

# MATH 15900 Precalculus

## Course Learning Objectives

The IUPUI Department of Mathematical Sciences has established the following mathematics learning objectives to make clear to students and instructors what knowledge, understanding, and skills students should acquire in Precalculus. In the IUPUI Department of Mathematical Sciences this material is found in the course Math 15900 *Precalculus*.

### Brief Summary of Math 15900 Learning Objectives

#### 1. Fundamental Concepts in Algebra

Students recognize and use properties of real numbers. They perform basic arithmetic operations on algebraic expressions and simplify algebraic expressions involving exponents and radicals.

#### 2. Equations and Inequalities.

Students solve linear, quadratic, and other types of equations. They solve applied problems. They perform basic arithmetic operations on complex numbers. They solve linear, polynomial, rational and absolute value inequalities.

#### 3. Functions and Graphs

Students recognize and graph polynomial, algebraic and absolute value functions and use them to solve word problems. They understand the concepts of domain, range, intercept, zero, and asymptote. They perform basic operations on functions like addition, subtraction, multiplication, division and composition. They define and find inverse functions, describe symmetries of graphs and apply transformations to functions.

#### 4. Polynomial Functions

Students sketch the graph of polynomial functions of degree greater than two using a sign diagram and test values. They know and use the Intermediate Value Theorem (IVT). They know and use the Division Algorithm for Polynomials, Remainder Theorem and Factor Theorem. They use long division and synthetic division to find a quotient and remainder and the zeros of a polynomial.

#### 5. Logarithmic and Exponential Functions

Students define and find inverse functions for both logarithmic and exponential functions. They solve word problems involving exponential and logarithmic functions. They sketch and analyze graphs of exponential and logarithmic functions, including finding domain, range, intercepts and asymptotes.

#### 6. Trigonometric Functions

Students understand how trigonometric functions relate to right triangles and solve word problems involving right triangles. They extend the definitions of the trigonometric functions beyond right triangles using the unit circle and they measure angles in radians as well as degrees. They draw and analyze graphs of trigonometric functions (including finding period, amplitude, and phase shift) and use them to solve word problems.

#### 7. Analytic Trigonometry

Students know basic trigonometric identities derived from the definitions and use them to prove other results. In particular, they understand and use the addition, double-angle, and half-angle formulas. They solve trigonometric equations and apply the equations to word problems. They define and graph inverse trigonometric functions and find values of both trigonometric and inverse trigonometric functions.

#### 8. Applications of Trigonometry

Students understand and apply the laws of sines and cosines. They use trigonometry to find the area of a triangle from two sides and the included angle. They use Heron's Formula to find the area of a triangle from three sides. They solve word problems involving oblique triangles.

#### 9. Topics of Analytic Geometry

Students recognize and write equations of conic sections in standard form to find their geometric properties. They graph circles, parabolas, ellipses and hyperbolas. They solve word problems involving conic sections.

#### 10. Systems of Equations

Students graph and solve linear and non-linear systems of equations. They solve applied problems resulting in a system of equations.