 6x - 27.$</td>
<td>$(x - 7)(x + 3)$</td>
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<td>$x^2 + 9x - 10.$</td>
<td>$(x - 6)(x - 5)$</td>
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<tr>
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<td>I have $x^2 - 6x + 9.$</td>
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<td>I have $x^2 + 16x + 60.$</td>
<td>Who has $(x - 11)(x + 2)$</td>
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<td>I have $x^2 - 9x - 22.$</td>
<td>Who has $(x - 2)(x - 7)$</td>
<td>I have $x^2 - 9x + 14.$</td>
<td>Who has $(x + 5)(x - 9)$</td>
</tr>
<tr>
<td>I have $x^2 - 4x - 45.$</td>
<td>Who has $(x + 9)(x + 3)$</td>
<td>I have $x^2 + 12x + 27.$</td>
<td>Who has $(x - 9)(x - 9)$</td>
</tr>
</tbody>
</table>

http://www.ilovemath.org/index.php?option=com_docman&task=doc_details&gid=100
Factoring Polynomials

Name________________________________________ Date________________

Directions: Solve each of the following problems. **SHOW ALL WORK**

1. \(2x^2 + 15x + 7\)  
2. \(16x^2 + 26x + 9\)  
3. \(7x^2 + 50x + 7\)  
4. \(8x^2 - 10x - 3\)  
5. \(25x^2 - 10x - 15\)

6. \(6x^2 + 25x + 11\)  
7. \(8x^2 + 18x + 9\)  
8. \(2x^2 - x - 3\)  
9. \(12x^2 - x - 20\)  
10. \(11x^2 + 77x + 66\)
Worksheet

Factoring Trinomials

1. $2x^2 + 15x + 7$
   \[(x + 7)(2x + 1)\]

2. $16x^2 + 26x + 9$
   \[(8x + 9)(2x + 1)\]

3. $7x^2 + 50x + 7$
   \[(x + 7)(7x + 1)\]

4. $8x^2 - 10x - 3$
   \[(2x - 3)(4x + 1)\]

5. $25x^2 - 10x - 15$
   \[(5x - 5)(5x + 3)\]

6. $6x^2 + 25x + 11$
   \[(3x + 11)(2x + 1)\]

7. $8x^2 + 18x + 9$
   \[(4x + 3)(2x + 3)\]

8. $2x^2 - x - 3$
   \[(2x - 3)(x + 1)\]

9. $12x^2 - x - 20$
   \[(4x + 5)(3x - 4)\]

10. $11x^2 + 77x + 66$
    \[(x + 6)(11x + 11)\]
Unit Lesson #8
Modified for Intellectual Disability, Includes a Writing to Learn Strategy

Lesson Plan by Daniel Haffner
Lesson: Factoring Trinomials
Length: 50 min.

Age or Grade Level Intended: Algebra 1

Academic Standard(s): A1.6.7 Factor the difference of two squares and other quadratics

Performance Objective(s): Given 10 problems, the student will factor the difference of two squares at least 8 out of 10 times correctly.

Assessment: Students will be given a worksheet. Students will have to complete 8 out of the 10 problems correctly to master the objective.

Advance Preparation by Teacher:
- Copies of the writing prompt (both admit slips and exit slips)
  - Admit Slip – Explain to a younger student why they should learn about polynomials. You can write about how polynomials are used in everyday life, what are the important points to remember about polynomials, things students should pay attention to in math class now to help them learn about polynomials later, etc
  - Exit Slip – The three best things I learned today were.
- Chalkboard, chalk (different color chalk),
- Copies of the worksheet for each student
- Print off game for every group of 3 in that a class can make. [http://www.ilovemath.org/index.php?option=com_docman&task=doc_details&gid=159](http://www.ilovemath.org/index.php?option=com_docman&task=doc_details&gid=159)
- Two dice for each group of 3 in the class.

Procedure:

Introduction:
1. As students walk into the room, hand them the writing prompt. Let students know that they will have five minutes to answer the prompt, which involves information they have learned throughout the unit, before turning it in. Let students work for 5 minutes. Ask three or four students to share their responses. Collect prompts. (Gardner’s: intrapersonal, verbal-linguistic)
2. Tell students that today will be the last day they will be working on factoring, but before students can learn about factoring perfect square trinomial, everyone is going to play a game.
3. Everyone needs to get into groups of three. (If it doesn’t work out join a group of 2 and be the third player). Pass out a board game and two dice to each group and explain the following rules.
   a. Tell the students that one person will have the answer key to the game and the other two people will be playing, and after 12 dice roles students will switch positions – this way everyone gets to play twice and have the answer key once.
b. Tell students to mark off all the problems they use so that they do not reuse them and every problem will be use once and only once.

c. If the person who rolls the dice does not get the answer then the other play gets to try to steal the point. Every problem is worth one point.

d. If a student roles a 3 and 4 then he or she gets to choose if they want 3,4 on the board or 4,3 (if neither of them are taken).


