Orangeburg Consolidated School District Five

High School Parent Handbook

www.ocsd5.net

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Mission

Orangeburg Consolidated School District Five exists to ensure academic success for all students.

Vision

Working Together Building a World-Class School System

Beliefs

- Student learning in a safe environment is our primary focus
- Embracing change creates an environment for growth
- Proficient use of technology is essential to success in a global society
- Building positive character is essential
- We support the development of professional learning communities

Goals

GOAL 1: INCREASE STUDENT LEARNING
By the 2015-2016 school year, OCSD5 will meet performance standards yearly on local, state and national tests while closing the achievement gap.
Strategies:
- Train and implement structured Response to Intervention model to assist students who are experiencing learning or behavior issues.
- Train and implement a comprehensive literacy and numeracy/mathematics program in grades pre-k through 12.
- Create a College-Bound Culture for all students by preparing them to make college and career choices after graduation.
- Increase student enrollment in Pre-Advanced and Advanced Placement courses and participation in AP exams; develop monitoring processes to compare enrollment projections with actual campus enrollment.
- Explore Early Childhood Education opportunities to include establishing tuition-based, space-available programs for four-year-old students who currently do not attend our programs.
- Hire and recruit campus teaching and learning coaches to model research-based instructional approaches and collaborate with all teachers to implement approaches that best meet student needs and monitor the student progress.
- Create, train and implement the teaching and learning framework.
- Develop a plan for implementation of the Common Core Standards.
- Implement an ongoing comprehensive PSAT and SAT preparation program for middle school students to increase the number of Duke TIP.
- Investigate the implementation of the IBO's primary years program and the middle years program.
- Investigate the implementation of the IB Career Certificate as an addition to the IB diploma program.

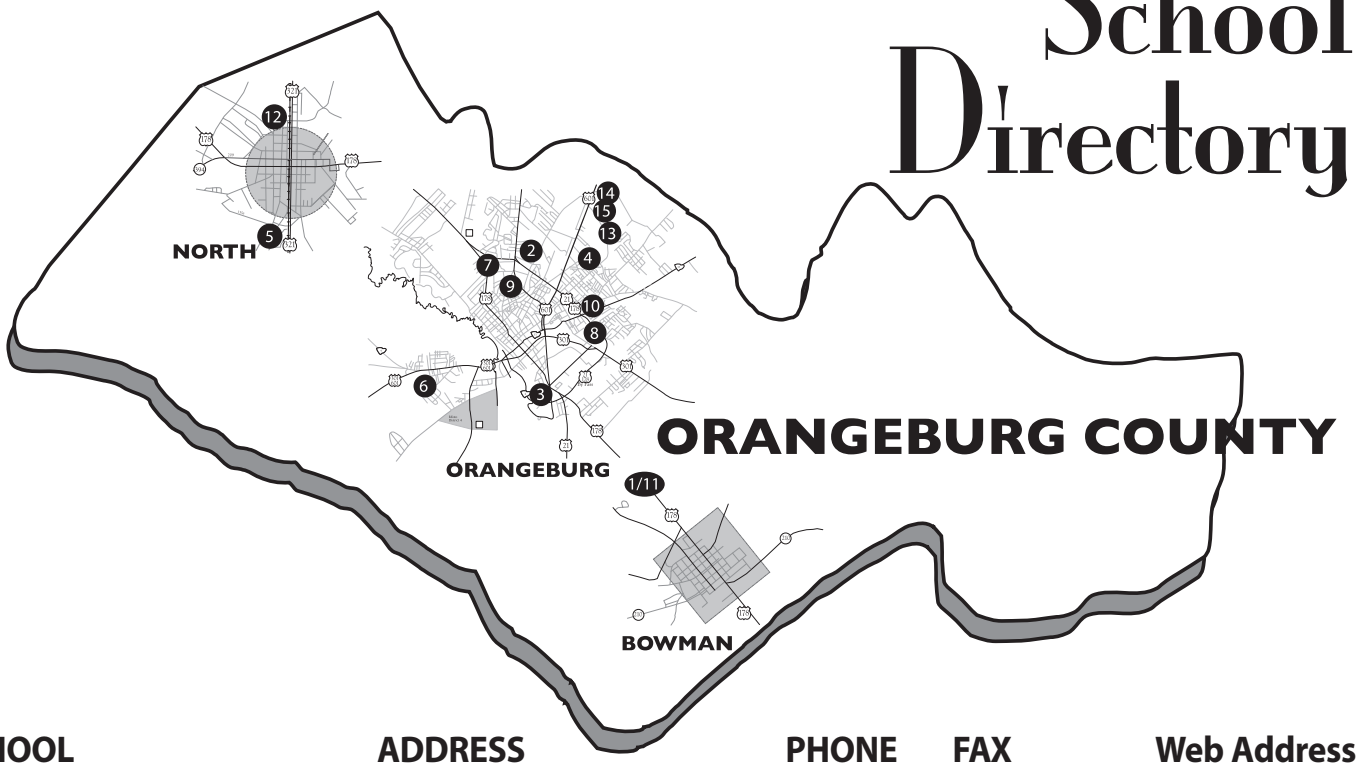
GOAL 2: IMPROVE RESOURCE MANAGEMENT
The district will base all financial decisions on an annual zero based budget protocol to ensure they are matched with district goals.
Strategies:
- Build easily accessible and accurate data systems for district wide use in academic and business departments.
- Initiate an annual zero based budget protocol to allow opportunities to review financial resources that are matched with district goals that have been identified in the Five-Year Strategic Plan.
- Establish a process to monitor, evaluate and communicate changes in the district wide budget; forecast if changes occur in state or national funding.
- Prioritize spending goals across the district and align them with student learning goals.
- Research, select, and implement a district-wide data management system.
- Initiate an annual zero-based budget protocol to allow opportunities to review financial resources that are matched with district goals that have been identified in the Five–Year Strategic Plan.
- Establish procedures to monitor, evaluate, predict, and communicate changes in the district-wide budget due to changes in state and national funding.
- Prioritize spending goals across the district and align them with student learning goals.
- Provide comprehensive management training.

GOAL 3: IMPROVE HUMAN CAPITAL
The district will focus on retaining, training, and developing the best personnel at all levels by utilizing a yearly evaluation system, as well as recruiting highly- qualified personnel according to national, state, and district guidelines.
Strategies:
- Strengthen teacher recruiting, selection, and staffing policies to attract and retain highly-qualified and highly-effective educators.
- Build leadership capacity in administrators and other staff members across the district.
- Establish accountability measures for all employees based on established goals and objectives as outlined in the job description.
- Evaluate all employees based on accountability measures contained in their respective job descriptions.

