

MAT 160 PRECALCULUS (5 credit hours)[KCTCS Course Information](#)

Official Course Description	Prepares students to enroll in a calculus sequence. Includes trigonometric functions, exponentials and logarithms, graphs, polar coordinates, conic sections, and systems of nonlinear equations. Students may not receive credit for both MAT 160 and either College Algebra or Trigonometry. Credit is not available by special examination. Pre-requisites: One of the following: 1. Math ACT score of 23 or above; 2. Placement exam recommendation; or 3. Consent of instructor.
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OFFICIAL COURSE COMPETENCIES/OBJECTIVES

Upon completion of this course, the student can:

1. Define a complex number and be able to add, subtract, multiply and divide complex numbers and simplify results.
2. Define function, relation, domain, range.
3. Determine the distance between two points and the midpoint of a line segment using appropriate formulas.
4. Complete the square to obtain the standard form of the equation of a circle.
5. Graph functions by recognizing horizontal and vertical shifts, reflections across the y-axis, stretches and compressions, and even and odd functions.
6. Identify and form the sum, difference, product and quotient of two functions.
7. Determine the domains of sum, difference, product and quotient of functions.
8. Evaluate a difference quotient.
9. Identify the vertex formula for a quadratic function.
10. Use completing the square to obtain the vertex formula from the standard equation of a quadratic function.
11. Graph polynomial functions.
12. Find zeros of a polynomial function.
13. Determine horizontal, vertical and oblique asymptotes of rational functions.
14. Graph rational functions, displaying their domain, intercepts and asymptotes.
15. Define one-to-one functions and inverses of functions.
16. Find and verify the inverse of a function.
17. Simplify exponential expressions.
18. Evaluate and graph exponential functions.
19. Solve exponential equations and applications thereof.
20. Demonstrate the inverse relationship between exponential and logarithmic functions.
21. Convert between logarithmic and exponential form.
22. Graph logarithmic functions.
23. Simplify logarithmic expressions.
24. Solve logarithmic equations and applications thereof.
25. Define positive angle, negative angle, standard position of an angle, degree, minute, second, coterminal angles, radian measure.
26. Convert between radian measure and degree measure.
27. Compute an arc length and the area of a circular sector.
28. Define the circular functions, including their domains.
29. Define the trigonometric functions in right triangle trigonometry.
30. Find trigonometric values for specific angles.
31. Use the basic trigonometric identities to simplify trigonometric expressions and solve equations involving trigonometric functions.
32. Find the measure of an angle from its trigonometric values.
33. Solve applied problems using trigonometry.
34. Sketch graphs of the trigonometric functions and modifications thereof.
35. Graph the inverse trigonometric functions
36. Prove trigonometric identities.
37. Solve equations involving inverse trigonometric functions.
38. Use the Law of Sines and Law of Cosines to solve triangles.
39. Sketch simple polar equations.
40. Solve nonlinear systems of equations.
41. Graph and write equations for the conic sections.

MAT 160 COURSE OUTLINE

- I. Complex Number Operations
 - A. Addition and subtraction
 - B. Multiplication
 - C. Division
 - D. Simplification of i to any power
- II. Relations and Rectangular Coordinates
 - A. Definitions of function, relation, domain, range
 - B. Distance and midpoint formulas
 - C. Circles
- III. Graphing Techniques
 - A. Horizontal and Vertical Shifts
 - B. Horizontal and Vertical reflection
 - C. Stretching and Compressing
 - D. Even and odd functions
- IV. Operations and Composition
 - A. Sum, difference product and quotient of two functions
 - B. Domains of sum, difference, product and quotient of two functions
 - C. Composites and their domains
 - D. Difference quotient
- V. Functions
 - A. Quadratic functions
 - B. Polynomial functions
 - 1. Roots, end-behavior, and turning points
 - 2. Intermediate Value Theorem
 - 3. Boundedness Theorem
 - 4. Zeros (Theory of Equations)
 - C. Rational functions
 - 1. Horizontal, vertical and oblique asymptotes
 - 2. Graphing rational functions
 - D. Inverse functions
 - 1. Definitions of one to one and inverse functions
 - 2. Horizontal line test
 - 3. Finding and verifying inverses
 - E. Exponential Functions
 - 1. Rules of exponents
 - 2. Definition of exponential function
 - 3. Graph exponential functions
 - 4. Solve exponential functions with the same base
 - 5. Compound interest
 - F. Logarithmic Functions
 - 1. Logarithmic and exponential expressions
 - 2. Definition of logarithm
 - 3. Graphing logarithmic functions
- VI. Evaluating Logarithms
 - A. Solve applied logarithmic problems
 - B. Change of base theorem
- VII. Exponential and Logarithmic Equations and Applications
 - A. Exponential growth and decay problems
 - B. Compound interest
- VIII. Angles
 - A. Definition of positive angle, negative angle, standard position, coterminal angles, degree and radian measure of angles.
 - B. Conversion between radian and degree measure
 - C. Arc length
 - D. Area of a sector
 - E. Conversion between decimal degree measure and degrees, minutes, seconds
- IX. Trigonometry
 - A. The Unit Circle
 - 1. Circular functions

