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System: Alexander City Schools

School: Benjamin Russell High School

Title: Algebra's Most Wanted: Polynomial Functions

Overview: This lesson is used to synthesize all of the concepts that students have been taught in the unit Polynomial Functions. Students will work in small groups to create a wanted poster for a polynomial function. Students will have to graph, analyze, and find the roots and extrema for a degree three or four polynomial.

Content Standards:

MA2013(9-12) 16. Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$. [A-APR2]

MA2013(9-12) 17. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. [A-APR3]

MA2013(9-12) 30. Graph functions expressed symbolically, and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* [F-IF7]

b. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. [F-IF7c]

Local/National Standard: NCTM Standards: Analyze functions of one variable by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.

Primary Learning Objectives: Students will 1) find the roots of a polynomial functions, find the relative maximum and minimum values of a polynomial function, 3) graph and 4) analyze a polynomial function.

Additional Learning Objectives: This lesson provides an opportunity for students to apply theorems concerning the roots of polynomials and factors of polynomials. Students will perform operations with polynomials including synthetic division. Students will solve quadratic equations and perform operations with radicals and complex numbers. Students will work both cooperatively and individually to complete the assignment.

Approximate Duration of Lesson: two 78 minute class periods

Materials and Equipment: Graph paper, , poster, markers, meter sticks,

Technology Resources: IPAD, graphing calculator

Background: Algebra 2 students have previously studied quadratic functions, complex number operations, polynomial operations, and roots of polynomials. They have also analyzed given graphs of polynomials. This lesson allows them the opportunity to synthesize all of this knowledge in a single assessment.

Procedures/ Activities: 1) Divide students into teams of 3 or 4 depending on the number of students in class (Groups may be created as the teacher desires.)

2) Have each team select a polynomial by drawing a slip of paper from a cup.

3) Provide the following information to students:

A wanted poster (or wanted sign) is a poster distributed to let the public know of an alleged criminal whom authorities wish to apprehend. They will generally include either a picture of the alleged criminal when a photograph is available, or of a facial composite image produced by a police. The poster will usually include a description of the wanted person(s) and the crime(s) for which they are sought. Wanted posters are usually produced by a police department or other public government body for display in a public place, such as on a physical bulletin board or in the lobby of a post office, but in ages past wanted posters have also been produced by vigilante groups, railway security, private agencies such as Pinkerton, or by express companies that have sustained a robbery. Wanted posters for particularly notorious fugitives frequently offer a bounty for the capture of the person, or for a person who can provide information leading to such capture.

You have been given the name (equation) of a wanted polynomial function. It is your job to create a wanted poster for it. In addition to its name, you must provide a sketch (graph) of the polynomial along with a FULL description of the culprit. Use your creativity to tell WHY the polynomial is wanted and to determine the reward for capture. Use one of the screencast presentation apps that we have discussed in class to document your work as you try to determine distinguishing characteristics of your polynomial. Create a wanted poster either on a poster or electronically using any software or app of your choice. (There is a FREE app called Wanted Poster Maker that you might want to try.)

4) Using the iBrainstorm app on the IPAD have students submit "stickies" that indicate the necessary characteristic for their descriptions (roots, extrema, end behavior, even/odd degree, intercepts, etc)

5) Students collaborate to describe and sketch their polynomial using the guidelines established in step 4. Students are encouraged to check their paper and pencil work (after the teacher has check off its completion) with a graphing calculator or graphing calculator app before graphing the polynomial in the final product.

6) Students can use the Internet to view images of wanted posters.

7) Students will use any IPAD app, website, or poster and markers, to create a wanted poster for their polynomial. (There is a free app that students can download titled Wanted Poster Maker.)

8) Students will by group present the screencast and wanted poster they created.

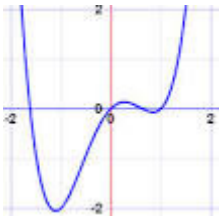
Attachments: Polynomial Wanted Poster (instructions for students)

Polynomial Function Scoring Guide

Assessment Strategies: This project serves as a product based assessment on all objectives for polynomial functions. All students must apply theorems concerning polynomial roots and analysis skills viable for describing any function. Students will be scored on their ability to FULLY describe the polynomial function, degree, name, number, type, and location of roots, number type and location of extrema, and end behavior. The video presentation will be evaluated according to the number of attributes recorded. Student posters will be scored for neatness and accuracy. See scoring guide. Students will also self-critique group dynamics and group presentation.

Extension: This lesson prepares student to sketch graphs of a variety of functions. Posters can be used by calculus students studying curve sketching techniques to predict graphs using first and second derivatives.

Remediation: Struggling students may need extra attention from peers and the teacher during this activity. Since students are required to work collaboratively, students should ask for help from peers first. There will be time however for one-on-one help as needed from the teacher. Using the graphing calculator to verify results will help students identify and correct their own results.



Algebra's Most Wanted: Polynomial Functions

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Self Critiuqe

(1 = lowest, 5 = highest)

Rate your group on the following criteria.

1. Group dynamics

Everyone in my group participated. Yes No

Did one person do more than the others? Yes No

Does everyone in your group deserve the same grade? Yes No

If no, explain.

_____

How well did your group work together? 1 2 3 4 5

2. Presentation

Calculator usage 1 2 3 4 5

Clear explanation 1 2 3 4 5

Answered questions 1 2 3 4 5

Overall performance 1 2 3 4 5

CATEGORY	4	3	2	1
Polynomial Description	All information was stated, accurate, and descriptive in the explanation.	90-99% of information was stated, accurate, and descriptive in the explanation.	75-89% of information was stated and accurate.	Less than 75% of the information was stated and accurate.
Video Representative Included (direction = degree = # roots, type, number and location of roots roots, location of extrema, end behavior including even / odd degree)	All 4 attributes were discussed on the video.	3 attributes were discussed on the video.	2 attributes were discussed on the video.	1 attribute was discussed on the video.
Attractive/Creative Wanted Poster	Very attractive and creative	Attractive and somewhat creative	Attractive but not creative	Not attractive or creative
Organization/Neatness	The product explanation was organized, well thought out, and the entire product was organized. The writing was legible and the graph was easily readable.	The product explanation was somewhat organized, transitions acceptable, and the entire product was slightly organized. The writing was fairly legible and the graph was readable.	The product explanation was very brief, disorganized, and the writing and/or graph were difficult to interpret.	The product explanation was not organized, or well thought out. The writing was not legible and the graph was not easily readable.