Manhattan Beach
Unified School District

# CONTENT STANDARDS

## GRADE EIGHT

ENGLISH-LANGUAGE ARTS

MATHEMATICS

SCIENCE

HISTORY-SOCIAL SCIENCE

# ENGLISH-LANGUAGE ARTS CONTENT STANDARDS

## GRADE EIGHT

### READING

#### 1.0 Word Analysis, Fluency, and Systematic Vocabulary Development

**Vocabulary and Concept Development**

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|---|---|
| 1.1 | Analyze idioms, analogies, metaphors, and similes to infer the literal and figurative meanings of phrases. **(CAHSEE)** |
| 1.2 | Understand the most important points in the history of English language and use common word origins to determine the historical influences on English word meanings. |
| 1.3 | Use word meanings within the appropriate context and show ability to verify those meanings by definition, restatement, example, comparison, or contrast. **(CAHSEE)** |

#### 2.0 Reading Comprehension (Focus on Informational Materials)

**Structural Features of Informational Materials**

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|---|---|
| 2.1 | Compare and contrast the features and elements of consumer materials to gain meaning from documents (e.g., warranties, contracts, product information, instruction manuals). **(CAHSEE)** |
| 2.2 | Analyze text that uses proposition and support patterns. **(CAHSEE)** |

**Comprehension and Analysis of Grade-Level-Appropriate Text**

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|---|---|
| 2.3 | Find similarities and differences between texts in the treatment, scope, or organization of ideas. **(CAHSEE)** |
| 2.4 | Compare the original text to a summary to determine whether the summary accurately captures the main ideas, includes critical details, and conveys the underlying meaning. |
| 2.5 | Understand and explain the use of a complex mechanical device by following technical directions. |
| 2.6 | Use information from a variety of consumer, workplace, and public documents to explain a situation or decision and to solve a problem. |

**Expository Critique**

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|---|---|
| 2.7 | Evaluate the unity, coherence, logic, internal consistency, and structural patterns of text. |

#### 3.0 Literary Response and Analysis

**Structural Features of Literature**

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|---|---|
| 3.1 | Determine and articulate the relationship between the purposes and characteristics of different forms of poetry (e.g., ballad, lyric, couplet, epic, elegy, ode, sonnet). |

**Narrative Analysis of Grade-Level-Appropriate Text**

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|---|---|
| 3.2 | Evaluate the structural elements of the plot (e.g., subplots, parallel episodes, climax), the plot's development, and the way in which conflicts are (or are not) addressed and resolved. |
| 3.3 | Compare and contrast motivations and reactions of literary characters from different historical eras confronting similar situations or conflicts. |
| 3.4 | Analyze the relevance of the setting (e.g., place, time, customs) to the mood, tone, and meaning of the text. |
| 3.5 | Identify and analyze recurring themes (e.g., good versus evil) across traditional and contemporary works. |
| 3.6 | Identify significant literary devices (e.g., metaphor, symbolism, dialect, irony) that define a writer's style and use those elements to interpret the work. |

**Literary Criticism**

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|---|---|
| 3.7 | Analyze a work of literature, showing how it reflects the heritage, traditions, attitudes, and beliefs of its author. (Biographical approach) **(CAHSEE)** |

### WRITING

#### 1.0 Writing Strategies

**Organization and Focus**

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|---|---|
| 1.1 | Create compositions that establish a controlling impression, have a coherent thesis, and end with a clear and well-supported conclusion. **(CAHSEE)** |
| 1.2 | Establish coherence within and among paragraphs through effective transitions, parallel structures, and similar writing techniques. |
| 1.3 | Support theses or conclusions with analogies, paraphrases, quotations, opinions from authorities, comparisons, and similar devices. **(CAHSEE)** |

**Research and Technology**

| | |
|---|---|
| 1.4 | Plan and conduct multiple-step information searches by using computer networks and modems. |
| 1.5 | Achieve an effective balance between researched information and original ideas. |

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# ENGLISH-LANGUAGE ARTS CONTENT STANDARDS continued

## GRADE EIGHT

**WRITING continued**

**1.0 Writing Strategies continued**

**Evaluation and Revision**

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|---|---|
| 1.6 | Revise writing for word choice; appropriate organization; consistent point of view; and transitions between paragraphs, passages, and ideas. **(CAHSEE)** |

**2.0 Writing Applications (Genres and Their Characteristics)**

**Using the writing strategies of grade eight outlined in Writing Standard 1.0, students:**

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|---|---|
| 2.1 | Write biographies, autobiographies, short stories, or narratives:<br>a. Relate a clear, coherent incident, event, or situation by using well-chosen details.<br>b. Reveal the significance of, or the writer's attitude about, the subject.<br>c. Employ narrative and descriptive strategies (e.g., relevant dialogue, specific action, physical description, background description, comparison or contrast of characters). |
| 2.2 | Write responses to literature:<br>a. Exhibit careful reading and insight in their interpretations.<br>b. Connect the student's own responses to the writer's techniques and to specific textual references.<br>c. Draw supported inferences about the effects of a literary work on its audience.<br>d. Support judgments through references to the text, other works, other authors, or to personal knowledge. **(CAHSEE)** |
| 2.3 | Write research reports:<br>a. Define a thesis.<br>b. Record important ideas, concepts, and direct quotations from significant information sources and paraphrase and summarize all perspectives on the topic, as appropriate.<br>c. Use a variety of primary and secondary sources and distinguish the nature and value of each.<br>d. Organize and display information on charts, maps, and graphs. |
| 2.4 | Write persuasive compositions:<br>a. Include a well-defined thesis (i.e., one that makes a clear and knowledgeable judgment).<br>b. Present detailed evidence, examples, and reasoning to support arguments, differentiating between facts and opinion.<br>c. Provide details, reasons, and examples, arranging them effectively by anticipating and answering reader concerns and counterarguments. |
| 2.5 | Write documents related to career development, including simple business letters and job applications:<br>a. Present information purposefully and succinctly and meet the needs of the intended audience.<br>b. Follow the conventional format for the type of document (e.g., letter of inquiry, memorandum). |
| 2.6 | Write technical documents:<br>a. Identify the sequence of activities needed to design a system, operate a tool, or explain the bylaws of an organization.<br>b. Include all the factors and variables that need to be considered.<br>c. Use formatting techniques (e.g., headings, differing fonts) to aid comprehension. |

**WRITTEN AND ORAL ENGLISH LANGUAGE CONVENTIONS**

**1.0 Written and Oral English Language Conventions**

**Sentence Structure**

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|---|---|
| 1.1 | Use correct and varied sentence types and sentence openings to present a lively and effective personal style. |
| 1.2 | Identify and use parallelism, including similar grammatical forms, in all written discourse to present items in a series and items juxtaposed for emphasis. |
| 1.3 | Use subordination, coordination, apposition, and other devices to indicate clearly the relationship between ideas. **(CAHSEE)** |

**Grammar**

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|---|---|
| 1.4 | Edit written manuscripts to ensure that correct grammar is used. **(CAHSEE)** |

**Punctuation and Capitalization**

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|---|---|
| 1.5 | Use correct punctuation and capitalization. **(CAHSEE)** |

**Spelling**

| | |
|---|---|
| 1.6 | Use correct spelling conventions. |

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# ENGLISH- LANGUAGE ARTS CONTENT STANDARDS continued

## GRADE EIGHT

### LISTENING AND SPEAKING continued

#### 1.0 Listening and Speaking Strategies continued

**Comprehension**

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|---|---|
| 1.1 | Analyze oral interpretations of literature, including language choice and delivery, and the effect of the interpretations on the listener. |
| 1.2 | Paraphrase a speaker's purpose and point of view and ask relevant questions concerning the speaker's content, delivery, and purpose. |

