Mathematics

Grade 6

Maryland College and Career Ready Curriculum Framework, 2017

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Introduction

These Standards define what students should understand and be able to do in their study of mathematics. Asking a student to understand something means asking a teacher to assess whether the student has understood it. But what does mathematical understanding look like? One hallmark of mathematical understanding is the ability to justify, in a way appropriate to the student's mathematical maturity, *why* a particular mathematical statement is true or where a mathematical rule comes from. There is a world of difference between a student who can summon a mnemonic device to expand a product such as $(a+b)(x+y)$ and a student who can explain where the mnemonic comes from. The student who can explain the rule understands the mathematics, and may have a better chance to succeed at a less familiar task such as expanding $(a+b+c)(x+y)$. Mathematical understanding and procedural skill are equally important, and both are assessable using mathematical tasks of sufficient richness.

The Standards set grade-specific standards but do not define the intervention methods or materials necessary to support students who are well below or well above grade-level expectations. It is also beyond the scope of the Standards to define the full range of supports appropriate for English language learners and for students with special needs. At the same time, all students must have the opportunity to learn and meet the same high standards if they are to access the knowledge and skills necessary in their post-school lives. The Standards should be read as allowing for the widest possible range of students to participate fully from the outset, along with appropriate accommodations to ensure maximum participation of students with special education needs. For example, for students with disabilities reading should allow for use of Braille, screen reader technology, or other assistive devices, while writing should include the use of a scribe, computer, or speech-to-text technology. In a similar vein, speaking and listening should be interpreted broadly to include sign language. No set of grade-specific standards can fully reflect the great variety in abilities, needs, learning rates, and achievement levels of

students in any given classroom. However, the Standards do provide clear signposts along the way to the goal of college and career readiness for all students.

How to Read the Maryland Common Core Curriculum Framework for Grade 6

This framework document provides an overview of the standards that are grouped together to form the domains of study for Grade 6 mathematics. The standards within each domain are grouped by clusters and are in the same order as they appear in the Common Core State Standards for Mathematics. This document is not intended to convey the exact order in which the standards within a domain will be taught nor the length of time to devote to the study of the unit.

The framework contains the following:

- **Domains** are intended to convey coherent groupings of content.
- **Clusters** are groups of related standards.
- **Standards** define what students should understand and be able to do.
- **Essential Skills and Knowledge** Statements provide language to help teachers develop common understandings and valuable insights into what a student must know and be able to do to demonstrate proficiency with each standard. Maryland mathematics educators thoroughly reviewed the standards and, as needed, provided statements to help teachers comprehend the full intent of each standard. The wording of some standards is so clear, however, that only partial support or no additional support seems necessary.
- **Framework Vocabulary Words** provide definitions of key mathematics vocabulary words found in the document

Standards for Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council’s report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy).

1. Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2. Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3. Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4. Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website,

and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to Precision

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers *x* and *y*.

8. Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1)$ equals 3. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x-1)(x^2 + x + 1)$ and $(x-1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the Process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Connecting the Standards for Mathematical Practice to the Standards for Mathematical Content

The Standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years. Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to mathematical content in mathematics instruction. The Standards for Mathematical Content are a balanced combination of procedure and understanding. Expectations that begin with the word "understand" are often especially good opportunities to connect the practices to the content. Students who lack understanding of a topic may rely on procedures too heavily. Without a flexible base from which to work, they may be less likely to consider analogous problems, represent problems coherently, justify conclusions, apply the mathematics to practical situations, use technology mindfully to work with the mathematics, explain the mathematics accurately to other students, step back for an overview, or deviate from a known procedure to find a shortcut. In short, a lack of understanding effectively prevents a student from engaging in the mathematical practices. In this respect, those content standards which set an expectation of understanding are potential "points of intersection" between the Standards for Mathematical Content and the Standards for Mathematical Practice. These points of intersection are intended to be weighted toward central and generative concepts in the school mathematics curriculum that most merit the time, resources, innovative energies, and focus necessary to qualitatively improve the curriculum, instruction, assessment, professional development, and student achievement in mathematics.

