# Mathematics Department

**Hint: click "Course Title" to access the subject's syllabus**

# Course Title:   Algebra 1

**Department:** Mathematics

**Length:** 1 Year (2 Semesters); 1.0 Credits Earned upon successful completion of the course.

**Prerequisites:** High School Placement Test, Prior Coursework (Pre-Algebra), Academic Dean Recommendation.

**Textbook:** Pearson, <u>Algebra 1: Common Core</u>

**Course Goals and Objectives:** The most important purpose for the Algebra 1 course is to build strong mathematical skills and problem solving techniques for success in all future mathematics courses.  In the study of Algebra, a student will not only master basic algebraic skills and concepts, but also apply them to more advanced topics and real world situations.

**Course Description:**  Algebra 1 is the first course in our sequence of classes towards preparation for college.  This course focuses on applying basic mathematical skills to the language of algebra (symbols representing numbers). Topics include, but are not limited to: simplifying algebraic expressions, solving equations, solving and graphing inequalities, linear functions, systems of equations and inequalities, exponential functions, polynomial functions and factoring.

**Course Content:**

**Semester 1:**
    a)  Algebraic Vocabulary
    b)  Properties of Real Numbers
    c)  Simplifying & Evaluating Algebraic Expressions
    d)  Solving Equations
    e)  Ratios, Rates, Conversions
    f)  Proportions
    g)  Percent Change
    h)  Graphing Inequalities
    i)  Solving Inequalities
    j)  Absolute Value Equations and Inequalities
    k)  Functions and Function Rules
    l)  Arithmetic Sequences

**Semester 2:**
    a)  Rate of Change and Slope
    b)  Forms of Lines (Slope-Intercept, Point-Slope, Standard Form)
    c)  Graphing Lines
    d)  Parallel and Perpendicular Lines
    e)  Systems of Equations and Inequalities

f) Exponent Properties
g) Exponential Functions
h) Geometric Sequences
i) Polynomial Functions
j) Factoring Techniques
k) Introduction to Quadratic Functions

# Course Title:   Algebra II

Department:            Mathematics

Length:                  1 year (2 semesters at 0.5 credits per semester)

Prerequisites:          Algebra I

                        Geometry

Textbook:                Algebra II  Charles, Hall, Kennedy et al.  Pearson

Course Goals and Objectives:       Build upon the skills learned in Algebra I and Geometry by
                                   applying them to linear, quadratic, and higher-order functions,
                                   and apply those skills to real-life problems.

Itemized Details of Course Content:

**First Semester**

a)  translating between algebraic and English-language expressions

b)  solving single-variable equations and absolute value equations

c)  solving and graphing single-variable inequalities and absolute value inequalities

d)  functions and relations

e)  linear functions and inequalities

f)  slope – intercept form and standard form of linear equations

g)  slope formula – writing equations for parallel and perpendicular lines

h)  linear correlations

i)  piecewise functions

j)  graphing absolute value functions and inequalities

k)  linear systems and their applications

l)  systems of inequalities

m) three variable / three equation systems

n)  quadratics – vertex and standard form

o)  factoring quadratics

**Second Semester**

a)  solving quadratics by taking square roots and completing the square

b)  the quadratic formula

c)  standard form of a polynomial

d)  classifying a polynomial by degree and number of terms

e)  factoring and finding roots of a polynomial

f)  DesCartes' Rule of Sign and the Fundamental Theorem of Algebra

g)  imaginary roots

h)  division of polynomials – long and synthetic

i)  the Remainder Theorem

j)  roots and radicals

k)  adding, subtracting, multiplying, and dividing radicals

l)  rational exponents

m)  exponential and logarithmic functions

n)  exponential growth and decay

o)  laws of exponents and logarithms

p)  solving exponential and logarithmic equations

q)  natural logarithms and their applications

# Course Title:   Advanced Placement Calculus

Department:          Mathematics

Length:              1 year (2 semesters); 1.0 credits earned upon successful completion of
the course

Prerequisites:       Honors Precalculus with a grade of C or better

Textbook:            Finney, Demana et al., Calculus—Graphical, Numerical, Algebraic, 5$^{th}$ ed.
(AP* Edition)

Additional Supplies:   -Notebook for taking notes and doing homework

-Pocket folders (may or may not be part of notebook)

-Pen or pencil to take notes

-TI-84 or TI-84 Plus Graphing Calculator is required.  Students are expected
to own or purchase a TI-84 graphing calculator; calculators will be provided
as needed to students.

-Other supplies (protractor, compass) or supplements may be needed
from time to time.  Instructor will let you know when such supplied are
needed.

