

MTH 161 Sections 40-42
Pre-Calculus I
Fall 2022



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| Credit/Contact Hours: 3 semester credits |
| Pre-requisites: Competency in MTE 1-9 as demonstrated through placement or unit completion or equivalent or Corequisite: MCR 6 : Learning Support for Precalculus I |
| Textbooks/Materials Required: Provided by ACPS ISBN: 978-0-538-73871-2 Title: Precalculus Author: Larson Edition: 8 th Edition |
| Classes Begin: Class Meeting Times: M-F Classes End: January 13, 2023 Drop Date (with refund): Withdrawal Date(without penalty): |
| The syllabus attachment is available online at the following address @ https://centralvirginia.edu/Admissions/Calendar/Fall-2022 |

Course Description:

Presents topics in power, polynomial, rational, exponential, and logarithmic functions, and systems of equations and inequalities. Credit will not be awarded for both [MTH 161](#): Precalculus I and [MTH 167](#): Precalculus with Trigonometry or equivalent.

This college credit dual enrollment course will move faster than a regular high school class. This course will study concepts including but not limited to: college algebra concepts, matrices, algebraic functions, exponential functions, and logarithmic functions, as well as problem solving strategies. These topics will be covered from the textbook using chapters 1-3 and 7-8. Students will also use scientific calculators in the classroom.

- Chapter 1: Functions and Their Graphs
- Chapter 2: Polynomial and Rational Functions
- Chapter 3: Exponential and Logarithmic Functions
- Chapter 7: Systems of Equations
- Chapter 8: Matrices

Policies for Attendance and Missing Assignments:

Students are responsible for all material in the course curriculum. Attendance at class is expected. Students should check the Canvas platform to get the assignment when they are absent.

Grading Scale and Procedures:

There will be tests, homework/assignments, quizzes, and a cumulative final exam. You will be allowed multiple attempts on the Measure of Progress assignments, but only one attempt on the Mastery of Content assessments. Your final grade will be based upon a 10 point scale and will be determined accordingly.

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| Tests/Quizzes (Mastery of Content)..... | 60% | Final Grade: | |
| Other Assignments (Measure of Progress)... | 20% | 90-100 | A |
| Exam | 20% | 80-89 | B |
| Total | 100% | 70-79 | C |
| | | 60-69 | D |
| | | Below 60 | F |

In order to take the next course, Mth 162, you must maintain a C average in the Mth 161 course.

We will be using the Canvas platform for our course.

Textbook Reading: Students are expected to read and study each section prior to the class lecture. This will enable students to grasp concepts during the lecture.

Homework: Students will be required to complete homework on a regular basis. Please keep all your homework throughout the semester; I encourage you to keep a notebook/binder with your homework in it. It will serve as a source of review for quizzes and tests.

Quizzes/Tests: There will be several assessments during the semester. These assessments will consist of problems similar to the homework and will be over the material we will have covered during class. Some assessments will require memorization of rules or theorems, some assessments will be calculator restricted. No sharing of calculators on assessments will be allowed.

Tests may be comprised of two parts, one calculator based, one non-calculator based. Test dates are listed on the course outline but may be revised by the instructor as necessary.

Calculator: Some problems will require the use of calculators. The required calculator is the TI-30XII-S, pictured below. You may **not** use a graphing calculator in this course. Although the use of a scientific calculator is allowed as you study, there will be some calculator restrictions on assessments. As you study, do not become dependent on your calculator. This is a math course, not a calculator use course. No sharing of calculators will be allowed on any evaluation. **Graphing calculators will not be allowed.**



Texas Instrument 30X IIS
Scientific Calculator
Calculator with 2 line 11
character display, basic
scientific/trigonometry
functions and suitable for
algebra, geometry and
statistics

- Supplies:**
1. 3 ring binder for math notebook with clean loose leaf paper
 2. Scientific calculator: **Only TI-30XIIs or other scientific calculator** may be used in MTH 161.
 3. Graph paper 4-5 squares per inch
 4. #2 pencils or mechanical pencils.

