West Virginia Mathematics

Algebra I

Adopted 2024

Algebra I

Expressions and Equations

1. Interpret the structure of expressions and equations in terms of the context they model. A1.EE.1
    1. Interpret linear, exponential, and quadratic expressions that represent a quantity in terms of its context. M.A1HS.1
        a. Interpret parts of an expression, such as terms, factors, and coefficients. M.A1HS.1.A
        b. Interpret complicated expressions by viewing one or more of their parts as a single entity. M.A1HS.1.B
        c. Interpret the parameters in a linear function or exponential function of the form f(x) = a*b^x in terms of a context. M.A1HS.1.C
    2. Use the structure of quadratic and exponential expressions to identify ways to rewrite them. M.A1HS.2
2. Extend the properties of exponents to rational exponents. A1.EE.2
    3. Explain the connections between expressions with rational exponents and expressions with radicals using properties of exponents. Extend from application of properties of exponents for expressions with integer exponents. M.A1HS.3
    4. Rewrite expressions involving radicals, including simplifying, and rational exponents using the properties of exponents. M.A1HS.4
3. Write expressions in equivalent forms to solve problems. A1.EE.3
    5. Choose and produce an equivalent form of linear, exponential, and quadratic expressions to reveal and explain properties of the quantity represented by the expression through connections to a graphical representation of the function. M.A1HS.5
        a. Factor a quadratic expression to reveal the zeros of the function it defines. M.A1HS.5.A
        b. Complete the square in a quadratic expression, when a=1 only, to reveal the maximum or minimum value of the function it defines. M.A1HS.5.B
    c. Use the properties of exponents to transform expressions in exponential functions. For example, the expression 1.15^t can be rewritten as (1.15^{1/12})^{12t} ≈ 1.012^{12t} to reveal the approximate equivalent monthly interest rate if the annual rate is 15%. M.A1HS.5.C
4. Perform arithmetic operations on polynomials. A1.EE.4
    6. Recognize that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Focus on linear or quadratic terms. M.A1HS.6
5. Create equations that describe numbers or relationships. A1.EE.5

7. Create equations and inequalities in one variable, representing linear and exponential relationships, and use them to solve problems. In the case of exponential equations, limit to situations with integer inputs. M.A1HS.7
8. Create equations in two or more variables, representing linear and exponential relationships between quantities. In the case of exponential equations, limit to situations with integer inputs. M.A1HS.8
9. Represent constraints by linear equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. M.A1HS.9

6. Solve equations and inequalities in one variable. A1.EE.6

10. Solve linear equations including equations with coefficients represented by letters, simple exponential equations that rely on application of the laws of exponents, and compound linear inequalities in one variable. M.A1HS.10
11. Solve quadratic equations in one variable by inspection (e.g., for $x^2 = 49$), taking square roots, factoring, completing the square when a=1 only, and the quadratic formula, as appropriate for the initial form of the equation. M.A1HS.11
    a. Recognize the concept of complex solutions when the quadratic formula gives complex solutions. M.A1HS.11.A
    b. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$. Derive the quadratic formula from this method of completing the square. M.A1HS.11.B

7. Solve systems of equations. A1.EE.7

12. Analyze and solve pairs of simultaneous linear equations. M.A1HS.12
    a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. M.A1HS.12.A
    b. Solve simple cases by inspection (e.g., $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6). M.A1HS.12.B
    c. Solve real-word and mathematical problems leading to two linear equations in two variables (e.g., given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair). M.A1HS.12.C
13. Understand and demonstrate ways to manipulate a system of two equations in two variables while preserving its solution set. M.A1HS.13
14. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Include examples of solution sets with no solutions, an infinite number of solutions, and one solution. M.A1HS.14
15. Solve a simple system consisting of a linear equation and a quadratic equation in two variables graphically. M.A1HS.15

8. Represent and solve equations and inequalities graphically. A1.EE.8

16. Recognize that the graph of a linear or exponential equation in two variables is the set of all its solutions plotted in the coordinate plane. M.A1HS.16

17. Explain why the x-coordinates of the points where the graphs of the linear and/or exponential equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately (e.g., using technology to graph the functions, make tables of values or find successive approximations). M.A1HS.17

18. Graph the solutions of a linear inequality in two variables as a half-plane and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. M.A1HS.18

Functions

1. Understand the concept of a function and use function notation. A1.F.1

    19. Use multiple representations of linear and exponential functions to recognize that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. Develop function notation utilizing the definition of a function to represent situations both algebraically and graphically. M.A1HS.19