**Organization and Delivery of Oral Communication**

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|---|---|
| 1.3 | Organize information to achieve particular purposes by matching the message, vocabulary, voice modulation, expression, and tone to the audience and purpose. |
| 1.4 | Prepare a speech outline based upon a chosen pattern of organization, which generally includes an introduction; transitions, previews, and summaries; a logically developed body; and an effective conclusion. |
| 1.5 | Use precise language, action verbs, sensory details, appropriate and colorful modifiers, and the active rather than the passive voice in ways that enliven oral presentations. |
| 1.6 | Use appropriate grammar, word choice, enunciation, and pace during formal presentations. |
| 1.7 | Use audience feedback (e.g., verbal and nonverbal cues):<br>a. Reconsider and modify the organizational structure or plan.<br>b. Rearrange words and sentences to clarify the meaning. |

**Analysis and Evaluation of Oral and Media Communications**

| | |
|---|---|
| 1.8 | Evaluate the credibility of a speaker (e.g., hidden agendas, slanted or biased material). |
| 1.9 | Interpret and evaluate the various ways in which visual image makers (e.g., graphic artists, illustrators, news photographers) communicate information and affect impressions and opinions. |

#### 2.0 Speaking Applications (Genres and Their Characteristics)

**Using the speaking strategies of grade eight outlined in Listening and Speaking Standard 1.0, students:**

| | |
|---|---|
| 2.1 | Deliver narrative presentations (e.g., biographical, autobiographical):<br>a. Relate a clear, coherent incident, event, or situation by using well-chosen details.<br>b. Reveal the significance of, and the subject's attitude about, the incident, event, or situation.<br>c. Employ narrative and descriptive strategies (e.g., relevant dialogue, specific action, physical description, background description, comparison or contrast of characters). |
| 2.2 | Deliver oral responses to literature:<br>a. Interpret a reading and provide insight.<br>b. Connect the students' own responses to the writer's techniques and to specific textual references.<br>c. Draw supported inferences about the effects of a literary work on its audience.<br>d. Support judgments through references to the text, other works, other authors, or personal knowledge. |
| 2.3 | Deliver research presentations:<br>a. Define a thesis.<br>b. Record important ideas, concepts, and direct quotations from significant information sources and paraphrase and summarize all relevant perspectives on the topic, as appropriate.<br>c. Use a variety of primary and secondary sources and distinguish the nature and value of each.<br>d. Organize and record information on charts, maps, and graphs. |
| 2.4 | Deliver persuasive presentations:<br>a. Include a well-defined thesis (i.e., one that makes a clear and knowledgeable judgment).<br>b. Differentiate fact from opinion and support arguments with detailed evidence, examples, and reasoning.<br>c. Anticipate and answer listener concerns and counterarguments effectively through the inclusion and arrangement of details, reasons, examples, and other elements.<br>d. Maintain a reasonable tone. |
| 2.5 | Recite poems (of four to six stanzas), sections of speeches, or dramatic soliloquies, using voice modulation, tone, and gestures expressively to enhance the meaning. |

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# MATHEMATICS CONTENT STANDARDS

## GRADES SIX THROUGH EIGHT PRE ALGEBRA COURSE 2

### NUMBER SENSE

**1.0 Students know the properties of, and compute with, rational numbers expressed in a variety of forms:**

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|---|---|
| 1.1 | Read, write, and compare rational numbers in scientific notation (positive and negative powers of 10) with approximate numbers using scientific notation. **(CAHSEE)** |
| 1.2 | Add, subtract, multiply, and divide rational numbers (integers, fractions, and terminating decimals) and take positive rational numbers to whole-number powers. **(CAHSEE)** |
| 1.3 | Convert fractions to decimals and percents and use these representations in estimations, computations, and applications. **(CAHSEE)** |
| 1.4 | Differentiate between rational and irrational numbers. |
| 1.5 | Know that every rational number is either a terminating or repeating decimal and be able to convert terminating decimals into reduced fractions. |
| 1.6 | Calculate the percentage of increases and decreases of a quantity. **(CAHSEE)** |
| 1.7 | Solve problems that involve discounts, markups, commissions, and profit and compute simple and compound interest. **(CAHSEE)** |

**2.0 Students use exponents, powers, and roots and use exponents in working with fractions:**

| | |
|---|---|
| 2.1 | Understand negative whole-number exponents. Multiply and divide expressions involving exponents with a common base. **(CAHSEE)** |
| 2.2 | Add and subtract fractions by using factoring to find common denominators. **(CAHSEE)** |
| 2.3 | Multiply, divide, and simplify rational numbers by using exponent rules. |
| 2.4 | Use the inverse relationship between raising to a power and extracting the root of a perfect square integer; for an integer that is not square, determine without a calculator the two integers between which its square root lies and explain why. |
| 2.5 | Understand the meaning of the absolute value of a number; interpret the absolute value as the distance of the number from zero on a number line; and determine the absolute value of real numbers. **(CAHSEE)** |

### ALGEBRA AND FUNCTIONS

**1.0 Students express quantitative relationships by using algebraic terminology, expressions, equations, inequalities, and graphs:**

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|---|---|
| 1.1 | Use variables and appropriate operations to write an expression, an equation, an inequality, or a system of equations or inequalities that represents a verbal description (e.g., three less than a number, half as large as area A). |
| 1.2 | Use the correct order of operations to evaluate algebraic expressions such as $3(2x\_ +5)^2$. |
| 1.3 | Simplify numerical expressions by applying properties of rational numbers (e.g., identity, inverse, distributive, associative, commutative) and justify the process used. |
| 1.4 | Use algebraic terminology (e.g., variable, equation, term, coefficient, inequality, expression, constant) correctly. |
| 1.5 | Represent quantitative relationships graphically and interpret the meaning of a specific part of a graph in the situation represented by the graph. |

**2.0 Students interpret and evaluate expressions involving integer powers and simple roots:**

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|---|---|
| 2.1 | Interpret positive whole-number powers as repeated multiplication and negative whole-number powers as repeated division or multiplication by the multiplicative inverse. Simplify and evaluate expressions that include exponents. |
| 2.2 | Multiply and divide monomials; extend the process of taking powers and extracting roots to monomials when the latter results in a monomial with an integer exponent. |

**3.0 Students graph and interpret linear and some nonlinear functions:**

| | |
|---|---|
| 3.1 | Graph functions of the form $y = nx^2$ and $y = nx^3$ and use in solving problems. |
| 3.2 | Plot the values from the volumes of three-dimensional shapes for various values of the edge lengths (e.g., cubes with varying edge lengths or a triangle prism with a fixed height and an equilateral triangle base of varying lengths). |
| 3.3 | Graph linear functions, noting that the vertical change (change in *y*-value) per unit of horizontal change (change in *x*-value) is always the same and know that the ratio ("rise over run") is called the slope of a graph. |
| 3.4 | Plot the values of quantities whose ratios are always the same (e.g., cost to the number of an item, feet to inches, circumference to diameter of a circle). Fit a line to the plot and understand that the slope of the line equals the quantities. |

**4.0 Students solve simple linear equations and inequalities over the rational numbers:**

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|---|---|
| 4.1 | Solve two-step linear equations and inequalities in one variable over the rational numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of the results. |
| 4.2 | Solve multi-step problems involving rate, average speed, distance, and time or a direct variation. |

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# MATHEMATICS CONTENT STANDARDS continued

## GRADES SIX THROUGH EIGHT PRE ALGEBRA COURSE 2

### MEASUREMENT AND GEOMETRY

**1.0 Students choose appropriate units of measure and use ratios to convert within and between measurement systems to solve problems:**

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|---|---|
| 1.1 | Compare weights, capacities, geometric measures, times, and temperatures within and between measurement systems (e.g., miles per hour and feet per second, cubic inches to cubic centimeters). **(CAHSEE)** |
| 1.2 | Construct and read drawings and models made to scale. |
| 1.3 | Use measures expressed as rates (e.g., speed, density) and measures expressed as products (e.g., person-days) to solve problems; check the units of the solutions; and use dimensional analysis to check the reasonableness of the answer. **(CAHSEE)** |