GOAL 4: INCREASE ENGAGEMENT
By the school year 2015-2016, the district will increase opportunities that promote stakeholder involvement and engagement each year.
Strategies:
- Set aside specific times each month to include meetings with teachers, support staff, students, parents, community, civic, church, political, and business leaders to discuss issues relevant to the district.
- Develop methods to increase mentoring and tutoring opportunities for community members.
- Create opportunities between various school-district partners, such as Chamber of Commerce, elected officials, higher education leaders, clergy and business partners to engage all entities in the success of the Orangeburg Consolidated Five school system.
- Prepare and distribute a weekly newsletter from the Superintendent to board members and a monthly newsletter to the community that summarizes district activities for the past week and includes a calendar of activities for the following week.
- Increase District visibility and engagement at community and school sponsored events.
- Use various media sources as a means publicizing District/student accomplishments and upcoming events.
- Utilize OCSD5 website and local county channels to televise school and District events.

GOAL 5: SAFETY ABOVE ALL ELSE
By the year 2016, all stakeholders will be satisfied with the safety and security of the school climate in OCSD5 as measured by national, state, and local data in the areas of learning environment, home-school relations, social, and physical environment.
Strategies:
- Review and revise the Crisis Management Manual (the red book) for schools and facilities based on district and county emergency preparedness procedures.
- Provide training for all district personnel on the national, state, county and district emergency preparedness plans.
- Review, evaluate, upgrade and install security monitoring systems at all district facilities ensuring that the public is aware of these measures.
- Develop, adopt, implement, and publicize to all stakeholders a Zero Tolerance policy for all individuals who threaten the safety and security of our schools.
- Review, evaluate, update, adopt and publicize to all stakeholders a Code of Student conduct to guide our uniform collective response to student behavioral issues.
- Hold a community awareness session to garner feedback on the proposed new code of conduct prior to adopting.
- Train school-based staff in Crisis Prevention Institute (CPI) or other behavioral intervention models to respond to student behavioral issues.
- Continue to work with local law enforcement entities to collaborate on procedures that will assist in providing a safe and secure environment for students, employees and the community at large.

School Directory



SCHOOL	ADDRESS	PHONE	FAX	Web Address
Elementary Schools				
1. Bethune-Bowman Elementary School	4857 Charleston Highway Rowesville, SC 29133	533-6371	533-6373	bbes.ocsd5.net
2. Brookdale Elementary School	394 Brookdale Drive Orangeburg, SC 29115	534-5982	533-6472	bes.ocsd5.net
3. Dover Elementary School	1411 Bedford Avenue North, SC 29112	247-2184	247-5010	des.ocsd5.net
4. Marshall Elementary School	1441 Marshall Avenue Orangeburg, SC 29118	534-7865	535-1645	mares.ocsd5.net
5. Mellichamp Elementary School	350 Murray Road Orangeburg, SC 29115	534-8044	533-6492	meles.ocsd5.net
6. Rivelon Elementary School	350 Thomas B. Eklund Circle Orangeburg, SC 29115	534-2949	533-6540	res.ocsd5.net
7. Sheridan Elementary School	1139 Hillsboro Road Orangeburg, SC 29115	534-7504	535-1650	ses.ocsd5.net
8. Whittaker Elementary School	790 Whittaker Parkway Orangeburg, SC 29115	534-6559	533-6466	wes.ocsd5.net
Middle Schools				
9. William J. Clark Middle School	919 Bennett Avenue Orangeburg, SC 29118	531-2200	533-6503	cms.ocsd5.net
10. Robert E. Howard Middle School	1255 Belleville Road Orangeburg, SC 29115	534-5470	535-1606	hms.ocsd5.net
High Schools				
11. Bethune-Bowman Middle/High School	4857 Charleston Highway Rowesville, SC 29133	516-6011	516-6013	bbmh.ocsd5.net
12. North Middle/High School	692 Cromer Avenue North, SC 29112	247-2541	247-5090	nmh.ocsd5.net
13. Orangeburg-Wilkinson High School	601 Bruin Parkway Orangeburg, SC 29115	534-6180	533-6310	ow.ocsd5.net
14. The Technology Center	3720 Magnolia Street Orangeburg, SC 29115	536-4473	533-6365	ttc.ocsd5.net
15. Nelson C. Nix Center of Excellence	3720 Magnolia Street Orangeburg, SC 29115	533-6581	516-6015	nec.ocsd5.net
16. High School for Health Professions	3720 Magnolia Street Orangeburg, SC 29115	533-6374	535-1635	hshp.ocsd5.net

English

TO SPEAKERS OF OTHER LANGUAGES (ESOL)

LISTENING (L)

Standard L1: The student will comprehend instructions given orally in English.

INDICATORS

L1.1 Follow one-step directions.
L1.2 Follow two-step directions.
L1.3 Follow multiple-step directions.

Standard L2: The student will comprehend essential elements of oral discourse in such forms as speeches, conversations, and texts read aloud in English.

INDICATORS

L2.1 Comprehend words, phrases, and simple sentences.
L2.2 Recognize and understand the main idea, purpose, or theme.
L2.3 Recognize and understand important supporting ideas and details.
L2.4 Identify the setting and the various characters who appear.
L2.5 Understand the figurative language and idiomatic expressions used.

Standard L3: The student will determine the attitude and/or perspective of a speaker who is using the English language.

INDICATORS

L3.1 Distinguish between fact and opinion.
L3.2 Identify the speaker's point of view, motivation, tone, stance, or position with regard to an issue.
L3.3 Draw inferences and conclusions and make predictions.

SPEAKING (S)

Standard S1: The student will establish conversational connections that express concrete information clearly in English.

INDICATORS

S1.1 Give simple and multiple-step directions.
S1.2 Provide personal information.
S1.3 Ask and answer simple questions.
S1.4 Use common social idioms, basic greetings, and standard repetitive phrases.

Standard S2: The student will participate in a conversation in English by making clear, logical, and detailed responses.

INDICATORS

S2.1 Identify people, places, objects, and basic concepts (e.g., numbers, days of the week, foods, occupations, time).
S2.2 Recount personal experiences and tell stories as oral responses to conversational cues.
S2.3 Summarize information and paraphrase the conversations of others.
S2.4 Use figurative language and idiomatic expressions.

Standard S3: The student will expand oral information logically and clearly in English.

INDICATORS

S3.1 Explain the elements of a conversation or a presentation by summarizing or paraphrasing it.
S3.2 Explain ideas and convey information in both temporal (i.e., sequencing) and spatial order (i.e., positional words).
S3.3 Clarify and support or refute ideas by using details, examples, and other means of elaboration.

Standard S4: The student will correctly and effectively convey his or her attitude and/or perspective in English in conversations and other forms of oral communication.

INDICATORS

S4.1 Express and establish his or her point of view by using clear and precise language.
S4.2 Defend his or her point of view by using forms of evidence such as specific details and concrete examples.
S4.3 Defend his or her point of view by making valid and appropriate appeals to the listener's reason and emotions.

READING (R)

Standard R1: The student will demonstrate pre-/early English reading skills.