Classroom Expectations: All students are expected to behave in an appropriate manner for college level coursework. Promptness and full class attendance are expected.

General Course Goals/Purpose:

The general purpose of this one-semester course is to prepare students for a course in statistics or applied calculus sequence by providing them with the necessary competencies in algebra and functions. Precalculus I can also be applied in conjunction with Precalculus II in preparation for a course in calculus with analytic geometry.

Course Objectives:

Relations and Functions

- Distinguish between relations and functions.
- Evaluate functions both numerically and algebraically.
- Determine the domain and range of functions in general, including root and rational functions.
- Perform arithmetic operations on functions, including the composition of functions and the difference quotient.
- Identify and graph linear, absolute value, quadratic, cubic, and square root functions and their transformations.
- Determine and verify inverses of one-to-one functions.

Polynomial and Rational Functions

- Determine the general and standard forms of quadratic functions.
- Use formula and completing the square methods to determine the standard form of a quadratic function.
- Identify intercepts, vertex, and orientation of the parabola and use these to graph quadratic functions.
- Identify zeros (real-valued roots) and complex roots and determine end-behavior of higher order polynomials and graph the polynomial, and graph.
- Determine if a function demonstrates even or odd symmetry.
- Use the Fundamental Theorem of Algebra, Rational Root test, and Linear Factorization Theorem to factor polynomials and determine the zeros over the complex numbers.
- Identify intercepts, end behavior, and asymptotes of rational functions, and graph.
- Solve polynomial and rational inequalities.
- Interpret the algebraic and graphical meaning of equality of functions ($f(x) = g(x)$) and inequality of functions ($f(x) > g(x)$)
- Decompose partial fractions of the form $P(x)/Q(x)$ where $Q(x)$ is a product of linear factors

Exponential and Logarithmic Functions

- Identify and graph exponential and logarithmic functions and their transformations.
- Use properties of logarithms to simplify and expand logarithmic expressions.
- Convert between exponential and logarithmic forms and demonstrate an understanding of the relationship between the two forms.
- Solve exponential and logarithmic equations using one-to-one and inverse properties.
- Solve application problems involving exponential and logarithmic functions.

Systems of Equations

- Solve three variable linear systems of equations using the Gaussian-elimination method.

Topics to be covered during the course:

Chapter 1 Functions and their graphs

At the end of this unit the student will:

- use nonrigid transformations to sketch graphs of functions

1.1 Rectangular Coordinates

- plot points in the Cartesian plane
- use the distance formula to find the distance between two points
- use the midpoint formula to find the midpoint of a line segment
- use a coordinate plane to model and solve real-life problems

1.2 Graphs of linear equations

- sketch graphs of equations
- find x- and y-intercepts
- use symmetry to sketch graphs of equations
- find equations and sketch graphs of circles
- use graphs of equations in solving real life problems

1.3 Linear equations in two variables

- use slope to graph linear equations in two variables
- find slopes of lines
- write linear equations in two variables
- use slope to identify parallel and perpendicular lines
- use linear equations in two variables to model and solve real life problems

1.4 Functions

- determine whether relations are functions
- use function notation and evaluate functions
- find domains of functions
- use functions to model and solve real life problems

1.5 Analyzing Graphs of functions

- use the vertical line test for functions
- find the zeros of functions
- determine intervals of increasing and decreasing for functions
- identify even and odd functions

1.6 A library of functions

- identify and graph linear and squaring functions
- identify and graph cubic, square root and reciprocal functions
- identify and graph piecewise functions
- recognize graphs of common functions

1.7 Transformations of functions - shifting, reflecting, and stretching graphs

- use vertical and horizontal shifts to sketch graphs of functions
- use reflections to sketch graphs of functions

1.8 Combinations of functions

- add, subtract, multiply and divide functions
- find the composition of functions
- use combinations of functions to model and solve real life problems

1.9 Inverse functions

- find inverse functions informally
- find inverse functions algebraically
- use the horizontal line test to determine if functions are one-to-one

