NORTHLAND
COMMUNITY & TECHNICAL COLLEGE

Liberal Arts Annual Assessment

Discipline: Mathematics		Instructor: Dr. Mike Simmers	
ILO Assessed 2	Academic Year F2024	# of Students Assessed 21	Class Average Score 77.95% Based on D2L Rubric
Course Prefix and Number: Math 1110		Course Title: College Algebra	# of Sections 1

Assignment Description

Given an nth degree polynomial, students are asked to construct properties of the polynomial (Rational Root Theorem, Descartes Rule), determine all zeroes, both real and imaginary. Students are then asked to factor the polynomial over the real and complex numbers. Also, students are asked to describe graph behavior and sketch a possible graph.

Patterns Observed Based on ILO Rubric (e.g., is one of the four Scoring Criteria weak or strong, is the rubric well aligned for the assignment, etc.)

The rubric is well aligned to the assignment. Score discrepancies appear in the synthesize, evaluate, and analyze information section. This is the main content area being assessed for determining the zeros of a polynomial.

Was a method of scoring the assignment used in addition to the ILO Rubric?

No, the assessment is scored out of a total of 100 points but can also be scored on a 0-4 scale.

If so, describe specific method of scoring:

_____

If so, identify contrasts or patterns observed between the course specific method and ILO method of scoring:

_____

Other Related Patterns Observed for Assignment

As is typical of mathematics, a student does very well on this assessment or poorly. It all stems from the synthesize, evaluate, and analyze portion of the assessment. This is the most important part of competency for thhis mathematical content area.

Identify whether this is the first, second, or third year for this specific ILO assessment.

The Math Dept. does this analysis every year but I am not sure how often it has been submitted as the specific ILO assessment.

Describe the primary method of instruction used for course content being assessed (e.g., group activity, case study, lecture, lab activity, etc.)

Lecture

Were adjustments to instruction and/or the assessment made since the prior assessment or offering? Briefly describe if so.

No

Are there significant differences in how students met the learning outcome(s) from the prior assessment or offering? Describe.

No

What changes will be made to improve student learning based on the current assessment outcomes?

This is usually a very successful assessment, for students, in college algebra. One could try to identify students who are struggling with the concepts and spend more one-on-one time with them or encourage time with the math tutors. Success in mathmeatics is about commitment and effort from both the students and the instructor.

Item Statistics: Openstax 5.2-5.5 test polynomials zeros

Class Statistics | User Statistics

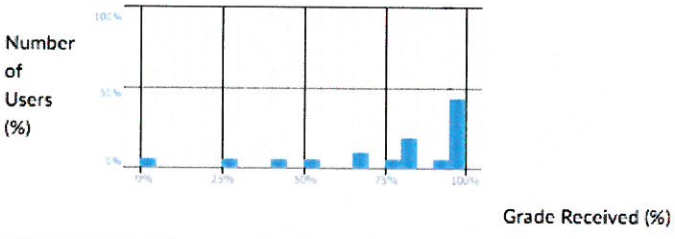
View By: User | Apply

Openstax 5.2-5.5 test polynomials zeros Class Statistics

Number of submitted grades: 21 / 24

Minimum:	0 %
Maximum:	100 %
Average:	77.95 %
Mode:	98 %, 100 %
Median:	83 %
Standard Deviation:	26.55 %