Codes for Common Core State Standards: Mathematics Grades K – 12

Elementary Grades

Domain Code	Domain Name	Applicable Grades
CC	Counting & Cardinality	K
EE	Expressions & Equations	6, 7, 8
F	Functions	8
G	Geometry	K, 1, 2, 3, 4, 5, 6, 7, 8
MD	Measurement & Data	K, 1, 2, 3, 4, 5
NBT	Number & Operations (Base Ten)	K, 1, 2, 3, 4, 5
NF	Number & Operations (Fractions)	3, 4, 5
NS	Number System	6, 7, 8
OA	Operations & Algebraic Thinking	K, 1, 2, 3, 4, 5
RP	Ratios & Proportional Relationship	6, 7
SP	Statistics & Probability	6, 7, 8

High School

Conceptual Category: Number & Quantity (N)

Domain Code	Domain Name	Applicable Grades
N-CN	Complex Number System	Not determined
N-Q	Quantities	Not determined
N-RN	Real Number System	8–12
N-VM	Vector & Matrix Quantities	Not determined

Conceptual Category: Algebra (A)

Domain Code	Domain Name	Applicable Grades
A-APR	Arithmetic with Polynomial & Rational Expressions	8–12
A-CED	Creating Equations	8–12
A-REI	Reasoning with Equations & Inequalities	8–12
A-SSE	Seeing Structure in Expressions	8–12

Conceptual Category: Functions (F)

Domain Code	Domain Name	Applicable Grades
F-BF	Building Functions	8–12
F-IF	Interpreting Functions	8–12
F-LE	Linear, Quadratic & Exponential Models	8–12
F-TF	Trigonometric Functions	Not determined

Conceptual Category: Geometry (G)

Domain Code	Domain Name	Applicable Grades
G-C	Circles	Not determined
G-CO	Congruence	Not determined
G-GMD	Geometric Measurement & Dimension	Not determined
G-MG	Modeling with Geometry	Not determined
G-GPE	Expressing Geometric Properties with Equations	Not determined
G-SRT	Similarity, Right Triangles & Trigonometry	Not determined

Conceptual Category: Statistics & Probability (S)

Domain Code	Domain Name	Applicable Grades
S-ID	Interpreting Categorical & Quantitative Data	8–12
S-IC	Making Inferences & Justifying Conclusions	Not determined
S-CP	Conditional Probability & Rules of Probability	Not determined
S-MD	Using Probability to Make Decisions	Not determined

Domain: Ratios and Proportional Relationships (RP)

Cluster: Understand ratio concepts and use ratio reasoning to solve problems.

Standard(s): 6.RP.1

Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*

Assessment Clarifications and Emphases

i. Expectations for ratios are limited to ratios of non-complex fractions.

ii. The initial numerator and denominator should be whole numbers.

Essential Skills and Knowledge

- Knowledge of ratio as a comparison of any two quantities
- Knowledge of a ratio is not always a comparison of part-to-whole; Can be part-to-part or whole-to-whole

Standard(s): 6.RP.2

Understand the concept of a unit rate $\frac{a}{b}$ associated with a ratio $a:b$ with $b \neq 0$ (b not equal to zero), and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is* $\frac{3}{4}$ *cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*

Assessment Clarifications and Emphases

i. Expectations for unit rates in this grade are limited to non-complex fractions.

ii. The initial numerator and denominator should be whole numbers.

Essential Skills and Knowledge

- Knowledge that a unit rate emphasizes finding an equivalent ratio with a denominator of 1.

Standard(s): 6.RP.3

Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

Assessment Clarifications and Emphases

i. Expectations for ratios in this grade are limited to ratios of non-complex fractions.

ii. The initial numerator and denominator should be whole numbers.

Essential Skills and Knowledge

- Knowledge of multiplicative recursive patterns
- Ability to use multiplicative relationships to extend an initial ratio to equivalent ratios; When working backward, use the inverse operation (division).
- Ability to recognize a linear relationship appears when the pairs are plotted on the coordinate plane

b. Solve unit rate problems including those involving unit pricing and constant speed. For example, If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

Assessment Clarifications and Emphases

i. Expectations for unit rates in this grade are limited to non-complex fractions.

ii. The initial numerator and denominator should be whole numbers.