Course Description:

Limits and continuity; definition of the derivative; power, product, quotient and chain
rules; implicit differentiation; related rates; derivatives of trigonometric, exponential, and

logarithmic functions; the Mean Value Theorem; optimization problems; the definite and indefinite integral; the Fundamental Theorem of Calculus; and applications of integration.

Itemzied Details of Course Content:

First Semester:

(a) Parametric equations, inverse functions, exponential, logarithmic, and trigonometric functions

(b) Limits and continuity, existence of limits, the Intermediate Value Theorem

(c) Differentiability and derivative, derivative rules, product rule, quotient rule, chain rule

(d) Implicit differentiation, derivatives of inverse trigonometric, exponential, and logarithmic functions

(e) Maxima and minima, the Extreme Value Theorem, finding extrema and critical points, the Mean Value Theorem, antidifferentiation, increasing and decreasing functions, the First and Second Derivative Tests, optimization, related rates

Second Semester:

(a) Estimating areas through finite sums, Riemann sums, antdifferentiation and integration, integrability, the Fundamental Theorem of calculus, average value of a function

(b) Integration by numerical approximation, integration by substitution, exponential and logistic functions

(c) Finding volume, arc length, and surface area, applications involving science and statistics

(d) Integration techniques, integration by parts, L'Hopital's Rule, improper integrals

# Course Title:   Advanced Placement Statistics

Department:             Mathematics

Length:                 1 year (2 semesters); 1.0 credits upon successful completion of the
course

Prerequisites:          Honors Algebra 2 with a grade of C or better

Textbook:               Larson & Farber, Elementary Statistics: Picturing the World, 6$^{th}$ ed.

Additional Supplies:    -Notebook

-Pocket folders (may or may not be part of notebook)

-Pen or pencil to take notes

-Loose paper & pencil for homework (paper neatly separated from
notebook is OK)

-TI-84 or TI-84 Plus Graphing Calculator is required. TI-83, TI-Nspire, TI-89,
TI-Nspire CAS, etc. may not be used.

Course Description:

General Overview: AP Statistics students will learn to reason statistically and use the tool
of probability to make statistically based decisions.

Itemized Details of Course Content:

First Semester:

(a) Data and statistics, types of data, statistical studies

(b) Data displays, mean, median and mode, measures of variation

(c) Probability, random variables, probability distributions

(d) The normal distribution, finding probabilities and values, sampling distributions and the Central Limit Theorem

Second Semester:

(a) Confidence intervals, finding confidence intervals for a mean and a proportion, finding sample sizes needed

(b) Hypothesis testing, Type I and Type II errors, testing hypothesis about a mean and a proportion, the t-distribution, the z- and t-tests

(c) Comparing two means, comparing two proportions

(d) Correlation and regression analysis, making inferences from line of best fit

(e) The chi-square distribution, testing for goodness of fit and independence

# Course Title:   Honors Algebra 1

**Department:**          Mathematics

**Length:**              1 year (2 semesters); 1.0 credit earned upon successful completion of the course

**Prerequisites:**       High School Placement Test and recommendation from freshman academic dean

**Textbook:**            Pearson, Algebra 1: Common Core

**Course Goals and Objectives:** To provide an equivalent full-year study of first-year Algebra to students wishing to prepare a foundation for advanced high school coursework in mathematics. This course will challenge students to think critically in order to solve mathematical problems with a symbolic language.

**Course Description:**

Honors Algebra 1 introduces students to variables, algebraic expressions, equations, functions, inequalities, proportions, graphical representation, and systems of equations. Students develop the ability to explore and solve mathematical problems, think critically, work cooperatively with others, and communicate mathematical ideas clearly.

Itemized Details of Course Content:

First Semester (the order of instruction may change based on teacher discretion)

    a) Variable and Expressions
    b) Order of Operations
    c) Properties of Real Numbers
    d) Adding, Subtracting, Multiplying, and Dividing Real Numbers
    e) Distributive Property
    f) Introduction to Equations with Patterns and Graphs
    g) Solving Equations
    h) Ratios, Rates, and Conversions

i) Solving Proportions
j) Percents
k) Solving Inequalities
l) Working with Sets (Unions and Intersections)
m) Patterns with Linear and Nonlinear Functions
n) Graphing and Writing a Function Rule
o) Rate of Change and Slope
p) Direct Variation
q) Slope-Intercept, Point-Slope, and Standard Forms
r) Parallel and Perpendicular Lines
s) Graphing Absolute Value Functions

