Alabama Mathematics

# Grade 7

Adopted 2019

## Student Mathematical Practices

1. **Make sense of problems and persevere in solving them.** MP.1
2. **Reason abstractly and quantitatively.** MP.2
3. **Construct viable arguments and critique the reasoning of others.** MP.3
4. **Model with mathematics.** MP.4
5. **Use appropriate tools strategically.** MP.5
6. **Attend to precision.** MP.6
7. **Look for and make use of structure.** MP.7
8. **Look for and express regularity in repeated reasoning.** MP.8

## Proportional Reasoning

A. **Analyze proportional relationships and use them to solve real-world and mathematical problems.** 7.RP.A

1. Calculate unit rates of length, area, and other quantities measured in like or different units that include ratios or fractions. 7.RP.A.1
2. Represent a relationship between two quantities and determine whether the two quantities are related proportionally. 7.RP.A.2
   a. Use equivalent ratios displayed in a table or in a graph of the relationship in the coordinate plane to determine whether a relationship between two quantities is proportional. 7.RP.A.2.A
   b. Identify the constant of proportionality (unit rate) and express the proportional relationship using multiple representations including tables, graphs, equations, diagrams, and verbal descriptions. 7.RP.A.2.B
   c. Explain in context the meaning of a point (x,y) on the graph of a proportional relationship, with special attention to the points (0,0) and (1, r) where r is the unit rate. 7.RP.A.2.C
3. Solve multi-step percent problems in context using proportional reasoning, including simple interest, tax, gratuities, commissions, fees, markups and markdowns, percent increase, and percent decrease. 7.RP.A.3

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## Nu Operations

**Apply and extend prior knowledge of addition, subtraction, multiplication, and division to operations with rational numbers.** 7.NS.A

4. Apply and extend knowledge of operations of whole numbers, fractions, and decimals to add, subtract, multiply, and divide rational numbers including integers, signed fractions, and decimals. 7.NS.A.4

   a. Identify and explain situations where the sum of opposite quantities is 0 and opposite quantities are defined as additive inverses. 7.NS.A.4.A

   b. Interpret the sum of two or more rational numbers, by using a number line and in real-world contexts. 7.NS.A.4.B

   c. Explain subtraction of rational numbers as addition of additive inverses. 7.NS.A.4.C

   d. Use a number line to demonstrate that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. 7.NS.A.4.D

   e. Extend strategies of multiplication to rational numbers to develop rules for multiplying signed numbers, showing that the properties of the operations are preserved. 7.NS.A.4.E

   f. Divide integers and explain that division by zero is undefined. Interpret the quotient of integers (with a non-zero divisor) as a rational number. 7.NS.A.4.F

   g. Convert a rational number to a decimal using long division, explaining that the decimal form of a rational number terminates or eventually repeats. 7.NS.A.4.G

5. Solve real-world and mathematical problems involving the four operations of rational numbers, including complex fractions. Apply properties of operations as strategies where applicable. 7.NS.A.5

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**Algebra and Functions**

**A. Create equivalent expressions using the properties of operations.** 7.AF.A

6. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. 7.AF.A.6

7. Generate expressions in equivalent forms based on context and explain how the quantities are related. 7.AF.A.7

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**B. Solve real-world and mathematical problems using numerical and algebraic expressions, equations, and inequalities.** 7.AF.B

8. Solve multi-step real-world and mathematical problems involving rational numbers (integers, signed fractions and decimals), converting between forms as needed. Assess the reasonableness of answers using mental computation and estimation strategies. 7.AF.B.8

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9. Use variables to represent quantities in real-world or mathematical problems and construct algebraic expressions, equations, and inequalities to solve problems by reasoning about the quantities. 7.AF.B.9

   a. Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. 7.AF.B.9.A

   b. Solve word problems leading to inequalities of the form px + q > r or px + q < r, where p, q, and r are specific rational numbers. Graph the solution set of the inequality, and interpret it in the context of the problem. 7.AF.B.9.B

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**Data Analysis, Statistics, and Probability**