Essential Skills and Knowledge

- Ability to use division to determine unit rate

c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means $\frac{30}{100}$ times the quantity); solve problems involving finding the whole given a part and the percent.

Assessment Clarifications and Emphases

i. Tasks may or may not contain context.
ii. Expectations for ratios in this grade are limited to ratios of non-complex fractions.
iii. The initial numerator and denominator should be whole numbers.

Essential Skills and Knowledge

- Ability to introduce percent as a special rate where a part is compared to a whole and the whole always has a value of 100
- Ability to solve problems using equivalent ratios. (NOTE: Proportions are not introduced until Grade 7.) This is developing proportional reasoning without formal proportions.

d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Assessment Clarifications and Emphases

i. Tasks may or may not contain context.
ii. Tasks require students to multiply and/or divide dimensioned quantities.
iii. Half of the tasks require students to correctly express the units of the result.
iv. Expectations for ratios in this grade are limited to ratios of non-complex fractions.
v. The initial numerator and denominator should be whole numbers.

Essential Skills and Knowledge

- Ability to expand ratio reasoning to units of measurement

Domain: The Number System (NS)

Cluster: Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

Standard(s): 6.NS.1

Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for* $\left(\frac{2}{3}\right)\div\left(\frac{3}{4}\right)$ *and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that* $\left(\frac{2}{3}\right)\div\left(\frac{3}{4}\right)=\frac{8}{9}$ *because* $\frac{3}{4}$ *of* $\frac{8}{9}$ *is* $\frac{2}{3}$. (In general, $\left(\frac{a}{b}\right)\div\left(\frac{c}{d}\right)=\frac{ad}{bc}$). *How much chocolate will each person get if 3 people share* $\frac{1}{2}$ *lb of chocolate equally? How many* $\frac{3}{4}$*-cup servings are in* $\frac{2}{3}$ *of a cup of yogurt? How wide is a rectangular strip of land with length* $\frac{3}{4}$ *mi and area* $\frac{1}{2}$ *square mi?*

Assessment Clarifications and Emphases

i. Only the answer is required.

ii. Note that italicized examples correspond to three meanings/uses of division: (1) equal sharing; (2) measurement; (3) unknown factor. These meanings/uses of division should be sampled equally.

iii. Tasks may involve fractions and mixed numbers but not decimals.

Essential Skills and Knowledge

- Ability to explore the concept that division breaks quantities into groups
- Ability to emphasize that when dividing by a value that is less than one, the quotient is greater than the dividend
- Ability to explore both the measurement concept and the partition concept of division of fractions

- Ability to introduce the fact that the measurement concept uses repeated subtraction or equal groups.
- Ability to explore the common denominator algorithm as a method of repeated subtraction.
- Knowledge of partition concept focuses on “How much is one?”
- Knowledge of algorithm $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$ (invert and multiply) is an extension of the partition concept.

Cluster: Compute fluently with multi-digit numbers and find common factors and multiples.

Standard(s): 6.NS.2

Fluently divide multi-digit numbers using the standard algorithm.

Assessment Clarifications and Emphases

i. The given dividend and divisor require an efficient/standard algorithm (e.g., $40584 \div 76$).
ii. Tasks do not have a context.
iii. Only the answer is required.
iv. Tasks have a maximum of five-digit dividends and a maximum of two-digit divisors.
v. Tasks may or may not have a remainder. Students understand that remainders can be written as fractions or decimals.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

Standard(s):6.NS.3

Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Assessment Clarifications and Emphases

i. Tasks do not have a context.

ii. Only one operation is required.

iii. The given addends require an efficient/standard algorithm (e.g., $72.63 + 4.875$).

iv. The given subtrahend and minuend require an efficient/standard algorithm (e.g., $177.3 - 72.635$).

v. The given factors require an efficient/standard algorithm (e.g., 72.3×4.8).

vi. The given dividend and divisor require an efficient/standard algorithm (e.g., $177.3 \div 0.36$).