**2.0 Students compute the perimeter, area, and volume of common geometric objects and use the results to find measures of less common objects. They know how perimeter, area, and volume are affected by changes of scale:**

| | |
|---|---|
| 2.1 | Use formulas routinely for finding the perimeter and area of basic two-dimensional figures and the surface area and volume of basic three-dimensional figures, including rectangles, parallelograms, trapezoids, squares, triangles, circles, prisms, and cylinders. |
| 2.2 | Estimate and compute the area of more complex or irregular two- and three-dimensional figures by breaking the figures down into more basic geometric objects. |
| 2.3 | Compute the length of the perimeter, the surface area of the faces, and the volume of a three-dimensional object built from rectangular solids. Understand that when the lengths of all dimensions are multiplied by a scale factor, the surface area is multiplied by the square of the scale factor and the volume is multiplied by the cube of the scale factor. |
| 2.4 | Relate the changes in measurement with a change of scale to the units used (e.g., square inches, cubic feet) and to conversions between units (1 square foot = 144 square inches or [1 $ft^2$] = [144 $in^2$], 1 cubic inch is approximately 16.38 cubic centimeters or [1$in^3$] = [16.38 $cm^3$]). |

**3.0 Students know the Pythagorean theorem and deepen their understanding of plane and solid geometric shapes by constructing figures that meet given conditions and by identifying attributes of figures:**

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|---|---|
| 3.1 | Identify and construct basic elements of geometric figures (e.g., altitudes, midpoints, diagonals, angle bisectors, and perpendicular bisectors; central angles, radii, diameters, and chords of circles) by using a compass and straightedge. |
| 3.2 | Understand and use coordinate graphs to plot simple figures, determine lengths and areas related to them, and determine their image under translations and reflections. |
| 3.3 | Know and understand the Pythagorean theorem and its converse and use it to find the length of the missing side of a right triangle and the lengths of other line segments and, in some situations, empirically verify the Pythagorean theorem by direct measurement. |
| 3.4 | Demonstrate an understanding of conditions that indicate two geometrical figures are congruent and what congruence means about the relationships between the sides and angles of the two figures. |
| 3.5 | Construct two-dimensional patterns for three-dimensional models, such as cylinders, prisms, and cones. |
| 3.6 | Identify elements of three-dimensional geometric objects (e.g., diagonals of rectangular solids) and describe how two or more objects are related in space (e.g., skew lines, the possible ways three planes might intersect). |

### STATISTICS, DATA ANALYSIS, AND PROBABILITY

**1.0 Students collect, organize, and represent data sets that have one or more variables and identify relationships among variables within a data set by hand and through the use of an electronic spreadsheet software program:**

| | |
|---|---|
| 1.1 | Know various forms of display for data sets, including a stem-and-leaf plot or box-and-whisker plot; use the forms to display a single set of data or to compare two sets of data. **(CAHSEE)** |
| 1.2 | Represent two numerical variables on a scatterplot and informally describe how the data points are distributed and any apparent relationship that exists between the two variables (e.g., between time spent on homework and grade level). **(CAHSEE)** |
| 1.3 | Understand the meaning of, and be able to compute, the minimum, the lower quartile, the median, the upper quartile, and the maximum of a data set. **(CAHSEE)** |

### MATHEMATICAL REASONING

**1.0 Students make decisions about how to approach problems:**

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|---|---|
| 1.1 | Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns. **(CAHSEE)** |
| 1.2 | Formulate and justify mathematical conjectures based on a general description of the mathematical question or problem posed. |
| 1.3 | Determine when and how to break a problem into simpler parts. |

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# MATHEMATICS CONTENT STANDARDS continued

## GRADES SIX THROUGH EIGHT PRE ALGEBRA COURSE 2

**MATHEMATICAL REASONING continued**

**2.0 Students use strategies, skills, and concepts in finding solutions:**

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|---|---|
| 2.1 | Use estimation to verify the reasonableness of calculated results. **(CAHSEE)** |
| 2.2 | Apply strategies and results from simpler problems to more complex problems. |
| 2.3 | Estimate unknown quantities graphically and solve for them by using logical reasoning and arithmetic and algebraic techniques. **(CAHSEE)** |
| 2.4 | Make and test conjectures by using both inductive and deductive reasoning. |
| 2.5 | Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning. |
| 2.6 | Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work. |
| 2.7 | Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy. |
| 2.8 | Make precise calculations and check the validity of the results from the context of the problem. |

**3.0 Students determine a solution is complete and move beyond a particular problem by generalizing to other situations:**

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|---|---|
| 3.1 | Evaluate the reasonableness of the solution in the context of the original situation. |
| 3.2 | Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems. |
| 3.3 | Develop generalizations of the results obtained and the strategies used and apply them to new problem situations. |

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# MATHEMATICS CONTENT STANDARDS continued

## GRADES EIGHT THROUGH TWELVE

**ALGEBRA I**

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|---|---|
| 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:<br>1.1 Students use properties of numbers to demonstrate whether assertions are true or false. |
| 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. **(CAHSEE)** |
| 3.0 | Students solve equations and inequalities involving absolute values. **(CAHSEE)** |
| 4.0 | Students simplify expressions before solving linear equations and inequalities in one variable, such as $3(2x-5) + 4(x-2) = 12$. **(CAHSEE)** |
| 5.0 | Students solve multi-step problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step. **(CAHSEE)** |
| 6.0 | Students graph a linear equation and compute the x- and y-intercepts (e.g., graph $2x + 6y = 4$). They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by $2x + 6y < 4$). **(CAHSEE)** |
| 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. **(CAHSEE)** |
| 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. **(CAHSEE)** |
| 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. **(CAHSEE)** |
| 10.0 | Students add, subtract, multiply, and divide monomials and polynomials. Students solve multi-step problems, including word problems, by using these techniques. **(CAHSEE)** |
| 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. |
| 12.0 | Students simplify fractions with polynomials in the numerator and denominator by factoring both and reducing them to the lowest terms. |
| 13.0 | Students add, subtract, multiply, and divide rational expressions and functions. Students solve both computationally and conceptually challenging problems by using these techniques. |
| 14.0 | Students solve a quadratic equation by factoring or completing the square. |
| 15.0 | Students apply algebraic techniques to solve rate problems, work problems, and percent mixture problems. **(CAHSEE)** |
| 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. |
| 17.0 | Students determine the domain of independent variables and the range of de-pendent variables defined by a graph, a set of ordered pairs, or a symbolic expression. **(CAHSEE)** |
| 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. |
| 19.0 | Students know the quadratic formula and are familiar with its proof by completing the square. |
| 20.0 | Students use the quadratic formula to find the roots of a second-degree polynomial and to solve quadratic equations. |
| 21.0 | Students graph quadratic functions and know that their roots are the *x*-intercepts. **(CAHSEE)** |
| 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. |
| 23.0 | Students apply quadratic equations to physical problems, such as the motion of an object under the force of gravity. |
| 24.0 | Students use and know simple aspects of a logical argument:<br>24.1 Students explain the difference between inductive and deductive reasoning and identify and provide examples of each.<br>24.2 Students identify the hypothesis and conclusion in logical deduction.<br>24.3 Students use counterexamples to show that an assertion is false and recognize that a single counterexample is sufficient to refute an assertion. |
| 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:<br>25.1 Students use properties of numbers to construct simple, valid arguments (direct and indirect) for, or formulate counterexamples to, claimed assertions.<br>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.<br>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. |

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# MATHEMATICS CONTENT STANDARDS continued