**A. Make inferences about a population using random sampling.** 7.DSP.A

10. Examine a sample of a population to generalize information about the population. 7.DSP.A.10

    a. Differentiate between a sample and a population. 7.DSP.A.10.A

    b. Compare sampling techniques to determine whether a sample is random and thus representative of a population, explaining that random sampling tends to produce representative samples and support valid inferences. 7.DSP.A.10.B

    c. Determine whether conclusions and generalizations can be made about a population based on a sample. 7.DSP.A.10.C

    d. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest, generating multiple samples to gauge variation and making predictions or conclusions about the population. 7.DSP.A.10.D

    e. Informally explain situations in which statistical bias may exist. 7.DSP.A.10.E

**B. Make inferences from an informal comparison of two populations.** 7.DSP.B

11. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. 7.DSP.B.11

12. Make informal comparative inferences about two populations using measures of center and variability and/or mean absolute deviation in context. 7.DSP.B.12

**C. Investigate probability models.** 7.DSP.C

13. Use a number from 0 to 1 to represent the probability of a chance event occurring, explaining that larger numbers indicate greater likelihood of the event occurring, while a number near zero indicates an unlikely event. 7.DSP.C.13

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14. Define and develop a probability model, including models that may or may not be uniform, where uniform models assign equal probability to all outcomes and non-uniform models involve events that are not equally likely. 7.DSP.C.14

    a. Collect and use data to predict probabilities of events. 7.DSP.C.14.A

    b. Compare probabilities from a model to observed frequencies, explaining possible sources of discrepancy. 7.DSP.C.14.B

15. Approximate the probability of an event using data generated by a simulation (experimental probability) and compare it to the theoretical probability. 7.DSP.C.15

    a. Observe the relative frequency of an event over the long run, using simulation or technology, and use those results to predict approximate relative frequency. 7.DSP.C.15.A

16. Find probabilities of simple and compound events through experimentation or simulation and by analyzing the sample space, representing the probabilities as percents, decimals, or fractions. 7.DSP.C.16

    a. Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams, and determine the probability of an event by finding the fraction of outcomes in the sample space for which the compound event occurred. 7.DSP.C.16.A

    b. Design and use a simulation to generate frequencies for compound events. 7.DSP.C.16.B

    c. Represent events described in everyday language in terms of outcomes in the sample space which composed the event. 7.DSP.C.16.C

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**Geometry and Measurement**

**A. Construct and describe geometric figures, analyzing relationships among them.** 7.GM.A

17. Solve problems involving scale drawings of geometric figures, including computation of actual lengths and areas from a scale drawing and reproduction of a scale drawing at a different scale. 7.GM.A.17

18. Construct geometric shapes (freehand, using a ruler and a protractor, and using technology), given a written description or measurement constraints with an emphasis on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. 7.GM.A.18

19. Describe the two-dimensional figures created by slicing three-dimensional figures into plane sections. 7.GM.A.19

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**B. Solve real-world and mathematical problems involving angle measure, circumference, area, surface area, and volume.** 7.GM.B

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20. Explain the relationships among circumference, diameter, area, and radius of a circle to demonstrate understanding of formulas for the area and circumference of a circle. 7.GM.B.20

    a. Informally derive the formula for area of a circle. 7.GM.B.20.A

    b. Solve area and circumference problems in real-world and mathematical situations involving circles. 7.GM.B.20.B

21. Use facts about supplementary, complementary, vertical, and adjacent angles in multi-step problems to write and solve simple equations for an unknown angle in a figure. 7.GM.B.21

22. Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right rectangular prisms. 7.GM.B.22

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**Grade 7 Accelerated Standards**

**Proportional Reasoning**

A. Analyze proportional relationships and use them to solve real-world problems and mathematical problems. 7A.PR.A

1. Calculate unit rates of length, area, and other quantities measured in like or different units that include ratios or fractions. 7A.PR.A.1