vii. Each addend is greater than or equal to 0.001 and less than or equal to 99.999.

viii. The subtrahend and minuend are each greater than or equal to 0.001 and less than or equal to 99.999. Positive differences only.

ix. For purposes of assessment with multiplication, the possibilities are 1-digit $\times$ 2-digit, 1-digit $\times$ 3- digit, 2-digit $\times$ 3-digit, 2-digit $\times$ 4-digit, or 2-digit $\times$ 5-digit.

x. For division, tasks are either 4-digit ÷ 2-digit or 3-digit ÷ 3-digit. (For example, $14.28 \div 0.68$ or $2.39 \div 0.684$).

xi. Every quotient is a whole number or a decimal terminating at the tenths, hundredths, or thousandths place

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

Standard(s):6.NS.4

Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express $36 + 8$ as $4(9 + 2)$.

Assessment Clarifications and Emphases

i. Tasks do not have a context.

ii. Tasks require writing or finding the equivalent expression with the greatest common factor.

Essential Skills and Knowledge

- Ability to build on student knowledge of and differentiate between factors and multiples (CC.4.OA4)
- Ability to build on student knowledge of factor pairs of whole numbers (CC.4.OA4)
- Ability to identify and differentiate between common factors and common multiples of 2 whole numbers

Cluster: Apply and extend previous understandings of numbers to the system of rational numbers.

Standard(s): 6.NS.5

Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, debits/credits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

Assessment Clarifications and Emphases

i. Tasks do not require students to perform any computations.

ii. Students may be asked to recognize the meaning of 0 in the situation, but will not be asked to explain.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

Standard(s): 6.NS.6

Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite.

Assessment Clarifications and Emphases

i. Tasks have "thin context" or no content.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.

Assessment Clarifications and Emphases

i. Tasks have "thin context" or no content.

ii. Students need not recognize or use traditional notation for quadrants (such as I, II, III, IV).

iii. Coordinates are not limited to integers.

Essential Skills and Knowledge

- Ability to introduce and define coordinate plane terminology, including coordinate plane and quadrants I, II, III, and IV

c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

Assessment Clarifications and Emphases

i. Tasks have "thin context" or no content.

ii. Students need not recognize or use traditional notation for quadrants (such as I, II, III, IV).

iii. Coordinates are not limited to integers.

Essential Skills and Knowledge

- Ability to include positive and negative fractions and decimals
- Ability to introduce a scale on number lines and axes for rational numbers

Standard(s): 6.NS.7

Understand ordering and absolute value of rational numbers.

a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret $-3 > -7$ as a statement that –3 is located to the right of –7 on a number line oriented from left to right.

Assessment Clarifications and Emphases

i. Tasks do not have a context.

ii. Tasks are not limited to integers.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. For example, write $-3°\ C > -7°\ C$ to express the fact that –3°C is warmer than –7°C.

Assessment Clarifications and Emphases

i. Tasks are not limited to integers.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of –30 dollars, write $|-30| = 30$ to describe the size of the debt in dollars.

Assessment Clarifications and Emphases

i. Tasks may or may not have context.

ii. Tasks are not limited to integers.

Essential Skills and Knowledge

- Ability to develop conceptual understanding to go beyond “absolute value always is positive”.
- Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.
- Ability to develop understanding within real-world contexts.

d. Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.

Assessment Clarifications and Emphases

i. Tasks may or may not have context.
ii. Tasks are not limited to integers.
iii. Prompts do not present students with a number line diagram, but students may draw a number line diagram as a strategy

Essential Skills and Knowledge

- Ability to develop understanding within real-world contexts

Standard(s): 6.NS.8

Solve real-world and mathematical problems by graphing points in all 4 quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with same first coordinate or same second coordinate.

Assessment Clarifications and Emphases

i. Tasks may or may not have context.
ii. Finding distances is limited to points with integer coordinates.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

Domain: Expressions and Equations (EE)

Cluster: Apply and extend previous understandings of arithmetic to algebraic expressions.

Standard(s): 6.EE.1

Write and evaluate numerical expressions involving whole-number exponents.