## GRADES EIGHT THROUGH TWELVE

### GEOMETRY

| | |
|---|---|
| 1.0 | 1.0 Students demonstrate understanding by identifying and giving examples of undefined terms, axioms, theorems, and inductive and deductive reasoning. |
| 2.0 | Students write geometric proofs, including proofs by contradiction. |
| 3.0 | Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. |
| 4.0 | Students prove basic theorems involving congruence and similarity. |
| 5.0 | Students prove that triangles are congruent or similar, and they are able to use the concept of corresponding parts of congruent triangles. |
| 6.0 | Students know and are able to use the triangle inequality theorem. |
| 7.0 | Students prove and use theorems involving the properties of parallel lines cut by a transversal, the properties of quadrilaterals, and the properties of circles. |
| 8.0 | Students know, derive, and solve problems involving the perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures. |
| 9.0 | Students compute the volumes and surface areas of prisms, pyramids, cylinders, cones, and spheres; and students commit to memory the formulas for prisms, pyramids, and cylinders. |
| 10.0 | Students compute areas of polygons, including rectangles, scalene triangles, equilateral triangles, rhombi, parallelograms, and trapezoids. |
| 11.0 | Students determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids. |
| 12.0 | Students find and use measures of sides and of interior and exterior angles of triangles and polygons to classify figures and solve problems. |
| 13.0 | Students prove relationships between angles in polygons by using properties of complementary, supplementary, vertical, and exterior angles. |
| 14.0 | Students prove the Pythagorean theorem. |
| 15.0 | Students use the Pythagorean theorem to determine distance and find missing lengths of sides of right triangles. |
| 16.0 | Students perform basic constructions with a straightedge and compass, such as angle bisectors, perpendicular bisectors, and the line parallel to a given line through a point off the line. |
| 17.0 | Students prove theorems by using coordinate geometry, including the midpoint of a line segment, the distance formula, and various forms of equations of lines and circles. |
| 18.0 | Students know the definitions of the basic trigonometric functions defined by the angles of a right triangle. They also know and are able to use elementary relationships between them. For example, $\tan(x) = \sin(x)/\cos(x)$, $(\sin(x))^2 + (\cos(x))^2 = 1$. |
| 19.0 | Students use trigonometric functions to solve for an unknown length of a side of a right triangle, given an angle and a length of a side. |
| 20.0 | Students know and are able to use angle and side relationships in problems with special right triangles, such as 30°, 60°, and 90° triangles and 45°, 45°, and 90° triangles. |
| 21.0 | Students prove and solve problems regarding relationships among chords, secants, tangents, inscribed angles, and inscribed and circumscribed polygons of circles. |
| 22.0 | Students know the effect of rigid motions on figures in the coordinate plane and space, including rotations, translations, and reflections. |

### ALGEBRA II

| | |
|---|---|
| 1.0 | Students solve equations and inequalities involving absolute value. |
| 2.0 | Students solve systems of linear equations and inequalities (in two or three variables) by substitution, with graphs, or with matrices. |
| 3.0 | Students are adept at operations on polynomials, including long division. |
| 4.0 | Students factor polynomials representing the difference of squares, perfect square trinomials, and the sum and difference of two cubes. |
| 5.0 | Students demonstrate knowledge of how real and complex numbers are related both arithmetically and graphically. In particular, they can plot complex numbers as points in the plane. |
| 6.0 | Students add, subtract, multiply, and divide complex numbers. |
| 7.0 | Students add, subtract, multiply, divide, reduce, and evaluate rational expressions with monomial and polynomial denominators and simplify complicated rational expressions, including those with negative exponents in the denominator. |
| 8.0 | Students solve and graph quadratic equations by factoring, completing the square, or using the quadratic formula. Students apply these techniques in solving word problems. They also solve quadratic equations in the complex number system. |
| 9.0 | Students demonstrate and explain the effect that changing a coefficient has on the graph of quadratic functions; that is, students can determine how the graph of a parabola changes as a, b, and c vary in the equation $y = a(x-b) 2 + c$. |
| 10.0 | Students graph quadratic functions and determine the maxima, minima, and zeros of the function. |
| 11.0 | Students prove simple laws of logarithms.<br>11.1 Students understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.<br>11.2 Students judge the validity of an argument according to whether the properties of real numbers, exponents, and logarithms have been applied correctly at each step. |

# MATHEMATICS CONTENT STANDARDS continued

## GRADES EIGHT THROUGH TWELVE

### ALGEBRA II continued

| | |
|---|---|
| 12.0 | Students know the laws of fractional exponents, understand exponential functions, and use these functions in problems involving exponential growth and decay. |
| 13.0 | Students use the definition of logarithms to translate between logarithms in any base. |
| 14.0 | Students understand and use the properties of logarithms to simplify logarithmic numeric expressions and to identify their approximate values. |
| 15.0 | Students determine whether a specific algebraic statement involving rational expressions, radical expressions, or logarithmic or exponential functions is sometimes true, always true, or never true. |
| 16.0 | Students demonstrate and explain how the geometry of the graph of a conic section (e.g., asymptotes, foci, eccentricity) depends on the coefficients of the quadratic equation representing it. |
| 17.0 | Given a quadratic equation of the form $ax^2 + by^2 + cx + dy + e = 0$, students can use the method for completing the square to put the equation into standard form and can recognize whether the graph of the equation is a circle, ellipse, parabola, or hyperbola. Students can then graph the equation. |
| 18.0 | Students use fundamental counting principles to compute combinations and permutations. |
| 19.0 | Students use combinations and permutations to compute probabilities. |
| 20.0 | Students know the binomial theorem and use it to expand binomial expressions that are raised to positive integer powers. |
| 21.0 | Students apply the method of mathematical induction to prove general statements about the positive integers. |
| 22.0 | Students find the general term and the sums of arithmetic series and of both finite and infinite geometric series. |
| 23.0 | Students derive the summation formulas for arithmetic series and for both finite and infinite geometric series. |
| 24.0 | Students solve problems involving functional concepts, such as composition, defining the inverse function and performing arithmetic operations on functions. |
| 25.0 | Students use properties from number systems to justify steps in combining and simplifying functions. |

### TRIGONOMETRY

| | |
|---|---|
| 1.0 | Students understand the notion of angle and how to measure it, in both degrees and radians. They can convert between degrees and radians. |
| 2.0 | Students know the definition of sine and cosine as y- and x-coordinates of points on the unit circle and are familiar with the graphs of the sine and cosine functions. |
| 3.0 | Students know the identity $\cos^2(x) + \sin^2(x) = 1$:<br>3.1 Students prove that this identity is equivalent to the Pythagorean theorem (i.e., students can prove this identity by using the Pythagorean theorem and, conversely, they can prove the Pythagorean theorem as a consequence of this identity).<br>3.2 Students prove other trigonometric identities and simplify others by using the identity $\cos^2(x) + \sin^2(x) = 1$. For example, students use this identity to prove that $\sec^2(x) = \tan^2(x) + 1$. |
| 4.0 | Students graph functions of the form $f(t) = A \sin(Bt + C)$ or $f(t) = A \cos(Bt + C)$ and interpret *A, B,* and *C* in terms of amplitude, frequency, period, and phase shift. |
| 5.0 | Students know the definitions of the tangent and cotangent functions and can graph them. |
| 6.0 | Students know the definitions of the secant and cosecant functions and can graph them. |
| 7.0 | Students know that the tangent of the angle that a line makes with the *x*-axis is equal to the slope of the line. |
| 8.0 | Students know the definitions of the inverse trigonometric functions and can graph the functions. |
| 9.0 | Students compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points. |
| 10.0 | Students demonstrate an understanding of the addition formulas for sines and cosines and their proofs and can use those formulas to prove and/or simplify other trigonometric identities. |
| 11.0 | Students demonstrate an understanding of half-angle and double-angle formulas for sines and cosines and can use those formulas to prove and/or simplify other trigonometric identities. |
| 12.0 | Students use trigonometry to determine unknown sides or angles in right triangles. |
| 13.0 | Students know the law of sines and the law of cosines and apply those laws to solve problems. |
| 14.0 | Students determine the area of a triangle, given one angle and the two adjacent sides. |
| 15.0 | Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa. |
| 16.0 | Students represent equations given in rectangular coordinates in terms of polar coordinates. |
| 17.0 | Students are familiar with complex numbers. They can represent a complex number in polar form and know how to multiply complex numbers in their polar form. |
| 18.0 | Students know DeMoivre's theorem and can give nth roots of a complex number given in polar form. |
| 19.0 | Students are adept at using trigonometry in a variety of applications and word problems. |

