Mathletics California Program of Studies Skill Quests



Grades 7 – 8



January, 2023

Mathletics

California Program of Studies Skill Quests January 2023

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Grade 7

1 Ratios and Proportional Relationships

1.1 Analyze proportional relationships and use them to solve real-world and mathematical problems

Outcome	Quests	Content
Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.	Unit rates with fractions	Solving unit rate problems involving fractions
Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.	Identify proportional relationships	ldentifying proportional relationships
Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.	Constant of proportionality	Identifying the constant of proportionality
Represent proportional relationships by equations.	Represent proportional relationships	Representing proportional relationships: equations
Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.	Graphs of proportional relationships	Interpreting graphs of proportional relationships

1.2 Recognize and represent proportional relationships between quantities

Outcome	Quests	Content
Use proportional relationships to solve multistep ratio and percent problems.	Ratio & percent problems	Solving multi-step ratio & percent problems

2 The Number System

2.1 Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers

Outcome	Quests	Content
Describe situations in which opposite quantities combine to make 0.	Opposites	Describing situations involving opposites
Understand p + q as the number	Add rational numbers	Opposites & absolute value
located a distance q from p, in the		Adding rational numbers
positive or negative direction		Adding positive & negative
depending on whether q is positive		fractions
or negative. Show that a number		Adding positive & negative
(are additive inverses). Interpret		decimals
sums of rational numbers by		Adding integers
describing real-world contexts.		
Understand subtraction of rational	Subtract rational	Subtracting rational numbers:
numbers as adding the additive	numbers	adding the inverse
inverse, $p - q = p + (-q)$. Show that		Subtracting positive &
the distance between two rational		negative fractions
numbers on the number line is the		Subtracting positive &
absolute value of their difference,		negative decimals
world contexts		Subtracting integers
world contexts.		Subtracting rational numbers:
Apply properties of operations as	Rational numbers:	Adding & subtracting rational
strategies to add and subtract	addition properties	numbers: properties
rational numbers.		
Understand that multiplication is	Multiply rational	Multiplying rational numbers
extended from fractions to rational numbers by requiring that	numbers	Multiplying positive & negative fractions
operations continue to satisfy the		Multiplying positive & negative
properties of operations,		decimals
particularly the distributive		Multiplying integers
property, leading to products such		Products of rational numbers:
as $(-1)(-1) = 1$ and the rules for		real-world contexts
Interpret products of rational		
numbers by describing real-world		
contexts.		
Understand that integers can be	Divide integers	Dividing integers
divided, provided that the divisor is		
not zero, and every quotient of		
integers (with non-zero divisor) is a		
rational number. If p and q are		

integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.		
		Quotients of rational numbers: real-world contexts
Apply properties of operations as strategies to multiply and divide rational numbers.	Rational numbers: properties	Multiply & divide rational numbers: properties
Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.	Convert rational numbers to decimals	Use long division to convert rationals to decimals
Solve real-world and mathematical problems involving the four operations with rational numbers.	Rational numbers problems: 4 operations	Rational numbers problems: 4 operations

3 Expressions and Equations

3.1 Use properties of operations to generate equivalent expressions

Outcome	Quests	Content
Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	Linear expressions: properties	Simplify algebraic expressions: add & subtract
Distributive property: algebraic expressions Factoring algebraic expressions	Distributive property: algebraic expressions Factoring algebraic	Distributive property: algebraic expressions Factoring algebraic
Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.	expressions Interpret expressions	expressions Rearranging expressions to interpret quantities

