

Grades 9, 10, 11, 12

Adopted 2023

Algebra I

Expressions

Polynomials, Roots, & Exponent Laws

EX. Students simplify algebraic and numerical expressions. **A1.EX**

1. Add, subtract, and multiply polynomials; compare the system of polynomials to the system of integers when performing operations. **A1.EX.1**
2. Simplify and perform operations with radical expressions without variables; rationalizing denominators should not include conjugates. **A1.EX.2**
3. Simplify algebraic expressions using the laws of exponents. **A1.EX.3**
4. Interpret the parts of expressions such as terms, factors, and coefficients in terms of a real-world context. **A1.EX.4**

Functions

Domain & Range, Function Notation

- FN1.** Students understand the concept of a function, domain and range, and use function notation; students use function notation to solve problems. **A1.FN1**
1. Explain that a function assigns each element in the domain to exactly one element in the range. **A1.FN.1**
 2. Use function notation to represent functions, understanding that if f is a function and x is an element of its domain, then $f(x)$ represents the output of f corresponding to the input x . **A1.FN.2**
 3. Graph functions given in function notation, understanding that the graph contains the points $(x, f(x))$. **A1.FN.3**
 4. Evaluate functions expressed in function notation for one or more elements in their domains (inputs); use function notation to describe a contextual situation. **A1.FN.4**

Construct & Compare

- FN2.** Students construct and compare linear, quadratic, and exponential models and solve problems. **A1.FN2**
5. Differentiate between real-world scenarios that can be modeled by exponential or linear functions by determining whether the relationship has a common difference or a common ratio. **A1.FN.5**
 6. Compare the growth pattern of exponential to linear or quadratic functions using graphs and tables and recognize how exponential growth exceeds other functions. **A1.FN.6**

Linear Functions, Equations, & Inequalities

Create & Solve

LFE1. Students create and solve equations that model linear relationships. **A1.LFE1**

1. Represent and solve real-world problems, using linear expressions, equations, and inequalities in one variable. **A1.LFE.1**
2. Construct linear functions from arithmetic sequences with and without context. **A1.LFE.2**
3. Solve linear formulas for a specified variable. **A1.LFE.3**
4. Solve linear equations, linear inequalities, and absolute value equations in one variable, including those with rational number coefficients, and variables on both sides of the equal or inequality sign; solve them fluently, explaining the process used. **A1.LFE.4**

Interpret Key Features

LFE2. Students interpret key features of equations that model linear relationships. **A1.LFE2**

5. Determine the domain and range of linear functions in mathematical problems. **A1.LFE.5**
6. Determine reasonable domain and range values of linear functions representing real-world situations, both continuous and discrete; interpret the solution as reasonable or unreasonable in context. **A1.LFE.6**
7. Interpret the key features of a linear and absolute value functions that models a relationship between two quantities in a given context. **A1.LFE.7**
8. Flexibly use different representations of a linear function, including graphs, tables, and equations. **A1.LFE.8**
9. Calculate and interpret the rate of change of a linear function represented in a table, graph, or as an equation in context of real-world and mathematical problems. **A1.LFE.9**
10. Translate among equivalent forms of equations for linear functions, including standard, point-slope, and slope-intercept forms; recognize that each form reveals key features in a given context. **A1.LFE.10**

Systems of Equations & Inequalities

LFE3. Students solve systems of equations and inequalities. **A1.LFE3**

11. Solve systems of linear equations by substitution, elimination, and graphing with and without a real-world context; understand that the solutions will be the same regardless of the method for solving. **A1.LFE.11**
12. Solve a system of equations consisting of a linear equation and a quadratic equation in two variables graphically with the assistance of technology. **A1.LFE.12**

13. Explain why a solution to the equation $f(x) = g(x)$ is the x -coordinate where the y -coordinate of $f(x)$ and $g(x)$ are the same using graphs, tables, or approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, quadratic, absolute value, and exponential. [A1.LFE.13](#)
14. Solve linear inequalities and systems of linear inequalities in two variables by graphing. [A1.LFE.14](#)

Graphing & Transformations

LFE4. Students graph linear functions, equations, and inequalities. [A1.LFE4](#)

