Precalculus

Course Text

Barnett, Raymond A., Michael R. Ziegler, and Karl E. Byleen. *Precalculus,* 6th edition, McGraw-Hill, 2008. ISBN: 978-0-07-331263-7.

Course Description

This course provides a working knowledge of precalculus and its applications. It begins with a review of algebraic operations. Emphasis is on solving and graphing equations that involve linear, polynomial, exponential, and logarithmic functions. Students learn to graph trigonometric and inverse trigonometric functions and learn to use the family of trigonometric identities. Other topics include conic sections, arithmetic and geometric sequences, and systems of equations.

Course Objectives

After completing this course, students will be able to:

- Perform operations on real numbers and polynomials.
- Simplify algebraic, rational, and radical expressions.
- Solve linear and quadratic equations and inequalities.
- Solve word problems involving linear and quadratic equations and inequalities.
- Solve polynomial, rational, and radical equations and applications.
- Solve and graph linear, quadratic, absolute value, and piecewise-defined functions.
- Perform operations with functions as well as find composition and inverse functions.
- Graph quadratic, the square root, cubic, and cube root functions.
- Graph and find zeroes of polynomial functions.
- Graph quadratic functions by completing the square, using the vertex formula, and using transformations.
- Solve and graph exponential and logarithmic equations.
- Express angle measure in degrees or radians.
- Evaluate and simplify trigonometric expressions.
- Know the six trigonometric functions and how to evaluate those trigonometric functions using positions on the unit circle with respect to the right triangle.
- Graph trigonometric and inverse trigonometric functions.
- Use trigonometric functions to solve a right triangle and apply the Law of Sines and the Law of Cosines to solve triangles that are acute or obtuse.
- Solve systems of linear equations and inequalities.
- Model and solve applications using linear systems.
- Evaluate and find partial sums of a series.
- Evaluate and find sums of an arithmetic sequence and a geometric sequence.
- Solve application problems involving arithmetic and geometric sequences and series.
- Define, identify, and graph conic sections including circle, ellipse, parabola, and hyperbola.

Course Prerequisites

Successful completion of Introductory and/or Intermediate Algebra courses is recommended before taking Pre-Calculus.

Important Terms

In this course, different terms are used to designate tasks:

• Practice Exercise: A non-graded assignment to assist you in practicing the skills discussed in a topic.

• Graded Exam: A graded online test.

Course Evaluation Criteria

StraighterLine does not apply letter grades. Students earn a percentage score. A passing percentage is **70%** or higher.

If you have chosen a Partner College to award credit for this course, your final grade will be based upon that college's grading scale. Only passing scores will be considered by Partner Colleges for an award of credit.

There are a total of **500 points** in the course:

Topics	Assessment	Points Available
1, 2, 3 & 4	Graded Exam #1	100
5, 6, 7 & 8	Graded Exam #2	100
9 & 10	Graded Exam #3	100
11, 12, 13 & 14	Graded Exam #4	100
Comprehensive Final	Graded Exam #5	100

Course Topics and Objectives

Topic	Lesson Topic	Subtopics	Objectives
1	Basic Algebraic Operations	• Real Numbers and Polynomials • Rational Expressions • Rational Exponents and Radicals	• Identify and use properties of real numbers. • Simplify algebraic expressions. • Identify and classify polynomial expressions. • Perform operations on polynomials. • Factor polynomials. • Write a rational expression in simplest form. • Compute rational expressions. • Simplify radical expressions. • Multiply and divide radical expressions.
2	Linear Equations and Inequalities in One Variable	• Linear Equations and Applications • Linear Inequalities and	• Solve linear equations by using all properties of equality and the rules. • Solve word problems using linear

		Applications • Absolute Value in Equations and Inequalities	equations. • Use the notation of inequalities. • Solve and graph linear inequalities. • Solve an application using inequalities. • Solve absolute value equations and inequalities.
3	Polynomial and Other Equations	• Solving Polynomial Equations • Equations Involving Radicals and Rational Exponents • Complex Numbers	• Solve quadratic equations using the quadratic formula. • Solve word problems involving quadratic equations. • Solve polynomial equations using the zero factor property. • Solve applications using these equation types. • Identify and simplify complex numbers. • Add and subtract complex numbers. • Multiply and divide complex numbers. • Solve rational and radical equations. • Solve quadratic equations using factoring, the square root property, and completing the square.
4	Functions and Graphs	• Rectangular Coordinates and the Graph of a Line • Relations, Functions, and Graphs • Linear Functions	• Use a table of values to graph linear equations. • Determine when lines are parallel or perpendicular. • Use linear graphs in an applied context. • Identify functions and state their domain and range. • Use function notation. • Write a linear equation in function form. • Use function form to identify the slope. • Use slope-intercept form to graph linear functions. • Write a linear equation in point-intercept form. • Use these forms to solve applications.
5	Operations on Functions and Analyzing Graphs	• The Algebra and Composition of Functions • One-to-One and Inverse Functions • Transformations and Symmetry	• Compose two functions and find the domain. • Identify one-to-one functions. • Find inverse functions using an algebraic method. • Graph a function and its inverse. • Use symmetry as an aid to graphing. • Perform stretches and compressions on a basic graph. • Perform vertical and horizontal shifts and reflections of a basic graph.
6	Graphing Polynomial and Rational Functions	• Graphing Polynomial Functions • Asymptotes and Rational Functions • Graphing Rational Functions	• Graph quadratic functions by completing the square and using transformations. • Graph a general quadratic function using the vertex formula. • Solve applications involving quadratic functions. • Graph polynomial functions. • Identify horizontal and vertical asymptotes.