INDICATORS

R1.1 Identify high-frequency words, including irregular verbs such as said, was, and is and irregular plural nouns such as mice and geese.
R1.2 Identify frequently used compound words and contractions.
R1.3 Identify relationships between words by using onsets and rimes (word families).
R1.4 Comprehend simple phrases and sentences.
R1.5 Use word clues such as the relationships between words, syntax, morphology, and cognates to decipher the meaning of unfamiliar words in phrases and sentences.

Standard R2: The student will understand key words and phrases in English.

INDICATORS

R2.1 Understand that words can have multiple meanings, both denotative and connotative.
R2.2 Use an understanding of key words and phrases to derive the meaning of simple passages.
R2.3 Use one or more strategies to determine the meanings of unfamiliar words and phrases (e.g., background or prior knowledge; contextual clues and illustrations; knowledge of morphology, syntax, phonics, word relationships; knowledge of synonyms, antonyms, homophones, homographs, cognates, and false cognates).

Standard R3: The student will comprehend instructions written in English.

INDICATORS

R3.1 Follow one-step instructions.
R3.2 Follow two-step instructions.
R3.3 Follow multiple-step instructions.

Standard R4: The student will determine the major elements of a text written in English.

INDICATORS

R4.1 Identify the central theme or problem.
R4.2 Identify the author's main purpose.
R4.3 Identify the main characters and the nature of their conflicts.
R4.4 Identify the setting.

Standard R5: The student will recognize important details in texts written in English.

INDICATORS

R5.1 Identify important supporting ideas and themes.
R5.2 Understand the meaning of information conveyed through various graphic sources (e.g., diagrams, charts, tables, simple illustrations).

Standard R6: The student will understand the content and the methodology used in texts written in English.

INDICATORS

R6.1 Draw inferences and conclusions and make predictions about main ideas, characters, and setting.
R6.2 Understand the relationship between cause and effect.
R6.3 Understand the use of compare/contrast strategies.
R6.4 Understand the chronological ordering of ideas and information.

Standard R7: The student will determine the attitude or perspective of the author and/or the characters in a text written in English.

INDICATORS

R7.1 Distinguish between fact and opinion in texts.
R7.2 Identify the author's point of view, motivation, tone, stance, or position with regard to an issue.
R7.3 Analyze the characters to determine their motivations, intentions, prejudices, and general outlook; the changes in opinion and behavior they undergo; and the nature of their interactions with the other characters.

Standard R8: The student will analyze various writing styles and forms in English texts.

INDICATORS

R8.1 Identify analogies (e.g., metaphors), symbols, patterns such as rhyming and repetition, and other rhetorical devices.
R8.2 Apply an understanding of the structure of English sentences to derive meaning from a text.
R8.3 Understand a variety of forms of writing such as personal and fictional narratives and persuasive, descriptive, and expository compositions.

WRITING (W)

Standard W1: The student will demonstrate pre-/early English writing skills.

INDICATORS

W1.1 Identify a relationship between oral and/or visual communication and written words.
W1.2 Use correct letter formation.
W1.3 Use word boundaries and directionality.
W1.4 Use high frequency words and functional vocabulary in labeling graphics and in forming phrases and sentences that express concrete as well as abstract information.

Standard W2: The student will use graphic organizers or outlines to plan, organize, and develop his or her writing in English.

INDICATORS

W2.1 Use graphic organizers or outlines to decide on appropriate content and titles for his or her compositions.
W2.2 Use graphic organizers or outlines to organize information logically.
W2.3 Use graphic organizers or outlines to write appropriate topic sentences for paragraphs on the basis of the particular subject.
W2.4 Use graphic organizers or outlines to determine the validity and appropriateness of particular details.

Standard W3: The student will write English compositions in a variety of forms.

INDICATORS

W3.1 Write personal or fictional narratives that trace a sequence of events and contain details about character and setting.

W3.2 Write persuasive and expository compositions that establish the validity of a thesis through the development of logical supporting points and concrete details.

W3.3 Write descriptive compositions that express ideas with enough clarity and detail to give the reader a clear impression of the object, person, or place described.

Standard W4: The student will revise his or her writing as well as that of others for logic, consistency, and clarity.

INDICATORS

W4.1 Revise drafts to improve coherence and the logical progression of ideas by rewriting and sharpening the focus of the topic and/or concluding sentences of key paragraphs.

W4.2 Revise drafts to improve coherence and the logical progression of ideas by adding appropriate transition words and phrases.

W4.3 Revise drafts for appropriate word choice.

W4.4 Revise drafts to achieve a consistency of style, tone, and point of view that is appropriate for the particular topic as well as the intended audience.

W4.5 Revise drafts to include a variety of sentence types as appropriate.

Standard W5: The student will correct the grammar and mechanics of his or her writing as well as that of others.

INDICATORS

W5.1 Recognize and correct word errors such as the misuse of the parts of speech (e.g., a noun incorrectly used as a verb), the inappropriate use of capitalization, and the misuse of the apostrophe.

W5.2 Recognize and correct grammatical and structural problems such as subject-verb and pronoun-antecedent agreement errors, pronoun case errors, and dangling and misplaced modifiers.

W5.3 Recognize and correct punctuation errors such as run-on sentences, comma splices, and misuse of quotation marks and the hyphen.

Common Core State Standards

READING / LANGUAGE ARTS

Introduction

On June 2, 2010, the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO) released a set of state-led education standards, called the Common Core State Standards. 48 states, 2 territories and the District of Columbia have adopted these national standards. The state of South Carolina adopted the Common Core State Standards in July 2010.

The Common Core State Standards were written for English-language arts and mathematics for grades K-12. The Common Core State Standards provide a consistent, clear understanding of what students are expected to learn, so teachers and parents have a roadmap for what they need to do to help them. The purpose of the standards is to create college and career ready students.

Most people are under the misunderstanding that the Common Core State Standards Initiative is driven by federal legislation. This initiative is a state-led effort that is not part of No Child Left Behind and adoption of the Standards is in no way mandatory. States began the work to create clear, consistent standards before the Recovery Act or the Elementary and Secondary Education Act blueprint was released because this work is being driven by the needs of the states, not the federal government.

<u>Timeline for the common core standards</u>

2010 - 2011 – Adoption of Common Core State Standards

2011 - 2012 – Professional Development on the Common Core

2012 - 2013 – Transition Year

2013 - 2014 – State Test will be comprised of the standards that are common to our state standards and the Common Core Standards

2014 - 2015 – Common Core State Standards Assessment

GRADES 9-10

READING STANDARDS FOR LITERATURE

Key Ideas and Details

1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
2. Determine a theme or central idea of a text and analyze in detail its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.
3. Analyze how complex characters (e.g., those with multiple or conflicting motivations) develop over the course of a text, interact with other characters, and advance the plot or develop the theme.

Craft and Structure

4. Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).
5. Analyze how an author's choices concerning how to structure a text, order events within it (e.g., parallel plots), and manipulate time (e.g., pacing, flashbacks) create such effects as mystery, tension, or surprise.
6. Analyze a particular point of view or cultural experience reflected in a work of literature from outside the United States, drawing on a wide reading of world literature.