# MATHEMATICS CONTENT STANDARDS continued

## GRADES EIGHT THROUGH TWELVE

### MATHEMATICAL ANALYSIS

| | |
|---|---|
| 1.0 | Students are familiar with, and can apply, polar coordinates and vectors in the plane. In particular, they can translate between polar and rectangular coordinates and can interpret polar coordinates and vectors graphically. |
| 2.0 | Students are adept at the arithmetic of complex numbers. They can use the trigonometric form of complex numbers and understand that a function of a complex variable can be viewed as a function of two real variables. They know the proof of DeMoivre's theorem. |
| 3.0 | Students can give proofs of various formulas by using the technique of mathematical induction. |
| 4.0 | Students know the statement of, and can apply, the fundamental theorem of algebra. |
| 5.0 | Students are familiar with conic sections, both analytically and geometrically:<br>5.1 Students can take a quadratic equation in two variables; put it in standard form by completing the square and using rotations and translations, if necessary; determine what type of conic section the equation represents; and determine its geometric components (foci, asymptotes, and so forth).<br>5.2 Students can take a geometric description of a conic section—for example, the locus of points whose sum of its distances from (1, 0) and (-1, 0) is 6—and derive a quadratic equation representing it. |
| 6.0 | Students find the roots and poles of a rational function and can graph the function and locate its asymptotes. |
| 7.0 | Students demonstrate an understanding of functions and equations defined parametrically and can graph them. |
| 8.0 | Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge. |

### LINEAR ALGEBRA

| | |
|---|---|
| 1.0 | Students solve linear equations in any number of variables by using Gauss-Jordan elimination. |
| 2.0 | Students interpret linear systems as coefficient matrices and the Gauss-Jordan method as row operations on the coefficient matrix. |
| 3.0 | Students reduce rectangular matrices to row echelon form. |
| 4.0 | Students perform addition on matrices and vectors. |
| 5.0 | Students perform matrix multiplication and multiply vectors by matrices and by scalars. |
| 6.0 | Students demonstrate an understanding that linear systems are inconsistent (have no solutions), have exactly one solution, or have infinitely many solutions. |
| 7.0 | Students demonstrate an understanding of the geometric interpretation of vectors and vector addition (by means of parallelograms) in the plane and in three-dimensional space. |
| 8.0 | Students interpret geometrically the solution sets of systems of equations. For example, the solution set of a single linear equation in two variables is interpreted as a line in the plane, and the solution set of a two-by-two system is interpreted as the intersection of a pair of lines in the plane. |
| 9.0 | Students demonstrate an understanding of the notion of the inverse to a square matrix and apply that concept to solve systems of linear equations. |
| 10.0 | Students compute the determinants of 2 X 2 and 3 X 3 matrices and are familiar with their geometric interpretations as the area and volume of the parallelepipeds spanned by the images under the matrices of the standard basis vectors in two-dimensional and three-dimensional spaces. |
| 11.0 | Students know that a square matrix is invertible if, and only if, its determinant is nonzero. They can compute the inverse to 2 X 2 and 3 X 3 matrices using row reduction methods or Cramer's rule. |
| 12.0 | Students compute the scalar (dot) product of two vectors in n-dimensional space and know that perpendicular vectors have zero dot product. |

### PROBABILITY AND STATISTICS

| | |
|---|---|
| 1.0 | Students know the definition of the notion of independent events and can use the rules for addition, multiplication, and complementation to solve for probabilities of particular events in finite sample spaces. |
| 2.0 | Students know the definition of conditional probability and use it to solve for probabilities in finite sample spaces. |
| 3.0 | Students demonstrate an understanding of the notion of discrete random variables by using them to solve for the probabilities of outcomes, such as the probability of the occurrence of five heads in 14 coin tosses. |
| 4.0 | Students are familiar with the standard distributions (normal, binomial, and exponential) and can use them to solve for events in problems in which the distribution belongs to those families. |
| 5.0 | Students determine the mean and the standard deviation of a normally distributed random variable. |
| 6.0 | Students know the definitions of the mean, median, and mode of a distribution of data and can compute each in particular situations. |
| 7.0 | Students compute the variance and the standard deviation of a distribution of data. |
| 8.0 | Students organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line and bar graphs, stem-and-leaf displays, scatterplots, and box-and-whisker plots. |

### ADVANCED PROBABILITY AND STATISTICS

| | |
|---|---|
| 1.0 | Students solve probability problems with finite sample spaces by using the rules for addition, multiplication, and complementation for probability distributions and understand the simplifications that arise with independent events. |
| 2.0 | Students know the definition of *conditional probability* and use it to solve for probabilities in finite sample spaces. |

# MATHEMATICS CONTENT STANDARDS continued

## GRADES EIGHT THROUGH TWELVE

### ADVANCED PROBABILITY AND STATISTICS continued

| | |
|---|---|
| 3.0 | Students demonstrate an understanding of the notion of *discrete random variables* by using this concept to solve for the probabilities of outcomes, such as the probability of the occurrence of five or fewer heads in 14 coin tosses. |
| 4.0 | Students understand the notion of a *continuous random variable* and can interpret the probability of an outcome as the area of a region under the graph of the probability density function associated with the random variable. |
| 5.0 | Students know the definition of the *mean of a discrete random variable* and can determine the mean for a particular discrete random variable. |
| 6.0 | Students know the definition of the *variance of a discrete random variable* and can determine the variance for a particular discrete random variable. |
| 7.0 | Students demonstrate an understanding of the standard distributions (normal, binomial, and exponential) and can use the distributions to solve for events in problems in which the distribution belongs to those families. |
| 8.0 | Students determine the mean and the standard deviation of a normally distributed random variable. |
| 9.0 | Students know the central limit theorem and can use it to obtain approximations for probabilities in problems of finite sample spaces in which the probabilities are distributed binomially. |
| 10.0 | Students know the definitions of the *mean*, *median*, and *mode of distribution* of data and can compute each of them in particular situations. |
| 11.0 | Students compute the variance and the standard deviation of a distribution of data. |
| 12.0 | Students find the line of best fit to a given distribution of data by using least squares regression. |
| 13.0 | Students know what the *correlation coefficient of two variables* means and are familiar with the coefficient's properties. |
| 14.0 | Students organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line graphs and bar graphs, stem-and-leaf displays, scatterplots, and box-and-whisker plots. |
| 15.0 | Students are familiar with the notions of a statistic of a distribution of values, of the sampling distribution of a statistic, and of the variability of a statistic. |
| 16.0 | Students know basic facts concerning the relation between the mean and the standard deviation of a sampling distribution and the mean and the standard deviation of the population distribution. |
| 17.0 | Students determine confidence intervals for a simple random sample from a normal distribution of data and determine the sample size required for a desired margin of error. |
| 18.0 | Students determine the *P*-value for a statistic for a simple random sample from a normal distribution. |
| 19.0 | Students are familiar with the *chi*-square distribution and *chi*-square test and understand their uses. |

### CALCULUS

| | |
|---|---|
| 1.0 | Students demonstrate knowledge of both the formal definition and the graphical interpretation of limit of values of functions. This knowledge includes one-sided limits, infinite limits, and limits at infinity. Students know the definition of convergence and divergence of a function as the domain variable approaches either a number or infinity:<br>1.1 Students prove and use theorems evaluating the limits of sums, products, quotients, and composition of functions.<br>1.2 Students use graphical calculators to verify and estimate limits.<br>1.3 Students prove and use special limits, such as the limits of $(\sin(x))/x$ and $(1-\cos(x))/x$ as $x$ tends to 0. |
| 2.0 | Students demonstrate knowledge of both the formal definition and the graphical interpretation of continuity of a function. |
| 3.0 | Students demonstrate an understanding and the application of the intermediate value theorem and the extreme value theorem. |
| 4.0 | Students demonstrate an understanding of the formal definition of the derivative of a function at a point and the notion of differentiability:<br>4.1 Students demonstrate an understanding of the derivative of a function as the slope of the tangent line to the graph of the function.<br>4.2 Students demonstrate an understanding of the interpretation of the derivative as an instantaneous rate of change. Students can use derivatives to solve a variety of problems from physics, chemistry, economics, and so forth that involve the rate of change of a function.<br>4.3 Students understand the relation between differentiability and continuity.<br>4.4 Students derive derivative formulas and use them to find the derivatives of algebraic, trigonometric, inverse trigonometric, exponential, and logarithmic functions. |
| 5.0 | Students know the chain rule and its proof and applications to the calculation of the derivative of a variety of composite functions. |
| 6.0 | Students find the derivatives of parametrically defined functions and use implicit differentiation in a wide variety of problems in physics, chemistry, economics, and so forth. |
| 7.0 | Students compute derivatives of higher orders. |
| 8.0 | Students know and can apply Rolle's theorem, the mean value theorem, and L'Hôpital's rule. |
| 9.0 | Students use differentiation to sketch, by hand, graphs of functions. They can identify maxima, minima, inflection points, and intervals in which the function is increasing and decreasing. |
| 10.0 | Students know Newton's method for approximating the zeros of a function. |
| 11.0 | Students use differentiation to solve optimization (maximum-minimum problems) in a variety of pure and applied contexts. |
| 12.0 | Students use differentiation to solve related rate problems in a variety of pure and applied contexts. |
| 13.0 | Students know the definition of the definite integral by using Riemann sums. They use this definition to approximate integrals. |

