

WTCS Repository

10-804-195 College Algebra w Apps

Course Outcome Summary

Course Information

Description This course covers those skills needed for success in Calculus and many application areas on a baccalaureate level. Topics include the real and complex number systems, polynomials, exponents, radicals, solving equations and inequalities (linear and nonlinear), relations and functions, systems of equations and inequalities (linear and nonlinear), matrices, graphing, conic sections, sequences and series, combinatorics, and the binomial theorem.

Total Credits 3.00

Pre/Corequisites

Prerequisite Each Wisconsin Technical College determines the General Education course prerequisites used by their academic institution. If prerequisites for a course are determined to be appropriate, the final Course Outcome Summary must identify the prerequisites approved for use by the individual Technical College.

Course Competencies

1. Apply mathematical problem solving skills

Assessment Strategies

- 1.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 1.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 1.1. you show work in a clear and logical manner.
- 1.2. you verify solutions.
- 1.3. you verify that the solution is within the stated range and reflect appropriate accuracy or precision.
- 1.4. you label solutions with appropriate units.

2. Use the fundamental concepts of algebra

Assessment Strategies

- 2.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 2.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 2.1. you apply properties of real numbers.
- 2.2. you locate real numbers on the number line.
- 2.3. you evaluate expressions using absolute value.

- 2.4. you relate absolute value to distances on the number line.
- 2.5. you represent absolute value expressions without the use of the absolute value.
- 2.6. you model a problem situation algebraically.
- 2.7. you apply positive integer exponents, negative integer exponents, and rational number exponents to evaluation and simplification of expressions.
- 2.8. you relate roots to rational number exponents.
- 2.9. you define monomial, binomial, trinomial, and polynomial.
- 2.10. you perform algebraic operations on polynomials.
- 2.11. you apply the binomial theorem to expand powers of binomials.
- 2.12. you factor polynomials.

3. Analyze the features of a graph of a given function or relation

Assessment Strategies

- 3.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 3.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 3.1. you use the Cartesian coordinate system.
- 3.2. you find distances in the Cartesian coordinate system.
- 3.3. you use function notation correctly.
- 3.4. you graph a relation or function in X and Y.
- 3.5. you differentiate between symmetry about the X-axis, the Y-axis, and the origin.
- 3.6. you determine the intercept of a graph.
- 3.7. you apply the vertical line test to distinguish between a relation and a function.
- 3.8. you define a relation or function.
- 3.9. you determine the domain and range of a relation or function.
- 3.10. you define a 1-1 function.
- 3.11. you apply the horizontal line test for 1-1.
- 3.12. you determine the inverse function of a 1-1 function.
- 3.13. you specify the relation between the domain and the range of a function and its inverse.

4. Solve linear and quadratic equations and inequalities

Assessment Strategies

- 4.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 4.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 4.1. you define a linear function, a linear equation, and a linear inequality.
- 4.2. you define a solution of an equation.
- 4.3. you relate the solution of an equation to the X-intercept of a graph of the function and to the root (or zero) of the function.
- 4.4. you distinguish between an identity and a conditional equation.
- 4.5. you define equivalent equations and inequalities.
- 4.6. you solve linear equations and inequalities (with or without absolute values) algebraically.
- 4.7. you solve linear equations and inequalities (with or without absolute values) graphically.
- 4.8. you define quadratic equations.
- 4.9. you solve quadratic equations using: graphical methods, factoring, completing the square, and the quadratic formula.
- 4.10. you solve 2nd or higher order equations or inequalities algebraically or graphically.
- 4.11. you model a verbal problem with an algebraic representation and a graph.
- 4.12. you solve the algebraic representation of a verbal problem.
- 4.13. you interpret the algebraic answer to a verbal problem in terms of the original problem.
- 4.14. you use the equivalent interval notation, absolute value notation, and/or inequality notation when writing solutions of inequalities.

