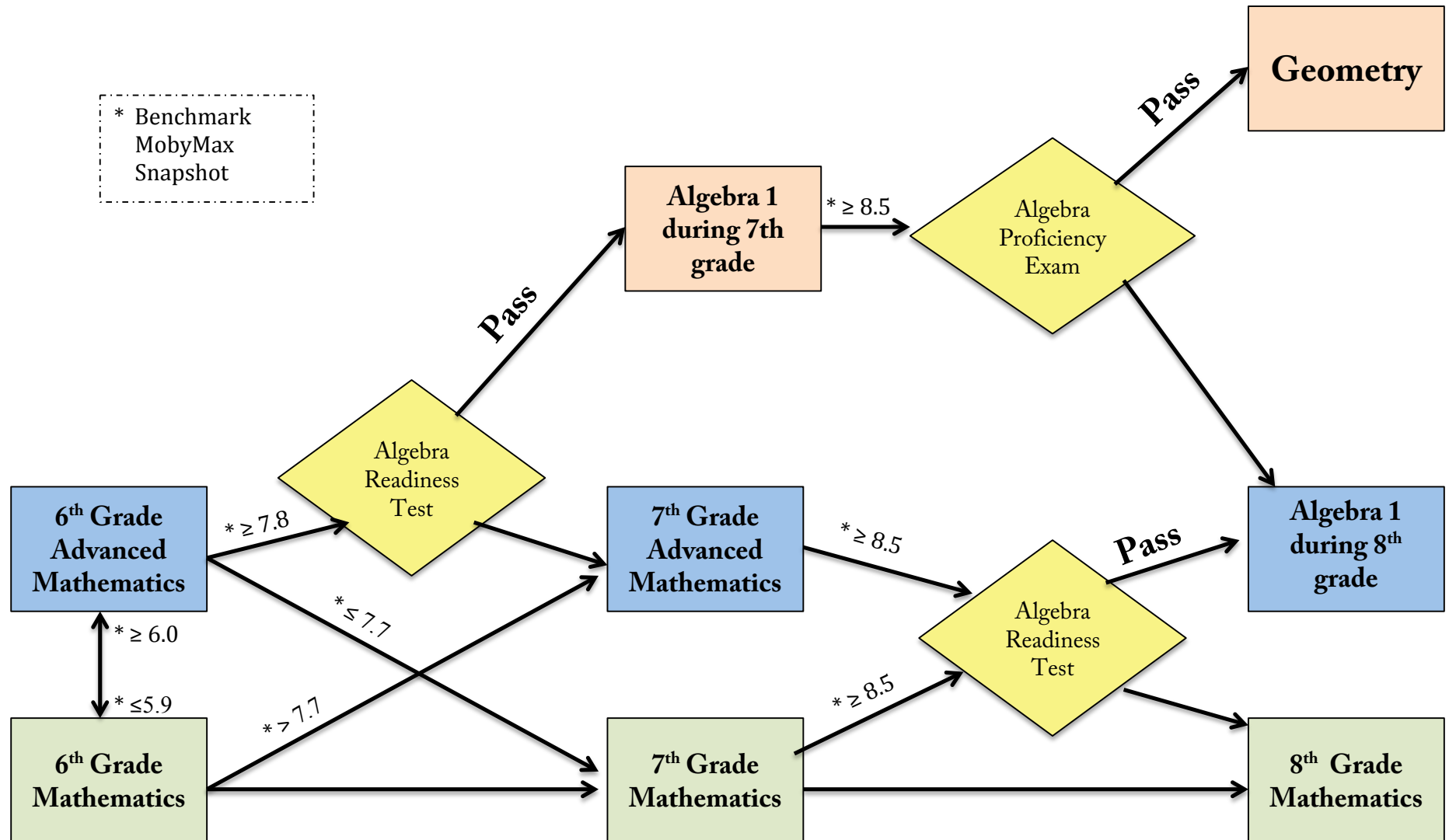


Altona Mathematics Flowchart

6th Grade

7th Grade

8th Grade



CCSS WHERE TO FOCUS GRADE 8 MATHEMATICS

An important subset of the major work in grades K–8 is the progression that leads toward middle school algebra.