15. Write linear equations that model the relationship between two quantities and produce a graph of the equation. [A1.LFE.15](#)
16. Graph linear functions expressed as an equation and show intercepts of the graph without technology. [A1.LFE.16](#)
17. Graph absolute value functions expressed as an equation with and without technology, showing intercepts and end behavior. [A1.LFE.17](#)
18. Graph and generalize the effect of transformations on linear and absolute value functions.
 - Transformations include: stretches, compressions, vertical, and horizontal[A1.LFE.18](#)
19. Given the graph of a linear function, explain the effects of the transformation from the parent function, $y=x$. [A1.LFE.19](#)

Statistical Relationships

LFE5. Students explore linear statistical relationships. [A1.LFE5](#)

20. Write linear functions that provide a reasonable fit to data and use them to make predictions, with and without technology; interpret the slope and y -intercept in context. [A1.LFE.20](#)
21. Calculate, using technology, the correlation coefficient between two quantitative variables and interpret this quantity as a measure of the strength of the linear association. [A1.LFE.21](#)
22. Compare and contrast correlation and causation in real-world problems. [A1.LFE.22](#)

Quadratic Functions & Equations

Create & Solve

QFE1. Students create and solve equations that model quadratic relationships. [A1.QFE1](#)

1. Represent and solve real-world problems using quadratic expressions and equations in one variable. [A1.QFE.1](#)
2. Write quadratic equations with real number solutions that model the relationship between two quantities and produce a graph of the equation. [A1.QFE.2](#)
3. Solve quadratic equations with real number solutions, containing one variable, including those with variables on both sides of the equal sign. Equations should be solved by:
 - Graphing,
 - Factoring (including perfect square trinomials and difference of squares binomials),
 - Using the quadratic formula,
 - Completing the square, or
 - Taking the square root.[A1.QFE.3](#)

Interpret Key Features

QFE2. Students interpret key features of equations that model quadratic relationships. [A1.QFE2](#)

4. Determine the domain and range of quadratic functions in mathematical problems. [A1.QFE.4](#)
5. Determine reasonable domain and range values of quadratic functions representing real-world situations, both continuous and discrete; interpret the solution as reasonable or unreasonable in context. [A1.QFE.5](#)
6. Interpret the key features of a quadratic function that models a relationship between two quantities in a given context. [A1.QFE.6](#)
7. Flexibly use different representations of a quadratic function, including graphs, tables, and equations. [A1.QFE.7](#)
8. Explain how each form of a quadratic expression (standard, factored, and vertex form) identifies different key attributes, using the different forms to interpret quantities in context. [A1.QFE.8](#)
9. Use factoring and completing the square to create equivalent forms of quadratic functions to reveal key attributes. [A1.QFE.9](#)

Graphing & Transformations

QFE3. Students graph quadratic functions and explore different transformations of $f(x) = x^2$. [A1.QFE3](#)

10. Graph quadratic functions given as an equation or in function notation, labeling key attributes, without technology. [A1.QFE.10](#)
11. Graph and describe the effect of transformations on quadratic functions.
 - Transformations include: stretches, compressions, vertical, and horizontal[A1.QFE.11](#)

12. Given the graph of a quadratic function, explain the effects of the transformation from the parent function, $y = x^2$. [A1.QFE.12](#)

Statistical Relationships

QFE4. Students explore quadratic statistical relationships. [A1.QFE4](#)

13. Write quadratic functions that provide a reasonable fit to data and use them to make predictions with technology. [A1.QFE.13](#)

Exponential Functions & Equations

Create & Solve

EFE1. Students create and solve problems that model exponential relationships. [A1.EFE1](#)

1. Represent and solve real-world problems, using exponential equations in one variable. [A1.EFE.1](#)
2. Represent real-world problems (growth, decay, and compound interest), using exponential equations. [A1.EFE.2](#)
3. Construct exponential equations from geometric sequences with and without context. [A1.EFE.3](#)

Interpret Key Features

EFE2. Students interpret key features of equations that model exponential relationships. [A1.EFE2](#)

4. Determine the domain and range of exponential functions in mathematical problems. [A1.EFE.4](#)
5. Determine reasonable domain and range values of exponential functions representing real-world situations, both continuous and discrete; interpret the solution as reasonable or unreasonable in context. [A1.EFE.5](#)
6. Interpret the key features of an exponential function that models a relationship between two quantities in a given context. [A1.EFE.6](#)
7. Flexibly use different representations of an exponential function, including graphs, tables, and equations. [A1.EFE.7](#)
8. Interpret the quantities in an exponential equation in the context of a real-world problem, including growth, decay, and compound interest. [A1.EFE.8](#)