Step by Step

1. Once the game is over, have students return to their seats. Ask and see if every group was able to find the answer to every problem. Go over some of the questions with students. Have a student explain how they got the answer and have the student justify or explain their thinking for the problems. (Bloom’s: knowledge, application, evaluation)

2. Go to the board and write \( x^2 - 8x + 16 \) and tell the students that this is an example of a perfect square trinomial. Ask the students why they think it is a perfect square trinomial? Guide students into figuring out that it can be factored down to a binomial squared. (Bloom’s: knowledge, comprehension; Gardner’s: verbal-linguistic)

   a. The first thing you need to do to solve \( x^2 - 8x + 16 \) is to rewrite the first and last terms as a product of the same thing. So \( x^2 - 8x + 16 \) will become \( x^2 - 8x + 4^2 \)

   b. Then look at the middle term which is 8x, and look at the first and last term products and take one of each and multiply them by 2, so 8x should = \( 2 \times 4 \times 2 \), well \( 2 \times 4 = 8 \) and \( 8x = 8x \)

   c. Therefore this trinomial is a perfect square, and can be wrote as \( (x - 4)^2 \)

3. Now have the students try \( 9x^2 + 12x + 4 \), they can work with a partner. (Bloom’s: interpersonal, logical-mathematical)

4. Have a two pairs of students go to separate areas of the board and write how they solved the problem. Have both pairs explain their thinking or reasoning (justify their answers). Go through it with them after they try it, \( 9x^2 + 12x + 4 = (3x)(3x) + 12x + 2 * 2 \). Does \( 12x=2(3x)(2) \) work as well as \( 2*3x=6x \) and \( 6x*2=12x \) ? Then, it can be written as \( (3x + 2)^2 \) (Gardner’s: interpersonal, verbal-linguistic)

5. Hand out the work sheet and have the students try doing it by themselves.

Closing

1. During the last 10 minutes of class, ask the students to repeat the steps on how to solve factoring a perfect square. How does one factor a trinomial with the leading coefficient one? How does one factor a trinomial with the leading coefficient note equal to one? Have students explain their answers with either an example or other kinds of reasoning (Bloom’s knowledge, application, evaluation; Gardner’s: verbal-linguistic, logical-mathematical, interpersonal)

2. Ask the students how would they graph the trinomials, or polynomials? (Bloom’s: knowledge)

3. Tell the students that tomorrow they will be graphing polynomials. This is important because graphing all the zeros of a polynomial will save time when they need to see what the graph of the equation looks like. Students will also be finishing up the unit
before the test. They will also be using a graphic organizer to help them remember all the types of factoring.

4. Hand students their exit slip. Tell students that you will be collecting it before they leave.

**Adaptations**

Intellectual Disability – Provide students with a copy of the notes, including how to do each step of the problem. Allow student to work with a peer on the homework. Students can say their answers out loud to the teacher for the writing prompts. Student will be seated at the front of the classroom during instruction time so teacher can monitor the student and partner work. Student will play the game near wherever the teacher is in the classroom so teacher can monitor student. Student will have a modified game board that includes multiple choice answers to the question(s) asked. Student will have a peer helper assist them in reading the answers or questions during the game.

**Reflections**

- Did I get the students interested in the lesson? Did they enjoy the game? Did they learn from the game?
- Do the students remember information from the previous lesson?
- Are they ready for the test?
- Was the lesson too long or too short?
- Were my adaptations effective?
- What would make the lesson go better next time?
Worksheet

Factoring Trinomials

1. \( x^2 + 10x + 25 \)  
2. \( x^2 + 12x + 36 \)  
3. \( x^2 - 16x + 64 \)  
4. \( x^2 + 20x + 100 \)  
5. \( 25x^2 - 30x + 9 \)  
6. \( x^2 - 2x + 1 \)  
7. \( x^2 - 24x + 144 \)  
8. \( x^2 - 14x + 49 \)  
9. \( 25x^2 - 40 + 15 \)  
10. \( 64x^2 - 144x + 81 \)
Worksheet
Factoring Trinomials

1. \( x^2 + 10x + 25 \)
   \((x + 5)(x + 5)\)

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

3. \( x^2 - 16x + 64 \)
   \((x - 8)(x - 8)\)

4. \( x^2 + 20x + 100 \)
   \((x + 10)(x + 10)\)

5. \( 25x^2 - 30x + 9 \)
   \((5x - 3)(5x - 3)\)

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

7. \( x^2 - 24x + 144 \)
   \((x - 12)(x - 12)\)

8. \( x^2 - 14x + 49 \)
   \((x - 7)(x - 7)\)

9. \( 25x^2 - 40x + 15 \)
   \((5x - 3)(5x + 3)\)

10. \( 64x^2 - 144x + 81 \)
    \((8x - 9)(8x - 9)\)
Entry Skip

Explain to a younger student why they should learn about polynomials. You can write about how polynomials are used in everyday life, what are the important points to remember about polynomials, things students should pay attention to in math class now to help them learn about polynomials later.

