

# Analysis of *California Mathematics* standards to *Common Core* standards Algebra I

CA Math Standard	Domain	Common Core Standard (CCS)	Alignment	Comments in reference to CCS
<p>1.0 Students identify and use the arithmetic properties of subsets of integers and rational, irrational, and real numbers, including closure properties for the four basic arithmetic operations where applicable:</p>	<p>7-Expressions and Equations 8-Expressions and Equations N-The Real Number System A-Arithmetic with Polynomials and Rational Expressions</p>	<p>7-NS.2b; Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If <math>p</math> and <math>q</math> are integers, then <math>-(p/q) = (-p)/q = p/(-q)</math>. Interpret quotients of rational numbers by describing real world contexts.</p> <p>7-NS.2d; 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</p> <p>8-NS.2; Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., <math>\pi^2</math>).</p> <p>N.RN.3; Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.</p> <p>A-APR.1; Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p> <p>A-APR.7; Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.</p>	<p>Yes</p>	
<p>1.1 Students use properties of numbers to demonstrate whether assertions are true or false.</p>			<p>No</p>	<p>May be embedded in CCS Mathematical Practice Standards</p>

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2.0 Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents.	8-Expressions and Equations N-The Real Number System A-Seeing Structure in Expressions	8-EE.1; Know and apply the properties of integer exponents to generate equivalent numerical expressions.  8-EE.2; Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$ , where $p$ is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.  N-RN.1; Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.  N-RN.2; Rewrite expressions involving radicals and rational exponents using the properties of exponents.  A-SSE.3c; Use the properties of exponents to transform expressions for exponential functions.	Partial	Reciprocal is not specifically stated in CCS
3.0 Students solve equations and inequalities involving absolute values.			No	
4.0 Students simplify expressions before solving linear equations and inequalities in one variable, such as $3(2x-5) + 4(x-2) = 12$ .	8-Expressions and Equations	8-EE.7; Solve linear equations in one variable. b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	No	CCS covers this standard in 8 <sup>th</sup> grade
5.0 Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step.	7-Expressions and Equations 8-Expressions and Equations A-Reasoning with Equations and Inequalities A-Creating Equations	7-EE.4; Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$ , where $p$ , $q$ , and $r$ are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$ , where $p$ , $q$ , and $r$ are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem.	Yes	

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		<p>8-EE.7; Solve linear equations in one variable.</p> <p>a. Give examples of linear equations in one variable with one solution, 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 <math>x = a</math>, <math>a = a</math>, or <math>a = b</math> results (where <math>a</math> and <math>b</math> are different numbers).</p> <p>b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.</p> <p>A-CED.3; Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.</p> <p>A-REL.1; Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.</p> <p>A-REL.3; Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.</p> <p>A-REL.5; Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.</p> <p>A-REL.6; Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.</p>		
<p>6.0 Students graph a linear equation and compute the <math>x</math>- and <math>y</math>-intercepts (e.g., graph <math>2x + 6y = 4</math>). They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by <math>2x + 6y &lt; 4</math>).</p>	<p>8-Expressions and Equations A-Reasoning with Equations and Inequalities F- Interpreting Functions</p>	<p>8.EE.5; Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.</p> <p>A-REL.10; Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).</p> <p>A-REL. 12; Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the</p>	<p>Yes</p>	

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		<p>solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.</p> <p>F-IF.7a; Graph linear and quadratic functions and show intercepts, maxima, and minima.</p>		
7.0 Students verify that a point lies on a line, given an equation of the line. Students are able to derive linear equations by using the point-slope formula.			No	
8.0 Students understand the concepts of parallel lines and perpendicular lines and how those slopes are related. Students are able to find the equation of a line perpendicular to a given line that passes through a given point.	G-Expressing Geometric Properties with Equations	G-GPE.5; Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).	No	CCS covers this standard in Geometry
9.0 Students solve a system of two linear equations in two variables algebraically and are able to interpret the answer graphically. Students are able to solve a system of two linear inequalities in two variables and to sketch the solution sets.	8-Expressions and Equations A- Algebra-Creating Equations A-Reasoning with Equations and Inequalities	<p>8-EE.8; Analyze and solve pairs of simultaneous linear equations.</p> <ol style="list-style-type: none"> <li>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.</li> <li>Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.</li> <li>Solve real-world and mathematical problems leading to two linear equations in two variables.</li> </ol> <p>A-CED.3; Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.</p> <p>A-REI.5; Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.</p> <p>A-REI.6; Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.</p>	Yes	

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		<p>A-REI 7; Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.</p> <p>A-REI 10; Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).</p> <p>A-REI.12; Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.</p>		
10.0 Students add, subtract, multiply, and divide monomials and polynomials. Students solve multistep problems, including word problems, by using these techniques.	A-Arithmetic with Polynomials and Rational Expressions	A-APR 1; Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	Yes	
11.0 Students apply basic factoring techniques to second- and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials.	A-Seeing Structure in Expressions A-Reasoning with Equations and Inequalities	<p>A-SSE.2; Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i></p> <p>A-SSE. 3; Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.</p> <ol style="list-style-type: none"> <li>Factor a quadratic expression to reveal the zeros of the function it defines.</li> <li>Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.</li> </ol> <p>A-REI.4b: Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</p>	Partial	CCS does not specifically reference third-degree polynomials
12.0 Students simplify fractions with polynomials in the numerator and denominator by factoring both and reducing them to the lowest terms.	A-Arithmetic with Polynomials and Rational Expressions	A-APR. 6; Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$ , where $a(x)$ , $b(x)$ , $q(x)$ , and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.	Yes	