Assessment Clarifications and Emphases

- **i.** Tasks involve expressing *b*-fold products $a \bullet a \bullet a \bullet ... \bullet a$ in the form $a \bullet b$, where *a* and *b* are non-zero whole numbers
- **ii.** Tasks do not require use of the laws of exponents
- **iii.** Tasks may involve simple fractions raised to small whole-number powers, e.g. $\left(\frac{1}{2}\right)^3, \left(\frac{2}{3}\right)^2$.
- **iv.** Tasks may involve nonnegative decimals raised to whole-number powers.
- **v.** Tasks may or may not have a context.

Essential Skills and Knowledge

- Ability to develop understanding of a whole-number exponent as shorthand for repeated multiplication of a number times itself
- Ability to introduce squares and cubes first because they can be represented geometrically
- Ability to extend understanding of order of operations to include exponents

Standard(s): 6.EE.2

Write, read, and evaluate expressions in which letters stand for numbers.

- **a.** Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation "*Subtract y from 5*" *as* $5 - y$.

Assessment Clarifications and Emphases

- **i.** Tasks do not have a context.

ii. Numerical values in these expressions may include whole numbers, fractions, and decimals.

Essential Skills and Knowledge

- Ability to define what a variable is
- Knowledge that there are multiple ways to read the same expression

b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression* $2(8+7)$ *as a product of two factors; view* $(8+7)$ *as both a single entity and a sum of two terms.*

Assessment Clarifications and Emphases

i. Tasks do not have a context.

ii. Numerical values in these expressions may include whole numbers, fractions, and decimals.

Essential Skills and Knowledge

- Ability to introduce and define coefficient and term
- Ability to read expressions aloud to explore the concept of quantities

c. Evaluate expressions at specific values for their variables. Include expressions that arise from formulas in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = \frac{1}{2}$.

Assessment Clarifications and Emphases

i. Tasks have “thin context” or no context.

ii. Numerical values in these expressions may include whole numbers, fractions, and decimals.

iii. Task will not require operations on negative numbers.

iv. Tasks are simple applications of formulas that are provided in the prompt.

v. Tasks do not require the student to manipulate the formula or isolate variables to solve an equation.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

Standard(s): 6.EE.3

Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression $3(2+x)$ to produce the equivalent expression $6+3x$; apply the distributive property to the expression $24x+18y$ to produce the equivalent expression $6(4x+3y)$; apply properties of operations to $y+y+y$ to produce the equivalent expression $3y$

Essential Skills and Knowledge

- Ability to use properties of operations to simplify expressions, therefore producing equivalent expressions

Standard(s): 6.EE.4

Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions* $y+y+y$ *and* $3y$ *are equivalent because they name the same number regardless of which number y stands for.*

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

Cluster: Reason about and solve one-variable equations and inequalities.

Standard(s): 6.EE.5

Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true

Assessment Clarifications and Emphases

i. Most of tasks involve values from an infinite set of nonnegative numbers (e.g., even numbers; whole numbers; fractions). Some tasks involve values from a finite set of nonnegative numbers (e.g., {2, 5, 7, 9}).

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

Standard(s): 6.EE.6

Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

Assessment Clarifications and Emphases

i. Tasks may require students to write an expression to represent a real-world or mathematical problem. Tasks do not require students to find a solution.

ii. Tasks may require students to interpret a variable as a specific unknown number, or, as a number that could represent any number in a specified set.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

Standard(s): 6.EE.7

Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

Assessment Clarifications and Emphases

i. Tasks are algebraic, not arithmetic.

ii. Half of the tasks involve whole-number values of *p* and *q*; and half of the tasks involve fraction or decimal values of *p* and *q*.

iii. Fractions and decimals should not appear together in the same problem.

iv. These tasks only involve equations with addition and multiplication.

v. A valid equation and the correct answer are both required for full credit.

Essential Skills and Knowledge

- Ability to reinforce that solving equations is finding values of the variable that make the equation true
- Ability to develop conceptual understanding of inverse operations
- Ability to develop an understanding of how to apply properties of equality
- Knowledge of preserving equivalence as you solve equations

Standard(s): 6.EE.8

Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

Assessment Clarifications and Emphases

i. Values of *c* are not limited to integers.

ii. Tasks involve $<$ and $>$, not $\leq$ and $\geq$.