5. Analyze the properties of linear and quadratic functions

Assessment Strategies

- 5.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 5.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 5.1. you determine slope, X-intercept, and Y-intercept.
- 5.2. you relate slope to parallel and perpendicular lines.
- 5.3. you use point-slope, slope-intercept, and standard forms of the equation of a line.
- 5.4. you convert between point-slope, slope-intercept, and standard forms of the equation of a line.
- 5.5. you use the midpoint formula.
- 5.6. you find the equation of a line that is parallel to or perpendicular to a given line through a specified point.
- 5.7. you find the equation of the perpendicular bisector of a given line segment.
- 5.8. you prove geometric theorems algebraically.
- 5.9. you graph quadratic functions.
- 5.10. you apply the concepts of vertically stretching or shrinking or shrinking, reflecting, or shifting a graph of a quadratic to transform the graph.
- 5.11. you determine the sum, difference, product, and quotient of two functions.
- 5.12. you determine the composition of two functions.
- 5.13. you note that function composition is non-commutative.
- 5.14. you apply geometric transformations as compositions.
- 5.15. you determine the vertex, axis of symmetry, and direction from the standard form of a quadratic function.
- 5.16. you change the form of a quadratic function to a standard form.
- 5.17. you find zeros of quadratic functions algebraically and graphically.

6. Use theories of equations to find the zeros of a polynomial function

Assessment Strategies

- 6.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 6.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 6.1. you define the degree of a polynomial function.
- 6.2. you identify local maxima and minima of a polynomial function using graphical and analytical methods.
- 6.3. you determine whether a function is increasing or decreasing on an interval.
- 6.4. you apply the concepts of continuity, discontinuity, the intermediate value theorem, and the bisection method of finding a zero to determine the features of a graph.
- 6.5. you determine the behavior of a polynomial function at the end points of its domain.
- 6.6. you apply transformations to polynomial functions.
- 6.7. you apply the remainder theorem, the factor theorem, the rational roots theorem, synthetic division, the upper and lower bounds theorem, and Descartes' law of signs to find zeros of a polynomial function.
- 6.8. you use the fundamental theorem of algebra to determine the number of roots of a polynomial equation.
- 6.9. you use graphical methods to estimate the roots of a polynomial equation.

7. Determine complex solutions to polynomial equations

Assessment Strategies

- 7.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 7.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 7.1. you define the imaginary unit i .
- 7.2. you define complex numbers and complex conjugates.

- 7.3. you perform operations with complex numbers including addition, subtraction, multiplication, and division.
- 7.4. you apply the fundamental theorem of algebra and the linear factorization theorem to determine solutions to polynomial equations.
- 7.5. you find complex (non-real) solutions to polynomial equations.

8. Perform computations with rational functions

Assessment Strategies

- 8.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 8.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 8.1. you define a rational expression.
- 8.2. you recognize a rational expression.
- 8.3. you simplify rational expressions.
- 8.4. you add, subtract, multiply and divide rational expressions.
- 8.5. you simplify complex fractions.
- 8.6. you define a rational function and the domain of a rational function.
- 8.7. you find vertical, horizontal, and oblique asymptotes.
- 8.8. you discuss the properties of $f(x) = 1/x$, graph it and apply transformations to rational functions.
- 8.9. you determine the behavior of rational functions as the absolute value of the variables becomes large.
- 8.10. you identify removable discontinuities.
- 8.11. you determine the end behavior for rational functions where the degree of the numerator does not exceed the degree of the denominator.
- 8.12. you graph rational functions.
- 8.13. you solve rational functions algebraically and graphically.
- 8.14. you discuss extraneous solutions.

9. Perform computations with radical functions

Assessment Strategies

- 9.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 9.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 9.1. you define radical, index, and radicand.
- 9.2. you define principal square root, cube root, nth root.
- 9.3. you determine the domain of radical expression.
- 9.4. you solve radical equations algebraically and check for extraneous roots.

10. Analyze exponential and logarithmic functions

Assessment Strategies

- 10.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 10.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 10.1. you define base and exponent.
- 10.2. you define the exponential function with base 10, base 2, fractional base, an arbitrary base, and base e.
- 10.3. you graph the exponential function with base 10, base 2, fractional base, an arbitrary base, and base e.
- 10.4. you apply transformations to exponential functions.
- 10.5. you apply exponential functions to such problems as exponential growth and decay, half-life, interest, annuities, and mortgages.
- 10.6. you solve exponential equations algebraically and graphically.
- 10.7. you define logarithmic functions with base a- also discuss possible values for the base.