3.2 Solve real-life and mathematical problems using numerical and algebraic expressions and equations

Outcome	Quests	Content
Solve multi-step real-life and	Problems with rational	Solving problems with rational
mathematical problems posed with	numbers	numbers
positive and negative rational		Converting terminating
numbers in any form (whole		decimals
numbers, fractions, and decimals),		
using tools strategically. Apply		
properties of operations to calculate		
with numbers in any form; convert		
between forms as appropriate; and		
assess the reasonableness of		
answers using mental computation		
and estimation strategies.		
Solve word problems leading to	Solve 2-step equations	Solving 2-step equations:
equations of the form $px + q = r$ and		word problems
p(x + q) = r, where p, q, and r are		2-step equations, positive
specific rational numbers. Solve		integer coefficients
equations of these forms fluently.		2-step equations, integer
Compare an algebraic solution to		coefficients
an arithmetic solution, identifying		2-step equations, positive
		rational coefficients

the sequence of the operations		2-step equations, rational
used in each approach.		coefficients
		2-step equations, distributive
		property
Solve word problems leading to	Solve 2-step	Creating & solving 2-step
inequalities of the form $px + q > r$ or	inequalities	inequalities
px + q < r, where p, q, and r are		Representing inequalities
specific rational numbers. Graph		Graphing the solution of an
the solution set of the inequality		inequality
and interpret it in the context of the		Solving 2-step inequalities
problem.		

4 Geometry

4.1 Draw, construct, and describe geometrical figures and describe the relationships between them

Outcome	Quests	Content
Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.	Scale drawings	Scale drawings
Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus 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.	Construct triangles	Triangle inequality theorem Constructing triangles with given conditions
Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	Cross sections of 3-D figures	Describing cross sections of 3- D figures

4.2 Solve real-life and mathematical problems involving angle measure, area, surface area, and volume

Outcome	Quests	Content
Know the formulas for the area and	Circles: area &	Finding the area of a circle
circumference of a circle and use	circumference	Introducing the parts of a
them to solve problems; give an		circle
informal derivation of the		Finding the circumference of a
relationship between the		circle
circumference and area of a circle.		
Use facts about supplementary,	Using angle facts to	Supplementary angles
complementary, vertical, and	solve problems	Complementary angles
adjacent angles in a multi-step		Adjacent angles
problem to write and solve simple		Vertical angles
equations for an unknown angle in		
a figure.		

Solve real-world and mathematical	Area, volume & surface	Area: polygons
problems involving area, volume	area	Solving real-life problems:
and surface area of two- and three-		area of polygons
dimensional objects composed of		Volume: right prisms
triangles, quadrilaterals, polygons,		Surface area: rectangular &
cubes, and right prisms.		triangular prisms

5 Statistics and Probability

5.1 Use random sampling to draw inferences about a population

Outcome	Quests	Content
Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.	Understand sampling	Understanding sampling
Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.	Draw inferences from samples	Drawing inferences from samples

5.2 Draw informal comparative inferences about two populations

Outcome	Quests	Content
Informally assess the degree of	Compare data	Comparing data distributions
visual overlap of two numerical	distributions	
data distributions with similar		
variabilities, measuring the		
difference between the centers by		
expressing it as a multiple of a		
measure of variability.		
Use measures of center and	Draw comparative	Drawing comparative
measures of variability for	inferences	inferences
numerical data from random		
samples to draw informal		
comparative inferences about two		
populations.		

5.3 Investigate chance processes and develop, use, and evaluate probability models

Outcome	Quests	Content
Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.	Introduction to probability	Introducing probability
Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.	Probability of chance events	Probability of chance events: relative frequency
Develop a uniform probability	Determine the probability of events	Theoretical probability Predicting outcomes of chance
probability to all outcomes, and use	probability of events	experiments
the model to determine probabilities of events.		Finding the complement of an event
Develop a probability model (which may not be uniform) by observing	Observe frequencies in data	Finding the approximate probability
frequencies in data generated from a chance process.		Comparing observed frequency & expected frequency
Understand that, just as with	Probability: compound	Investigating mutually
compound event is the fraction of outcomes in the sample space for which the compound event occurs.		Calculating probabilities of compound events
Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.	Sample spaces for compound events	Representing sample spaces & identifying outcomes
Design and use a simulation to generate frequencies for compound events.	Independent & dependent compound events	Independent & dependent compound events