Essential Skills and Knowledge

- Ability to develop conceptual understanding of representing solutions to inequalities on a number line diagram.
- Knowledge of $\leq$ and $\geq$.
- Knowledge of symbolic components of the graph of an inequality; Specifically, open circle vs. closed circle, direction of shading

- Knowledge that an open circle represents a value that is NOT actually part of the solution set
- Knowledge that solutions to $x > c$ or $x < c$ are not just integers but also fractions and decimals.

Cluster: Represent and analyze quantitative relationships between dependent and independent variables.

Standard(s): 6.EE.9

Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation $d = 65t$ to represent the relationship between distance and time.

Assessment Clarifications and Emphases

i. Tasks that involve writing an equation should not go beyond the equation types described in 6.EE.7 ($x + p = q$ and $px = q$ where p, q and x are all nonnegative rational numbers.

Essential Skills and Knowledge

- Ability to differentiate between independent and dependent variables
- Knowledge of the relationship between the two variables
- Knowledge of terminology associated with graphing ordered pairs (5.OA.3)
- Ability to write an equation based on a graph or a table

Domain: Geometry (G)

Cluster: Solve real-world and mathematical problems involving area, surface area, and volume.

Standard(s): 6.G.1

Find area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

Essential Skills and Knowledge

- Ability to combine triangles to create rectangles
- Ability to partition quadrilaterals and polygons into all triangles or a combination of triangles and rectangles/squares
- Knowledge of the base and height of a right triangle are the length and width of a rectangle to discover the formula $A = \frac{bh}{2}$.

Standard(s): 6.G.2

Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = Bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

Assessment Clarifications and Emphases

i. Tasks do not have a context.

ii. Tasks require focusing on the connection between packing the solid figure and computing the volume.

iii. Tasks focus on using the formulas in problem-solving contexts.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

Standard(s): 6.G.3

Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard SC 6

Standard(s): 6.G.4

Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.

Domain: Statistics and Probability (SP)

Cluster: Develop understanding of statistical variability

Standard(s): 6.SP.1

Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, “How old am I?” is not a statistical question, but “How old are the students in my school?” is a statistical question because one anticipates variability in students’ ages.

Assessment Clarifications and Emphases

i. Tasks do not assess mode and range.

Essential Skills and Knowledge

- Ability to introduce and develop statistical reasoning
- Ability to determine the difference between a statistical question and a non-statistical question

Standard(s): 6.SP.2

Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

Assessment Clarifications and Emphases

i. Tasks might present several distributions graphically and ask which two have nearly the same center, nearly the same spread, or nearly the same overall shape.

ii. Tasks do not assess mode and range.

Essential Skills and Knowledge

- Ability to develop conceptual understanding of the characteristics of a data set
- Ability to develop an understanding of outliers

Standard(s) 6.SP.3

Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number

Assessment Clarifications and Emphases

i. Tasks might ask students to rate statements True/False/Not Enough Information, such as, “The average height of trees in Watson Park is 65 feet. Are there any trees in Watson Park taller than 65 feet?”
ii. Tasks do not assess mode and range.

Essential Skills and Knowledge

- Knowledge of median and mean as measures of center
- Knowledge of range as a measure of variation
- Ability to look at a set of data and estimate the measures of center

Cluster: Summarize and describe distributions.

Standard(s): 6.SP.4

Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

Assessment Clarifications and Emphases

i. Tasks ask students to identify which display corresponds to a given set of data.
ii. Tasks do not assess mode and range.

Essential Skills and Knowledge

- Ability to recognize that a dot plot is a line plot
- Ability to recognize that a box plot is a box-and-whisker plot

Standard(s): 6.SP.5

Summarize numerical data sets in relation to their context, such as by:

a. Reporting the number of observations.

b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data was gathered.

d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data was gathered

Assessment Clarifications and Emphases (6.SP.5a–d)

i. Tasks have a text-based and a graphics-based overview of a numerical data set.

ii. Tasks require students to identify/select from unambiguously true or false statements such as, “About half of the values are greater than the average”; “If this point were deleted from the data set, the median would not change”; etc.

iii. Tasks do not assess mode and range.