______________________________________________________________________________
______________________________________________________________________________
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Exit Skip

Three things I learned in class today (that I did not know before) are.....

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
Unit Lesson #9
Modified for Vision Impairment, Includes a Graphic Organizer

Lesson Plan by Daniel Haffner
Lesson: Graphing Polynomials
Length: 50 minutes
Age or Grade Level Intended: Algebra 1

Academic Standard(s):
A.1.6.8 Understand and describe the relationship among the solutions of and equation, the zeros of a function, the x-intercepts of a graph, and the factors of a polynomial expression.

Performance Objective(s):
Given 10 problems, the student will find the zero’s of the polynomial at least 8 out of 10 times correctly.

Given 10 problems, the student will graph the polynomials by using the zero’s of the polynomial at least 8 out of 10 times correctly.

Assessment:
Students will be given a worksheet. Students will have to complete 8 out of the 10 problems correctly to master the objective.

Advance Preparation by Teacher:
- Have a graph on the on the ground with tape. With the origin, x-axis, and y-axis all marked
- Gum and cooked spaghetti so it bends
- Wax paper
- Graph paper

Procedure:

Introduction:

1. Have two volunteer students remind the class about the factoring they learned the previous day. Fill in any gaps the students might have missed or prod the students to give more to their explanations. (Bloom’s: knowledge)
2. Give every student some wax paper and graph paper, have the students put the graph paper under the wax paper so they can see the lines.
3. Then give every one 2 spaghetti sticks and a piece of gum. Now tell the students that they need to make a function on the wax paper. Tell them that it will be best if they make the spaghetti cross the x-axis on an integer. (Gardner’s: Bodily-Kinesthetic)
4. Have them chew the gum and use little pieces to keep the spaghetti still.
5. Now write each zero value in the form of \((x-\_\_\_\-)\) and then multiply all the polynomials together to get a function.

6. Now ask them how would they go from the big polynomial to find the zeros? Have them talk it over with a partner but justify their answer to the question after discussion. (Bloom’s: Knowledge, Comprehension; Gardner’s: Bodily-Kinesthetic, Verbal-Linguistic, Interpersonal)

**Step by Step**

1. Have everybody get into groups of five or six. (Gardner’s: interpersonal)
2. Give each group and equations \(f(x) = x^3 - 3x^2 - 9x + 27, f(x) = x^3 - 18x + 8, f(x) = 2x^3 - 6x^2 + 5x, f(x) = x^3 + 3x^2 - 3x - 9, f(x) = -x^3 - 5x^2 + 6x\)
3. On the board write the equation \(f(x) = x^3 - 7x^2 + 4x + 12\) now ask the students how they would find all the zeros? (Gardner’s: logical-mathematical, interpersonal)
4. Tell students: First use the rational root theorem, so the roots are \(1,-1\) from the leading term, and \(1, -1, 12, -12, 2, -2, 6, -6, 3, -3, 4, -4\) from the constant term. Which give us \(1, -1, 12, -12, 2, -2, 6, -6, 3, -3, 4, -4\) to check.
5. Tell students: Now we just let \(x\) be one of them until we find all roots. \(f(1)=10, f(-1)=0, f(2)=0, f(-2)=-32, f(3)=-12, f(-3)=-90, f(4)=-20, f(-4)=-180, f(6)=0, f(-6)=-480, f(12)=780, f(-12)=-2772\)
6. So the roots of the polynomial are \(-1, 2, 6\)
7. Now have the groups work on their polynomial function and find all zeros. Have the groups of students demonstrate on the board the different possibilities that their function could be, just knowing the zeros of the function, with their spaghetti and new pieces of gum. Have students challenge answers and/or justify answers so students have a chance to explain their thinking and reasoning. (Bloom’s: application, analysis, evaluation; Gardner’s: interpersonal, verbal-linguistic, logical-mathematical, bodily-kinesthetic)
8. Have each group tell all the possibilities of the roots using the rational root theorem, and tell the class what ones are actually roots. Have each group of students show their graphs and explain them. (Bloom’s: application, analysis; Gardner’s: verbal-linguistic, interpersonal)
9. Hand out the graphic organizers to students. Explain to students how they should fill in the graphic organizer. Each of the bottom boxes, there are seven of them, needs an example of the problem or term. The middle box will have three examples, one for each step of the problem. Ask if students have any questions and help them fill out one or two of the boxes first before letting them work on it. Tell students they can use the graphic organizer to study for the test in two days so it will not be collected until after test time.