Grade 8

1 The Number System

1.1 Know that there are numbers that are not rational, and approximate them by rational numbers

Outcome	Quests	Content
Know that numbers that are not	Rational & irrational	Describing properties of
rational are called irrational.	numbers	irrational numbers
Understand informally that every		Classifying real numbers
number has a decimal expansion;		Converting repeating decimals
for rational numbers show that the		to rational numbers
decimal expansion repeats		Repeating & terminating
eventually, and convert a decimal		decimals as fractions
expansion which repeats eventually		
into a rational number.		
Use rational approximations of	Approximate irrational	Comparing irrational numbers
irrational numbers to compare the	numbers	Locating irrational numbers on
size of irrational numbers, locate		a number line
them approximately on a number		Approximating the value of an
line diagram, and estimate the		irrational number
value of expressions (e.g. π^2).		Finding square roots of non-
		perfect squares

2 Expressions and Equations

2.1 Work with radicals and integer exponents

Know and apply the properties of integer exponents to generate equivalent numerical expressions.Properties of integer exponentsUsing exponent notation Product of powers, numerical baseguivalent numerical expressions.Product of powers, numerical baseProduct of powers, algebraic baseQuotient of powers, algebraic basePower of a power, numerical baseQuotient of powers, algebraic basePower of a power, algebraic baseVertar and set and	Outcome	Quests	Content
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expressed in scientific notation, scientific notation notation	Perform operations with numbers	Calculations in	Calculations in scientific
including problems where both	expressed in scientific notation,	scientific notation	notation

decimal and scientific notation are	
used. Use scientific notation and	
choose units of appropriate size for	
measurements of very large or very	
small quantities (e.g., use	
millimeters per year for seafloor	
spreading). Interpret scientific	
notation that has been generated	
by technology.	

2.2 Understand the connections between proportional relationships, lines, and linear equations

Outcome	Quests	Content
Graph proportional relationships,	Proportional	Graphing proportional
slope of the graph Compare two	relationships	Comparing proportional
different proportional relationships		relationships
represented in different ways.		
Use similar triangles to explain why	Understand slope & y-	Using similar triangles to
the slope m is the same between	intercept	understand slope
any two distinct points on a non-		Writing equations of
vertical line in the coordinate plane;		proportional relationships
derive the equation y = mx for a line		Writing equations of
through the origin and the equation		nonproportional relationships
y = mx + b for a line intercepting the		Identifying the slope in an
vertical axis at b.		equation or graph
		Identifying the y-intercept on a graph
		Graphing equations in slope-
		intercept form
		Graphing equations not in
		slope-intercept form
		Finding the y-intercept
		algebraically

2.3 Analyze and solve linear equations and pairs of simultaneous linear equations

Outcome	Quests	Content
Give examples of linear equations	Solution types of linear	Solution types of linear
in one variable with one solution,	equations	equations
infinitely many solutions, or no		
solutions. Show which of these		
possibilities is the case by		
successively transforming the given		

equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).		
Solve linear equations with rational number coefficients, including	Solve linear equations	Solving 3-step linear equations
equations whose solutions require expanding expressions using the		Solving linear equations, variables on both sides
distributive property and collecting like terms.		Solving linear equations, distributive property
		Using substitution to check solutions
Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.	Identify solutions, systems of equations	Identifying solutions, systems of equations
Solve systems of two linear equations in two variables	Solve systems of equations	Solving systems of equations graphically
algebraically, and estimate solutions by graphing the		Solving systems of equations using elimination
equations. Solve simple cases by inspection.		Solving systems of equations using substitution
		Checking the solution of a system of equations
Solve real-world and mathematical problems leading to to linear equations in two variables.	Write & solve systems of equations	Writing & solving systems of equations

