Iowa Mathematics

# Grade 5

## Operations and Algebraic Thinking 5.OA

**1 Write and interpret numerical expressions.** 5.OA.A

1. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols, including expressions in which whole numbers and fractions appear. 5.OA.A.1
2. Write simple expressions that record calculations with numbers and interpret numerical expressions without evaluating them. For example, express the calculation "add 8 and 7, then multiply by 1 2 as 1 2 × (8 + 7). Recognize that 3 × ( 18 19 + 2 3 ) is three times as large as 18 19 +2 3 , without having to calculate the indicated sum or product. 5.OA.A.2

**2 Analyze a pair of number sequences.** 5.OA.B

1. Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns and graph the ordered pairs on a coordinate plane; explain informally why this is so. For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. 5.OA.B.3

## Numbers and Operations in Base Ten 5.NBT

**1 Understand the place value system.** 5.NBT.A

1. Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1 10 of what it represents in the place to its left. 5.NBT.A.1
2. Explain and use patterns in the number of zeros of the product when multiplying a number by powers of 10 and use patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. 5.NBT.A.2
3. Read, write, and compare decimals to thousandths. 5.NBT.A.3
   a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form. For example, 347.392 = 300 + 40 + 7 + 0.3 + 0.09 + 0.002. 5.NBT.A.3.A
   b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons. 5.NBT.A.3.B

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4 Use place value understanding to round decimals to any place. For example, 5.43 rounded to the tenths is 5.4 because the last digit must be in the place the decimal is rounded to. Note: 5.40 would not be correct as it is rounded to the hundredths, not tenths. 5.NBT.A.4

**2 Perform operations with multi-digit whole numbers and with decimals to hundredths.** 5.NBT.B

1 Fluently multiply whole multi-digit numbers including using an algorithm. Algorithms may include the standard algorithm, partial products, area model. Note: Fluency of this standard is critical by the end of grade level. 5.NBT.B.5

2 Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division, including the standard algorithm. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. 5.NBT.B.6

3 Add, subtract, multiply, and divide decimals to hundredths. Be able to illustrate and explain using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. 5.NBT.B.7

**Number and Operations–Fractions** 5.NF

**1 Use equivalent fractions as a strategy to add and subtract fractions.** 5.NF.A

1 Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example, 2 3 + 5 4 = 8 12 + 15 12 = 23 12. (In general, $aa\ bb + cc\ dd = (aaaa + bbbb)\ bbbb$ ). 5.NF.A.1

2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators. For example, by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. For example, my friend and I each have some lemons. We need 1 cup of lemon juice to make lemonade. If I squeeze 1 2 cup of lemon juice and my friend squeezes 2 5 a cup of lemon juice how much lemon juice do we have? Is it enough? 5.NF.A.2

**2 Apply and extend previous understandings of multiplication and division to multiply and divide fractions.** 5.NF.B

1 Interpret that a fraction is the division of the numerator by the denominator ($aa\ bb = aa \div bb$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, by using visual fraction models or equations to represent the problem. For example, if 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie? 5.NF.B.3

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2 Apply and extend earlier understandings of multiplication to multiply a fraction or whole number by a fraction. (This standard does not include mixed numbers) 5.NF.B.4

   a Interpret the product $(aa\ bb) \times qq$ as a part of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $aa \times qq \div bb$. Recognize that $1\ bb \times qq = qq \div bb$ (dividing by a whole is the same as multiplying by the reciprocal. For example, use a visual fraction model to show $(2\ 3) \times 4 = 8\ 3$, and create a story context for this equation. Do the same with $(2\ 3) \times (4\ 5) = 8\ 15$. (In general, $(aa\ bb) \times (cc\ dd) = aaaa\ bbbb$.) 5.NF.B.4.A

   b Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles and represent fraction products as rectangular areas. 5.NF.B.4.B

3 Interpret multiplication as scaling (resizing) by: 5.NF.B.5

   a Comparing the size of a product to the size of one factor based on the size of the other factor, without performing the indicated multiplication. 5.NF.B.5.A

   b Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence $aa\ bb = nn{\times}aa\ nn{\times}bb$ to the effect of multiplying $aa\ bb$ by 1. 5.NF.B.5.B

4 Solve real world problems involving multiplication of fractions and mixed numbers. For example, by using visual fraction models or equations to represent the problem. 5.NF.B.6

5 Apply and extend earlier understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (This standard does not include dividing fractions by fractions). 5.NF.B.7

   a Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. For example, create a story context for $(1\ 3) \div 4$, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that $(1\ 3) \div 4 = 1\ 12$ because $(1\ 12) \times 4 = 1\ 3$. 5.NF.B.7.A

   b Interpret division of a whole number by a unit fraction and compute such quotients. For example, create a story context for $4 \div (1\ 5)$, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that $4 \div (1\ 5) = 20$ because $20 \times (1\ 5) = 4$. 5.NF.B.7.B

   c Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions. For example, by using visual fraction models and equations to represent the problem: how much chocolate will each person get if 3 people share 1 2 lb of chocolate equally? How many 1 3 cup servings are in 2 cups of raisins? 5.NF.B.7.C

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## Measurement and Data 5.MD

1. **Convert like measurement units within a given measurement system.** 5.MD.A
   1. Convert among different-sized standard measurement units within a given measurement system and use these conversions in solving multi-step, real world problems. For example, (convert 5 cm to 0.05 m). 5.MD.A.1

2. **Represent and interpret data.** 5.MD.B
   1. Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}, \frac{1}{4}, \frac{1}{8}$). Use operations on fractions to solve problems involving information presented in line plots. 5.MD.B.2
      a. $\frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \frac{4}{8}, \frac{5}{8}, \frac{6}{8}, \frac{7}{8}, \frac{8}{8}$ 5.MD.B.2.A
      b. $\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{4}{4}$ 5.MD.B.2.B
      c. $\frac{1}{2}, \frac{2}{2}$ 5.MD.B.2.C

3. **Geometric measurement: understand concepts of volume and relate volume to multiplication and addition.** 5.MD.C
   1. Recognize volume as an attribute of solid figures and understand concepts of volume measurement. 5.MD.C.3
      a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume. 5.MD.C.3.A
      b. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units. 5.MD.C.3.B
   2. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. 5.MD.C.4
   3. Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume. 5.MD.C.5
      a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes and show that the volume is the same as would be if found by multiplying the edge lengths or equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes to represent the associative property of multiplication. 5.MD.C.5.A
      b. Apply the formulas $V = l \times w \times h$ and $V = B \times h$ (where $B$ stands for the area of the base) for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems. 5.MD.C.5.B
      c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts (composite figures), applying this technique to solve real world problems. For example, find the volume of composite figures. 5.MD.C.5.C

## Geometry 5.G

1. **Graph points on the coordinate plane to solve real-world and mathematical problems.** 5.G.A

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1. Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Plot points in the first quadrant of a coordinate plane. Understand that the first number indicates how far to travel from the origin in the direction of the x-axis, and the second number indicates how far to travel in the direction of the yaxis, with the convention that the names of the two axes and the coordinates correspond $(xx, yy)$. 5.G.A.1
2. Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane and interpret coordinate values of points in the context of the situation. 5.G.A.2

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**2 Classify two-dimensional figures into categories based on their properties.** 5.G.B

1. Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles. 5.G.B.3
2. Classify two-dimensional figures in a hierarchy based on properties. 5.G.B.4