10. Ask for questions about either the homework or the graphic organizer and if students do not have any then give the students the worksheet and tell them that it will be homework, like the graphic organizer, if they do not finish it.
Closing

1. Now ask the students why would it be important to find all the zeros? Answer: if you can find the zeros you know that you can find how the function looks easier than just plugging in random point. (Bloom’s: analysis)

2. Ask the students why graphing the functions are important? Are there any real applications in the world? Have students explain their thinking. (answer: in the business world). (Bloom’s: application; Gardner’s: verbal-linguistic, interpersonal)

3. Why might it more beneficial to graph functions than to write them out? (So people can visually see what is happening.) (Bloom’s: application, analysis)

4. Ask the students what type of review game they would like to play: fly swatter, Jeopardy, a contest between teams, or telephone equations. Tell students that tomorrow they will be playing their review game to prepare for the test in two days.

Adaptations

Visual-Impairment – Have a PowerPoint of the equations so that they can be enlarged on the board for students to see (also enlarge the homework and graphic organizer sheets). Have students solve the problems on the overhead projector or electronic whiteboard so that they are enlarged. Have the students pull the desks together in groups (so they don’t talk across rows) and so the classroom is easier to move around too for the student. Instead of having the student use small pieces of gum and wet spaghetti, have the student use chenille stems (instead of spaghetti) and let the student chew gum but use stick tack so they can have bigger pieces to secure the wider chenille stems with (enlarge the graph for student to use too).

Reflections
- Were my adaptations effective?
- Were the students engaged?
- Was the gum too messy? Did the spaghetti work? Should I have used other supplies?
- Did the graphic organizer help the students understand it or was there a better organizer to use?
- Did the students pass the assessment part? Why or why not?
Name _______________________

Worksheet
Factoring Trinomials

Directions: Find all zeros and draw a basic graph of the function

1. \( f(x) = x^3 - 7x - 6 \)
2. \( f(x) = 3x^3 + 8x^2 - 2x - 12 \)
3. \( f(x) = -2x^3 + 50x \)
4. \( f(x) = x^4 + 2x^2 - 49x - 98 \)
5. \( f(x) = 4x^4 - 8x^3 - 16x^2 + 32x \)
6. \( f(x) = x^3 - 4x^2 + 4x \)
7. \( f(x) = -2x^3 - 2x \)
8. \( f(x) = 4x^3 - 2x^2 - 17x + 6 \)
9. \( f(x) = x^4 - 4x^2 - 45 \)
10. \( f(x) = 6x^4 + 8x^3 - 9x^2 - 8x + 3 \)
Worksheet
Factoring Trinomials

Directions: Find all zeros and draw a basic graph of the function

1. \( f(x) = x^3 - 7x - 6 \)
   - \( X=3, -2, -1 \)

2. \( f(x) = -x^3 - 8x^2 - 15x \)
   - \( X=-5, -3, 0 \)

3. \( f(x) = -2x^3 + 50x \)
   - \( X=5, -5, 0 \)

4. \( f(x) = x^3 + 2x^2 - 49x - 98 \)
   - \( X=-7, 7, -2 \)

5. \( f(x) = -4x^3 - 8x^2 + 32x \)
   - \( X=-4, 2, 0 \)

6. \( f(x) = x^3 - 4x^2 + 4x \)
   - \( X=2, 2, 0 \)

7. \( f(x) = -2x^3 - 2x \)
   - \( X=0, 0, 0 \)

8. \( f(x) = x^3 - 2x^2 + x - 2 \)
   - \( X=2, 2, 2 \)

9. \( f(x) = -4x^2 + 4x \)
   - \( X=0, 1 \)

10. \( f(x) = x^3 - 14x^2 + 56x - 64 \)
    - \( X=8, 4, 2 \)
Lesson Plan by Daniel Haffner
Lesson: Graphing Polynomials
Length: 50 minutes
Age or Grade Level Intended: Algebra 1

The students will play a review game where they will study for the material the next day. The students were given a choice of games to play in lesson 9. The teacher should prepare the materials for the game that the class selected. The students will play the game for 35-40 minutes and the last 10 minutes of the class period will be saved for further questions students might have about the test the next day. Students will be encouraged to study their notes, their homework, and any other materials that were created or handed out during class.
1. Write the polynomial \(-7 + 52x^4 + 17x^5 - 13x\) in descending order of the exponents.