Integration of Knowledge and Ideas

7. Analyze the representation of a subject or a key scene in two different artistic mediums, including what is emphasized or absent in each treatment (e.g., Auden's "Musée des Beaux Arts" and Breughel's Landscape with the Fall of Icarus).
8. (Not applicable to literature)
9. Analyze how an author draws on and transforms source material in a specific work (e.g., how Shakespeare treats a theme or topic from Ovid or the Bible or how a later author draws on a play by Shakespeare).

Range of Reading and Level of Text Complexity

10. By the end of grade 9, read and comprehend literature, including stories, dramas, and poems, in the grades 9–10 text complexity band proficiently, with scaffolding as needed at the high end of the range. By the end of grade 10, read and comprehend literature, including stories, dramas, and poems, at the high end of the grades 9–10 text complexity band independently and proficiently.

READING STANDARDS: INFORMATIONAL TEXT

Key Ideas and Details

1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
2. Determine a central idea of a text and analyze its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.
3. Analyze how the author unfolds an analysis or series of ideas or events, including the order in which the points are made, how they are introduced and developed, and the connections that are drawn between them.

Craft and Structure

4. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper).
5. Analyze in detail how an author's ideas or claims are developed and refined by particular sentences, paragraphs, or larger portions of a text (e.g., a section or chapter).
6. Determine an author's point of view or purpose in a text and analyze how an author uses rhetoric to advance that point of view or purpose.

Integration of Knowledge and Ideas

7. Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account.
8. Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning.
9. Analyze seminal U.S. documents of historical and literary significance (e.g., Washington's Farewell Address, the Gettysburg Address, Roosevelt's Four Freedoms speech, King's "Letter from Birmingham Jail"), including how they address related themes and concepts.

Range of Reading and Level of Text Complexity

10. By the end of grade 9, read and comprehend literary nonfiction in the grades 9–10 text complexity band proficiently, with scaffolding as needed at the high end of the range. By the end of grade 10, read and comprehend literary nonfiction at the high end of the grades 9–10 text complexity band independently and proficiently.

WRITING STANDARDS

Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
   a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.
   b. Develop claim(s) and counterclaims fairly, supplying evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level and concerns.
   c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
   d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
   e. Provide a concluding statement or section that follows from and supports the argument presented.
2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
   a. Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
   b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
   c. Use appropriate and varied transitions to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
   d. Use precise language and domain-specific vocabulary to manage the complexity of the topic.
   e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
   f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).
3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.
   a. Engage and orient the reader by setting out a problem, situation, or observation, establishing one or multiple point(s) of view, and introducing a narrator and/or characters; create a smooth progression of experiences or events.
   b. Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters.
   c. Use a variety of techniques to sequence events so that they build on one another to create a coherent whole.
   d. Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.
   e. Provide a conclusion that follows from and reflects on what is experienced, observed, or resolved over the course of the narrative.

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development,

organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 9–10.)
6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

Research to Build and Present Knowledge

7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

a. Apply grades 9–10 Reading standards to literature (e.g., "Analyze how an author draws on and transforms source material in a specific work [e.g., how Shakespeare treats a theme or topic from Ovid or the Bible or how a later author draws on a play by Shakespeare]").

b. Apply grades 9–10 Reading standards to literary nonfiction (e.g., "Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning").

Range of Writing

10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

SPEAKING AND LISTENING STANDARDS

Comprehension and Collaboration

1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
   a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
   b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.
   c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
   d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
2. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.

Presentation of Knowledge and Ideas

4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
6. Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grades 9–10 Language standards 1 and 3 for specific expectations.)

LANGUAGE STANDARDS

Conventions of Standard English

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
   a. Use parallel structure.*
   b. Use various types of phrases (noun, verb, adjectival, adverbial, participial, prepositional, absolute) and clauses (independent, dependent; noun, relative, adverbial) to convey specific meanings and add variety and interest to writing or presentations.
2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
   a. Use a semicolon (and perhaps a conjunctive adverb) to link two or more closely related independent clauses.
   b. Use a colon to introduce a list or quotation.
   c. Spell correctly.

Knowledge of Language

3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
   a. Write and edit work so that it conforms to the guidelines in a style manual (e.g., MLA Handbook, Turabian's Manual for Writers) appropriate for the discipline and writing type.

Vocabulary Acquisition and Use

4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 9–10 reading and content, choosing flexibly from a range of strategies.
   a. Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.
   b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., analyze, analysis, analytical; advocate, advocacy).
   c. Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, or its etymology.
   d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).
5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
   a. Interpret figures of speech (e.g., hyperbole, paradox) in context and analyze their role in the text.
   b. Analyze nuances in the meaning of words with similar denotations.
6. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

GRADES 11-12

READING STANDARDS FOR LITERATURE

Key Ideas and Details

1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
2. Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.
3. Analyze the impact of the author's choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).

Craft and Structure

4. Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (Include Shakespeare as well as other authors.)
5. Analyze how an author's choices concerning how to structure specific parts of a text (e.g., the choice of where to begin or end a story, the choice to provide a comedic or tragic resolution) contribute to its overall structure and meaning as well as its aesthetic impact.
6. Analyze a case in which grasping point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, or understatement).

Integration of Knowledge and Ideas

7. Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text. (Include at least one play by Shakespeare and one play by an American dramatist.)
8. (Not applicable to literature)
9. Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics.

Range of Reading and Level of Text Complexity

10. By the end of grade 11, read and comprehend literature, including stories, dramas, and poems, in the grades 11–CCR text complexity band proficiently, with scaffolding as needed at the high end of the range. By the end of grade 12, read and comprehend literature, including stories, dramas, and poems, at the high end of the grades 11–CCR text complexity band independently and proficiently.

READING STANDARDS: INFORMATIONAL TEXT

Key Ideas and Details

1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
2. Determine two or more central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to provide a complex analysis; provide an objective summary of the text.
3. Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.

Craft and Structure

4. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).
5. Analyze and evaluate the effectiveness of the structure an author uses in his or her exposition or argument, including whether the structure makes points clear, convincing, and engaging.
6. Determine an author's point of view or purpose in a text in which the rhetoric is particularly effective, analyzing how style and content contribute to the power, persuasiveness, or beauty of the text.

Integration of Knowledge and Ideas

7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
8. Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning (e.g., in U.S. Supreme Court majority opinions and dissents) and the premises, purposes, and arguments in works of public advocacy (e.g., The Federalist, presidential addresses).
9. Analyze seventeenth-, eighteenth-, and nineteenth-century foundational U.S. documents of historical and literary significance (including The Declaration of Independence, the Preamble to the Constitution, the Bill of Rights, and Lincoln's Second Inaugural Address) for their themes, purposes, and rhetorical features.

Range of Reading and Level of Text Complexity

10. By the end of grade 11, read and comprehend literary nonfiction in the grades 11–CCR text complexity band proficiently, with scaffolding as needed at the high end of the range. By the end of grade 12, read and comprehend literary nonfiction at the high end of the grades 11–CCR text complexity band independently and proficiently.