- 10.8. you define the common logarithmic function and the natural logarithmic function.
- 10.9. you discuss the inverse relationship between the logarithmic function and the exponential function (same base).
- 10.10. you determine the domain and range of logarithmic functions.
- 10.11. you produce the graph of a logarithmic function (with various bases) considering the domain and the range.
- 10.12. you solve exponential and logarithmic functions algebraically and graphically.

11. Solve non-linear systems of equations

Assessment Strategies

- 11.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 11.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 11.1. you solve a nonlinear system of equations algebraically.
- 11.2. you use graphing calculator to solve non-linear systems of equation.
- 11.3. you use nonlinear systems of equation to solve applied problems.

12. Solve systems of linear equations

Assessment Strategies

- 12.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 12.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 12.1. you solve systems of linear equations in three or more variables algebraically.
- 12.2. you use the graphing calculator to solve systems of linear equations in three or more variables.
- 12.3. you use systems of three equations to solve applied problems.

13. Perform basic operations with matrices

Assessment Strategies

- 13.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 13.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 13.1. you add matrices.
- 13.2. you subtract matrices.
- 13.3. you multiply a matrix by a scalar.
- 13.4. you multiply matrices when possible.
- 13.5. you solve application problems using basic operations with matrices.
- 13.6. you perform basic operations with matrices using the graphing calculator.

14. Use the inverse of a square matrix

Assessment Strategies

- 14.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 14.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 14.1. you recognize the identity matrix of a square matrix.
- 14.2. you recognize when two square matrices are inverses of one another.
- 14.3. you find the inverse of a square matrix, if it exists.

- 14.4. you use inverses of matrices to solve systems of equations.
- 14.5. you solve application problems involving matrix inverses.
- 14.6. you use a graphing calculator to compute matrix inverses.

15. Solve systems of equations using matrix equations

Assessment Strategies

- 15.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 15.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 15.1. you identify a matrix equation.
- 15.2. you write matrix equations as a system of linear equations.
- 15.3. you write a system of linear equations as a matrix equation.
- 15.4. you find the solution of a system of linear equations by using inverses of matrices.
- 15.5. you solve application problems using systems of linear equations and matrix equations.

16. Solve systems of linear inequalities

Assessment Strategies

- 16.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 16.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 16.1. you graph linear inequalities algebraically.
- 16.2. you graph systems of linear inequalities algebraically.

17. Produce the graph of a conic section

Assessment Strategies

- 17.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 17.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 17.1. you distinguish between the type of conic sections produced when a quadratic polynomial in two unknowns is graphed.
- 17.2. you find the center and the semi-major and semi-minor axes given the polynomial form of the equation of an ellipse.
- 17.3. you find the center, the axes, and the asymptotes given the polynomial form of the equation of a hyperbola.
- 17.4. you find the center, the axis, and the directrix given the polynomial form of the equation for a parabola.
- 17.5. you sketch the graph of a conic section given its equation in polynomial form.

18. Solve problems involving sequences and series

Assessment Strategies

- 18.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 18.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 18.1. you find terms of sequences given the n th term.
- 18.2. you find a general term for a sequence.
- 18.3. you convert between sigma notation and other notation for a series.
- 18.4. you find the n th term of an arithmetic and geometric sequence.

- 18.5. you find the common difference of an arithmetic sequence.
- 18.6. you construct an arithmetic and geometric sequence.
- 18.7. you find the common ratio of a geometric sequence.
- 18.8. you find the sum of the first n terms of an arithmetic and geometric sequence.
- 18.9. you find the sum of an infinite geometric series, if it exists.

19. Use the Binomial Theorem

Assessment Strategies

- 19.1. by submitting all in-class and take home assignments with passing grades according to the grading scale in the syllabus.
- 19.2. by participating actively in class discussions and activities.

Criteria

Performance will be successful when:

- 19.1. you expand a power of a binomial using Pascal's triangle or factorial notation.
- 19.2. you find a specific term of binomial expansion.