Grade Distribution



Scoring Criteria	Deficient 1	Minimally Competent 2	Competent 3	Highly Competent 4	Rating
Articulate and defend a thesis. position, or hypothesis ***Explain the polynomial characteristics and tail behavior based on the degree of the polynomial and its leading coefficient. This is component a-d/1-4. (5 pts)***	No response/ incorrect answer.	Correct answer but no explanation.	Correct answer but rationale for answer does not fully address degree/coefficient.	Correct answer. Know that tail behavior is based on both leading coefficient and degree and answer is expressed as a coherent statement.	
Gather relevant information ***Finding possible rational roots (p/q) and Descartes' rule information (this is components e/5 and f/6) (5pts, 10 pts resp.)***	No response/ no pertinent work on paper.	List factors of p and q but make significant errors; partial completion of Descartes' rule Some relative information but missing key ideas. (one component correct and other incorrect.)	Information is correct but some minor notation / computation errors. Work provided logically follows proper thought processes. (or one component correct and other partially correct.)	Do components e and f correctly with proper/nearly perfect notation	
Synthesize, evaluate and analyze information ***Use information along with synthetic division and quad formula to find all roots (this is component g/7). (70 pts)***	No response/ no pertinent work on paper.	Begin process of synthetic division using possible factors with minimal success. Do division with highest degree and never reduce their polynomial down to find final two roots (quadratic). Forget 0 cubic coefficient when doing synthetic division.	Determine and verify the rational roots and unsuccessfully search for remaining two real/complex roots using quadratic methods.	Do component g correctly with proper/nearly perfect notation.	
Make logical connections ***After they have all the roots, factor the polynomial completely (connection between the two) This is component h/8 and i/9. (4 pts, 6 pts resp.))***	No response/ no pertinent work on paper.	Lists factors but have wrong signs in factors (signs from zeroes) Lists only linear factors.	Lists factors mostly correctly with one sign incorrect or minor parenthesis omission. Lists quadratic factor with minor errors.	Do components h and i correctly with proper/nearly perfect notation based on results they got in part g. Above and beyond if they factor over the set of complex numbers. Graph follows multiplicity and end behavior traits.	
Total Score =					

Course: Subj ____Math___ **Numb** ___1110_____**Section** _____ **Campus**_____ **COMPLETE ONE SHEET PER STUDENT**
Describe the activity assessed: __**Given an n^{th} degree polynomial, students are asked to construct properties of the polynomial (Rational Root Theorem, Descartes Rule), determine all zeroes, both real and imaginary. Students are then asked to factor the polynomial over the real and complex numbers. Also, students are asked to describe graph behavior and sketch a possible graph.**

NCTC/CHS M1110 College Algebra Polynomial Zeros assessment Name_____
SHOW WORK TO RECEIVE ANY CREDIT FOR EACH PROBLEM PART

Use the Rational Root Theorem, the Remainder Theorem, and synthetic division to determine all roots and factors (linear and quadratic) of the polynomial. Answer the following questions in your analysis:

$$f(x) = 36x^6 + 72x^5 + 35x^4 + 2x^2 - 1$$

1. (1 pt) Degree = _____ 2. (1 pt) # of zeros: _____ 3. (1 pt) Max. # of turns: _____

4. (2 pts) Write a sentence that describes the end behavior of the graph. Explain your answer.

   Acts like _____, arrows _____ because ...

5. (5 pts) Descartes's possible zero combinations

i) Number of sign changes for f(x): ii) Number of sign changes for f(-x):

# of pos zeros	# of neg zeros	# of complex zeros

6. (10 pts) Family of possible rational zeros:

   factors of p: factors of q:

   Possible rational roots: $\frac{p}{q} =$

$f(x) = 36x^6 + 72x^5 + 35x^4 + 2x^2 - 1$ $\frac{p}{q} =$

4. (70 pts) Determine all the zeros using synthetic division, the remainder theorem, and the quadratic formula, $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$. (Hint: there are fractional roots.) FACTORING TECHNIQUES ALLOWED ONLY WHEN SOLVING THE QUADRATIC.

Zeros of f(x) are: x =

5. (4 pts) Write the polynomial as a product of linear factors

f(x) =

NCTC/CHS M1110 College Algebra Polynomial Zeros assessment Name_____
SHOW WORK TO RECEIVE ANY CREDIT FOR EACH PROBLEM PART

6. (6 pts) List the multiplicity and graph behavior of each real zero; graph a possible version of the function.