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The Most Comprehensive Review of Algebra I

By

Reza Nazari

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Arithmetic with Polynomials and Rational Expressions - Perform arithmetic operations on polynomials. [Linear and quadratic]
A-ARP.1 Understand 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.
Creating Equations - Create equations that describe numbers or relationships. [Linear, quadratic, and exponential (integer inputs only); for A.CED.3 linear only]
A-CED.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. A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. A-CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law $V = IR$ to highlight resistance R.
Reasoning with Equations and Inequalities - Understand solving equations as a process of reasoning and explain the reasoning. [Master linear; learn as general principle.]
A-REI.1 Explain each step in solving a simple equation 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.
Solve equations and inequalities in one variable. [Linear inequalities; literal equations that are linear in the variables being solved for; quadratics with real solutions]
A-REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. A-REI.4 Solve quadratic equations in one variable. A-REI.4.a Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. A-REI.4.b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a plus or minus bi for real numbers a and b.

Solve systems of equations. [Linear-linear and linear-quadratic]
A-REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. A-REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. A-REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
Represent and solve equations and inequalities graphically. [Linear and exponential; learn as general principle.]
A-REI.10 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). A-REI.11 Explain why the x-coordinates of the points where the graphs of the 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. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. A-REI.12 Graph 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
Functions
Interpreting Functions - Understand the concept of a function and use function notation. [Learn as general principle; focus on linear and exponential and on arithmetic and geometric sequences.]
F-IF.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 f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$. F-IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. F-IF.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 $f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1)$ for n ? 1.
Interpret functions that arise in applications in terms of the context. [Linear, exponential, and quadratic]
F-IF.4 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 include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h 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.

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

Analyze functions using different representations. [Linear, exponential, quadratic, absolute value, step, piecewise-defined]

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

F-IF.7.a Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-IF.7.b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F-IF.7.e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

F-IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.8.a 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.

F-IF.8.b Use the properties of exponents to interpret expressions for exponential functions.

F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

Building Functions - Build a function that models a relationship between two quantities. [For F.BF.1, 2, linear, exponential, and quadratic]

F-BF.1 Write a function that describes a relationship between two quantities.

F-BF.1.a Determine an explicit expression, a recursive process, or steps for calculation from a context.

F-BF.1.b Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.

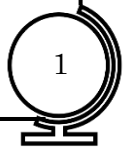
F-BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

Chapter 1: Fundamentals and Building Blocks



Math Topics that you'll learn in this Chapter:

- ✓ Adding and Subtracting Integers
- ✓ Multiplying and Dividing Integers
- ✓ Translate Phrases into an Algebraic Statement
- ✓ Order of Operations
- ✓ Integers and Absolute Value
- ✓ Proportional Ratios
- ✓ Similarity and Ratios
- ✓ Percent Problems
- ✓ Percent of Increase and Decrease
- ✓ Discount, Tax, and Tip
- ✓ Simple Interest
- ✓ The Distributive Property
- ✓ Approximating Irrational Numbers



Adding and Subtracting Integers

Solve.

1) $-(9)+15=$ ____

2) $15-(-11-9)=$ ____

3) $(-10)+(-6)=$ ____

4) $(-10)+(-6)+7=$ ____

5) $-(23)+19=$ ____

6) $(-7+5)-9=$ ____

7) $28+(-32)=$ ____

8) $(-11)+(-9)+5=$ ____

9) $25-(8-7)=$ ____

10) $-(29)+17=$ ____

11) $(-38)+(-3)+29=$ ____

12) $15-(-7+9)=$ ____

13) $24-(8-2)=$ ____

14) $(-7+4)-9=$ ____

15) $(-17)+(-3)+9=$ ____

16) $(-26)+(-7)+8=$ ____

17) $(-9)+(-11)=$ ____

18) $8-(-23-13)=$ ____

19) $(-16)+(-2)=$ ____

20) $25-(7-4)=$ ____

21) $23+(-12)=$ ____

22) $(-18)+(-6)=$ ____

23) $17-(-21-7)=$ ____

24) $-(28)-(-16)+5=$ ____

25) $(-9+4)-8=$ ____

26) $(-28)+(-6)+17=$ ____

27) $-(21)-(-15)+9=$ ____

28) $(-31)+(-6)=$ ____

29) $(-18)+(-10)+13=$ ____

30) $(-30)+(-11)+12=$ ____

31) $-(28)-(-10)+6=$ ____

32) $6-(-16-11)=$ ____

Multiplying and Dividing Integers

Solve.

1) $(-6) \times (-7) =$ _____

2) $8 \times (-5) =$ _____

3) $48 \div (-8) =$ _____

4) $(-72) \div 9 =$ _____

5) $(4) \times (-6) =$ _____

6) $(-9) \times (-11) =$ _____

7) $(10) \div (-5) =$ _____

8) $144 \div (-12) =$ _____

9) $(10) \times (-2) =$ _____

10) $(-8) \times (-2) \times 5 =$ _____

11) $(8) \div (-2) =$ _____

12) $45 \div (-15) =$ _____

13) $(5) \times (-7) =$ _____

14) $(-6) \times (-5) \times 4 =$ _____

15) $(12) \div (-6) =$ _____

16) $(14) \div (-7) =$ _____

17) $196 \div (-14) =$ _____

18) $(27 - 13) \times (-2) =$ _____

19) $125 \div (-5) =$ _____

20) $66 \div (-6) =$ _____

21) $(-6) \times (-5) \times 3 =$ _____

22) $(15 - 6) \times (-3) =$ _____

23) $(32 - 24) \div (-4) =$ _____

24) $72 \div (-6) =$ _____

25) $(-14 + 8) \times (-7) =$ _____

26) $(-3) \times (-9) \times 3 =$ _____

27) $84 \div (-12) =$ _____

28) $(-12) \times (-10) =$ _____

29) $22 \times (-3) =$ _____

30) $(-2) \times (-6) \times 5 =$ _____

31) $(24) \div (-3) =$ _____

32) $(-15) \div (3) =$ _____