WRITING STANDARDS

Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
   a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences claim(s), counterclaims, reasons, and evidence.
   b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level, concerns, values, and possible biases.
   c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
   d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
   e. Provide a concluding statement or section that follows from and supports the argument presented.
2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
   a. Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
   b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
   c. Use appropriate and varied transitions and syntax to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
   d. Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.
   e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
   f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).
3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.
   a. Engage and orient the reader by setting out a problem, situation, or observation and its significance, establishing one or multiple point(s) of view, and introducing a narrator and/or characters; create a smooth progression of experiences or events.
   b. Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters.
   c. Use a variety of techniques to sequence events so that they build on one another to create a coherent whole and build toward a particular tone and outcome (e.g., a sense of mystery, suspense, growth, or resolution).
   d. Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.
   e. Provide a conclusion that follows from and reflects on what is experienced, observed, or resolved over the course of the narrative.

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 11–12.)
6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge

7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
   a. Apply grades 11–12 Reading standards to literature (e.g., "Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics").
   b. Apply grades 11–12 Reading standards to literary nonfiction (e.g., "Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning [e.g., in U.S. Supreme Court Case majority opinions and dissents] and the premises, purposes, and arguments in works of public advocacy [e.g., The Federalist, presidential addresses]").

Range of Writing

10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

SPEAKING AND LISTENING STANDARDS

Comprehension and Collaboration

1. Initiate and participate effectively in a range of collaborative discussions (one- on- one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
   a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas.
   b. Work with peers to promote civil, democratic discussions and decision making, set clear goals and deadlines, and establish individual roles as needed.
   c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
   d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.
2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.

Presentation of Knowledge and Ideas

4. Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
6. Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 for specific expectations.)

LANGUAGE STANDARDS

Conventions of Standard English

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
   a. Apply the understanding that usage is a matter of convention, can change over time, and is sometimes contested.
   b. Resolve issues of complex or contested usage, consulting references (e.g., Merriam-Webster's Dictionary of English Usage, Garner's Modern American Usage) as needed.
2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
   a. Observe hyphenation conventions.
   b. Spell correctly.

Knowledge of Language

3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
   a. Vary syntax for effect, consulting references (e.g., Tufte's Artful Sentences) for guidance as needed; apply an understanding of syntax to the study of complex texts when reading.
4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies.
   a. Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.
   b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable).
   c. Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, its etymology, or its standard usage.
   d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).
5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
   a. Interpret figures of speech (e.g., euphemism, oxymoron) in context and analyze their role in the text.
   b. Analyze nuances in the meaning of words with similar denotations.
5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
   a. Interpret figures of speech (e.g., hyperbole, paradox) in context and analyze their role in the text.
   b. Analyze nuances in the meaning of words with similar denotations.
6. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Common Core State Standards

MATHEMATICS

MATHEMATICS STANDARDS FOR HIGH SCHOOL

The high school standards specify the mathematics that all students should study in order to be college and career ready. Additional mathematics that students should learn in order to take advanced courses such as calculus, advanced statistics, or discrete mathematics is indicated by (+), as in this example:

> (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers).

All standards without a (+) symbol should be in the common mathematics curriculum for all college and career ready students. Standards with a (+) symbol may also appear in courses intended for all students.

The high school standards are listed in conceptual categories:

- Number and Quantity
- Algebra
- Functions
- Modeling
- Geometry
- Statistics and Probability

Conceptual categories portray a coherent view of high school mathematics; a student's work with functions, for example, crosses a number of traditional course boundaries, potentially up through and including calculus.

Modeling is best interpreted not as a collection of isolated topics but in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (?). The star symbol sometimes appears on the heading for a group of standards; in that case, it should be understood to apply to all standards in that group.

Mathematics | High School—Number and Quantity

Numbers and Number Systems. During the years from kindergarten to eighth grade, students must repeatedly extend their conception of number. At first, "number" means "counting number": 1, 2, 3... Soon after that, 0 is used to represent "none" and the whole numbers are formed by the counting numbers together with zero. The next extension is fractions. At first, fractions are barely numbers and tied strongly to pictorial representations. Yet by the time students understand division of fractions, they have a strong concept of fractions as numbers and have connected them, via their decimal representations, with the base-ten system used to represent the whole numbers. During middle school, fractions are augmented by negative fractions to form the rational numbers. In Grade 8, students extend this system once more, augmenting the rational numbers with the irrational numbers to form the real numbers. In high school, students will be exposed to yet another extension of number, when the real numbers are augmented by the imaginary numbers to form the complex numbers.

With each extension of number, the meanings of addition, subtraction, multiplication, and division are extended. In each new number system—integers, rational numbers, real numbers, and complex numbers—the four operations stay the same in two important ways: They have the commutative, associative, and distributive properties and their new meanings are consistent with their previous meanings.

Extending the properties of whole-number exponents leads to new and productive notation. For example, properties of whole-number exponents suggest that $(5^{1/3})^3$ should be $5^{(1/3)3} = 5^1 = 5$ and that $5^{1/3}$ should be the cube root of 5.

Calculators, spreadsheets, and computer algebra systems can provide ways for students to become better acquainted with these new number systems and their notation. They can be used to generate data for numerical experiments, to help understand the workings of matrix, vector, and complex number algebra, and to experiment with non-integer exponents.

Quantities. In real world problems, the answers are usually not numbers but quantities: numbers with units, which involves measurement. In their

work in measurement up through Grade 8, students primarily measure commonly used attributes such as length, area, and volume. In high school, students encounter a wider variety of units in modeling, e.g., acceleration, currency conversions, derived quantities such as person-hours and heating degree days, social science rates such as per-capita income, and rates in everyday life such as points scored per game or batting averages. They also encounter novel situations in which they themselves must conceive the attributes of interest. For example, to find a good measure of overall highway safety, they might propose measures such as fatalities per year, fatalities per year per driver, or fatalities per vehicle-mile traveled. Such a conceptual process is sometimes called quantification. Quantification is important for science, as when surface area suddenly "stands out" as an important variable in evaporation. Quantification is also important for companies, which must conceptualize relevant attributes and create or choose suitable measures for them.

Number and Quantity Overview

The Real Number System

- Extend the properties of exponents to rational exponents
- Use properties of rational and irrational numbers.

Quantities

- Reason quantitatively and use units to solve problems

The Complex Number System

- Perform arithmetic operations with complex numbers
- Represent complex numbers and their operations on the complex plane
- Use complex numbers in polynomial identities and equations

Vector and Matrix Quantities

- Represent and model with vector quantities.
- Perform operations on vectors.
- Perform operations on matrices and use matrices in applications.

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

The Real Number System N -RN

Extend the properties of exponents to rational exponents.

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. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.*
2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Use properties of rational and irrational numbers.

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.

Quantities* N -Q

Reason quantitatively and use units to solve problems.

1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
2. Define appropriate quantities for the purpose of descriptive modeling.
3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

The Complex Number System N -CN

Perform arithmetic operations with complex numbers.