2. Represent a relationship between two quantities and determine whether the two quantities are related proportionally. 7A.PR.A.2

    a. Use equivalent ratios displayed in a table or in a graph of the relationship in the coordinate plane to determine whether a relationship between two quantities is proportional. 7A.PR.A.2.A

    b. Identify the constant of proportionality (unit rate) and express the proportional relationship using multiple representations including tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. 7A.PR.A.2.B

    c. Explain in context the meaning of a point (x,y) on the graph of a proportional relationship, with special attention to the points (0,0) and (1, r) where r is the unit rate. 7A.PR.A.2.C

3. Solve multi-step percent problems in context using proportional reasoning, including simple interest, tax, gratuities, commissions, fees, markups and markdowns, percent increase, and percent decrease. 7A.PR.A.3

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B. Analyze the relationship between proportional and non-proportional situations. 7A.PR.B

4. Determine whether a relationship between two variables is proportional or non-proportional. 7A.PR.B.4
5. Graph proportional relationships. 7A.PR.B.5
    a. Interpret the unit rate of a proportional relationship, describing the constant of proportionality as the slope of the graph which goes through the origin and has the equation y = mx where m is the slope. 7A.PR.B.5.A
6. Interpret y = mx + b as defining a linear equation whose graph is a line with m as the slope and b as the y-intercept. 7A.PR.B.6
    a. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in a coordinate plane. 7A.PR.B.6.A
    b. Given two distinct points in a coordinate plane, find the slope of the line containing the two points and explain why it will be the same for any two distinct points on the line. 7A.PR.B.6.B
    c. Graph linear relationships, interpreting the slope as the rate of change of the graph and the y-intercept as the initial value. 7A.PR.B.6.C
    d. Given that the slopes for two different sets of points are equal, demonstrate that the linear equations that include those two sets of points may have different y-intercepts. 7A.PR.B.6.D
7. Compare proportional and non-proportional linear relationships represented in different ways (algebraically, graphically, numerically in tables, or by verbal descriptions) to solve real-world problems. 7A.PR.B.7

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**Number Systems and Operations**

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A. Apply and extend prior knowledge of addition, subtraction, multiplication, and division to operations with rational numbers. 7A.NS.A

8. Apply and extend knowledge of operations of whole numbers, fractions, and decimals to add, subtract, multiply, and divide rational numbers including integers, signed fractions, and decimals. 7A.NS.A.8

a. Identify and explain situations where the sum of opposite quantities is 0 and opposite quantities are defined as additive inverses. 7A.NS.A.8.A

b. Interpret the sum of two or more rational numbers, by using a number line and in real-world contexts. 7A.NS.A.8.B

c. Explain subtraction of rational numbers as addition of additive inverses. 7A.NS.A.8.C

d. Use a number line to demonstrate that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. 7A.NS.A.8.D

e. Extend strategies of multiplication to rational numbers to develop rules for multiplying signed numbers, showing that the properties of the operations are preserved. 7A.NS.A.8.E

f. Divide integers and explain that division by zero is undefined. Interpret the quotient of integers (with a non-zero divisor) as a rational number. 7A.NS.A.8.F

g. Convert a rational number to a decimal using long division, explaining that the decimal form of a rational number terminates or eventually repeats. 7A.NS.A.8.G

9. Solve real-world and mathematical problems involving the four operations of rational numbers, including complex fractions. Apply properties of operations as strategies where applicable. 7A.NS.A.9

B. Understand that the real number system is composed of rational and irrational numbers. 7A.NS.B

10. Define the real number system as composed of rational and irrational numbers. 7A.NS.B.10

a. Explain that every number has a decimal expansion; for rational numbers, the decimal expansion repeats in a pattern or terminates. 7A.NS.B.10.A

b. Convert a decimal expansion that repeats in a pattern into a rational number. 7A.NS.B.10.B

11. Locate rational approximations of irrational numbers on a number line, compare their sizes, and estimate the values of irrational numbers. 7A.NS.B.11

**Algebra and Functions**

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A. Create equivalent expressions using the properties of operations. 7A.AF.A

12. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. 7A.AF.A.12

13. Generate expressions in equivalent forms based on context and explain how the quantities are related. 7A.AF.A.13

B. Apply concepts of rational and integer exponents 7A.AF.B

14. Develop and apply properties of integer exponents to generate equivalent numerical and algebraic expressions. 7A.AF.B.14

15. Use square root and cube root symbols to represent solutions to equations. 7A.AF.B.15

    a. Evaluate square roots of perfect squares (less than or equal to 225) and cube roots of perfect cubes (less than or equal to 1000). 7A.AF.B.15.A

    b. Explain that the square root of a non-perfect square is irrational. 7A.AF.B.15.B

16. Express and compare very large or very small numbers in scientific notation. 7A.AF.B.16

    a. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used, expressing answers in scientific notation. 7A.AF.B.16.A

    b. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. 7A.AF.B.16.B

    c. Interpret scientific notation that has been generated by technology. 7A.AF.B.16.C

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C. Solve real-world and mathematical problems using numerical and algebraic expressions, equations, and inequalities. 7A.AF.C

17. Solve multi-step real-world and mathematical problems involving rational numbers (integers, signed fractions, and decimals), converting between forms as needed. Assess the reasonableness of answers using mental computation and estimation strategies. 7A.AF.C.17

18. Use variables to represent quantities in a real-world or mathematical problem and construct algebraic expressions, equations, and inequalities to solve problems by reasoning about the quantities. 7A.AF.C.18

    a. Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. 7A.AF.C.18.A

    b. Solve word problems leading to inequalities of the form px + q > r or px + q < r, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. 7A.AF.C.18.B

19. Create equations in two variables to represent relationships between quantities in context; graph equations on coordinate axes with labels and scales and use them to make predictions. Limit to contexts arising from linear functions. 7A.AF.C.19

20. Represent constraints by equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. Limit to contexts arising from linear. 7A.AF.C.20

21. Solve multi-step linear equations in one variable, including rational number coefficients, and equations that require using the distributive property and combining like terms. 7A.AF.C.21

    a. Determine whether linear equations in one variable have one solution, no solution, or infinitely many solutions of the form x = a, a = a, or a = b (where a and b are different numbers). 7A.AF.C.21.A

    b. Represent and solve real-world and mathematical problems with equations and interpret each solution in the context of the problem. 7A.AF.C.21.B

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D. Explain, evaluate, and compare functions. 7A.AF.D

22. Identify the effect on the graph of replacing f(x) by f(x) + k, k · f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and explain the effects on the graph using technology, where appropriate. Limit to linear functions. 7A.AF.D.22

23. Construct a function to model the linear relationship between two variables. 7A.AF.D.23

    a. Interpret the rate of change (slope) and initial value of the linear function from a description of a relationship from two points in a table or graph. 7A.AF.D.23.A

24. 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). Limit to linear equations. 7A.AF.D.24

25. Find approximate solutions by graphing the functions, making tables of values, or finding successive approximations, using technology where appropriate. 7A.AF.D.25

**Data Analysis, Statistics, and Probability**

A. Make inferences about a population using random sampling. 7A.DSP.A

26. Examine a sample of a population to generalize information about the population. 7A.DSP.A.26

    a. Differentiate between a sample and a population. 7A.DSP.A.26.A

    b. Compare sampling techniques to determine whether a sample is random and thus representative of a population, explaining that random sampling tends to produce representative samples and support valid inferences. 7A.DSP.A.26.B

    c. Determine whether conclusions and generalizations can be made about a population based on a sample. 7A.DSP.A.26.C

    d. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest, generating multiple samples to gauge variation and make predictions or conclusions about the population. 7A.DSP.A.26.D

    e. Informally explain situations in which statistical bias may exist. 7A.DSP.A.26.E

B. Make inferences from an informal comparison of two populations. 7A.DSP.B

27. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. 7A.DSP.B.27

28. Make informal comparative inferences about two populations using measures of center and variability and/or mean absolute deviation in context. 7A.DSP.B.28

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C. Investigate probability models. 7A.DSP.C