Graphing

EFE3. Students graph exponential functions. [A1.EFE3](#)

9. Graph exponential functions that model real-world problems (growth, decay, and compound interest), showing key attributes. [A1.EFE.9](#)

Statistical Relationships

EFE4. Students explore exponential statistical relationships. [A1.EFE4](#)

10. Write exponential functions that provide a reasonable fit to data and use them to make predictions with technology. [A1.EFE.10](#)

Statistics & Probability

Numerical Data

SP1. Students summarize and describe distributions. [A1.SP1](#)

1. Use box plots and histograms to determine the statistics appropriate to the shape of the data distribution; compare the center and spread of two or more data sets. [A1.SP.1](#)
2. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points. [A1.SP.2](#)

Bivariate Data

SP2. Students will investigate patterns of association in bivariate data. [A1.SP2](#)

3. Summarize data from two categorical variables in a frequency table; interpret relative frequencies in the context of the data, recognizing data trends and associations. [A1.SP.3](#)
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Geometry

Right Triangles

Special Right Triangles & Pythagorean Theorem

RT1. Students explore right triangles and apply the Pythagorean Theorem. [G.RT1](#)

1. Apply the properties of special right triangles (30° - 60° - 90° and 45° - 45° - 90°) to solve real-world and mathematical problems. [G.RT.1](#)
2. Prove and apply the Pythagorean Theorem and its converse. [G.RT.2](#)

Trigonometry Ratios

RT2. Students apply trigonometric ratios to solve problems. [G.RT2](#)

3. Explain how the definitions for trigonometric ratios are developed by similarity and how the side ratios in right triangles are properties of the angles in the triangle. [G.RT.3](#)
4. Explain the relationship between the sine and cosine of complementary angles and use them to solve problems. [G.RT.4](#)
5. Determine the sine, cosine, and tangent ratios of acute angles given the side lengths of right triangles. [G.RT.5](#)
6. Use trigonometric ratios (sine, cosine, and tangent) to calculate missing side lengths and angle measures in a right triangle, including applications of angles of elevation and depression; include real-world and mathematical problems. [G.RT.6](#)

Circles

Circle Relationships

CIR1. Students explore and use circle relationships to solve problems. **G.CIR1**

1. Apply the precise definition and standard geometric notation for a circle to understand geometric relationships. **G.CIR.1**
2. Recognize and apply relationships between angles, radii, and chords, tangents, and secants including:
 - The relationship between central, inscribed, and circumscribed angles,
 - Inscribed angles on a diameter are right angles,
 - The radius of a circle is perpendicular to the tangent where the radius intersects the circle, and
 - The relationship of angles and segments formed by chords, secants and/or tangents to a circle.**G.CIR.2**
3. Use the proportional relationship between the measure of an arc length of a circle and the circumference of the circle to solve problems. **G.CIR.3**
4. Use the proportional relationship between the measure of the area of a sector of a circle and the area of the circle to solve problems. **G.CIR.4**
5. Explain why the formulas for the area and circumference of a circle work using dissection and informal limit arguments. **G.CIR.5**

Equation of a Circle

CIR2. Students solve problems involving the equation of a circle. **G.CIR2**

6. Write the equation of a circle, given the radius and center, where the center is at the origin or another point. **G.CIR.6**
7. Identify the center and radius of a circle, given the equation of a circle, where the center is at the origin or another point. **G.CIR.7**
8. Apply the equation of a circle to solve real-world problems. **G.CIR.8**

Geometric Figures

Three-Dimensional

GF1. Students explore and solve problems involving three-dimensional figures. [G.GF.1](#)

1. Find the volume and surface area of complex three-dimensional figures composed of prisms, pyramids, cones, cylinders, and spheres. [G.GF.1](#)
2. Use three-dimensional geometric figures and their measures to model real-world objects and solve problems. [G.GF.2](#)
3. Explain why the formulas for the volume and surface area of a cylinder, pyramid, and cone work. [G.GF.3](#)
4. Apply the Pythagorean Theorem to determine missing measurements in a three-dimensional figure. [G.GF.4](#)
5. Identify the three-dimensional figure generated by rotating a two-dimensional figure. [G.GF.5](#)

Two-Dimensional

GF2. Students explore and solve problems involving two-dimensional figures. [G.GF.2](#)