Essential Skills and Knowledge

- See the skills and knowledge that are stated in the Standard.
- Knowledge of conceptual understanding of statistical interpretation, focusing on the context of data sets
- Ability to identify data that are outliers and understand how they affect the measures of central tendency

Vocabulary

Ratio:

A ratio is a relationship between two (or more) quantities, amounts, or sizes. Ratios can be expressed in the form $\left(\frac{a}{b}\right)$, a to b, or $a:b$.

Ratios can be expressed as comparisons of:

1. **Part-to-whole:** comparison of one part of a whole to all the parts of the same whole. *For example, a part-to-whole ratio would be the ratio of boys to the whole class.*
2. **Part-to-part:** comparison of one part of a whole to another part of the same whole. *For example, a part-to-part ratio would be the ratio of boys to girls in a class.*

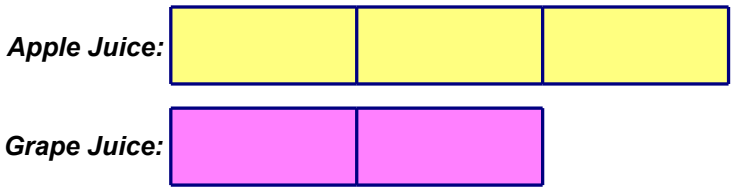
Measures of two different units are called a **rate**. For example, a rate would be the ratio of miles per gallon or miles per hour.

Unit rate:

A **rate** where the denominator is 1 unit. For example, if 15 bars of soap cost $6.75, one bar would cost $0.45: $\frac{\$6.75}{15} = \frac{\$0.45}{1}$.

Tape diagrams:

Tape diagrams are visual models that use rectangles to represent the parts of a ratio. Tape diagrams are best used when the two quantities have the same units. They can be used to solve problems and also to highlight the multiplicative relationship between the quantities. *For example, a particular fruit juice mixes apple juice and grape juice with a ratio of 3 to 2. The total amount of juice is represented as a partition into 5 parts of equal size, represented by 5 rectangles.*



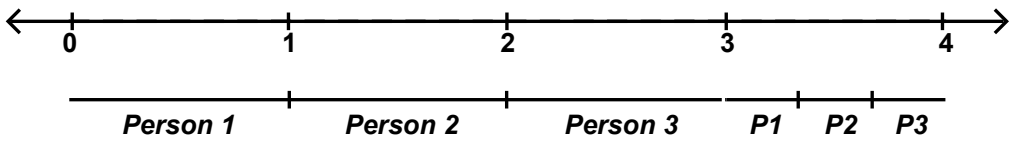
If the diagram represents 5 cups of juice mixture, then each of these rectangles represents 1 cup. If the total amount of juice mixture is 1 gallon, then each part represents $\frac{1}{5}$ *gallon and there are* $\frac{3}{5}$ *gallon of apple juice and* $\frac{2}{5}$ *gallon of grape juice* (example from Progressions for the Common Core State Standards in Mathematics 6-7, Ratios and Proportional Relationships).

Percent:

Percent, %, means "per 100" or "out of 100". It is also another name for hundredths. A percent can be written as the ratio of the part out of 100 and as a decimal. *For example, if 35 milliliters out of every 100 milliliters in a juice mixture are orange juice, then the juice mixture is 35% orange juice (by volume). If a juice mixture is viewed as made of 100 equal parts, of which 35 are orange juice, then the juice mixture is 35% orange juice:* $35\% = \frac{35}{100} = 0.35$ (example from Progressions for the Common Core State Standards in Mathematics 6-7, Ratios and Proportional Relationships).

Measurement concept:

The process of using repeated subtraction or equal groups in order to interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions. *For example, interpret* $4 \div 3$ *as "How many sets of 3 are in 4?" or "How can 4 pints of ice cream be divided equally among 3 people?"*



Therefore, each person gets $1\frac{1}{3}$ pints of ice cream.