			• Use asymptotes to determine the equation of a rational function from its graph. • Graph general rational functions. • Solve applications involving rational functions. • Find the domain and intercepts of a rational function.
7	Exponential and Logarithmic Functions	• Exponential Functions • Logarithms and Logarithmic Functions • The Exponential Function and Natural Logarithm	• Evaluate an exponential function. • Graph exponential functions. • Solve certain exponential equations. • Write exponential equations in logarithmic form. • Graph logarithmic functions and find their domains. • Apply the properties of logarithms. • Evaluate and graph the natural logarithm and exponential functions. • Solve applications of logarithmic and exponential functions.
8	Exponential and Logarithmic Equations	• Exponential Equations • Logarithmic Equations • Applications of Exponential and Logarithmic Equations	• Write logarithmic and exponential equations in simplified form. • Solve exponential equations. • Solve logarithmic equations. • Solve applications involving exponential and logarithmic equations. • Use exponential equations to find the interest compounded n times per year. • Use exponential equations to find the interest compounded continuously.
9	An Introduction to Trigonometric Functions	• Special Angles and the Unit Circle • Graphs of Basic Trigonometric Functions • Applications of Basic Trigonometric Functions	• Correctly use vocabulary associated with a study of angles and triangles. • Convert between degrees and radians for nonstandard angles. • Define the six trigonometric functions in terms of a point on the unit circle or in terms of a real number. • Identify and discuss important characteristics of tangent and cotangent. • Solve applications of trigonometric functions. • Find values of the six trigonometric functions from their ratio definition. • Graph the basic trigonometric functions.
10	Trigonometric Identities	• Transformations and Applications of Trigonometric Graphs • Family of Trigonometric Identities • The Inverse Trigonometric Functions and Their Applications	• Use fundamental identities to express a given trigonometric function in terms of the other five. • Solve applications using these identities. • Find the inverse trigonometric functions and evaluate related expressions. • Apply the definition and notation of inverse trigonometric functions to simplify expressions. • Graph sine and cosine functions with various amplitudes and periods.

			• Write the equation for a given graph.
11	Applications of Trigonometry	• The Law of Sines • The Law of Cosines • More Applications of Trigonometry	• Solve ASA and AAS triangles. • Use the Law of Sines to solve applications. • Apply the Law of Cosines when two sides and an included angle are known (SAS). • Apply the Law of Cosines when three sides are known (SSS). • Solve applications using the Law of Cosines. • Solve more applications involving trigonometric functions. • Solve the SSA case, including the ambiguous case.
12	Systems of Linear Equations in Two Variables	• Solving Systems Graphically, by Substitution, and Using Elimination • Solving Linear Systems Using Matrix Equations • Applications of Linear Systems	• Solve linear systems by graphing, by substitution, and by elimination. • Use system of equations to mathematically model and solve applications. • Form the augmented matrix of a system of equations. • Solve a system of equations using row operations. • Recognize inconsistent and dependent systems. • Use system of equations to mathematically model and solve applications.
13	Conic Sections	• The Parabola • The Ellipse and the Circle • The Hyperbola	• Define and identify a parabola. • Graph a parabola. • Solve applications of parabolas. • Define and identify an ellipse and a circle. • Graph an ellipse and a circle. • Solve applications of ellipses and circles. • Define and identify a hyperbola. • Graph a hyperbola. • Solve applications of hyperbolas.
14	Sequences and Series	• Sequences and Series • Arithmetic Sequences • Geometric Sequences	• Write the terms of a sequence given the general term. • Determine the general term of a sequence. • Find the partial sum of a series. • Use summation notation to write and evaluate series. • Solve applications involving arithmetic sequences. • Find the sum of a geometric series. • Solve application problems involving geometric sequences and series.
15	Course Review	• Course Review	• None