2. Evaluate \(4a^3 + a^2 - 9a - 2\) when \(a = 1/3\)

3 - 4 Simplify.

3 \((9x^4 - 12x^3y + 3y^2) + (x^4 - 5x^3y + 14y^2)\)

Answer: 

4. \((7a^3 + 9b^2 - 9) - 4(3a^3 - 5b^2 + 8) + 9a^3\)

Answer: 

5 - 8 Multiply and simplify.

5. \(8x^2y(3x^3y - 7xy + 8y)\)

5. __________

6. \((x + 7)(x - 9)\)

6. __________

7. \((3a - 2)^2\)

7. __________

8. \((2x - 5)(4x^2 + 6x - 3)\)

8. __________

9 - 10. Factor by finding the GCF.

9. \(18y^3 - 27y^2\)

9. __________

10. \(10a^6b^4c^3 - 15a^4b^2c^5 + 30a^3b^3c\)

10. __________
11-15. Factor each trinomial.

11. $x^2 + 15x + 14$

12. $x^2 + 4x - 12$

13. $x^2 - 12x - 45$

14. $x^4 - 6x^2 - 72$

15. $5x^2 + 38x - 16$
16—18. Factor these “Special Case” Polynomials.

16. \(9x^2 + 12x + 4\) 

17. \(x^2 - 144\)

18. \(x^2 - 64\)

19. Find the perimeter.

20. Find the area of the shaded region.
Algebra I Test- “Polynomials”

Show your Work – No Credit Will Be Given Without Work!

1. Write the polynomial \(-7 + 52x^4 + 17x^5 - 13x\) in descending order of the exponents.

(a) \(52x^4 + 17x^5 - 13x - 7\)
(b) \(-7 - 13x + 52x^4 + 17x^5\)
(c) \(17x^5 + 52x^4 - 13x - 7\)
(d) not listed

2. Evaluate \(4a^3 + a^2 - 9a - 2\) when \(a = 1/3\)

(a) \(-4\frac{20}{27}\)
(b) \(-2\frac{14}{27}\)
(c) \(10\frac{4}{27}\)
(d) not listed

3—4 Simplify.

3. \((9x^4 - 12x^3y + 3y^2) + (x^4 - 5x^3y + 14y^2)\)

Answer __________

(a) \(9x^4 - 17x^3y + 3y^2\)
(b) \(10x^8 - 17x^6y^2 + 17y^4\)
(c) \(10x^4 + x^3y\)
(d) not listed

4. \((7a^3 + 9b^2 - 9) - 4(3a^3 - 5b^2 + 8) + 9a^3\)

Answer __________

(a) \(4a^3 + 29b^2 - 41\)
(b) \(28a^3 - 4b^2 + 23\)
(c) \(4a^3 - 4b^2 + 23\)
(d) not listed
5 - 8 Multiply and simplify.

5. $8x^2y(3x^3y - 7xy + 8y)$

5. \[ \]

(a) $11x^5 - 15x^3y^2 + 16x^2y^2$
(b) $24x^6 - 56x^2y + 64x^2y$
(c) $24x^5 - 56x^3y^2 + 64x^2y^2$
(d) not listed

6. $(x + 7)(x - 9)$

6. \[ \]

(a) $x^2 - 63$
(b) $x^2 + 2x - 63$
(c) $x^2 - 2x + 63$
(d) not listed

7. $(3a - 2)^2$

7. \[ \]

(a) $9a^2 - 4$
(b) $9a^2 - 4a + 4$
(c) $9a^2 - 12a + 4$
(d) not listed

8. $(2x - 5)(4x^2 + 6x - 3)$

8. \[ \]

(a) $8x^3 - 8x^2 - 36x + 15$
(b) $8x^3 + 32x^2 + 24x + 15$
(c) $8x^3 - 32x^2 - 36x - 15$
(d) not listed

9-10. Factor by finding the GCF.

9. $18y^3 - 27y^2$

9. \[ \]

(a) $9(2y^3 - 3y^2)$
(b) $9y(2y^3 - 3y^2)$
(c) $9y^2(2y^3 - 3y^2)$
(d) not listed
10. $10a^6b^4c^3 - 15a^4b^2c^5 + 30a^3b^3c$

(a) $5(2a^6b^4c^3 - 3a^4b^2c^5 + 6a^3b^3c)$  (b) $15ab^5c^5$
(c) $5a^3b^2(2a^3b^2c^3 - 3ac^5 + 6bc)$  (d) not listed

11-15. Factor each trinomial.