3 Functions

3.1 Define, evaluate, and compare functions

Outcome	Quests	Content
Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	Identify functions	Identifying functions
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	Compare functions	Comparing functions represented in different ways
Interpret the equation y = mx + b as defining a linear function, whose	Interpret y = mx + b as linear	Represent linear relationships in different forms
graph is a straight line; give examples of functions that are not linear.		Equations of linear & non- linear relationships

3.2 Use functions to model relationships between quantities

Outcome	Quests	Content
Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	Rate of change & initial value	Rate of change & initial value
Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the	Distance-time graphs	Distance-time graphs

qualitative features of a function	
that has been described verbally.	

4 Geometry

4.1 Understand congruence and similarity using physical models, transparencies, or geometry software

Outcome	Quests	Content
Verify experimentally the properties	Introduction to rigid	Translating points on the
of rotations, reflections, and	transformations	coordinate plane
translations:		Reflecting points across the x- or y-axis
		Rotating points about the origin
Lines are taken to lines and line	Preserved properties:	Preserved properties: length
segments to line segments of the same length.	length	r reserved properties, rengar
Angles are taken to angles of the	Preserved properties:	Preserved properties: angles
same measure.	angles	
Parallel lines are taken to parallel	Preserved properties:	Preserved properties: parallel
Inderstand that a two-dimensional	Congruency: rigid	Congruency: rigid
figure is congruent to another if the	transformations	transformations
second can be obtained from the		
first by a sequence of rotations,		
reflections, and translations; given		
two congruent figures, describe a		
sequence that exhibits the		
congruence between them.		
Describe the effect of dilations,	Transformations,	Dilations, coordinates
translations, rotations, and	coordinates	Translations, coordinates
reflections on two-dimensional		Rotations, coordinates
figures using coordinates.		Reflections, coordinates
		Sequences of transformations
Understand that a two-dimensional	Similarity:	Introducing similarity
figure is similar to another if the	transformations	Similarity: transformations
second can be obtained from the		
first by a sequence of rotations,		
reflections, translations, and		
dilations; given two similar two-		
dimensional figures, describe a		
sequence that exhibits the similarity		
between them.	T · I O I	
Use informal arguments to	Triangles & angle	Angle sum theorem
establish facts about the angle sum	relationships	Exterior angle theorem
about the angles created when		Angle relationships: parallel lines, transversal

parallel lines are cut by a	Using scale to analyze similar
transversal, and the angle-angle	triangles
criterion for similarity of triangles.	Identifying similar triangles

4.2 Understand and apply the Pythagorean theorem

Outcome	Quests	Content
Explain a proof of the Pythagorean	The Pythagorean	Identifying the hypotenuse,
theorem and its converse.	theorem & its converse	right triangles
		Identifying right triangles,
		Pythagorean theorem
		Pythagorean triples
Apply the Pythagorean theorem to	Apply the Pythagorean	Pythagorean theorem: missing
determine unknown side lengths in	theorem	short side
right triangles in real-world and		Pythagorean theorem: missing
mathematical problems in two and		hypotenuse
three dimensions.		Pythagorean theorem: missing
		side
		Pythagorean theorem in 2-D &
		3-D
Apply the Pythagorean theorem to	Distance between two	Finding the distance between
find the distance between two	points	two points
points in a coordinate system.		

4.3 Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres

Outcome	Quests	Content
Know the formulas for the volumes	Volume: cones,	Volume: cones
of cones, cylinders, and spheres	cylinders & spheres	Volume: cylinders
and use them to solve real-world		Volume: spheres
and mathematical problems.		

5 Statistics and Probability

5.1 Investigate patterns of association in bivariate data

Outcome	Quests	Content
Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	Use & interpret scatter plots	Using & interpreting scatter plots
Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	Estimate the line of best fit	Estimating the line of best fit
Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.	Interpret the line of best fit	Interpreting the line of best fit
Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.	Two-way tables	Constructing & interpreting two-way tables



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