29. Use a number between 0 and 1 to represent the probability of a chance event occurring, explaining that larger numbers indicate greater likelihood of the event occurring, while a number near zero indicates an unlikely event. 7A.DSP.C.29

30. Define and develop a probability model, including models that may or may not be uniform, where uniform models assign equal probability to all outcomes and non-uniform models involve events that are not equally likely. 7A.DSP.C.30

    a. Collect and use data to predict probabilities of events. 7A.DSP.C.30.A

    b. Compare probabilities from a model to observe frequencies, explaining possible sources of discrepancy. 7A.DSP.C.30.B

31. Approximate the probability of an event by using data generated by a simulation (experimental probability) and compare it to theoretical probability. 7A.DSP.C.31

    a. Observe the relative frequency of an event over the long run, using simulation or technology, and use those results to predict approximate relative frequency. 7A.DSP.C.31.A

32. Find probabilities of simple and compound events through experimentation or simulation and by analyzing the sample space, representing the probabilities as percents, decimals, or fractions. 7A.DSP.C.32

    a. Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams, and determine the probability of an event by finding the fraction of outcomes in the sample space for which the compound event occurred. 7A.DSP.C.32.A

    b. Design and use a simulation to generate frequencies for compound events. 7A.DSP.C.32.B

    c. Represent events described in everyday language in terms of outcomes in the sample space which composed the event. 7A.DSP.C.32.C

**Geometry and Measurement**

A. Construct and describe geometrical figures, analyzing relationships among them. 7A.GM.A

33. Solve problems involving scale drawings of geometric figures including computation of actual lengths and areas from a scale drawing and reproduction of a scale drawing at a different scale. 7A.GM.A.33

34. Construct geometric shapes (freehand, using a ruler and a protractor, and using technology) given measurement constraints with an emphasis on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. 7A.GM.A.34

35. Describe the two-dimensional figures created by slicing three-dimensional figures into plane sections 7A.GM.A.35

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B. Solve real-world and mathematical problems involving angle measure, area, surface area, and volume. 7A.GM.B

36. Explain the relationships among circumference, diameter, area, and radius of a circle to demonstrate understanding of formulas for the area and circumference of a circle. 7A.GM.B.36

    a. Informally derive the formula for area of a circle. 7A.GM.B.36.A

    b. Solve area and circumference problems in real-world and mathematical situations involving circles. 7A.GM.B.36.B

37. Use facts about supplementary, complementary, vertical, and adjacent angles in multi-step problems to write and solve simple equations for an unknown angle in a figure. 7A.GM.B.37

38. Analyze and apply properties of parallel lines cut by a transversal to determine missing angle measures. 7A.GM.B.38

    a. Use informal arguments to establish that the sum of the interior angles of a triangle is 180 degrees. 7A.GM.B.38.A

39. Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right rectangular prisms. 7A.GM.B.39

40. Informally derive the formulas for the volume of cones and spheres by experimentally comparing the volumes of cones and spheres with the same radius and height to a cylinder with the same dimensions. 7A.GM.B.40

41. Use formulas to calculate the volumes of three-dimensional figures to solve real-world problems. 7A.GM.B.41

C. Understand congruence and similarity using physical models or technology. 7A.GM.C

42. Verify experimentally the properties of rigid motions (rotations, reflections, and translations): lines are taken to lines, and line segments are taken to line segments of the same length; angles are taken to angles of the same measure; and parallel lines are taken to parallel lines. 7A.GM.C.42

    a. Given a pair of two-dimensional figures, determine if a series of rigid motions maps one figure onto the other, recognizing that if such a sequence exists the figures are congruent; describe the transformation sequence that verifies a congruence relationship. 7A.GM.C.42.A

43. Use coordinates to describe the effect of transformations (dilations, translations, rotations, and reflections) on two-dimensional figures. 7A.GM.C.43

44. Given a pair of two-dimensional figures, determine if a series of dilations and rigid motions maps one figure onto the other, recognizing that if such a sequence exists the figures are similar; describe the transformation sequence that exhibits the similarity between them. 7A.GM.C.44