K	1	2	3	4	5	6	7	8
Know number names and the count sequence	Represent and solve problems involving addition and subtraction	Represent and solve problems involving addition and subtraction	Represent & solve problems involving multiplication and division	Use the four operations with whole numbers to solve problems	Understand the place value system	Apply and extend previous understandings of multiplication and division to divide fractions by fractions	Apply and extend previous understanding of operations with fractions to add, subtract, multiply, and divide rational numbers	Work with radical and integer exponents
Count to tell the number of objects	Understand and apply properties of operations and the relationship between addition and subtraction	Add and subtract within 20	Understand properties of multiplication and the relationship between multiplication and division	Generalize place value understanding for multi-digit whole numbers	Perform operations with multi-digit whole numbers and decimals to hundredths	Apply and extend previous understandings of numbers to the system of rational numbers	Analyze proportional relationships and use them to solve real-world and mathematical problems	Understand the connections between proportional relationships, lines, and linear equations**
Compare numbers	Add and subtract within 20	Use place value understanding and properties of operations to add and subtract	Multiply & divide within 100	Use place value understanding and properties of operations to perform multidigit arithmetic	Use equivalent fractions as a strategy to add and subtract fractions	Understand ratio concepts and use ratio reasoning to solve problems	Use properties of operations to generate equivalent expressions	Analyze and solve linear equations and pairs of simultaneous linear equations
Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from	Work with addition and subtraction equations	Measure and estimate lengths in standard units	Solve problems involving the four operations, and identify & explain patterns in arithmetic	Extend understanding of fraction equivalence and ordering	Apply and extend previous understandings of multiplication and division to multiply and divide fractions	Apply and extend previous understandings of arithmetic to algebraic expressions	Solve real-life and mathematical problems using numerical and algebraic expressions and equations	Define, evaluate, and compare functions
Work with numbers 11–19 to gain foundations for place value	Extend the counting sequence	Relate addition and subtraction to length	Develop understanding of fractions as numbers	Build fractions from unit fractions by applying and extending previous understandings of operations	Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition	Reason about and solve one-variable equations and inequalities		Use functions to model relationships between quantities
	Understand place value		Solve problems involving measurement and estimation of intervals of time, liquid volumes, & masses of objects	Understand decimal notation for fractions, and compare decimal fractions	Graph points in the coordinate plane to solve real-world and mathematical problems*	Represent and analyze quantitative relationships between dependent and independent variables		
	Use place value understanding and properties of operations to add and subtract		Geometric measurement: understand concepts of area and relate area to multiplication and to addition					
	Measure lengths indirectly and by iterating length units							

* Indicates a cluster that is well thought of as a part of a student's progress to algebra, but that is currently not designated as major by the assessment consortia in their draft materials. Apart from the one asterisked exception, the clusters listed here are a subset of those designated as major in the assessment consortia's draft documents.

** Depends on similarity ideas from geometry to show that slope can be defined and then used to show that a linear equation has a graph which is a straight line and conversely.

A Guide to the Colorado Academic Standards



Working Together

To support families and teachers in realizing the goals of the Colorado Academic Standards, this guide provides an overview of the learning expectations for eighth grade mathematics and offers some possible learning experiences students may engage in during this school year.

Why Standards?

Created by Coloradans for Colorado students, the Colorado Academic Standards provide a grade-by-grade road map to help ensure students are ultimately successful in college, careers, and life. The standards aim to improve what students learn and how they learn in ten content areas, emphasizing critical-thinking, creativity, problem solving, collaboration, and communication as important life skills in the 21st century.

Mathematics for Middle Schools (6-8)

The mathematics standards throughout middle and high school build on the strong foundation of number developed during elementary school. Students begin to branch into other areas of mathematics such as probability, statistics and algebra. The study of geometry and geometric proof is also formalized during these years. The work of geometric proof is also extended to all parts of mathematics as students construct viable arguments and critique the reasoning of others. In each grade students investigate the world around them through mathematics. They confront problems and persevere in solving them as they strategically apply mathematical tools and techniques.

Where can I learn more?

- Contact your school district regarding local decisions related to standards, curriculum, resources, and instruction.
- Colorado Academic Standards Booklets: <http://www.cde.state.co.us/standardsandinstruction/GradeLevelBooks.asp>
- Mary Pittman, Mathematics Content Specialist at 303-854-4560, Pittman_m@cde.state.co.us



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At the end of Sixth Grade, students can...



Mathematics

Sixth Grade



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Mathematics Learning Expectations for Sixth Grade

Number Sense, Properties, and Operations

Compare quantities using ratios and unit rates (miles per hour); fluently add, subtract, multiply and divide fractions and decimals; understand the concept of negative numbers and absolute values, extend the number line and coordinate grids to include negative numbers.