# MATHEMATICS CONTENT STANDARDS continued

## GRADES EIGHT THROUGH TWELVE

**CALCULUS continued**

| | |
|---|---|
| 14.0 | Students apply the definition of the integral to model problems in physics, economics, and so forth, obtaining results in terms of integrals. |
| 15.0 | Students demonstrate knowledge and proof of the fundamental theorem of calculus and use it to interpret integrals as antiderivatives. |
| 16.0 | Students use definite integrals in problems involving area, velocity, acceleration, volume of a solid, area of a surface of revolution, length of a curve, and work. |
| 17.0 | Students compute, by hand, the integrals of a wide variety of functions by using techniques of integration, such as substitution, integration by parts, and trigonometric substitution. They can also combine these techniques when appropriate. |
| 18.0 | Students know the definitions and properties of inverse trigonometric functions and the expression of these functions as indefinite integrals. |
| 19.0 | Students compute, by hand, the integrals of rational functions by combining the techniques in standard 17.0 with the algebraic techniques of partial fractions and completing the square. |
| 20.0 | Students compute the integrals of trigonometric functions by using the techniques noted above. |
| 21.0 | Students understand the algorithms involved in Simpson's rule and Newton's method. They use calculators or computers or both to approximate integrals numerically. |
| 22.0 | Students understand improper integrals as limits of definite integrals. |
| 23.0 | Students demonstrate an understanding of the definitions of convergence and divergence of sequences and series of real numbers. By using such tests as the comparison test, ratio test, and alternate series test, they can determine whether a series converges. |
| 24.0 | Students understand and can compute the radius (interval) of the convergence of power series. |
| 25.0 | Students differentiate and integrate the terms of a power series in order to form new series from known ones. |
| 26.0 | Students calculate Taylor polynomials and Taylor series of basic functions, including the remainder term. |
| 27.0 | Students know the techniques of solution of selected elementary differential equations and their applications to a wide variety of situations, including growth-and-decay problems. |

# SCIENCE CONTENT STANDARDS

## GRADE EIGHT

**FOCUS ON PHYSICAL SCIENCE**

**Motion**

**1. The velocity of an object is the rate of change of its position. As a basis for understanding this concept:**

| | |
|---|---|
| a. | Students know position is defined in relation to some choice of a standard reference point and a set of reference directions. |
| b. | Students know that average speed is the total distance traveled divided by the total time elapsed and that the speed of an object along the path traveled can vary. |
| c. | Students know how to solve problems involving distance, time, and average speed. |
| d. | Students know the velocity of an object must be described by specifying both the direction and the speed of the object. |
| e. | Students know changes in velocity may be due to changes in speed, direction, or both. |
| f. | Students know how to interpret graphs of position versus time and graphs of speed versus time for motion in a single direction. |

**Forces**

**2. Unbalanced forces cause changes in velocity. As a basis for understanding this concept:**

| | |
|---|---|
| a. | Students know a force has both direction and magnitude. |
| b. | Students know when an object is subject to two or more forces at once, the result is the cumulative effect of all the forces. |
| c. | Students know when the forces on an object are balanced, the motion of the object does not change. |
| d. | Students know how to identify separately the two or more forces that are acting on a single static object, including gravity, elastic forces due to tension or compression in matter, and friction. |
| e. | Students know that when the forces on an object are unbalanced, the object will change its velocity (that is, it will speed up, slow down, or change direction). |
| f. | Students know the greater the mass of an object, the more force is needed to achieve the same rate of change in motion. |
| g. | Students know the role of gravity in forming and maintaining the shapes of planets, stars, and the solar system. |

**Structure of Matter**

**3. Each of the more than 100 elements of matter has distinct properties and a distinct atomic structure. All forms of matter are composed of one or more of the elements. As a basis for understanding this concept:**

| | |
|---|---|
| a. | Students know the structure of the atom and know it is composed of protons, neutrons, and electrons. |
| b. | Students know that compounds are formed by combining two or more different elements and that compounds have properties that are different from their constituent elements. |
| c. | Students know atoms and molecules form solids by building up repeating patterns, such as the crystal structure of NaCl or long-chain polymers. |
| d. | Students know the states of matter (solid, liquid, gas) depend on molecular motion. |
| e. | Student s know that in solids the atoms are closely locked in position and can only vibrate; in liquids the atoms and molecules are more loosely connected and can collide with and move past one another; and in gases the atoms and molecules are free to move independently, colliding frequently. |
| f. | Students know how to use the periodic table to identify elements in simple compounds. |

**Earth in the Solar System (Earth Science)**

**4. The structure and composition of the universe can be learned from studying stars and galaxies and their evolution. As a basis for understanding this concept:**

| | |
|---|---|
| a. | Students know galaxies are clusters of billions of stars and may have different shapes. |
| b. | Students know that the Sun is one of many stars in the Milky Way galaxy and that stars may differ in size, temperature, and color. |
| c. | Students know how to use astronomical units and light years as measures of distances between the Sun, stars, and Earth. |
| d. | Students know that stars are the source of light for all bright objects in outer space and that the Moon and planets shine by reflected sunlight, not by their own light. |
| e. | Students know the appearance, general composition, relative position and size, and motion of objects in the solar system, including planets, planetary satellites, comets, and asteroids. |

**Reactions**

**5. Chemical reactions are processes in which atoms are rearranged into different combinations of molecules. As a basis for understanding this concept:**

| | |
|---|---|
| a. | Students know reactant atoms and molecules interact to form products with different chemical properties. |
| b. | Students know the idea of atoms explains the conservation of matter: In chemical reactions the number of atoms stays the same no matter how they are arranged, so their total mass stays the same. |
| c. | Students know chemical reactions usually liberate heat or absorb heat. |
| d. | Students know physical processes include freezing and boiling, in which a material changes form with no chemical reaction. |
| e. | Students know how to determine whether a solution is acidic, basic, or neutral. |

# SCIENCE CONTENT STANDARDS continued

## GRADE EIGHT

**Chemistry of Living Systems (Life Science)**

**6. Principles of chemistry underlie the functioning of biological systems. As a basis for understanding this concept:**

| | |
|---|---|
| a. | Students know that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms. |
| b. | Students know that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur. |
| c. | Students know that living organisms have many different kinds of molecules, including small ones, such as water and salt, and very large ones, such as carbohydrates, fats, proteins, and DNA. |

**Periodic Table**

**7. The organization of the periodic table is based on the properties of the elements and reflects the structure of atoms. As a basis for understanding this concept:**

| | |
|---|---|
| a. | Students know how to identify regions corresponding to metals, nonmetals, and inert gases. |
| b. | Students know each element has a specific number of protons in the nucleus (the atomic number) and each isotope of the element has a different but specific number of neutrons in the nucleus. |
| c. | Students know substances can be classified by their properties, including their melting temperature, density, hardness, and thermal and electrical conductivity. |