1.10 Mathematical Modeling

- write mathematical models for direct, inverse and joint variation
- use the regression feature of a graphing calculator to find equation of least squares regression

Chapter 2 Polynomial and Rational Functions

At the end of this unit the student will be able to:

2.1 Quadratic functions

- analyze graphs of quadratic functions
- write quadratic functions in standard form and sketch graphs of quadratic functions

2.2 Polynomial functions of higher degree

- use transformations to sketch graphs of polynomial functions
- use the Leading Coefficient Test to determine the end behavior of graphs of polynomial functions
- use the zeros of polynomial functions as sketching aids
- use the Intermediate value theorem to locate zeros of polynomial functions

2.3 Polynomial and synthetic division

- use long division to divide polynomials by other polynomials
- use synthetic division to divide polynomials by binomials of $(x - k)$
- use the remainder theorem and the factor theorem

2.4 Complex numbers

- use the imaginary unit i to write complex numbers
- add, subtract, and multiply complex numbers

- c. use complex conjugates to write the quotient of two complex numbers in standard form
- d. find the complex solutions of quadratic equations

2.5 Zeros of polynomial functions

- a. use the fundamental theorem of algebra to determine the zeros of polynomial functions
- b. find the rational zeros of polynomial functions
- c. find conjugate pairs of complex zeros
- d. find zeros of polynomials by factoring
- e. use Descartes's Rule of Signs and the upper and lower bound rules to find zeros of polynomials

2.6 Rational functions

- a. find the domains of rational functions
- b. find the horizontal and vertical asymptotes of graphs of rational functions
- c. analyze and sketch graphs of rational functions
- d. how to sketch graphs of rational functions that have slant asymptotes

2.7 Nonlinear Inequalities

- a. Solve polynomial inequalities
- b. solve rational inequalities
- c. use inequalities to model and solve real-life problems

Chapter 3 Exponential and Logarithmic Functions

At the end of this unit the student will be able to:

3.1 Exponential functions and their graphs

- a. recognize and evaluate exponential functions with base a
- b. graph exponential functions
- c. recognize and evaluate exponential functions with base e
- d. use exponential functions to model and solve real life applications

3.2 Logarithmic functions and their graphs

- a. recognize and evaluate logarithmic functions with base a
- b. graph logarithmic functions
- c. recognize and evaluate natural logarithmic functions
- d. use logarithmic functions to model and solve real life applications

3.3 Properties of logarithms

- a. use the change of base formulas to rewrite and evaluate logarithmic expressions
- b. use properties of logarithms to evaluate or rewrite logarithmic expressions

- c. use logarithmic functions to model and solve real life applications

3.4 Exponential and logarithmic equations

- a. solve simple exponential and logarithmic equations
- b. solve more complicated exponential and logarithmic equations
- c. use exponential and logarithmic equations to model and solve real life applications

3.5 Exponential and logarithmic models

- a. recognize the five most common types of models involving exponential and logarithmic functions
- b. use exponential growth and decay functions to model and solve real life problems
- c. use Gaussian functions to model and solve real life problems
- d. use logistic growth functions to model and solve real life problems
- e. use logarithmic functions to model and solve real life problems

Chapter 7 Systems of Equations and Inequalities

At the end of this unit the student will be able to:

7.1 Linear and Nonlinear Systems of Equations

- a. use the method of substitution to solve systems of equations in two variables
- b. use a graphical approach to solve systems of equations in two variables
- c. use systems of equations to model and solve real life problems

7.2 Two-variable linear systems

- a. use elimination to solve systems of equations in two variables
- b. interpret graphically the numbers of solutions of systems of linear equations in two variables
- c. use systems of equations in two variables to model and solve real life problems

7.3 Multivariable linear systems

- a. use back substitution to solve linear systems in row-echelon form
- b. use Gaussian elimination to solve systems of linear equations
- c. solve non-square systems of linear equations
- d. use systems of equations in three or more variables to model and solve application problems

7.4 Partial Fractions

- a. Recognize partial fraction decomposition of rational expressions
- b. Find partial fraction decomposition of rational expressions