Patterns, Functions, and Algebraic Structures

Analyze relationships in tables, graphs, and equations of independent and dependent variables; solve one-variable equations and inequalities; apply the order of operations to evaluate algebraic expressions.

Data Analysis, Statistics, and Probability

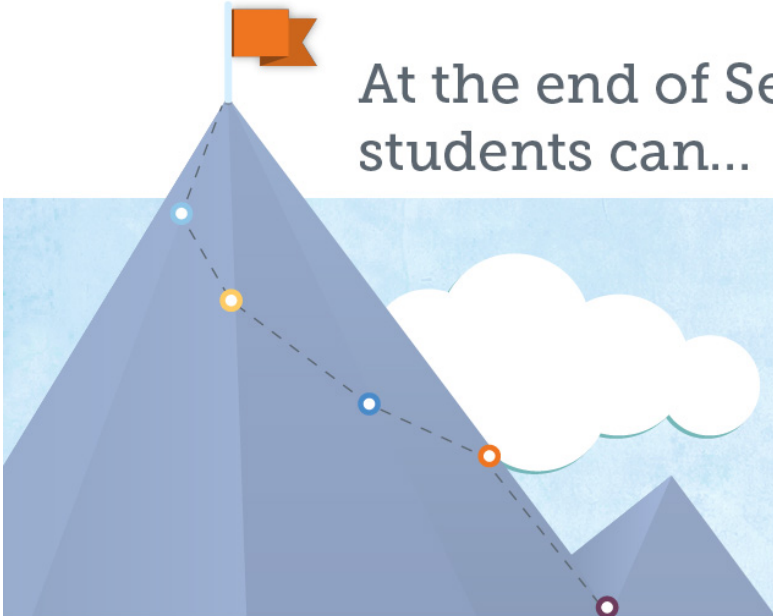
Create graphs (dotplots, boxplots, histograms); describe data by examining the center (averages) and spread (variability) of a distribution.

Shape, Dimension, and Geometric Relationships

Understand and apply formulas for the area of triangles and quadrilaterals (parallelograms, trapezoids); find the volume of rectangular boxes; calculate the surface area of three-dimensional figures.

Throughout the Sixth Grade, you may find students...

- Determining a cyclist's speed in miles per hour by creating ratio tables, graphs, and number lines.
- Calculating a better deal (buying a gallon or four quarts of milk) using unit prices or ratios.
- Explaining the connection between a compass on a map and the horizontal and vertical axes on a coordinate grid.
- Recognizing situations involving negative numbers such as temperature, sea level, and bank account balances.
- Designing efficient packaging by creating two-dimensional cutouts and folding them into three-dimensional boxes.
- Distinguishing between the independent and dependent variables within phone plan options.
- Collecting and analyzing data to answer the question: how many hours does the typical sixth grade student sleep?
- Explaining why average home prices are reported as medians rather than means.



At the end of Seventh Grade, students can...



Mathematics

Seventh Grade



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Mathematics Learning Expectations for Seventh Grade

Number Sense, Properties, and Operations

Fluently add, subtract, multiply and divide with both positive and negative numbers, including fractions and decimals; solve problems involving percentages and other types of proportions; explain operations with positive and negative numbers; change fractions to decimals and explain when a fraction will be a repeating or terminating decimal.

Patterns, Functions, and Algebraic Structures

Recognize and analyze proportional relationships in tables, graphs and equations; connect ratios to the concept of slope; create equations and inequalities for real-life situations.

Data Analysis, Statistics, and Probability

Find the probability of an event and connect probability to sampling; explore the importance of randomness when creating a sample; describe a population based on data from a random-sample; compare two different populations using averages and measures of variability.

Shape, Dimension, and Geometric Relationships

Create drawings to scale; find the measures of angles formed by the intersection of lines; explain how to tell if two triangles are congruent; explore shapes created when slicing a three-dimensional object; calculate the area and circumference of circles.

Throughout the Seventh Grade, you may find students...

- Finding the wholesale price of a shirt with a 12% markup.
- Determining a 20% tip for dinner at a restaurant.
- Exploring when a \$20 discount is better than a 20% discount.
- Calculating the temperature after a 7 degree drop from -15 degrees.
- Explaining why negative two multiplied by negative six equals positive twelve.
- Creating scale models of a zoo to connect the concept of scale to proportions.
- Conducting a study to determine if the average height of seventh grade boys is different from the average height of seventh grade girls.
- Calculating the probability of getting a heads when flipping a coin or getting the sum of seven when tossing number cubes.
- Explaining the meaning of a weather forecast with a 50% chance of rain.
- Describing shapes formed when slicing a variety of fruit.