1. Know there is a complex number *i* such that $i2 = -1$, and every complex number has the form $a + bi$ with *a* and *b* real.
2. Use the relation $i2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
3. (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

Represent complex numbers and their operations on the complex plane.

4. (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.
5. (+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. *For example,* $(-1 + \sqrt{3}\,i)^3 = 8$ *because* $(-1 + \sqrt{3}\,i)$ *has modulus 2 and argument* 120°.
6. (+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.

Use complex numbers in polynomial identities and equations.

7. Solve quadratic equations with real coefficients that have complex solutions.
8. (+) Extend polynomial identities to the complex numbers. *For example, rewrite x2 + 4 as (x + 2i)(x – 2i).*
9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Vector and Matrix Quantities N -VM

Represent and model with vector quantities.

1. (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., $\boldsymbol{v}$, $|\boldsymbol{v}|$, $||\boldsymbol{v}||$, v).
2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.
3. (+) Solve problems involving velocity and other quantities that can be represented by vectors.

Perform operations on vectors.

4. (+) Add and subtract vectors.

   a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.

   b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.

   c. Understand vector subtraction $\boldsymbol{v} - \boldsymbol{w}$ as $\boldsymbol{v} + (-\boldsymbol{w})$, where $-\boldsymbol{w}$ is the additive inverse of $\boldsymbol{w}$, with the same magnitude as $\boldsymbol{w}$ and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.

5. (+) Multiply a vector by a scalar.

   a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$.

   b. Compute the magnitude of a scalar multiple $c\boldsymbol{v}$ using $||c\boldsymbol{v}|| = |c|v$. Compute the direction of $c\boldsymbol{v}$ knowing that when $|c|v \neq 0$, the direction

of $c\boldsymbol{v}$ is either along $\boldsymbol{v}$ (for $c > 0$) or against $\boldsymbol{v}$ (for $c < 0$).

Perform operations on matrices and use matrices in applications.

6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
8. (+) Add, subtract, and multiply matrices of appropriate dimensions.
9. (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.
11. (+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.
12. (+) Work with 2 x 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

Mathematics | High School—Algebra

Expressions. An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances.

Reading an expression with comprehension involves analysis of its underlying structure. This may suggest a different but equivalent way of writing the expression that exhibits some different aspect of its meaning. For example, $p + 0.05p$ can be interpreted as the addition of a 5% tax to a price p. Rewriting $p + 0.05p$ as $1.05p$ shows that adding a tax is the same as multiplying the price by a constant factor.

Algebraic manipulations are governed by the properties of operations and exponents, and the conventions of algebraic notation. At times, an expression is the result of applying operations to simpler expressions. For example, $p + 0.05p$ is the sum of the simpler expressions p and $0.05p$. Viewing an expression as the result of operation on simpler expressions can sometimes clarify its underlying structure.

A spreadsheet or a computer algebra system (CAS) can be used to experiment with algebraic expressions, perform complicated algebraic manipulations, and understand how algebraic manipulations behave.

Equations and inequalities. An equation is a statement of equality between two expressions, often viewed as a question asking for which values of the variables the expressions on either side are in fact equal. These values are the solutions to the equation. An identity, in contrast, is true for all values of the variables; identities are often developed by rewriting an expression in an equivalent form.

The solutions of an equation in one variable form a set of numbers; the solutions of an equation in two variables form a set of ordered pairs of numbers, which can be plotted in the coordinate plane. Two or more equations and/or inequalities form a system. A solution for such a system must satisfy every equation and inequality in the system.

An equation can often be solved by successively deducing from it one or more simpler equations. For example, one can add the same constant to both sides without changing the solutions, but squaring both sides might lead to extraneous solutions. Strategic competence in solving includes looking ahead for productive manipulations and anticipating the nature and number of solutions.

Some equations have no solutions in a given number system, but have a solution in a larger system. For example, the solution of $x + 1 = 0$ is an integer, not a whole number; the solution of $2x + 1 = 0$ is a rational number, not an integer; the solutions of $x^2 - 2 = 0$ are real numbers, not rational numbers; and the solutions of $x^2 + 2 = 0$ are complex numbers, not real numbers.

The same solution techniques used to solve equations can be used to rearrange formulas. For example, the formula for the area of a trapezoid, $A = ((b_1+b_2)/2)h$, can be solved for h using the same deductive process.

Inequalities can be solved by reasoning about the properties of inequality. Many, but not all, of the properties of equality continue to hold for inequalities and can be useful in solving them.

Connections to Functions and Modeling. Expressions can define functions, and equivalent expressions define the same function. Asking when two functions have the same value for the same input leads to an equation; graphing the two functions allows for finding approximate solutions of the equation. Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling.

Algebra Overview

Seeing Structure in Expressions

- Interpret the structure of expressions
- Write expressions in equivalent forms to solve problems

Arithmetic with Polynomials and Rational Expressions

- Perform arithmetic operations on polynomials
- Understand the relationship between zeros and factors of polynomials
- Use polynomial identities to solve problems
- Rewrite rational expressions

Creating Equations

- Create equations that describe numbers or relationships

Reasoning with Equations and Inequalities

- Understand solving equations as a process of reasoning and explain the reasoning
- Solve equations and inequalities in one variable
- Solve systems of equations
- Represent and solve equations and inequalities graphically

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Seeing Structure in Expressions A-SSE

Interpret the structure of expressions

1. Interpret expressions that represent a quantity in terms of its context.*

   a. Interpret parts of an expression, such as terms, factors, and coefficients.

   b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.*

2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*

Write expressions in equivalent forms to solve problems

3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*

   a. Factor a quadratic expression to reveal the zeros of the function it defines.

   b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

   c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} = 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.**

Arithmetic with Polynomials & Rational Expressions A -APR

Perform arithmetic operations on polynomials

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.

Understand the relationship between zeros and factors of polynomials

2. Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by x – a is $p(a)$, so $p(a) = 0$ if and only if (x – a) is a factor of $p(x)$.

3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

Use polynomial identities to solve problems

4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*

5. +) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.[1]

Rewrite rational expressions

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.

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.

Creating Equations* A -CED

Create equations that describe numbers or relationships

1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*

Reasoning with Equations and Inequalities A -RE I

Understand solving equations as a process of reasoning and explain the reasoning

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.

2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve equations and inequalities in one variable

3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

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.

   b. 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.

Solve systems of equations

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.

6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line y = –3x* and the circle *x2 + y2 = 3.*

8. (+) Represent a system of linear equations as a single matrix equation in a vector variable.

9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 x 3 or greater).

Represent and solve equations and inequalities graphically

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).

11. Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.*

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.

Mathematics | High School—Functions

Functions describe situations where one quantity determines another. For example, the return on $10,000 invested at an annualized percentage rate of 4.25% is a function of the length of time the money is invested. Because we continually make theories about dependencies between quantities in nature and society, functions are important tools in the construction of mathematical models.