6. Apply theorems about quadrilaterals, including those involving angles, diagonals, and sides to solve problems. [G.GF.6](#)
7. Prove that a given quadrilateral is a parallelogram, rhombus, rectangle, square, kite, or trapezoid, and apply these relationships to solve problems. [G.GF.7](#)
8. Prove and apply theorems about triangles including:
 - Angle-Sum Theorem,
 - Exterior Angle Theorem,
 - Isosceles Triangle Theorem and its converse,
 - Midsegment Theorem,
 - Proportionality Theorem,
 - Inequality Theorem and its converse,
 - and Geometric Mean Theorem.[G.GF.8](#)
9. Calculate the perimeter of polygons when given the vertices, including using the distance formula. [G.GF.9](#)
10. Calculate the area of triangles and rectangles when given the vertices, including using the distance formula and decomposing figures. [G.GF.10](#)
11. Describe reflectional and rotational symmetry as they apply to a rectangle, parallelogram, trapezoid, or regular polygon. [G.GF.11](#)

Geometric Probability

GF3. Students determine probability in geometric contexts. [G.GF.3](#)

12. Calculate probabilities as a proportion of area in a geometric context. [G.GF.12](#)

Lines & Angles

Define & Construct

LA1. Students use precise definitions and various construction tools to create geometric figures. **G.LA1**

1. Use precise definitions and standard geometric notation for angles, perpendicular lines, parallel lines, and line segments based on the undefined notions of point, line, and distance along a line. **G.LA.1**
2. Make formal geometric constructions with a variety of tools and methods including:
 - Congruent segments and angles,
 - Segment and angle bisectors,
 - Perpendicular lines and perpendicular bisectors of a line segment,
 - Parallel lines, and
 - An equilateral triangle, a square, and a regular hexagon inscribed in a circle.**G.LA.2**

Coordinate Geometry

LA2. Students reason about geometric figures using the coordinate plane. **G.LA2**

3. Determine the point that cuts a line segment into a specified ratio on a number line and a coordinate plane, including finding the midpoint. **G.LA.3**
4. Derive the distance and midpoint formulas and use the formulas, including the slope formula, to verify geometric relationships on a coordinate plane. **G.LA.4**

Parallel & Perpendicular Lines

LA3. Students solve problems involving parallel and perpendicular lines. **G.LA3**

5. Prove and apply slope criteria of parallel and perpendicular lines to solve problems. **G.LA.5**
6. Write an equation of a line that is parallel or perpendicular to a given line and passing through a given point. **G.LA.6**
7. Prove and apply theorems about lines and angles including:
 - Vertical angles,
 - Angles formed by parallel lines cut by a transversal, and
 - Points on a perpendicular bisector.**G.LA.7**

Transformations

Coordinate Plane

TRF1. Students transform figures on the coordinate plane. **G.TRF1**

1. Describe rotations, reflections, and translations as functions that take points in the coordinate plane as inputs and give other points as outputs; write in prime notation. **G.TRF.1**
2. Compare transformations that preserve distance and angle (rotations, reflections, and translations) to those that do not (dilations) to develop definitions for congruence and similarity. **G.TRF.2**

Plane

TRF2. Students transform figures and make geometric constructions. **G.TRF2**

3. Apply understanding of angles, circles, perpendicular lines, parallel lines, and line segments to develop definitions for rotations, reflections, and translations. **G.TRF.3**
4. Use geometric constructions to represent rotations, reflections, translations, and dilations in the plane with a variety of tools and methods. **G.TRF.4**
5. Given two congruent figures, identify the sequence of transformations that maps one figure to another. **G.TRF.5**

Similarities & Congruence

Similarity

SC1. Students use similarity criteria to solve problems. **G.SC1**

1. Given two figures, apply the definition of similarity in terms of a dilation to identify similar figures, proportional sides, and corresponding congruent angles. **G.SC.1**
2. Develop and apply the criteria of similarity for triangles (AA~, SAS~, and SSS~) to solve problems and prove geometric relationships. **G.SC.2**
3. Use transformations to prove all circles are similar. **G.SC.3**

Triangle Congruence

SC2. Students apply congruence criteria to solve problems. **G.SC2**

4. Explain, using rigid motion transformations, why two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. **G.SC.4**
5. Develop and apply the criteria for triangle congruence (ASA, SAS, AAS, SSS, and HL) to solve problems and prove geometric relationships. **G.SC.5**