

# Math

## ALGEBRA II

### STANDARD 1

*The student understands and applies the concepts and procedures of number sense and numeration.*

To meet this standard, the student will:

**Benchmark A2.1.1: Understand numbers, ways of representing numbers, relationships among numbers, and number systems**

**Indicators:**

- A2.1.1.1 Develop a deeper understanding of very large and very small numbers and of various representations of them
- A2.1.1.2 Compare and contrast the properties of numbers and number systems; including real and complex numbers
- A2.1.1.3 Understand vectors and matrices as systems that have some of the properties of the real-number system

**Benchmark A2.1.2: Demonstrate understanding of operations and how they relate to one another**

Indicators

- A2.1.2.1 Develop fluency in operations with real and complex numbers, and matrices
- A2.1.2.2 Solve multi-step problems involving applications of percent, ratio, and rate as they arise throughout the course
- A2.1.2.3 Use a graphing calculator effectively for applications that arise throughout the course
- A2.1.2.4 Judge the effects of such operations as multiplication, division, and computing powers and roots on the magnitudes of quantities
- A2.1.2.5 Evaluate, simplify, or rearrange numbers of rational powers in exponential or radical form
- A2.1.2.6 Develop an understanding of properties of, and representations for the addition and multiplication of vectors and matrices

**Benchmark A2.1.3: Compute fluently and make reasonable estimates, using a variety of strategies and tools**

**Indicators:**

- A2.1.3.1 Distinguish between exact and approximate representations of the same quantity and choose appropriately between them in the given situation (e.g. pi, square roots of non-perfect squares)
- A2.1.3.2 Judge the reasonableness of answers to problems by considering likely results within the situation described in the problem
- A2.1.3.3 Judge the reasonableness of answers produced by a calculator, a computer, or pencil and paper, using mental mathematics and estimation

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## ALGEBRA II

### STANDARD 2

*The student understands and applies the concepts and procedures of algebra and patterns.*

To meet this standard, the student will:

**Benchmark A2.2.1: Translate verbal to mathematical expressions (and visa versa) and apply to real world problems**

**Indicators:**

- A2.2.1.1 Appropriately communicate mathematical situations and solutions
- A2.2.1.2 Translate word problems into mathematical expressions, like matrices, equations or inequalities
- A2.2.1.3 Represent real world linear and nonlinear relationships in tables, graphs, or equations
- A2.2.1.4 Translate among tables, equations and graphs

**Benchmark A2.2.2: Solve problems, using the strategy of algebraic modeling**

**Indicators:**

- A2.2.2.1 Rearrange formulas involving variables with rational powers, with and without substitution, as they arise in topics throughout the course (e.g., analytic geometry, measurement)
- A2.2.2.2 Use algebraic modeling as one of several problem-solving strategies in various topics of the course (e.g., relations, measurement, direct and inverse variation, the Pythagorean theorem, percent)
- A2.2.2.3 Solve and graph quadratic equations by a variety of means (e.g., taking square root, factoring, quadratic formula, completing the square)
- A2.2.2.4 Solve and graph equations and inequalities involving polynomial functions, direct and inverse variations, absolute value, greatest integer function, and exponential functions
- A2.2.2.5 Use equations and inequalities with absolute value to solve problems
- A2.2.2.6 Understand, apply concepts of, and evaluate solutions for quadratic and exponential relations in real world situations

**Benchmark A2.2.3: Determine, through investigation, the properties of the slope and y-intercept of a linear relation**

**Indicators:**

- A2.2.3.1 Identify and rearrange the equation of a line in any of the forms  $y=mx + b$ ,  $Ax + By + C=0$ ,  $x=a$ ,  $y=b$ ,  $y-y_1 =m(x-x_1)$
- A2.2.3.2 Determine the slope of a line and identify it as a constant rate of change
- A2.2.3.3 Identify the properties of the slopes of line segments (e.g. direction, positive or negative rate of change, steepness, parallelism, perpendicularity)

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**Benchmark A2.2.4: Solve systems of equations and inequalities**

**Indicators:**

- A2.2.4.1 Solve systems of two and three variables using graphing, elimination, substitution, and matrices
- A2.2.4.2 Determine a point of intersection of two relations, by hand, and by using graphing calculators
- A2.2.4.3 Use a linear inequality to solve real-world problems
- A2.2.4.4 Understand and apply the process of linear programming

**Benchmark A2.2.5: Compare the graphs and formulas of linear and non-linear relations**

**Indicators:**

- A2.2.5.1 Graph quadratic equations using intercepts and vertex
- A2.2.5.2 Graph equations and inequalities involving polynomial functions, variations, absolute value, greatest integer function, rational functions, and exponential functions

**Benchmark A2.2.6: Operate with polynomials**

**Indicators:**

- A2.2.6.1 Add, subtract, multiply, divide (with long division and synthetic division), and apply powers to polynomials
- A2.2.6.2 Expand and simplify polynomial expressions involving one or more variable
- A2.2.6.3 Understand factoring methods including special cases (perfect square trinomials, difference of perfect squares, difference of perfect cubes)
- A2.2.6.4 Expand polynomials to a power using Pascal's triangle and the binomial theorem