11. $x^2 + 15x + 14$

(a) $(x + 2)(x + 7)$  (b) $(x + 1)(x + 14)$
(c) $(x + 1)(x + 15)$  (d) not listed

12. $x^2 + 4x - 12$

(a) $(x + 2)(x + 6)$  (b) $(x - 2)(x + 6)$
(c) $(x + 2)(x - 6)$  (d) not listed

13. $x^2 - 12x - 45$

(a) $(x - 9)(x - 5)$  (b) $(x + 3)(x - 15)$
(c) $(x - 3)(x + 15)$  (d) not listed

14. $x^4 - 6x^2 - 72$

(a) $(x^2 - 12)(x^2 + 6)$  (b) $(x^2 - 12x)(x^2 + 6x)$
(c) $(x^2 - 18)(x^2 + 4)$  (d) not listed
15. $5x^2 + 38x - 16$

(a) $(5x - 8)(x + 2)$
(b) $(5x - 2)(x + 8)$
(c) $(5x - 1)(x + 16)$
(d) not listed

16 - 18. Factor these “Special Case” Polynomials.

16. $9x^2 + 12x + 4$

(a) $(3x + 4)(3x + 4)$
(b) $(3x + 2)(3x + 2)$
(c) $(9x + 2)(x + 2)$
(d) not listed

17. $x^2 - 144$

(a) $(x + 12)(x - 12)$
(b) $(x - 12)(x - 12)$
(c) $(x^2 - 12)$
(d) not listed

18. $x^2 - 64$

(a) $(x - 8)(x + 8)$
(b) $2(x^2 - 32)$
(c) $2(x - 4)(x + 4)$
(d) not listed
19. Find the perimeter.

\[ 3x - 2 \]

(a) \( 12x \)  
(b) \( 9x^2 \)  
(c) \( 6x \)  
(d) \( 12x - 8 \)

20. Find the area of the shaded region.

\[ x^2 + 121 \]  
(a) \( x^2 + 121 \)  
(b) \( 121 \)  
(c) \( 22x + 121 \)  
(d) \( 2x^2 + 22x + 121 \)
Test - “Polynomials”

Algebra 1

Name: KEY

Show your Work

1. Write the polynomial \(-7 + 52x^4 + 17x^5 - 13x\) in descending order of the exponents.
   \[17x^5 + 52x^4 - 13x - 7\]

2. Evaluate \(4a^3 + a^2 - 9a - 2\) when \(a = 1/3\)
   \[-\frac{20}{27}\]

   \(3. (9x^4 - 12x^3y + 3y^2) + (x^4 - 5x^3y + 14y^2)\)
   \[10x^4 - 17x^3y + 17y^2\]

4. \((7a^3 + 9b^2 - 9) - 4(3a^3 - 5b^2 + 8) + 9a^3\)
   \[4a^3 + 29b^2 - 41\]

5. Multiply and simplify.
   \(5. 8x^2y(3x^3y^2 - 7xy + 8y)\)
   \[24x^5y^2 - 56x^3y^2 + 64x^2y^2\]

6. \((x + 7)(x - 9)\)
   \[x^2 - 2x + 63\]

7. \((3a - 2)^2\)
   \[9a^2 - 12a + 4\]

8. \((2x - 5)(4x^2 + 6x - 3)\)
   \[8x^3 - 8x^2 - 36x + 15\]

9. Factor by finding the GCF.
   \(9. 18y^3 - 27y^2\)
   \[9y^2(2y^3 - 3y^2)\]

10. Factor each trinomial.
    \(10.10a^6b^4c^3 - 15a^4b^2c^5 + 30a^3b^3c\)
    \[5a^3b^2c(2a^3b^2c^2 - 3ac^4 + 6b)\]

11-15. Factor each trinomial.

11. \(x^2 + 15x + 14\)
    \((x + 1)(x + 14)\)

12. \(x^2 - 2x + 3\)
    \((x - 1)(x - 3)\)

13. \(x^2 + 5x + 6\)
    \((x + 2)(x + 3)\)

14. \(x^2 - 9\)
    \((x + 3)(x - 3)\)

15. \(x^2 - x - 6\)
    \((x + 2)(x - 3)\)
12. $x^2 + 4x - 12$
   $(x - 2)(x + 6)$

13. $x^2 - 12x - 45$
   $(x + 3)(x - 15)$

14. $x^4 - 6x^2 - 72$
   $(x^2 - 12)(x^2 + 6)$

15. $5x^2 + 38x - 16$
   $(5x - 2)(x + 8)$

16—18. Factor these “Special Case” Polynomials.