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13.0 Students add, subtract, multiply, and divide rational expressions and functions. Students solve both computationally and conceptually challenging problems by using these techniques.	A-Arithmetic with Polynomials and Rational Expressions	A-APR.7; Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.	Yes	
14.0 Students solve a quadratic equation by factoring or completing the square.	A-Reasoning with Equations and Inequalities  F-Interpreting Functions	A-REI. 4; Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in $x$ into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.  F-IF. 8a; Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	Yes	
15.0 Students apply algebraic techniques to solve rate problems, work problems, and percent mixture problems.			No	
16.0 Students understand the concepts of a relation and a function, determine whether a given relation defines a function, and give pertinent information about given relations and functions.	8-Functions  F-Interpreting Functions	8-F.1; 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.  8-F.2; Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).  8-F.3; Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.  8-F.4; 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.  F-IF.1; Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element	Yes	

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		<p>of the range. If <math>f</math> is a function and <math>x</math> is an element of its domain, then <math>f(x)</math> denotes the output of <math>f</math> corresponding to the input <math>x</math>. The graph of <math>f</math> is the graph of the equation <math>y = f(x)</math>.</p> <p>F-IF.2; Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</p>		
17.0 Students determine the domain of independent variables and the range of dependent variables defined by a graph, a set of ordered pairs, or a symbolic expression.	<p>6-Expressions and Equations</p> <p>8-Functions</p> <p>F-Interpreting Functions</p>	<p>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.</p> <p>8-F.1; 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.</p> <p>8-F.2; Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).</p> <p>F-IF.1; Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If <math>f</math> is a function and <math>x</math> is an element of its domain, then <math>f(x)</math> denotes the output of <math>f</math> corresponding to the input <math>x</math>. The graph of <math>f</math> is the graph of the equation <math>y = f(x)</math>.</p> <p>F-IF.2; Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</p> <p>F-IF.5; Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.</p>	Yes	
18.0 Students determine whether a relation defined by a graph, a set of ordered pairs, or a symbolic expression is a function and justify the conclusion.	<p>8-Functions</p> <p>F-Interpreting Functions</p>	<p>8-Cluster domain; Use functions to model relationships between quantities.</p> <p>8-F.1; 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.</p>	Yes	

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		<p>8-F.2; Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).</p> <p>8-F.5; 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 qualitative features of a function that has been described verbally.</p> <p>F-IF.1; Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If <math>f</math> is a function and <math>x</math> is an element of its domain, then <math>f(x)</math> denotes the output of <math>f</math> corresponding to the input <math>x</math>. The graph of <math>f</math> is the graph of the equation <math>y = f(x)</math>.</p> <p>F-IF.2; Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</p> <p>F-IF.5; Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.</p>		
19.0 Students know the quadratic formula and are familiar with its proof by completing the square.	A-Reasoning with Equations and Inequalities	A-REI.4a; Use the method of completing the square to transform any quadratic equation in $x$ into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.	Yes	
20.0 Students use the quadratic formula to find the roots of a second-degree polynomial and to solve quadratic equations.	A-Reasoning with Equations and Inequalities	A-REI.4b; Solve quadratic equations by inspection (e.g., for $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers $a$ and $b$ .	Yes	
21.0 Students graph quadratic functions and know that their roots are the $x$ -intercepts.	A-Seeing Structure in Expressions  F-Interpreting Functions	A-SSE.3a; Factor a quadratic expression to reveal the zeros of the function it defines. F-FI.7; Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. <ul style="list-style-type: none"> <li>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> </ul>	Yes	



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		c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. F-IF.8; Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.		
22.0 Students use the quadratic formula or factoring techniques or both to determine whether the graph of a quadratic function will intersect the $x$ -axis in zero, one, or two points.	F-Interpreting Functions	F-IF.8; Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	Partial	Does not specifically state using the discriminant
23.0 Students apply quadratic equations to physical problems, such as the motion of an object under the force of gravity.	A-Creating Equations	A-CED; 1. Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i>	Partial	CCS does not specifically mention motion of an object under the force of gravity

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24.0 Students use and know simple aspects of a logical argument:	Mathematical Practice	MP.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.	Yes	
24.1 Students explain the difference between inductive and deductive reasoning and identify and provide examples of each.	Mathematical Practice	MP.3	Implied	CCS is not explicit regarding this standard
24.2 Students identify the hypothesis and conclusion in logical deduction.	Mathematical Practice	MP.3	Implied	CCS is not explicit regarding this standard
24.3 Students use counterexamples to show that an assertion is false and recognize that a single counterexample is sufficient to refute an assertion.	Mathematical Practice	MP.3	No	
25.0 Students use properties of the number system to judge the validity of results, to justify each step of a procedure, and to prove or disprove statements:	Mathematical Practice	MP.3	Implied	CCS is not explicit regarding this standard

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25.1 Students use properties of numbers to construct simple, valid arguments (direct and indirect) for, or formulate counterexamples to, claimed assertions.	Mathematical Practice	MP.3	No	
25.2 Students judge the validity of an argument according to whether the properties of the real number system and the order of operations have been applied correctly at each step.	Mathematical Practice	MP.3	Implied	CCS is not explicit regarding this standard
25.3 Given a specific algebraic statement involving linear, quadratic, or absolute value expressions or equations or inequalities, students determine whether the statement is true sometimes, always, or never.	Mathematical Practice	MP.3	No	