**Benchmark A2.2.7: Manipulate polynomial expressions to solve equations of first, second and third degrees**

**Indicators:**

- A2.2.7.1 Solve first-degree equations, including equations with rational and irrational coefficients, using an algebraic method
- A2.2.7.2 Solve quadratic equations with real and complex solutions using algebraic methods, factoring, or the quadratic formula
- A2.2.7.3 Solve polynomial equations by finding the real zeros of polynomial functions & state the multiplicity of each

**Benchmark A2.2.8: Determine, through investigation, the relationships between the form of an equation and the shape of its graph including linear, quadratic and general even or odd degree equations**

**Indicators:**

- A2.2.8.1 Demonstrate an understanding that straight lines represent linear relations and curves represent their respective non-linear relations
- A2.2.8.2 Identify properties and relationships of data in tables, graphs, and equations (distinguish between relations and functions, dependent and independent variables, domain and range)
- A2.2.8.3 Determine values of a relation by using the formula of the relation
- A2.2.8.4 Identify, by calculating finite differences in its table of values, the equation of the relation
- A2.2.8.5 Graph simple polynomial functions of even or odd degree based on value of leading coefficient and exponential functions
- A2.2.8.6 Identify and perform transformations from one function to another

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**Benchmark A2.2.9: Manipulate expressions of rational powers**

**Indicators:**

- A2.2.9.1 Evaluate, simplify or rearrange expressions of rational powers in exponential or radical form
- A2.2.9.2 Add, subtract, multiply and divide rational expressions
- A2.2.9.3 Add, subtract, multiply and divide radical expressions
- A2.2.9.4 Apply and solve formulas of growth and decay, and compound interest using properties of exponential and logarithmic equations

**Benchmark A2.2.10: Describe a function and its relations**

**Indicators:**

- A2.2.10.1 Identify a function and its range and domain
- A2.2.10.2 Determine and evaluate operations and the composite of functions
- A2.2.10.3 Determine and describe the inverse of a given relation
- A2.2.10.4 Write, graph, and apply special functions, like piecewise, step, and absolute value

# Math

## ALGEBRA II

### STANDARD 3

The student *understands and applies the concepts and procedures of geometry.*

To meet this standard, the student will:

**Benchmark A2.3.1: Specify locations and describe spatial relationships using coordinate geometry**

**Indicator:**

A2.3.1.1 Apply coordinate geometry to spatial relationships

**Benchmark A2.3.2: Apply transformations and use symmetry to analyze mathematical situations**

**Indicator:**

A2.3.2.1 Understand and represent translations, reflections, rotations, and dilations of objects in the plane by using coordinates, vectors, functions notations, and matrices

**Benchmark A2.3.3: Develop the equations for conic sections given a graph or specific information regarding its characteristics**

**Indicators:**

A2.3.3.1 Visualize three-dimensional objects (specifically conics) and analyze their cross sections  
A2.3.3.2 Apply the equations for conic sections to the appropriate situation

**Benchmark A2.3.4: Use trigonometric relationships to determine lengths and angle measures**

**Indicator:**

A2.3.4.1 Use trigonometric ratios and right triangles to determine lengths and angle measures in mathematical and real world applications

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## ALGEBRA II

### STANDARD 4

The student understands and applies the concepts and procedures of *measurement*.

To meet this standard, the student will:

**Benchmark A2.4.1: Understand measurable attributes of objects and the units, systems, and processes of measurement**

**Indicators:**

- A2.4.1.1 Solve problems involving situations involving one or more formulas from geometry, science, statistics, or other
- A2.4.1.2 Evaluate the distance between two points in the coordinate plane in two- or three-dimensions

**Benchmark A2.4.2: Apply appropriate techniques, tools, and formulas to determine measurements**

**Indicators:**

- A2.4.2.1 Use trigonometric relationships to solve problems involving triangles in real world situations where lines of sight or angles of elevations or depression apply
- A2.4.2.2 Judge the reasonableness of answers to measurement problems considering likely results within the situations described in the problem

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## ALGEBRA II

### STANDARD 5

The student understands and applies the concepts and procedures of *data analysis and probability*.

To meet this standard, the student will:

**Benchmark A2.5.1: Determine relationships between two variables by collecting and analyzing data**

**Indicators:**

- A2.5.1.1 Demonstrate an understanding of some principles of sampling and surveying and apply the principles in designing and carrying out experiments to investigate the relationships between variables
- A2.5.1.2 Organize and analyze data, using appropriate techniques (e.g., making tables and graphs: line or curve of best fit)

**Benchmark A2.5.2: Describe the connections between various representations of relations**

**Indicators:**

- A2.5.2.1 Describe trends and relationships observed in data, make inferences from data, compare the inferences with hypotheses about the data, and explain the differences between the inferences and the hypotheses
- A2.5.2.2 Communicate the findings of an experiment clearly and concisely, using appropriate mathematical forms (e.g., written explanations, formulas, charts, tables, graphs.), and justify the conclusions reached
- A2.5.2.3 Solve and/or pose problems related to an experiment, using the findings of the experiment

**Benchmark A2.5.3: Express and apply algebraic and geometric sequences**

**Indicators:**

- A2.5.3.1 Write terms of an algebraic and geometric sequence, given the formula for the nth term
- A2.5.3.2 Determine the explicit and recursive formulas to express algebraic and geometric sequences

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