Second Semester (the order of instruction may change based on teacher discretion)

a) Solving Systems of Equations by Graphing, Substitution, and Elimination
b) Applications of Linear Systems
c) Linear Inequalities and Systems of Linear Inequalities
d) Exponents
e) Exponential Functions
f) Exponential Growth and Decay
g) Geometric Sequences
h) Adding and Subtracting Polynomials
i) Multiplying Binomials
j) Factoring
k) Quadratic Graphs and Their Properties
l) Solving Quadratic Equations
m) Factoring to Solve Quadratic Equations
n) Completing the Square
o) The Quadratic Formula and the Discriminate
p) Systems of Linear and Quadratic Equations
q) Pythagorean Theorem
r) Simplifying Radicals
s) Solving Radical Equations
t) Graphing Square Root Functions
u) Trigonometric Ratios
v) Simplifying Rational Expressions
w) Adding, Subtracting, Multiplying and Dividing Rational Expressions
x) Dividing Polynomials
y) Solving Rational Equations
z) Inverse Variation

# Course Title: Honors Geometry

**Department:**     Mathematics

**Length:**     1 year (2 semesters); 1.0 credit earned upon successful completion of the course

**Prerequisites:**     Completion of Algebra 1 and recommendation from Algebra 1 teacher and sophomore academic dean

**Textbook:**     Pearson, Geometry: Common Core

**Course Goals and Objectives:** To provide an equivalent full-year study of Geometry to students wishing to prepare a foundation for advanced high school coursework in mathematics. This course will challenge students to think critically in order to solve mathematical problems with a geometric emphasis. The objective of this course is to provide the student with the requisite foundation for the study of advanced algebra and trigonometry.

**Course Description:**

The study of Geometry includes math vocabulary, organization of proofs, points, lines, planes and angles, parallel lines and planes, transformations and congruence, congruent triangles, similar polygons, right triangles, circles, areas of plane and solid figures, volumes and surface areas of solids, using formulas in solving problems, visualizing geometric situations, and using geometric ideas in real situations

Itemized Details of Course Content:

First Semester (the order of instruction may change based on teacher discretion)

t) Nets and Drawings for Visualizing Geometry
u) Points, Lines, and Planes
v) Measuring Segments, and Angles
w) Exploring Angle Pairs
x) Midpoint and Distance in the Coordinate Plane
y) Perimeter, Circumference, and Area

z) Conditional and Biconditional Statements
aa) Inductive and Deductive Reasoning
bb) Reasoning in Algebra and Geometry
cc) Proving Angles Congruent
dd) Lines and Angles
ee) Properties of Parallel Lines and Proving Lines Parallel
ff) Parallel and Perpendicular Lines and their Slopes
gg) Parallel Lines and Triangles
hh) Equations of Lines in the Coordinate Plane
ii) Congruent Figures
jj) Triangle Congruence Using SSS, SAS, ASA, and AAS
kk) Using Corresponding Parts of Congruent Triangles (CPCTC)
ll) Isosceles and Equilateral Triangles
mm) Congruence in Right Triangles and Overlapping Triangles
nn) Midsegments of Triangles
oo) Bisectors in Triangles
pp) Medians and Altitudes
qq) Indirect Proofs
rr) Inequalities in One and Two Triangles
ss) The Polygon-Angle Sum Theorems
tt) Properties and Conditions of Parallelograms, Rhombuses, Rectangles, Squares, Trapezoids, and Kites
uu) Proving that a Quadrilateral is a Parallelogram
vv) Polygons in the Coordinate Plane
ww) Applying Coordinate Geometry
xx) Proofs Using Coordinate Geometry

Second Semester (the order of instruction may change based on teacher discretion)

aa) Ratios and Proportions
bb) Similar Polygons
cc) Proving Triangles Similar
dd) Similarity in Right Triangles
ee) Proportions in Triangles
ff) The Pythagorean Theorem and its Converse
gg) Special Right Triangles
hh) Trigonometry
ii) Angles of Elevation and Depression
jj) Law of Sines and Cosines
kk) Translations, Reflections, Rotations, and Dilations
ll) Compositions of Isometries
mm) Triangle Congruence
nn) Similarity Transformations

oo) Areas of Parallelograms, Triangles, Trapezoids, Rhombuses, Kites, and Regular Polygons
pp) Perimeters and Areas of Similar Figures
qq) Trigonometry and Area
rr) Circles and Arcs
ss) Areas of Circles and Sectors
tt) Geometric Probability
uu) Space Figures and Cross Sections
vv) Surface Area and Volume of Prisms, Cylinders, Pyramids, Cones, and Spheres
ww)    Areas and Volumes of Similar Solids
xx) Tangent Lines
yy) Chords and Arcs
zz) Inscribed Angles
aaa)    Angle Measures and Segment Lengths
bbb)    Circles in the Coordinate Plane
ccc)    Locus: A Set of Points

# Course Title:   Honors Algebra 2 with Trigonometry

**Department:** Mathematics

**Length:** 1 Year (2 Semesters); 1.0 Credits Earned upon successful completion of the course.

**Prerequisites:** Passing Completion of Honors Algebra 1, Honors Geometry or Placement by Academic Dean from above average skills demonstrated in previous coursework.

