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The Most Comprehensive Review of Algebra I

By

Reza Nazari

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Algebra
Seeing Structure in Expressions **A.SSE**
Interpret the structure of expressions.
MGSE9 – 12.A.SSE.1 Interpret expressions that represent a quantity in terms of its context. **MGSE9 – 12.A.SSE.1a** Interpret parts of an expression, such as terms, factors, and coefficients, in context. **MGSE9 – 12.A.SSE.1b** Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors. **MGSE9 – 12.A.SSE.2** Use the structure of an expression to rewrite it in different equivalent forms.
Write expressions in equivalent forms to solve problems.
MGSE9 – 12.A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. **MGSE9 – 12.A.SSE.3a** Factor any quadratic expression to reveal the zeros of the function defined by the expression. **MGSE9 – 12.A.SSE.3b** Complete the square in a quadratic expression to reveal the maximum and minimum value of the function defined by the expression.
Arithmetic with Polynomials and Rational Expressions **A.APR**
Perform arithmetic operations on polynomials.
MGSE9 – 12.A.APR.1 Add, subtract, and multiply polynomials; understand that polynomials form a system analogous to the integers in that they are closed under these operations.
Creating Equations **A.CED**
Create equations that describe numbers or relationships.
MGSE9 – 12.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, and exponential functions (integer inputs only). **MGSE9 – 12.A.CED.2** Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (The phrase "in two or more variables" refers to formulas like the compound interest formula, in which $A = P(1 + r/n)^{nt}$ has multiple variables.) **MGSE9 – 12.A.CED.3** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints. **MGSE9 – 12.A.CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Reasoning with Equations and Inequalities	**A. REI**
Understand solving equations as a process of reasoning and explain the reasoning.	
MGSE9 – 12. A. REI. 1 Using algebraic properties and the properties of real numbers, justify the steps of a simple, one-solution equation. Students should justify their own steps, or if given two or more steps of an equation, explain the progression from one step to the next using properties.	

Solve equations and inequalities in one variable.

MGSE9 – 12. A. REI. 3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. For example, given ax + 3 = 7, solve for x.

MGSE9 – 12. A. REI. 4 Solve quadratic equations in one variable.

MGSE9 – 12. A. REI. 4a 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 $ax^2 + bx + c = 0$.

MGSE9 – 12. A. REI. 4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation (limit to real number solutions).

Solve systems of equations.

MGSE9 – 12. A. REI. 5 Show and explain why the elimination method works to solve a system of two-variable equations.

MGSE9 – 12. A. REI. 6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

Represent and solve equations and inequalities graphically.

MGSE9 – 12. 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.

MGSE9 – 12. A. REI. 11 Using graphs, tables, or successive approximations, show that the solution to the equation $f(x) = g(x)$ is the x-value where the y-values of $f(x)$ and $g(x)$ are the same.

MGSE9 – 12. A. REI. 12 Graph the solution set to a linear inequality in two variables.

Functions

Interpreting Functions **F.IF**

Understand the concept of a function and use function notation.

MGSE9 – 12.F.IF.1 Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e., each input value maps to exactly one output value. If f is a function, and x is the input (an element of the domain), then $f(x)$ is the output (an element of the range). Graphically, the graph is $y = f(x)$.

MGSE9 – 12.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.

MGSE9 – 12.F.IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. (Generally, the scope of high school math defines this subset as the set of natural numbers $1, 2, 3, 4, \ldots$) By graphing or calculating terms, students should be able to show how the recursive sequence $a_1 = 7, a_n = a_n - 1 + 2$; the sequence $s_n = 2(n - 1) + 7$; and the function $f(x) = 2x + 5$ (when x is a natural number) all define the same sequence.

Interpret functions that arise in applications in terms of the context.

MGSE9 – 12.F.IF.4 Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

MGSE9 – 12.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

MGSE9 – 12.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.

MGSE9 – 12.F.IF.7 Graph functions expressed algebraically and show key features of the graph both by hand and by using technology.

> **MGSE9 – 12.F.IF.7a** Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).
>
> **MGSE9 – 12.F.IF.7e** Graph exponential and logarithmic functions, showing intercepts and end behavior.

MGSE9 – 12.F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

> **MGSE9 – 12.F.IF.8a** 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.

MGSE9 – 12.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

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