Iowa Mathematics

Algebra 1

Number and Quantity A1.N

N-RN. The Real Number System A1.N-RN

1 Use properties of rational and irrational numbers. A1.N-RN.B

1 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. A1.N-RN.B.3

N-Q. Quantities A1.N-Q

1 Reason quantitatively and use units to solve problems. A1.N-Q.A

1 Use units to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (A1 and A2) A1.N-Q.A.1

2 Define appropriate quantities for the purpose of descriptive modeling. A1.N-Q.A.2

3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A1.N-Q.A.3

Algebra A1.A

A-SSE. Seeing Structure in Expressions and Equations A1.A-SSE

1 Interpret the structure of expressions. A1.A-SSE.A

1 Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients. A1.A-SSE.A.1.A

2 Use the structure of an expression to identify ways to rewrite it. For example, see $xx4 - yy4$ as $(xx2)2 - (yy2)2$, thus recognizing it as a difference of squares that can be factored as $(xx2 - yy2)(xx2 + yy2)$. A1.A-SSE.A.2

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2 Write expressions and equations in equivalent forms to solve problems. A1.A-SSE.B

1 Choose and produce an equivalent form of an expression or equation to reveal and explain properties of the quantity represented by the expression. ★ (A1 and A2) A1.A-SSE.B.3

a Factor a quadratic expression to reveal the zeros of the function it defines. A1.A-SSE.B.3.A

b Complete the square in a quadratic equation to reveal the maximum or minimum value of the function it defines. A1.A-SSE.B.3.B

c Use the properties of exponents to transform expressions for exponential functions. For example, the expression $3xx$ can be rewritten as $(1 + 2)xx$ to reveal the growth rate is 200%. A1.A-SSE.B.3.C

A-CED. Creating Equations A1.A-CED

1 Create equations that describe numbers or relationships. A1.A-CED.A

1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. A1.A-CED.A.1

2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A1.A-CED.A.2

3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. A1.A-CED.A.3

4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law $VV = IIII$ to highlight resistance RR. A1.A-CED.A.4

A-REI. Reasoning with Equations and Inequalities A1.A-REI

1 Understand solving equations as a process of reasoning and explain the reasoning. A1.A-REI.A

1 Explain each step-in solving equations as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. (A1 and A2) A1.A-REI.A.1

2 Solve rational and radical equations in one variable and give examples showing how extraneous solutions may arise. (A1 and A2) A1.A-REI.A.2

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2 Solve equations and inequalities in one variable. A1.A-REI.B

1 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. A1.A-REI.B.3

2 Solve quadratic equations in one variable. (A1 and A2) A1.A-REI.B.4

a Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(xx - pp)2 = qq$ that has the same solutions. A1.A-REI.B.4.A

b Solve quadratic equations with real solutions using any method. A1.A-REI.B.4.B

3 Solve systems of equations. A-REI.C

1 Explain how the strategy of elimination results in finding solution(s) to a system of equations. A1.A-REI.C.5

2 Solve systems of linear equations exactly and approximately. For example, with graphs, focusing on pairs of linear equations in two variables. A1.A-REI.C.6

3 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. (A1 and A2) A1.A-REI.C.7

4 Represent and solve equations and inequalities graphically. A1.A-REI.D

1 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). (A1 and A2) A1.A-REI.D.10

2 Explain why the solution(s) of a system of equations are the point(s) of intersection(s) on a coordinate plane. Find the solutions approximately. For example, using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $ff(xx)$ and/or $gg(xx)$ are quadratic, exponential, rational, absolute value functions, polynomial, exponential, and logarithmic functions. ★ (A1 and A2) A1.A-REI.D.11

3 Graph and interpret (with the use of technology) the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. (A1 and A2) A1.A-REI.D.12

Functions A1.F

F-IF. Interpreting Functions A1.F-IF

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

1 Understand 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. If ff is a function and xx is an element of its domain, then $ff(xx)$ denotes the output of ff corresponding to the input xx. The graph of ff is the graph of the equation $yy = ff(xx)$. A1.F-IF.A.1

2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. A1.F-IF.A.2

3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $ff(0) = ff(1) = 1, ff(nn + 1) = ff(nn) + ff(nn - 1)$for $nn \geq 1$. A1.F-IF.A.3

2 Interpret functions that arise in applications in terms of the context. A1.F-IF.B

1 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features may include intercepts; intervals where the function is increasing, decreasing, positive, or negative; maximum and minimum; and symmetries. ★ (A1 and A2) A1.F-IF.B.4

2 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function. A1.F-IF.B.5

3 Calculate and interpret the average rate of change of a nonlinear function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★ (A1 and A2) A1.F-IF.B.6

3 Analyze functions using different representations. A1.F-IF.C

1 Graph functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases. A1.F-IF.C.7

a Graph linear and quadratic functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases, including intercepts, maxima, and minima if they exist. ★ (A1 and A2) A1.F-IF.C.7.A

Note: b, c, and d, exist and can be found in A2.

2 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. For example, use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. (A1 and A2) A1.F-IF.C.8

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F. Building Functions A1.F-BF

1 Build a function that models a relationship between two quantities. A1.F-BF.A

1 Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context. A1.F-BF.A.1A

2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. Note: Interpret arithmetic sequences as linear functions and geometric sequences as exponential functions. ★ (A1 and A2) A1.F-BF.A.22

2 Build new functions from existing functions. A1.F-BF.B

1 Identify the effect on linear and quadratic graphs of replacing $ff(xx)$ by $ff(xx) + kk$, $kkkk(xx)$, $ff(kkkk)$, and $ff(xx + kk)$ for specific values of kk (both positive and negative); find the value of kk given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. A1.F-BF.B.3

F-LE. Linear, Quadratic, and Exponential Models ★ A1.F-LE

1 Construct and compare linear, quadratic, and exponential models and solve problems. A1.F-LE.A

1 Distinguish between situations that can be modeled with linear functions and with exponential functions. A1.F-LE.A.1

a Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. A1.F-LE.A.1.A

b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. A1.F-LE.A.1.B

c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. A1.F-LE.A.1.C

2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). (A1 and A2) A1.F-LE.A.2

3 Use graphs and tables to show that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. A1.F-LE.A.3

2 Interpret expressions for functions in terms of the situation they model. A1.F-LE.B

1 Interpret the parameters in a linear or exponential function in terms of a context. (A1 and A2) A1.F-LE.B.5

Statistics and Probability

S-ID. Interpreting Categorical and Quantitative Data A1.S-ID

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1. Summarize, represent, and interpret data on a single count or measurement variable.★ A1.S-ID.A
    1. Represent data with plots on the real number line (dot plots, histograms, and box plots) in a modeling context. ★ A1.S-ID.A.1
    2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★ A1.S-ID.A.2
    3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★ A1.S-ID.A.3
2. Summarize, represent, and interpret data on two categorical and quantitative variables.★ A1.S-ID.B
    1. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★ A1.S-ID.B.5
    2. Represent data on two quantitative variables on a scatter plot and describe how the variables are related. ★ A1.S-ID.B.6
        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, quadratic, and exponential models. A1.S-ID.B.6.A
        b. Informally assess the fit of a function by plotting and analyzing residuals. A1.S-ID.B.6.B
        c. Fit a linear function for a scatter plot that suggests a linear association. A1.S-ID.B.6.C
3. Interpret linear models.★ A1.S-ID.C
    1. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★ A1.S-ID.C.7
    2. Compute (using technology) and interpret the correlation coefficient of a linear fit. ★ A1.S-ID.C.8
    3. Distinguish between correlation and causation. ★ A1.S-ID.C.9