**Textbook:** Pearson, Algebra 2: Common Core

**Course Goals and Objectives:** The purpose for the Honors Algebra 2 with Trigonometry course is to build strong mathematical skills and problem solving techniques for complex problems.  In the study of Algebra 2, a student will not only master solving skills and concepts, but also apply them to more advanced topics and real world situations.  Students who complete this course will also develop critical thinking techniques to have success in many difficult content areas.

**Course Description:**  Honors Algebra 2 with Trigonometry is a course designed for the high level mathematics student.  This fast-paced, rigorous course focuses on advancement in the student's knowledge of algebra in preparation for other high level advanced courses. Students will be challenged to master the wide range of content offered in this course.  Topics include, but are not limited to: absolute value equations and inequalities, linear functions, quadratic functions, factoring, polynomial functions, radicals, rational exponents, exponential and logarithmic functions, rational functions, and trigonometric functions.

**Course Content:**

**Semester 1:**
- m) Review of Algebra 1 (Expressions, Equations, Inequalities)
- n) Absolute Value Equations and Inequalities
- o) Functions
- p) Linear Functions
- q) Absolute Value Equations
- r) Systems of Equations and Inequalities
- s) Quadratic Functions
- t) Factoring
- u) Quadratic Equations
- v) Imaginary Numbers
- w) Polynomial Functions
- x) Advanced Factoring
- y) Long and Synthetic Division
- z) Polynomial Equations
- aa) Fundamental Theorem of Algebra

**Semester 2:**

l) Radicals
m) Rational Exponents
n) Radical Equations
o) Function Operations
p) Exponential Functions
q) Exponential Growth and Decay
r) Logarithmic Functions
s) Exponential and Logarithmic Equations
t) Natural Logarithms
u) Rational Functions
v) Rational Expressions
w) Rational Equations
x) Periodic Functions
y) Angles in the Coordinate Plane
z) The Unit Circle
aa) Trigonometric Functions
bb) Trigonometric Identities

# Course Title:  Honors Precalculus

Department:              Mathematics

Length:                  1 year (2 semesters); 1.0 credits earned upon successful completion of the course

Prerequisites:           Successful completion of Algebra 1, Geometry, and Algebra 2 (or their equivalents)

Textbook:                Precalculus with Limits, 3$^{rd}$ Edition; Ron Larson, Cengage Learning

Course Goals and Objectives: The study of calculus requires a thorough and complete background in algebra, trigonometry, and geometry.  To that end, precalculus conducts a grand review of those topics in greater detail than previously studied, ending with the introduction of the derivative and the integral.  A student will further develop his mathematical literacy and problem-solving skills in both theoretical and practical applications in preparation for a calculus course.

Course Description:

General Overview: Precalculus students will incorporate their existing knowledge to further explore ideas introduced in their prior coursework.  These existing concepts will be refined and sharpened to serve as a satisfactory preparation for calculus.

Itemized Details of Course Content:

1$^{st}$ Semester (the order of instruction may change based on teacher discretion)

a) basic cartesian operations and graphing
b) properties and identification of functions, including their transformations, operations on them, and their inverses
c) polynomial division
d) complex numbers
e) finding the zeros of polynomials
f) rational functions
g) polynomial inequalities
h) exponential and logarithmic functions
i) trigonometric functions in radian measure, including their reciprocals and inverses
j) trigonometric identities and formulae

k) the law of sines and cosines
l) finding the area of a triangle
m) vectors and vector operations
n) trigonometric forms of complex numbers

2<sup>nd</sup> Semester (the order of instruction may change based on teacher discretion)

a) solving systems of equations by substitution, graphing, or elimination, including multivariable linear systems
b) partial fractions
c) solving systems of inequalities
d) linear programming
e) matrices, including operations on them, their inverses, and obtaining and using their determinants
f) sequences and series, including arithmetic and geometric
g) mathematical induction
h) the binomial theorem
i) combinatorics and probability
j) lines in the plane
k) conic sections, including parabolas, ellipses, hyperbolas, and their rotations
l) parametric equations
m) polar coordinates and their graphs
n) the three-dimensional coordinate system, to include vectors, lines, and planes
o) the cross product
p) limits (including limits at infinity and the limits of sequences)
q) tangent lines and the derivative
r) the area under a curve and the integral