16. $9x^2 + 12x + 4$
   $(3x + 2)(3x + 2)$

17. $x^2 - 144$
   $(x + 12)(x - 12)$

18. $x^2 - 64$
   $(x - 8)(x + 8)$

19. Find the perimeter.

20. Find the area of the shaded region.
Test- “Polynomials”

Algebra 1

Name: __________ KEY __________

Show your Work

1. Write the polynomial -7 + 52x^4 + 17x^5 - 13x in descending order of the exponents.
(a) 52x^4 + 17x^5 - 13x - 7
(b) -7 - 13x + 52x^4 + 17x^5
(c) 17x^5 + 52x^4 - 13x - 7
(d) not listed

2. Evaluate 4a^3 + a^2 - 9a - 2 when a = 1/3
(a) -4 \( \frac{20}{27} \)
(b) -2 \( \frac{14}{27} \)
(c) 10 \( \frac{4}{27} \)
(d) not listed

3—4 Simplify.
3. \( (9x^4 - 12x^3y + 3y^2) + (x^4 - 5x^3y + 14y^2) \)
(a) 9x^4 - 17x^3y + 3y^2
(b) 10x^8 - 17x^6y^2 + 17y^4
(c) 10x^4 + x^3y
(d) not listed

4. \( (7a^3 + 9b^2 - 9) - 4(3a^3 - 5b^2 + 8) + 9a^3 \)
(a) 4a^3 + 29b^2 - 41
(b) 28a^3 - 4b^2 + 23
(c) 4a^3 - 4b^2 + 23
(d) not listed

5—8 Multiply and simplify.
5. \( 8x^2y(3x^2y - 7xy + 8y) \)
(a) 11x^5 - 15x^3y^2 + 16x^2y^2
(b) 24x^6 - 56x^2y + 64x^2y
(c) 24x^5 - 56x^3y^2 + 64x^2y^2
(d) not listed

6. \( (x + 7)(x - 9) \)
(a) \( x^2 - 63 \)
(b) \( x^2 + 2x - 63 \)
(c) \( x^2 - 2x + 63 \)
(d) not listed

7. \( (3a - 2)^2 \)
(a) \( 9a^2 - 4 \)
(b) \( 9a^2 - 4a + 4 \)
(c) \( 9a^2 - 12a + 4 \)
(d) not listed
8. \((2x - 5)(4x^2 + 6x - 3)\)  
(a) \(8x^3 - 8x^2 - 36x + 15\)  
(b) \(8x^3 + 32x^2 + 24x + 15\)  
(c) \(8x^3 - 32x^2 + 36x - 15\)  
(d) not listed

9-10. Factor by finding the GCF.

9. \(18y^3 - 27y^2\)  
(a) \(9(2y^3 - 3y^2)\)  
(b) \(9y(2y^3 - 3y^2)\)  
(c) \(9y^2(2y^3 - 3y^2)\)  
(d) not listed

10. \(10a^4b^4c^3 - 15a^4b^2c^5 + 30a^3b^3c\)  
(a) \(5(2a^4b^4c^3 - 3a^4b^2c^5 + 6a^3b^3c)\)  
(b) \(15ab^5c^5\)  
(c) \(5a^3b^2(2a^3b^2c^3 - 3ac^5 + 6bc)\)  
(d) not listed

11-15. Factor each trinomial.

11. \(x^2 + 15x + 14\)  
(a) \((x + 2)(x + 7)\)  
(b) \((x + 1)(x + 14)\)  
(c) \((x + 1)(x + 15)\)  
(d) not listed

12. \(x^2 + 4x - 12\)  
(a) \((x + 2)(x + 6)\)  
(b) \((x - 2)(x + 6)\)  
(c) \((x + 2)(x - 6)\)  
(d) not listed

13. \(x^2 - 12x - 45\)  
(a) \((x - 9)(x - 5)\)  
(b) \((x + 3)(x - 15)\)  
(c) \((x - 3)(x + 15)\)  
(d) not listed

14. \(x^4 - 6x^2 - 72\)  
(a) \((x^2 - 12)(x^2 + 6)\)  
(b) \((x^2 - 12x)(x^2 + 6x)\)  
(c) \((x^2 - 18)(x^2 + 4)\)  
(d) not listed

15. \(5x^2 + 38x - 16\)  
(a) \((5x - 8)(x + 2)\)  
(b) \((5x - 2)(x + 8)\)  
(c) \((5x - 1)(x + 16)\)  
(d) not listed

16—18. Factor these “Special Case” Polynomials.