    20. Use function notation, evaluate functions for inputs in their domains and interpret statements that use function notation in terms of a context. M.A1HS.20

    21. Recognize arithmetic and geometric sequences are functions, sometimes defined recursively, whose domain is a subset of the integers (e.g., the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n)+ f(n-1) for n ≥ 1). M.A1HS.21

2. Interpret functions that arise in applications in terms of a context. A1.F.2

    22. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of quantities, and sketch graphs showing key features given a verbal description of the relationship. Relate the domain of a function to its linear, exponential, and quadratic graphs and, where applicable, to the quantitative relationship it describes. M.A1HS.22

        a. Key features of linear and exponential graphs include: intercepts; and intervals where the function is increasing, decreasing, positive, or negative. M.A1HS.22.A

        b. Key features of quadratic graphs include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximum or minimum; symmetry; and end behavior. M.A1HS.22.B

3. Analyze functions using different representations. A1.F.3

    23. Graph linear, exponential, and quadratic functions expressed symbolically and show key features of the graph. M.A1HS.23

        a. For linear functions, focus on intercepts. M.A1HS.23.A

        b. For exponential functions, focus on intercepts and end behavior. M.A1HS.23.B

        c. For quadratic functions, focus on intercepts, maxima, minima, end behavior, and the relationship between coefficients and roots to represent in factored form. M.A1HS.23.C

    24. Compare properties of two linear, exponential, or quadratic functions each represented in a different way, such as algebraically, graphically, numerically in tables, or from verbal descriptions. M.A1HS.24

    25. Write a function defined by a linear, exponential, or quadratic expression in different but equivalent forms to reveal and explain different properties of the function. M.A1HS.25

        a. Use the process of factoring and completing the square for a=1 only in a quadratic function to show zeros, extreme values, symmetry of the graph,

the relationship between coefficients and roots represented in factored form and interpret these in terms of a context. M.A1HS.25.A

b. Use the properties of exponents to interpret expressions in exponential functions. M.A1HS.25.B

4. Build a function that models a relationship between two quantities. A1.F.4

26. Write linear, exponential, and quadratic functions that describe a relationship between two quantities. M.A1HS.26

a. Determine an explicit expression, a recursive process, or steps for calculation from a context. M.A1HS.26.A

b. Combine standard function types using arithmetic operations. M.A1HS.26.B

27. Construct linear and exponential functions, including arithmetic and geometric sequences to model situations, given a graph, a description of a relationship or given input-output pairs (include reading these from a table). M.A1HS.27

5. Build new functions from existing functions. A1.F.5

28. Identify the effect on the graphs of linear and exponential functions, f(x), with f(x) + k, and the graphs of quadratic functions, g(x), with g(x) + k, k g(x), g(kx), and g(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. M.A1HS.28

6. Construct and compare linear, quadratic, and exponential models and solve problems. A1.F.6

29. Distinguish between situations that can be modeled with linear functions, with exponential functions, and with quadratic functions. M.A1HS.29

a. Prove that linear functions grow by equal differences over equal intervals; exponential functions grow by equal factors over equal intervals. M.A1HS.29.A

b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. M.A1HS.29.B

c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. M.A1HS.29.C

d. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically. Extend the comparison of linear and exponential growth to quadratic growth. M.A1HS.29.D

Geometry

1. Use coordinates to prove simple geometric theorems algebraically. A1.G.1

30. Prove the slope criteria for parallel and perpendicular lines and use the slope criteria to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). M.A1HS.30

31. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles. M.A1HS.31

Statistics and Probability

1. Summarize, represent, and interpret data on a single count or measurement variable. A1.SP.1

    32. Select applicable representations to display data on the real number line (e.g., dot plots, histograms, and box plots). M.A1HS.32

    33. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation only as a tool to describe spread and not to explicitly find standard deviation) of two or more different data sets. M.A1HS.33

    34. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). M.A1HS.34

2. Summarize, represent, and interpret data on two categorical and quantitative variables. A1.SP.2

    35. Represent data on two quantitative variables on a scatter plot and describe how the variables are related. M.A1HS.35

        a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models. M.A1HS.35.A

        b. Informally assess the fit of a function by plotting and analyzing residuals. Focus should be on situations for which linear models are appropriate. M.A1HS.35.B

        c. Fit a linear function for scatter plots that suggest a linear association. M.A1HS.35.C

3. Interpret linear models. A1.SP.3

    36. Interpret the rate of change and the constant term of a linear model in the context of the data. Use technology to compute and interpret the correlation coefficient of a linear fit. M.A1HS.36

    37. Distinguish between correlation and causation. M.A1HS.37