# Course Title: Precalculus

Department:             Mathematics

Length:                 1 year (2 semesters); 1.0 credit earned upon successful completion of the
                        course

Prerequisites:          Successful completion of Algebra 1, Geometry, and Algebra 2 (or their
                        equivalents)

Textbook:               Precalculus with Limits, 3$^{rd}$ Edition; Ron Larson, Cengage Learning


Course Goals and Objectives: The study of calculus requires a thorough and complete

background in algebra, trigonometry, and geometry. A student will further develop his

mathematical literacy and problem-solving skills in both theoretical and practical applications in

preparation for a calculus course.


Course Description:

> Precalculus combines the trigonometric, geometric, and algebraic techniques needed to
> prepare students for the study of calculus, and strengthens students' conceptual
> understanding of problems and mathematical reasoning in solving problems. Facility with
> these topics is especially important for students intending to study calculus, physics, and
> other sciences, and/or engineering in college. This course includes development of
> higher-level mathematics skills. Trigonometric functions; vectors and matrices; complex
> numbers; functions and their graphs; infinite series; conic sections; limits; among other
> essential topics are stressed in this course. Online resources will be used, as well as a
> variety of technology to help in the learning process. Interesting questions will be given
> to reflect and ponder over. Group work and discussions will be encouraged. Problem
> solving will be developed and enhanced by the use of graphing calculators. A variety of
> teaching methods will be used to help students learn – a focus will be on teaching and
> learning. Appropriate assessments will be given to determine a student's achievement,
> effort, and understanding.


> Itemized Details of Course Content:

> First Semester (the order of instruction may change based on teacher discretion)

a) graphing in the Cartesian coordinate system

b) properties and identification of functions, including their transformations, operations on them, and their inverses

c) polynomials, division of polynomials, finding the zeros of polynomials

d) complex numbers, graphing complex numbers, fractals

e) rational functions

f) polynomial inequalities

g) exponential and logarithmic functions

h) trigonometric functions in radian measure, including their reciprocals and inverses, the unit circle

i) trigonometric identities and formulae

j) the law of sine and cosine

k) vector and vector operations

l) math projects

m) applications and modeling

Second Semester (the order of instruction may change based on teacher discretion)

a) solving systems of equations by substitution, graphing, or elimination

b) partial fractions

c) solving systems of inequalities

d) matrices, including operations on them, their inverses, and obtaining and using their determinants

e) sequences and series, including arithmetic and geometric

f) combinatics and probability

g) polar coordinates and their graphs

h) the three-dimensional coordinates system, to include vectors, lines, and planes

i) the cross product

j) conic sections

k) limits, including limits at infinity and limits of sequences

l) tangent lines and the derivative

m) math projects

n) applications and modeling

# Course Title:   Trigonometry with Functions

Department:          Mathematics

Length:              1 year (2 semesters at 0.5 credits per semester)

Prerequisites:       Algebra II

Textbook:            <u>Trigonometry</u>  Lial, Hornsby, Schneider, & Daniels  Pearson

Course Goals and Objectives:     Intensely study triangles and their properties, with the goal of
applying these skills to real problems such as navigation,
cartography, gear mechanics, and scientific applications

Itemized Details of Course Content:

First Semester

a)  review of applicable geometry

b)  expressing angles in decimal and degree-minute-second form

c)  standard position and coterminal angles

d)  similar triangles

e)  the six trigonometric functions

f)  quadrantal angles

g)  reciprocal, quotient, and Pythagorean identities

h)  signs, domains, and ranges of trigonometric functions

i)  right angle trigonometric terminology

j)  the cofunctions and their relationships

k)  finding values of trigonometric functions using reference angles

l)  solving right triangles

m)  applications to navigation and cartography

n)  angles of elevation and depression

o)  radian measure, degree measure, and the unit circle

p) arc length and sector area

q) applications to linear and angular speed

Second Semester

a) graphing the trigonometric functions

b) verifying trigonometric identities

c) sum and difference formulas for sine, cosine, and tangent

d) double angle and half angle identities

e) trigonometric equations

f) Law of Sines and Law of Cosines

g) ambiguous cases

h) solving oblique triangles

i) area formula, including Heron's Formula

j) applications again to navigation and cartography