Arkansas Mathematics Standards

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

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.GF1

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.GF2

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.GF3

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