

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 an 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 copy for every student of the graphic organizer
- Have a graph 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 with the word "degrees of polynomials" on the top. Tell students that the next bubbles represent three different degrees of polynomials by writing a "1," a "2," and a "3" in each of the bubbles. Have students list the steps to solve the different types of problems underneath each one of the bubbles. Tell students they can use the graphic organizer to study for the test tomorrow so it will not be collected till 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)

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. $f(x) = x^3 - 7x - 6$

6. $f(x) = x^3 - 4x^2 + 4x$

2. $f(x) = 3x^3 + 8x^2 - 2x - 12$

7. $f(x) = -2x^3 - 2x$

3. $f(x) = -2x^3 + 50x$

8. $f(x) = 4x^3 - 2x^2 - 17x + 6$

4. $f(x) = x^3 + 2x^2 - 49x - 98$

9. $f(x) = x^4 - 4x^2 - 45$

5. $f(x) = 4x^4 - 8x^3 - 16x^2 + 32x$

10. $f(x) = 6x^4 + 8x^3 - 9x^2 - 8x + 3$

Name _____ KEY _____

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

6. $f(x) = x^3 - 4x^2 + 4x$

X=2, 2, 0

2. $f(x) = -x^3 - 8x^2 - 15x$

X=-5, -3, 0

7. $f(x) = -2x^3 - 2x$

X=0, 0, 0

3. $f(x) = -2x^3 + 50x$

X=5, -5, 0

8. $f(x) = x^3 - 2x^2 + x - 2$

X=2, 2, 2

4. $f(x) = x^3 + 2x^2 - 49x - 98$

X=-7, 7, -2

9. $f(x) = -4x^2 + 4x$

X=0, 1

5. $f(x) = -4x^3 - 8x^2 + 32x$

X=-4, 2, 0

10. $f(x) = x^3 - 14x^2 + 56x - 64$

X=8, 4, 2

Name: _____

Graphic Organizer