In school mathematics, functions usually have numerical inputs and outputs and are often defined by an algebraic expression. For example, the time in hours it takes for a car to drive 100 miles is a function of the car's speed in miles per hour, v; the rule $T(v) = 100/v$ expresses this relationship algebraically and defines a function whose name is T.

The set of inputs to a function is called its domain. We often infer the domain to be all inputs for which the expression defining a function has a

value, or for which the function makes sense in a given context.

A function can be described in various ways, such as by a graph (e.g., the trace of a seismograph); by a verbal rule, as in, "I'll give you a state, you give me the capital city;" by an algebraic expression like $f(x) = a + bx$; or by a recursive rule. The graph of a function is often a useful way of visualizing the relationship of the function models, and manipulating a mathematical expression for a function can throw light on the function's properties.

Functions presented as expressions can model many important phenomena. Two important families of functions characterized by laws of growth are linear functions, which grow at a constant rate, and exponential functions, which grow at a constant percent rate. Linear functions with a constant term of zero describe proportional relationships.

A graphing utility or a computer algebra system can be used to experiment with properties of these functions and their graphs and to build computational models of functions, including recursively defined functions.

Connections to Expressions, Equations, Modeling, and Coordinates.

Determining an output value for a particular input involves evaluating an expression; finding inputs that yield a given output involves solving an equation. Questions about when two functions have the same value for the same input lead to equations, whose solutions can be visualized from the intersection of their graphs. Because functions describe relationships between quantities, they are frequently used in modeling. Sometimes functions are defined by a recursive process, which can be displayed effectively using a spreadsheet or other technology.

Functions Overview

Interpreting Functions

- Understand the concept of a function and use function notation
- Interpret functions that arise in applications in terms of the context
- Analyze functions using different representations

Building Functions

- Build a function that models a relationship between two quantities
- Build new functions from existing functions

Linear, Quadratic, and Exponential Models

- Construct and compare linear, quadratic, and exponential models and solve problems
- Interpret expressions for functions in terms of the situation they model

Trigonometric Functions

- Extend the domain of trigonometric functions using the unit circle
- Model periodic phenomena with trigonometric functions
- Prove and apply trigonometric identities

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Interpreting Functions F-IF

Understand the concept of a function and use function notation

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 f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
2. Use function notation, evaluate functions for inputs in their domains,

and interpret statements that use function notation in terms of a context.

3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*

Interpret functions that arise in applications in terms of the context

4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.**

5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**

6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*

Analyze functions using different representations

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*

   a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

   b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

   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.

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.

   b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay*.

9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

Building Functions F-BF

Build a function that models a relationship between two quantities

1. Write a function that describes a relationship between two quantities.*

   a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

   b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*

   c. (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*

2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.*

Build new functions from existing functions

3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

4. Find inverse functions.

   a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x–1)$ for $x \neq 1$.*

   b. (+) Verify by composition that one function is the inverse of another.

   c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.

   d. (+) Produce an invertible function from a non-invertible function by restricting the domain.

5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

Linear, Quadratic, and Exponential Models* F -LE

Construct and compare linear, quadratic, and exponential models and solve problems

1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

   a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

   b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

   c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

Interpret expressions for functions in terms of the situation they model

5. Interpret the parameters in a linear or exponential function in terms of a context.

Trigonometric Functions F-TF

Extend the domain of trigonometric functions using the unit circle

1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi – x$, $\pi + x$, and $2\pi – x$ in terms of their values for x, where x is any real number.

4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

Model periodic phenomena with trigonometric functions

5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.*
6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.*

Prove and apply trigonometric identities

8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.
9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Mathematics | High School—Modeling

Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Quantities and their relationships in physical, economic, public policy, social, and everyday situations can be modeled using mathematical and statistical methods. When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data.

A model can be very simple, such as writing total cost as a product of unit price and number bought, or using a geometric shape to describe a physical object like a coin. Even such simple models involve making choices. It is up to us whether to model a coin as a three-dimensional cylinder, or whether a two-dimensional disk works well enough for our purposes. Other situations—modeling a delivery route, a production schedule, or a comparison of loan amortizations—need more elaborate models that use other tools from the mathematical sciences. Real-world situations are not organized and labeled for analysis; formulating tractable models, representing such models, and analyzing them is appropriately a creative process. Like every such process, this depends on acquired expertise as well as creativity.

Some examples of such situations might include:

- Estimating how much water and food is needed for emergency relief in a devastated city of 3 million people, and how it might be distributed.
- Planning a table tennis tournament for 7 players at a club with 4 tables, where each player plays against each other player.
- Designing the layout of the stalls in a school fair so as to raise as much money as possible.
- Analyzing stopping distance for a car.
- Modeling savings account balance, bacterial colony growth, or investment growth.
- Engaging in critical path analysis, e.g., applied to turnaround of an aircraft at an airport.
- Analyzing risk in situations such as extreme sports, pandemics, and terrorism.
- Relating population statistics to individual predictions.

In situations like these, the models devised depend on a number of factors: How precise an answer do we want or need? What aspects of the situation do we most need to understand, control, or optimize? What resources of time and tools do we have? The range of models that we can create and analyze is also constrained by the limitations of our mathematical, statistical, and technical skills, and our ability to recognize significant variables and relationships among them. Diagrams of various kinds, spreadsheets and other technology, and algebra are powerful tools for understanding and solving problems drawn from different types of real-world situations.

One of the insights provided by mathematical modeling is that essentially the same mathematical or statistical structure can sometimes model seemingly different situations. Models can also shed light on the mathematical structures themselves, for example, as when a model of bacterial growth makes more vivid the explosive growth of the exponential function.

The basic modeling cycle can be summarized. It involves (1) identifying variables in the situation and selecting those that represent essential features, (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables, (3) analyzing and performing operations on these relationships to draw conclusions, (4) interpreting the results of the mathematics in terms of the original situation, (5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable, (6) reporting on the conclusions and the reasoning behind them. Choices, assumptions, and approximations are present throughout this cycle.

In descriptive modeling, a model simply describes the phenomena or summarizes them in a compact form. Graphs of observations are a familiar descriptive model— for example, graphs of global temperature and atmospheric CO_2 over time.

Analytic modeling seeks to explain data on the basis of deeper theoretical ideas, albeit with parameters that are empirically based; for example, exponential growth of bacterial colonies (until cut-off mechanisms such as pollution or starvation intervene) follows from a constant reproduction rate. Functions are an important tool for analyzing such problems.

Graphing utilities, spreadsheets, computer algebra systems, and dynamic geometry software are powerful tools that can be used to model purely mathematical phenomena (e.g., the behavior of polynomials) as well as physical phenomena.

Modeling Standards *Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (*).*

Mathematics | High School—Geometry

An understanding of the attributes and relationships of geometric objects can be applied in diverse contexts—interpreting a schematic drawing, estimating the amount of wood needed to frame a sloping roof, rendering computer graphics, or designing a sewing pattern for the most efficient use of material.

