2020 Colorado Academic Standards

Family and Community Guides

High School

Colorado Academic Standards

Mathematics

To support families, communities, and teachers in realizing the goals of the Colorado Academic Standards (CAS), this guide provides an overview of the learning expectations for preschool. This guide offers some learning experiences students may engage in at school that may also be supported at home.

Mathematics

The mathematics standards in the high school grades build on the strong foundation of number, algebra, statistics, and geometry developed during elementary and middle school. The study of geometry shifts to include more reasoning and proving mathematical ideas. This thinking is extended to all parts of mathematics as students construct viable arguments and critique the reasoning of others. Students learn to apply different kinds of non-linear functions to describe quantities that change in the world around them. They confront problems and persevere in solving them as they strategically apply mathematical tools and techniques.

Expectations for Integrated Mathematics 1 Students:

- **Number and Quantity**: Choose the correct units for a problem such as feet versus miles and consider these units when solving problems.
- **Algebra and Functions**: Fluently write equations for lines; solve systems of linear equations and inequalities; represent the relationship between two quantities using linear and exponential functions; rearrange exponential equations by using properties of exponents.
- **Data, Statistics, and Probability**: Estimate the mean and standard deviation of a population from sample data; describe if two variables are strongly or weakly correlated; explain the difference between correlation and causation.
- **Geometry**: Fluently use rotations, reflections, and translations to show relationships between shapes; prove theorems about lines, angles, triangles, and parallelograms.

Throughout Integrated Mathematics 1 You May Find Students:

- 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 monthly interest rate for a savings account with an annual interest of 4.5%.
- Distinguishing whether the growth of a population of prairie dogs is linear or exponential.
- Writing geometric proofs to prove ideas about angles, lines, and figures.
- 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.
- Determining the amount of water wasted by a dripping faucet over the course of one year.

Expectations for Integrated Mathematics 2 Students:

- **Number and Quantity**: Calculate with fractional exponents and imaginary numbers (complex numbers); explain why the solutions to some quadratic equations are imaginary.
- **Algebra and Functions**: Fluently graph functions and interpret key features of each function; fluently add, subtract, and multiply polynomials; use tables, graphs, and equations to solve systems of linear and quadratic functions; represent the relationship between two quantities using quadratic functions; rearrange quadratic equations by factoring and completing the square; compare and contrast linear, quadratic, and exponential functions.
- **Data, Statistics, and Probability**: Compute probabilities of multiple events and determine if one event influences another.
- **Geometry**: Fluently determine if two triangles are congruent or similar; prove geometric theorems about congruency, similarity, and circles; prove and use the Pythagorean Theorem; develop the trigonometric ratios (sine, cosine, tangent) and use them to solve a variety of right triangle problems.

Throughout Integrated Mathematics 2 You May Find Students:

- Creating quadratic equations that describe the gravitational forces on the earth which cause the trajectory of a kicked football.
- Calculating where a snowboarder will land 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.
- Determining the dimensions of a soup can that minimizes packaging materials.
- Calculating heights of buildings, flagpoles, and trees using ratios (trigonometry).
- Exploring how the Hopewell people of the Ohio Valley (2000 years ago) created earthworks using right triangles.
- Researching how imaginary numbers are used in the production of movies.
- Calculating the probability of getting cancer given a history of smoking.
- Estimating the volume of a tree trunk by relating it to the volume of a cylinder.
- Using tracing paper to define a series of rigid motions (translations, rotations, and reflections) to get one shape on top of another, proving they are congruent.

Expectations for Integrated Mathematics 3 Students:

- **Algebra and Functions**: Fluently write formulas for arithmetic and geometric sequences; fluently divide polynomials; create graphs of polynomials by identifying zeros and describe key features of the graph; solve rational and radical equations; create equations and inequalities for linear, quadratic, rational and exponential functions; find inverse functions; use logarithms and technology to solve exponential equations; describe patterns that repeat in cycles using trigonometry.
- **Data, Statistics, and Probability**: Recognize the purpose of surveys, experiments, and observational studies; compare treatment and control groups from an experiment, explain the purpose of a normal curve; calculate margin of error.
- **Geometry**: Fluently use coordinates to calculate lengths and angles using equations derived from the Pythagorean Theorem; construct geometric figures using a compass and straightedge; apply proportional reasoning to find arc lengths and areas for parts of circles; determine if two lines are parallel or perpendicular by calculating their slopes.

Throughout Integrated Mathematics 3 You May Find Students:

- Modeling the motion of a Ferris wheel, pendulum, or ocean tides with a trigonometric function.
- Describing the meaning of a ± 4% margin of error for a presidential candidate polling at 48%.
- Examining control and treatment group data from an experiment testing the effectiveness of a new study technique.
- Comparing the strengths of earthquakes using logarithms.
- Explaining how a mortgage calculator uses geometric series to determine monthly payments.
- Applying the concept of area to calculate the population density for various parts of Colorado.
- Verifying the best location (that minimizes patient/visitor drive times) for a hospital serving three different communities.
- Designing a city's architectural plans using drafting tools and explaining the geometric principles underlying the plans.
- 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.

Expectations for Algebra 1 Students:

- **Algebra and Functions**: Choose the correct units for a problem such as feet versus miles and consider these units when solving problems; 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, Statistics, and Probability**: Describe if two variables are strongly or weakly correlated; explain the difference between correlation and causation.

Throughout Algebra 1 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.

Expectations for Geometry Students:

- **Geometry**: 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 straightedge; prove and use the Pythagorean Theorem; develop the trigonometric ratios (sine, cosine, tangent) and use them to determine lengths and angles of right triangles; apply proportional reasoning to 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 and construct 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.
- Using tracing paper to define a series of rigid motions (translations, rotations, and reflections) to get one shape on top of another, proving they are congruent.

Expectations for Algebra 2 Students:

- **Number and Quantity**: Calculate with fractional exponents and imaginary numbers (complex numbers); explain why the solutions to some quadratic equations are imaginary.
- **Algebra and Functions**: Fluently divide polynomials; fluently write formulas for arithmetic and geometric sequences; create graphs of polynomials by identifying zeros and describe key features of the graph; create equations and inequalities for linear, quadratic, rational and exponential functions; solve rational and radical equations.
- Solve systems of equations and inequalities; find inverse functions; use logarithms and technology to solve exponential equations; describe patterns that repeat in cycles using trigonometry.
- **Data, Statistics, and Probability**: Recognize the purpose of surveys, experiments, and observational studies; compare treatment and control groups from an experiment; estimate the mean and standard deviation of a population from sample data; explain the purpose of a normal curve; calculate margins of errors; compute probabilities of multiple events and determine if one event influences another.

Throughout Algebra 2 You May Find Students:

- Determining the monthly interest rate for a savings account with an annual interest of 4.5%.
- Explaining how a mortgage calculator uses geometric series to determine monthly payments.
- Researching how imaginary numbers are used in the production of movies.
- Modeling the motion of a Ferris wheel, pendulum, or ocean tides with a trigonometric function.
- Comparing the strengths of earthquakes using logarithms.
- Examining control and treatment group data from an experiment testing the effectiveness of a new study technique.
- Calculating the probability of getting cancer given a history of smoking.
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