7.5 Systems of Inequalities

- a. Sketch the graphs of inequalities in two variables
- b. Solve systems of inequalities
- c. Use systems of inequalities in two variables to model and solve real-life problems

7.6 Linear Programming

- a. Solve linear programming problems
- b. Use linear programming to model and solve real-life problems

Chapter 8 Matrices and Determinants

At the end of this unit the student will be able to:

8.1 Matrices and Systems of Equations

- a. write a matrix and identify its order
- b. perform elementary row operations on matrices
- c. use matrices and Gaussian elimination to solve systems of linear equations
- d. use matrix and Gauss-Jordan elimination to solve systems of linear equations

8.2 Operations with Matrices

- a. decide whether two matrices are equal
- b. add, subtract and multiply matrices by real numbers
- c. multiply matrices
- d. use matrix operations to model and solve real life problems

8.3 Inverse of a Square Matrix

- a. verify that two matrices are inverses of each other
- b. use Gauss-Jordan elimination to find the inverses of matrices
- c. use a formula to find the inverse of a 2 x 2 matrix
- d. use inverse matrices to solve systems of linear equations

8.4 Determinants of a Square matrix

- a. find the determinants of 2 x 2 matrices
- b. find minors and cofactors of square matrices
- c. find the determinants of square matrices

8.5 Applications of Matrices and Determinants

- a. use Cramer's rule to solve systems of linear equations
- b. use determinants to find the areas of triangles
- c. use determinants to find the equation of a line
- d. use determinants to test for collinear points

Students with Disabilities

It is CVCC's policy to provide reasonable accommodations to qualified students with documented disabilities. Our goal is to help students succeed in this course. If you have a documented physical, mental, or learning disability and you need a reasonable accommodation to help you achieve success, please contact Student Accessibility Services at (434) 832-7299 or email ada@centralvirginia.edu. To best provide the accommodation you need, make this request as soon as possible since accommodations cannot be made to change a grade you have received for course work already completed. For further information, please go to the CVCC Homepage, click on the Resources tab, and then click on ADA/Disability Services.

Title IX Statement

As a recipient of federal funds, Central Virginia Community College is required to comply with Title IX of the Higher Education Amendments of 1972, 20 U.S.C. § 1681 et seq. ("Title IX"), which prohibits discrimination on the basis of sex in education programs or activities, admission, and employment. Under certain circumstances, sexual harassment constitutes sexual discrimination prohibited by Title IX. Inquiries concerning the application of Title IX may be referred to the College's Title IX Coordinator or to the U.S. Department of Education's Office for Civil Rights. The Title IX Coordinator is Marc Zoccola, whose office is located at Amherst Hall 2102, and may be contacted by phone at (434) 832-7804 or by email at TitleIX@centralvirginia.edu

Early Alerts

CVCC uses Navigate to inform students when they are performing poorly or have issues in a class, and kudos, to congratulate and encourage students when they are doing well. Instructors can raise flags and kudos at any time on their own, or through "Progress Surveys" which instructors fill out at specific times throughout the semester. The raising of a flag or posting of a kudo will trigger an automatic email to you (the student). Student Services may also contact you to inform you of any flags you have received and what you can do to have the flag removed and what resources CVCC offers to help achieve success in your course(s). CVCC's Student Services Coordinator Hunter Overstreet is the Early Alert lead and can be reached at: overstreeth@centralvirginia.edu, (434) 832 – 7799.

*** Note that flags DO NOT affect your grade or standing at CVCC, nor do they show up anywhere on your CVCC transcript. ***

COVID-19 Statement

The health and safety of the CVCC community are our top priorities. Due to COVID-19, in Fall 2020 most courses and services will be offered virtually with limited exceptions. While college offices remain closed to the public, faculty and staff are available online and by phone. Please visit centralvirginia.edu (Links to an external site.) and or call 434- 832-7800 for more information. The CVCC Fall 2020 Reopening Plan is [available here](#) (Links to an external site.).

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