2. Exact values of trigonometric functions
 3. Calculator approximations
 4. Linear and angular velocity
 - B. Right triangles
 1. Trigonometric functions
 2. Find trigonometric values for an angle passing through a specified point
 3. Find trigonometric values for specified angles
 4. Basic identities
 - C. Finding trigonometric function values
 1. Reference angle
 2. Exact and approximate values of angles
 3. Find angles given trigonometric ratio
 - D. Solving right triangles
 1. Angles of elevation and depression
 2. Navigation and bearing
 3. Applied problems
 - E. Graphing trigonometric functions
 1. Basic graphs
 2. Vertical and horizontal translations
 3. Periodicity, amplitude and phase shift
 4. Graphing inverse trigonometric functions
 - F. Harmonic motion (optional)
 - G. Trigonometric identities and equations
 1. Verify trigonometric identities (basic, sum, difference, multiple and half-angle)
 2. Trigonometric equations
 - H. Law of Sines and Law of Cosines
 - I. Polar equations and graphs (introduction)
- X. Conic Sections
- A. Circles
 - B. Parabolas
 - C. Hyperbolas
 - D. Ellipses
 - E. Nonlinear systems of equations

GENERAL EDUCATION COMPETENCIES

- A. Knowledge of human cultures and the physical and natural worlds through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts.
- B. Intellectual and practical skills, including
 - inquiry and analysis
 - critical and creative thinking
 - written and oral communication
 - quantitative literacy
 - information literacy
 - teamwork and problem solving
- C. Personal and social responsibility, including
 - civic knowledge and engagement (local and global)
 - intercultural knowledge and competence
 - ethical reasoning and action
 - foundations and skills for lifelong learning
- D. Integrative and applied learning, including synthesis and advanced accomplishment across general and specialized skills.

STUDENT LEARNING OUTCOMES FOR QUANTITATIVE REASONING (Approved Fall 2017)

In MAT 160, students will learn to:

1. Interpret information presented in mathematical and/or statistical forms by (Gen Ed Comp B):
 - Stating the definition of the six trigonometric functions in their multiple forms.
 - Stating basic trigonometric identities.
 - Using radian and degree measure.
 - Determining the inverse functions for the six trigonometric functions.
 - Recognizing functions and specifying the domain and the range of a given function
2. Illustrate and communicate mathematical and/or statistical information symbolically, visually, and/or numerically by (Gen Ed Comp A, B, C):
 - Solving problems involving right triangles. .
 - Determining the amplitude and period of the trigonometric functions.
 - Plotting points in polar coordinates.
 - Graphing linear, quadratic, polynomial, rational, exponential, logarithmic, piecewise, inverse and trigonometric functions
3. Determine when computations are needed and execute the appropriate computations by (Gen Ed Comp A, B):
 - Computing trigonometric function values using the definitions.
 - Finding trigonometric values of angles using right triangle and unit circle trigonometry.
 - Calculating complex roots of numbers.
 - Solving polynomial, rational, exponential, logarithmic and trigonometric equations.
 - Performing operations with functions and finding inverse functions.
4. Apply an appropriate model to the problem to be solved by (Gen Ed Comp A, B, C):
 - Applying the trigonometric function definitions to right triangles.
 - Solving application problems using radian measure.
 - Writing expressions from data, verbal descriptions or graphs.
 - Solving application problems using linear, quadratic, exponential, logarithmic and trigonometric functions.
5. Make inferences, evaluate assumptions, and assess limitations in estimation modeling and/or statistical analysis by (Gen Ed Comp A, D):
 - Proving trigonometric identities.
 - Solving problems using the sum and difference and double-angle formulas.
 - Solving general triangles using the Law of Sines and the Law of Cosines.
 - Solving linear and nonlinear systems of equations.

LEARNING RESOURCES

- ✓ Swokowski, E. W. & Cole, J. A. (2005). *Algebra and trigonometry with analytic geometry (11th ed.)*. Belmont, CA: Thomson Brooks/Cole.
- ✓ Sullivan, M. & Sullivan III, M. (2004). *Algebra and trigonometry: Graphing, data, and analysis (2nd ed.)*. Upper Saddle River, NJ: Prentice Hall.
- ✓ Hunderford, T. (2005). *Contemporary college algebra and trigonometry: A graphing approach (2nd ed.)*. Belmont, CA: Thomson Brooks/Cole.
- ✓ Lial, M., Hornsby, J., & Schneider, D. (2005). *College algebra and trigonometry (3rd ed.)*. Boston, MA: Addison Wesley.
- ✓ Barnett, R., Ziegler, M., & Byleen, K. (2005). *College algebra with trigonometry: Graphs and models with MathZone (1st ed.)*. Columbus, OH: McGraw Hill.