16. \(9x^2 + 12x + 4\)  
(a) \((3x + 4)(3x + 4)\)  
(b) \((3x + 2)(3x + 2)\)  
(c) \((9x + 2)(x + 2)\)  
(d) not listed
17. \(x^2 - 144\)

(a) \((x + 12)(x - 12)\)  
(b) \((x - 12)(x - 12)\)

(c) \((x^2 - 12)\)  
(d) not listed

18. \(x^2 - 64\)

(a) \((x - 8)(x + 8)\)  
(b) \(2(x^2 - 32)\)

(c) \(2(x - 4)(x + 4)\)  
(d) not listed

19. Find the perimeter.

(b) \(12x\)  
(b) \(9x^2\)

(b) \(6x\)  
(d) \(12x - 8\)

20. Find the area of the shaded region.

(a) \(x^2 + 121\)  
(b) \(121\)

(c) \(22x + 121\)  
(d) \(2x^2 + 22x + 121\)
Explanation of Modifications

This unit test was modified in a way that would allow the student to check their answer against the multiple choice answers given. The student will still have to show their work in order to receive any credit. However, by having a set of answer choices the student will have the opportunity to check their work. If they get an answer that was not given then they know they can go back and work through the problem again. The students will have to show their work because it will allow me to give them partial credit if they still do not select the correct answer. I understand that some students will show a little bit of work and then just select an answer and hope it's the right one. However, there is only a 25% chance that the student would guess the right answer. The chance of the student selecting enough right answers each to pass the test with a 70% or more decreases with each guess and it is very unlikely they could pass the test that way.

In addition, all of my students will have the chance to use a calculator. By the time students come into my classroom, they should know how to add or multiply. I do not want my students spending lots of time in class working out double digit multiplication problems or doing long division problems. Basic math is not the focus of my test and I am not really concerned about whether they can do those problems correctly, I already assume they can even if it takes some a longer time than others. I want my students concentrating on factoring and polynomials which is why I am allowing all my students to use a calculator.

These two modifications provide assistance to my students with disabilities while still allowing them to prove to me that they know the material. A student will still need to show their work in order to receive any credit. By having the students show me work, I can see where they are messing up or where they do not understand something so I can go back and repeat lessons if needed. I want to help all my students and I think these modifications allow me to do that fairly.
Reflection Paper

I had never really thought that reading belonged in the math classroom. I had never done any reading when I took math in middle school or high school and I did not expect to do any with my students when I started college. However, after writing the unit I have seen that reading in the content area does not necessarily mean having all of the students read a book. I had not thought about using articles from the internet or magazines to help my students understand math, or at least why they should learn about certain math techniques. In addition, I had not thought about having a collection of tradebooks that have a math theme for my classroom. I liked some of the books that I found so much that I already bought them on the internet for use in my own classroom. Learning about the writing strategies in the classroom was helpful as well. I have always wanted my students to think about math and I think these strategies really make students use a higher level of thinking like in the Bloom’s questions. Reading in the classroom does not have to be something that takes up a lot of time or distract students from the real purpose of the class. In addition, reading can help all students in the classroom learn about the material, including those who have a disability.

One of the most important things that I have come to learn is that some of the modifications I have made for my students with disabilities can be made for all my students. If I give a note taking guide to some of my students, I can give it to all of my students. If I let a few students work together on an assignment, I can let all of my students work with partners on the assignment. By using a PowerPoint to display the notes or information as bigger text, I am helping all my students and not just the ones with a visual impairment. There will always be some adaptations or modifications that do not apply to all the students but most of the changes to my lessons can be made for all students. By incorporating different intelligences from Gardner’s
multiple intelligences, like bodily-kinesthetic or intrapersonal, I am helping all my students learn, like those with ADHD or those with Autism.

The one tool that I think will be the most helpful for me will be the different writing to learn strategies. I really liked the method of having students write out the problem, what they are thinking, how they solved it with mathematics, and how they solved it in words (used in lesson plan 6). I think this method really allows me to see what is going on in students’ heads and it lets me know where a student might be getting off track. In addition, I think it helps the student to slow down and really begin to think about their own thinking and how they are understanding math.

In looking at the textbook that I have to use with the lesson, I realize that I did not really rely on it that much. Instead, I think that the textbook is more of extra practice and support. If the students are trying to remember how they did something when they are at home they can use the textbook to help. There are also extra practices problems and answers in the textbook. I really only used the textbook as a reference for problems to do for homework or to use for my notes. There were not very many reading sections in the textbook either so I do not think that the textbook could really be used for a reading in the content area strategy. Instead, I would have to provide articles for the student to read. However, I am ok with that because I can control what the students read and I can pick articles that would interest my students. This means that the next year, I can find different articles that might interest my student because students’ interests change from year to year and textbooks have to stay the same for at least 5 years. Overall, I think that reading and writing can be used in the math classroom. A teacher may have to put in more work but I think the results in the end will be worth it as students understand more of what they are learning.