**Density and Buoyancy**

**8. All objects experience a buoyant force when immersed in a fluid. As a basis for understanding this concept:**

| | |
|---|---|
| a. | Students know density is mass per unit volume. |
| b. | Students know how to calculate the density of substances (regular and irregular solids and liquids) from measurements of mass and volume. |
| c. | Students know the buoyant force on an object in a fluid is an upward force equal to the weight of the fluid the object has displaced. |
| d. | Students know how to predict whether an object will float or sink. |

**Investigation and Experimentation**

**9. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:**

| | |
|---|---|
| a. | Plan and conduct a scientific investigation to test a hypothesis. |
| b. | Evaluate the accuracy and reproducibility of data. |
| c. | Distinguish between variable and controlled parameters in a test. |
| d. | Recognize the slope of the linear graph as the constant in the relationship $y = kx$ and apply this principle in interpreting graphs constructed from data. |
| e. | Construct appropriate graphs from data and develop quantitative statements about the relationships between variables. |
| f. | Apply simple mathematic relationships to determine a missing quantity in a mathematic expression, given the two remaining terms (including speed = distance/ time, density = mass/volume, force = pressure x area, volume = area x height). |
| g. | Distinguish between linear and nonlinear relationships on a graph of data. |

# HISTORY-SOCIAL SCIENCE CONTENT STANDARDS

## GRADE EIGHT

### UNITED STATES HISTORY AND GEOGRAPHY: GROWTH AND CONFLICT

**8.1 Students understand the major events preceding the founding of the nation and relate their significance to the development of American constitutional democracy.**

| | |
|---|---|
| 1. | Describe the relationship between the moral and political ideas of the Great Awakening and the development of revolutionary fervor. |
| 2. | Analyze the philosophy of government expressed in the Declaration of Independence, with an emphasis on government as a means of securing individual rights (e.g., key phrases such as "all men are created equal, that they are endowed by their Creator with certain unalienable Rights"). |
| 3. | Analyze how the American Revolution affected other nations, especially France. |
| 4. | Describe the nation's blend of civic republicanism, classical liberal principles, and English parliamentary traditions. |

**8.2 Students analyze the political principles underlying the U.S. Constitution and compare the enumerated and implied powers of the federal government.**

| | |
|---|---|
| 1. | Discuss the significance of the Magna Carta, the English Bill of Rights, and the Mayflower Compact. |
| 2. | Analyze the Articles of Confederation and the Constitution and the success of each in implementing the ideals of the Declaration of Independence. |
| 3. | Evaluate the major debates that occurred during the development of the Constitution and their ultimate resolutions in such areas as shared power among institutions, divided state-federal power, slavery, the rights of individuals and states (later addressed by the addition of the Bill of Rights), and the status of American Indian nations under the commerce clause. |
| 4. | Describe the political philosophy underpinning the Constitution as specified in the *Federalist Papers* (authored by James Madison, Alexander Hamilton, and John Jay) and the role of such leaders as Madison, George Washington, Roger Sherman, Gouverneur Morris, and James Wilson in the writing and ratification of the Constitution. |
| 5. | Understand the significance of Jefferson's Statute for Religious Freedom as a forerunner of the First Amendment and the origins, purpose, and differing views of the founding fathers on the issue of the separation of church and state. |
| 6. | Enumerate the powers of government set forth in the Constitution and the fundamental liberties ensured by the Bill of Rights. |
| 7. | Describe the principles of federalism, dual sovereignty, separation of powers, checks and balances, the nature and purpose of majority rule, and the ways in which the American idea of constitutionalism preserves individual rights. |

**8.3 Students understand the foundation of the American political system and the ways in which citizens participate in it**.

| | |
|---|---|
| 1. | Analyze the principles and concepts codified in state constitutions between 1777 and 1781 that created the context out of which American political institutions and ideas developed. |
| 2. | Explain how the ordinances of 1785 and 1787 privatized national resources and transferred federally owned lands into private holdings, townships, and states. |
| 3. | Enumerate the advantages of a common market among the states as foreseen in and protected by the Constitution's clauses on interstate commerce, common coinage, and full-faith and credit. |
| 4. | Understand how the conflicts between Thomas Jefferson and Alexander Hamilton resulted in the emergence of two political parties (e.g., view of foreign policy, Alien and Sedition Acts, economic policy, National Bank, funding and assumption of the revolutionary debt). |
| 5. | Know the significance of domestic resistance movements and ways in which the central government responded to such movements (e.g., Shays' Rebellion, the Whiskey Rebellion). |
| 6. | Describe the basic law-making process and how the Constitution provides numerous opportunities for citizens to participate in the political process and to monitor and influence government (e.g., function of elections, political parties, interest groups). |
| 7. | Understand the functions and responsibilities of a free press. |

**8.4 Students analyze the aspirations and ideals of the people of the new nation.**

| | |
|---|---|
| 1. | Describe the country's physical landscapes, political divisions, and territorial expansion during the terms of the first four presidents. |
| 2. | Explain the policy significance of famous speeches (e.g., Washington's Farewell Address, Jefferson's 1801 Inaugural Address, John Q. Adams's Fourth of July 1821 Address). |
| 3. | Analyze the rise of capitalism and the economic problems and conflicts that accompanied it (e.g., Jackson's opposition to the National Bank; early decisions of the U.S. Supreme Court that reinforced the sanctity of contracts and a capitalist economic system of law). |
| 4. | Discuss daily life, including traditions in art, music, and literature, of early national America (e.g., through writings by Washington Irving, James Fenimore Cooper). |

**8.5 Students analyze U.S. foreign policy in the early Republic.**

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| 1. | Understand the political and economic causes and consequences of the War of 1812 and know the major battles, leaders, and events that led to a final peace. |
| 2. | Know the changing boundaries of the United States and describe the relationships the country had with its neighbors (current Mexico and Canada) and Europe, including the influence of the Monroe Doctrine, and how those relationships influenced westward expansion and the Mexican-American War. |
| 3. | Outline the major treaties with American Indian nations during the administrations of the first four presidents and the varying outcomes of those treaties. |

# HISTORY-SOCIAL SCIENCE CONTENT STANDARDS

## GRADE EIGHT

**UNITED STATES HISTORY AND GEOGRAPHY: GROWTH AND CONFLICT continued**

**8.6 Students analyze the divergent paths of the American people from 1800 to the mid-1800s and the challenges they faced, with emphasis on the Northeast.**

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|---|---|
| 1. | Discuss the influence of industrialization and technological developments on the region, including human modification of the landscape and how physical geography shaped human actions (e.g., growth of cities, deforestation, farming, mineral extraction). |
| 2. | Outline the physical obstacles to and the economic and political factors involved in building a network of roads, canals, and railroads (e.g., Henry Clay's American Sys-tem). |
| 3. | List the reasons for the wave of immigration from Northern Europe to the United States and describe the growth in the number, size, and spatial arrangements of cities (e.g., Irish immigrants and the Great Irish Famine). |
| 4. | Study the lives of black Americans who gained freedom in the North and founded schools and churches to advance their rights and communities. |
| 5. | Trace the development of the American education system from its earliest roots, including the roles of religious and private schools and Horace Mann's campaign for free public education and its assimilating role in American culture. |
| 6. | Examine the women's suffrage movement (e.g., biographies, writings, and speeches of Elizabeth Cady Stanton, Margaret Fuller, Lucretia Mott, Susan B. Anthony). |
| 7. | Identify common themes in American art as well as transcendentalism and individualism (e.g., writings about and by Ralph Waldo Emerson, Henry David Thoreau, Herman Melville, Louisa May Alcott, Nathaniel Hawthorne, Henry Wadsworth Longfellow). |

**8.7 Students analyze the divergent paths of the American people in the South from 1800 to the mid-1800s and the challenges they faced.**

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|---|---|
| 1. | Describe the development of the agrarian economy in the South, identify the locations of the cotton-producing states, and discuss the significance of cotton and the cotton gin. |
| 2. | Trace the origins and development of slavery; its effects on black Americans and on the region's political, social, religious, economic, and cultural development; and identify the strategies that were tried to both overturn and preserve it (e.g., through the writings and historical documents on Nat Turner, Denmark Vesey). |
| 3. | Examine the characteristics of white Southern society and how the physical environment influenced events and conditions prior to the Civil War. |
| 4. | Compare the lives of and opportunities for free blacks in the North with those of free blacks in the South. |