At the end of Eighth Grade, students can...



Mathematics

Eighth Grade



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Mathematics Learning Expectations for Eighth Grade

Number Sense, Properties, and Operations

Calculate using radicals ($\sqrt{2}$, $\sqrt[3]{27}$) and exponents (7^2 , 5^{-6}); explain the difference between rational and irrational numbers; locate rational and irrational numbers on a number line; use scientific notation to write very large or small numbers (6.02×10^{23}).

Patterns, Functions, and Algebraic Structures

Fluently solve linear equations and systems of linear equations; explain the meaning of a function in mathematics; distinguish between functions whose graphs are linear (make a straight line) and those which are not linear; use tables, graphs, and equations to show linear relationships; describe the meaning of the slope (steepness) and y-intercept of a linear situation.

Data Analysis, Statistics, and Probability

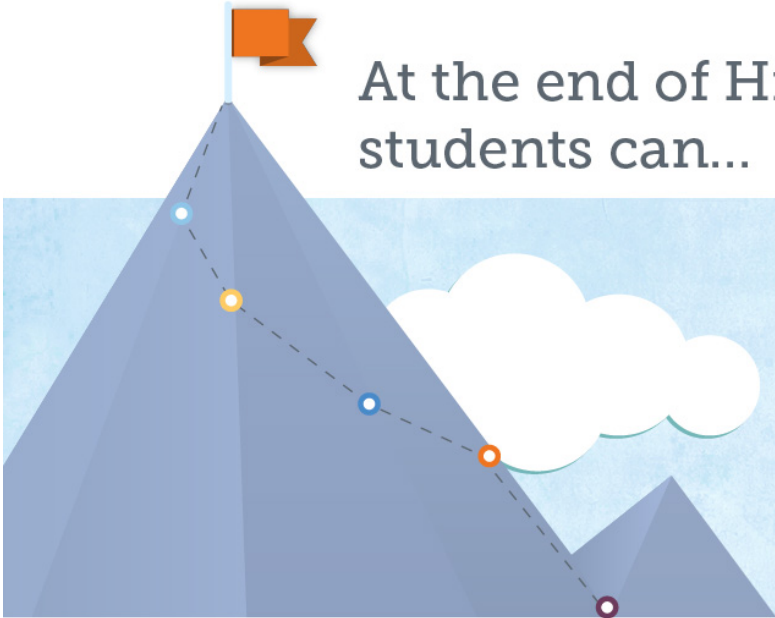
Identify if two variables have a relationship by informally examining graphs and tables; create graphs and equations to describe linear relationships.

Shape, Dimension, and Geometric Relationships

Calculate distances and areas using the Pythagorean Theorem; calculate the volume of cones, cylinders and spheres; describe how rotating, stretching, shrinking, reflecting or sliding a shape impacts its shape and size; understand the difference between congruency and similarity; explain the concept of similarity and make connections between slope and similar triangles.

Throughout the Eighth Grade, you may find students...

- Measuring classmates' height and arm-span, and making a graph to show how height and arm-span are related.
- Solving a variety of algebra equations for "x" such as $3x + 28 = 8x - 34$.
- Using graphs and tables of data to determine if the relationship between the height of a plant and the amount it is watered each day is a function.
- Graphing phone plans with a flat rate of \$20 and a \$0.10 per minute fee on calls and identifying the y-intercept as the flat fee and slope as the per-minute charge.
- Proving why the sum of the angles in a triangle is always 180 degrees.
- Comparing the steepness of stairs and ramps for a variety of buildings (rise to run).
- Calculating the height of a kite using 150 feet of string that is directly above a pool 60 feet away from where you are standing.
- Computing the shortest distance between two points.
- Finding the height of a flag pole using shadows and similar triangles.
- Comparing when the cost of a cell phone plan is greater than, equal to, or less than the cost of another cell phone plan.
- Explaining why $1/7$ is rational but $\sqrt{2}$ is irrational.



At the end of High School, students can...



Mathematics

Algebra I
High School



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Mathematics Learning Expectations for Algebra I

Number Sense, Properties, and Operations

Choose the correct units for a problem such as feet versus miles and consider these units when solving problems.