**8.8 Students analyze the divergent paths of the American people in the West from 1800 to the mid-1800s and the challenges they faced.**

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|---|---|
| 1. | Discuss the election of Andrew Jackson as president in 1828, the importance of Jacksonian democracy, and his actions as president (e.g., the spoils system, veto of the National Bank, policy of Indian removal, opposition to the Supreme Court). |
| 2. | Describe the purpose, challenges, and economic incentives associated with westward expansion, including the concept of Manifest Destiny (e.g., the Lewis and Clark expedition, accounts of the removal of Indians, the Cherokees' "Trail of Tears," settlement of the Great Plains) and the territorial acquisitions that spanned numerous decades. |
| 3. | Describe the role of pioneer women and the new status that western women achieved (e.g., Laura Ingalls Wilder, Annie Bidwell; slave women gaining freedom in the West; Wyoming granting suffrage to women in 1869). |
| 4. | Examine the importance of the great rivers and the struggle over water rights. |
| 5. | Discuss Mexican settlements and their locations, cultural traditions, attitudes toward slavery, land-grant system, and economies. |
| 6. | Describe the Texas War for Independence and the Mexican-American War, including territorial settlements, the aftermath of the wars, and the effects the wars had on the lives of Americans, including Mexican Americans today. |

**8.9 Students analyze the early and steady attempts to abolish slavery and to realize the ideals of the Declaration of Independence.**

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| 1. | Describe the leaders of the movement (e.g., John Quincy Adams and his proposed constitutional amendment, John Brown and the armed resistance, Harriet Tubman and the Underground Railroad, Benjamin Franklin, Theodore Weld, William Lloyd Garrison, Frederick Douglass). |
| 2. | Discuss the abolition of slavery in early state constitutions. |
| 3. | Describe the significance of the Northwest Ordinance in education and in the banning of slavery in new states north of the Ohio River. |
| 4. | Discuss the importance of the slavery issue as raised by the annexation of Texas and California's admission to the union as a free state under the Compromise of 1850. |
| 5. | Analyze the significance of the States' Rights Doctrine, the Missouri Compromise (1820), the Wilmot Proviso (1846), the Compromise of 1850, Henry Clay's role in the Missouri Compromise and the Compromise of 1850, the Kansas-Nebraska Act (1854), the *Dred Scott v. Sandford* decision (1857), and the Lincoln-Douglas debates (1858). |
| 6. | Describe the lives of free blacks and the laws that limited their freedom and economic opportunities. |

# HISTORY-SOCIAL SCIENCE CONTENT STANDARDS continued

## GRADE EIGHT

**UNITED STATES HISTORY AND GEOGRAPHY: GROWTH AND CONFLICT continued**

**8.10 Students analyze the multiple causes, key events, and complex consequences of the Civil War.**

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| 1. | Compare the conflicting interpretations of state and federal authority as emphasized in the speeches and writings of statesmen such as Daniel Webster and John C. Calhoun. |
| 2. | Trace the boundaries constituting the North and the South, the geographical differences between the two regions, and the differences between agrarians and industrialists. |
| 3. | Identify the constitutional issues posed by the doctrine of nullification and secession and the earliest origins of that doctrine. |
| 4. | Discuss Abraham Lincoln's presidency and his significant writings and speeches and their relationship to the Declaration of Independence, such as his "House Divided" speech (1858), Gettysburg Address (1863), Emancipation Proclamation (1863), and inaugural addresses (1861 and 1865). |
| 5. | Study the views and lives of leaders (e.g., Ulysses S. Grant, Jefferson Davis, Robert E. Lee) and soldiers on both sides of the war, including those of black soldiers and regiments. |
| 6. | Describe critical developments and events in the war, including the major battles, geographical advantages and obstacles, technological advances, and General Lee's surrender at Appomattox. |
| 7. | Explain how the war affected combatants, civilians, the physical environment, and future warfare. |

**8.11 Students analyze the character and lasting consequences of Reconstruction.**

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| 1. | List the original aims of Reconstruction and describe its effects on the political and social structures of different regions. |
| 2. | Identify the push-pull factors in the movement of former slaves to the cities in the North and to the West and their differing experiences in those regions (e.g., the experiences of Buffalo Soldiers). |
| 3. | Understand the effects of the Freedmen's Bureau and the restrictions placed on the rights and opportunities of freedmen, including racial segregation and "Jim Crow" laws. |
| 4. | Trace the rise of the Ku Klux Klan and describe the Klan's effects. |
| 5. | Understand the Thirteenth, Fourteenth, and Fifteenth Amendments to the Constitution and analyze their connection to Reconstruction. |

**8.12 Students analyze the transformation of the American economy and the changing social and political conditions in the United States in response to the Industrial Revolution.**

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| 1. | Trace patterns of agricultural and industrial development as they relate to climate, use of natural resources, markets, and trade and locate such development on a map. |
| 2. | Identify the reasons for the development of federal Indian policy and the wars with American Indians and their relationship to agricultural development and industrialization. |
| 3. | Explain how states and the federal government encouraged business expansion through tariffs, banking, land grants, and subsidies. |
| 4. | Discuss entrepreneurs, industrialists, and bankers in politics, commerce, and industry (e.g., Andrew Carnegie, John D. Rockefeller, Leland Stanford). |
| 5. | Examine the location and effects of urbanization, renewed immigration, and industrialization (e.g., the effects on social fabric of cities, wealth and economic opportunity, the conservation movement). |
| 6. | Discuss child labor, working conditions, and laissez-faire policies toward big business and examine the labor movement, including its leaders (e.g., Samuel Gompers), its demand for collective bargaining, and its strikes and protests over labor conditions. |
| 7. | Identify the new sources of large-scale immigration and the contributions of immigrants to the building of cities and the economy; explain the ways in which new social and economic patterns encouraged assimilation of newcomers into the mainstream amidst growing cultural diversity; and discuss the new wave of nativism. |
| 8. | Identify the characteristics and impact of Grangerism and Populism. |
| 9. | Name the significant inventors and their inventions and identify how they improved the quality of life (e.g., Thomas Edison, Alexander Graham Bell, Orville and Wilbur Wright). |

**HISTORY-SOCIAL SCIENCE ANALYSIS SKILLS (6-8):**

**Chronological and Spatial Thinking**

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| 1. | Students explain how major events are related to one another in time. |
| 2. | Students construct various time lines of key events, people, and periods of the historical era they are studying. |
| 3. | Students use a variety of maps and documents to identify physical and cultural features of neighborhoods, cities, states, and countries and to explain the historical migration of people, expansion and disintegration of empires, and the growth of economic systems. |

# HISTORY-SOCIAL SCIENCE CONTENT STANDARDS continued

## GRADE EIGHT

**HISTORY-SOCIAL SCIENCE ANALYSIS SKILLS (6-8): continued**

**Research, Evidence, and Point of View**

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| 1. | Students frame questions that can be answered by historical study and research. |
| 2. | Students distinguish fact from opinion in historical narratives and stories. |
| 3. | Students distinguish relevant from irrelevant information, essential from incidental information, and verifiable from unverifiable information in historical narratives and stories. |
| 4. | Students assess the credibility of primary and secondary sources and draw sound conclusions from them. |
| 5. | Students detect the different historical points of view on historical events and determine the context in which the historical statements were made (the questions asked, sources used, author's perspectives). |

**Historical Interpretation**

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|---|---|
| 1. | Students explain the central issues and problems from the past, placing people and events in a matrix of time and place. |
| 2. | Students understand and distinguish cause, effect, sequence, and correlation in historical events, including the long- and short-term causal relations. |
| 3. | Students explain the sources of historical continuity and how the combination of ideas and events explains the emergence of new patterns. |
| 4. | Students recognize the role of chance, oversight, and error in history. |
| 5. | Students recognize that interpretations of history are subject to change as new information is uncovered. |
| 6. | Students interpret basic indicators of economic performance and conduct cost-benefit analyses of economic and political issues. |