Patterns, Functions, and Algebraic Structures

Fluently write equations for lines; add, subtract, and multiply polynomials; rearrange quadratic equations by factoring and completing the square; represent the relationship between two quantities using linear, quadratic, and exponential functions; compare and contrast linear, quadratic, and exponential functions; use tables, graphs and equations to solve systems of linear and quadratic functions.

Data Analysis, Statistics, and Probability

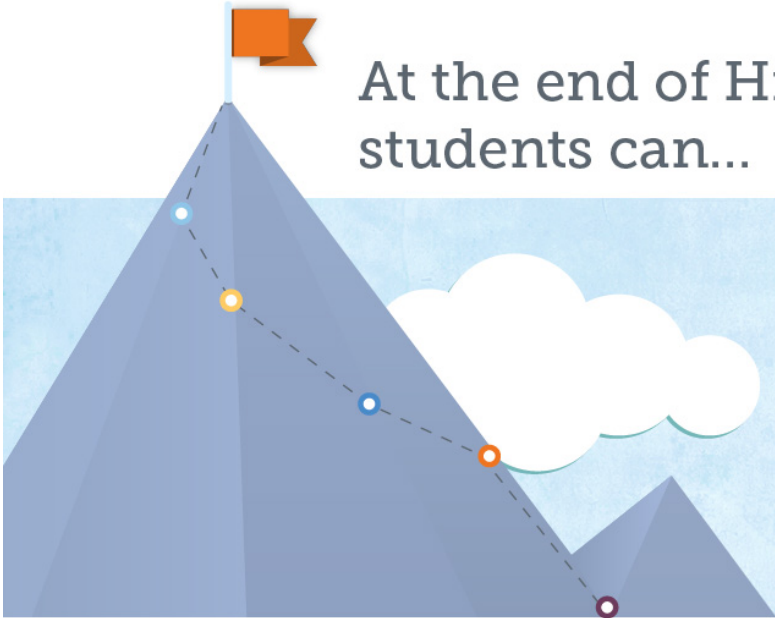
Describe if two variables are strongly or weakly correlated; explain the difference between correlation and causation.

Throughout Algebra I, you may find students...

- Distinguishing whether the growth of a population of prairie dogs is linear or exponential.
- Creating quadratic equations that describe the

motion of the earth or the trajectory of a kicked football.

- Explaining why a scientist needs to know if the distance to a nearby asteroid was calculated using miles or kilometers.
- Using graphs, tables, and equations to describe the spread of a virus over time.
- Determining the amount of water wasted by a dripping faucet over the course of one year.
- Examining the relationship between a person's income and their parents' income and making an argument about the relationship between the incomes.
- Using spreadsheets and other technologies to create and represent profit and/or losses of a business.
- Calculating where a snowboarder will land (on a mountain) after completing a jump using a linear equation to model the height of the mountain and a quadratic equation to model the path of the jump.



At the end of High School, students can...



Mathematics

Geometry
High School



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Mathematics Learning Expectations for Geometry

Shape, Dimension, and Geometric Relationships

Fluently determine if two triangles are congruent or similar; fluently use coordinates to calculate lengths and angles; prove geometric theorems about congruency, similarity, and circles; construct geometric figures using a compass and straight edge; prove the Pythagorean Theorem by using the concept of similarity; develop the trigonometric ratios (sine, cosine, tangent) and use them to solve a variety of right triangle problems; find arc lengths and areas for parts of circles; calculate lengths and areas of figures on a coordinate plane using equations derived from the Pythagorean Theorem; determine if two lines are parallel or perpendicular by calculating their slopes; describe rotations, reflections, translations and dilations algebraically on a coordinate grid.

Throughout Geometry, you may find students...

- Applying the concept of area to calculate the population density for various parts of Colorado.
- Determining the dimensions of a soup can that minimizes packaging materials.
- Using constructions tools and software programs to explore properties of shapes and proving theorems based on these explorations.
- Writing geometric proofs to prove ideas about angles, lines, and figures.
- Calculating heights of buildings, flagpoles, and trees using ratios (trigonometry).
- Using properties of circles to explain why the outside wheels of a car turn faster than the inside wheels of a car when turning a corner.
- Verifying the best location (that minimizes patient/visitor drive times) for a hospital serving three different communities.
- Estimating the volume of a tree trunk by relating it to the volume of a cylinder.
- Exploring how the Hopewell people of the Ohio Valley (2000 years ago) created earthworks using right triangles.
- Designing a city's architectural plans using drafting tools and explaining the geometric principles underlying their plans.