Although there are many types of geometry, school mathematics is devoted primarily to plane Euclidean geometry, studied both synthetically (without coordinates) and analytically (with coordinates). Euclidean geometry is characterized most importantly by the Parallel Postulate, that through a point not on a given line there is exactly one parallel line. (Spherical geometry, in contrast, has no parallel lines.)

During high school, students begin to formalize their geometry experiences from elementary and middle school, using more precise definitions and developing careful proofs. Later in college some students develop Euclidean and other geometries carefully from a small set of axioms.

The concepts of congruence, similarity, and symmetry can be understood from the perspective of geometric transformation. Fundamental are the rigid motions: translations, rotations, reflections, and combinations of these, all of which are here assumed to preserve distance and angles (and therefore shapes generally). Reflections and rotations each explain a particular type of symmetry, and the symmetries of an object offer insight into its attributes—as when the reflective symmetry of an isosceles triangle assures that its base angles are congruent.

In the approach taken here, two geometric figures are defined to be congruent if there is a sequence of rigid motions that carries one onto the other. This is the principle of superposition. For triangles, congruence

means the equality of all corresponding pairs of sides and all corresponding pairs of angles. During the middle grades, through experiences drawing triangles from given conditions, students notice ways to specify enough measures in a triangle to ensure that all triangles drawn with those measures are congruent. Once these triangle congruence criteria (ASA, SAS, and SSS) are established using rigid motions, they can be used to prove theorems about triangles, quadrilaterals, and other geometric figures.

Similarity transformations (rigid motions followed by dilations) define similarity in the same way that rigid motions define congruence, thereby formalizing the similarity ideas of "same shape" and "scale factor" developed in the middle grades. These transformations lead to the criterion for triangle similarity that two pairs of corresponding angles are congruent.

The definitions of sine, cosine, and tangent for acute angles are founded on right triangles and similarity, and, with the Pythagorean Theorem, are fundamental in many real-world and theoretical situations. The Pythagorean Theorem is generalized to nonright triangles by the Law of Cosines. Together, the Laws of Sines and Cosines embody the triangle congruence criteria for the cases where three pieces of information suffice to completely solve a triangle. Furthermore, these laws yield two possible solutions in the ambiguous case, illustrating that Side-Side-Angle is not a congruence criterion.

Analytic geometry connects algebra and geometry, resulting in powerful methods of analysis and problem solving. Just as the number line associates numbers with locations in one dimension, a pair of perpendicular axes associates pairs of numbers with locations in two dimensions. This correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof. Geometric transformations of the graphs of equations correspond to algebraic changes in their equations.

Dynamic geometry environments provide students with experimental and modeling tools that allow them to investigate geometric phenomena in much the same way as computer algebra systems allow them to experiment with algebraic phenomena.

Connections to Equations. The correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof.

Geometry Overview

Congruence

- Experiment with transformations in the plane
- Understand congruence in terms of rigid motions
- Prove geometric theorems
- Make geometric constructions

Similarity, Right Triangles, and Trigonometry

- Understand similarity in terms of similarity transformations
- Prove theorems involving similarity
- Define trigonometric ratios and solve problems involving right triangles
- Apply trigonometry to general triangles

Circles

- Understand and apply theorems about circles
- Find arc lengths and areas of sectors of circles

Expressing Geometric Properties with Equations

- Translate between the geometric description and the equation for a conic section
- Use coordinates to prove simple geometric theorems algebraically

Geometric Measurement and Dimension

- Explain volume formulas and use them to solve problems
- Visualize relationships between two-dimensional and three-dimensional objects

Modeling with Geometry

- Apply geometric concepts in modeling situations

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Congruence G-CO

Experiment with transformations in the plane

1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

Understand congruence in terms of rigid motions

6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

Prove geometric theorems

9. Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.
10. Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.

11. Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.

Make geometric constructions

12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

Similarity, Right Triangles, and Trigonometry G-SRT

Understand similarity in terms of similarity transformations

1. Verify experimentally the properties of dilations given by a center and a scale factor:

   a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

   b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Prove theorems involving similarity

4. Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*
5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Define trigonometric ratios and solve problems involving right triangles

6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
7. Explain and use the relationship between the sine and cosine of complementary angles.
8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.*

Apply trigonometry to general triangles

9. (+) Derive the formula $A = 1/2\ ab\ \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.
11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Circles G-C

Understand and apply theorems about circles

1. Prove that all circles are similar.
2. Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*
3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
4. (+) Construct a tangent line from a point outside a given circle to the circle.

Find arc lengths and areas of sectors of circles

5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

Expressing Geometric Properties with Equations G-GPE

Translate between the geometric description and the equation for a conic section

1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
2. Derive the equation of a parabola given a focus and directrix.
3. (+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

Use coordinates to prove simple geometric theorems algebraically

4. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).*
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).
6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.*

Geometric Measurement and Dimension G-GMD

Explain volume formulas and use them to solve problems

1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*
2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.?

Visualize relationships between two-dimensional and three-dimensional objects

4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Modeling with Geometry G-MG

Apply geometric concepts in modeling situations

1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*
2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).*
3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).*

Mathematics | High School—Statistics and Probability*

Decisions or predictions are often based on data—numbers in context. These decisions or predictions would be easy if the data always sent a clear message, but the message is often obscured by variability. Statistics provides tools for describing variability in data and for making informed decisions that take it into account.

Data are gathered, displayed, summarized, examined, and interpreted to discover patterns and deviations from patterns. Quantitative data can be described in terms of key characteristics: measures of shape, center, and spread. The shape of a data distribution might be described as symmetric, skewed, flat, or bell shaped, and it might be summarized by a statistic measuring center (such as mean or median) and a statistic measuring spread (such as standard deviation or interquartile range). Different distributions can be compared numerically using these statistics or compared visually using plots. Knowledge of center and spread are not enough to describe a distribution. Which statistics to compare, which plots to use, and what the results of a comparison might mean, depend on the question to be investigated and the real-life actions to be taken.

Randomization has two important uses in drawing statistical conclusions. First, collecting data from a random sample of a population makes it possible to draw valid conclusions about the whole population, taking variability into account. Second, randomly assigning individuals to different treatments allows a fair comparison of the effectiveness of those treatments. A statistically significant outcome is one that is unlikely to be due to chance alone, and this can be evaluated only under the condition of randomness. The conditions under which data are collected are important in drawing conclusions from the data; in critically reviewing uses of statistics in public media and other reports, it is important to consider the study design, how the data were gathered, and the analyses employed as well as the data summaries and the conclusions drawn.

Random processes can be described mathematically by using a probability model: a list or description of the possible outcomes (the sample space), each of which is assigned a probability. In situations such as flipping a coin, rolling a number cube, or drawing a card, it might be reasonable to assume various outcomes are equally likely. In a probability model, sample points represent outcomes and combine to make up events; probabilities of events can be computed by applying the Addition and Multiplication Rules. Interpreting these probabilities relies on an understanding of independence and conditional probability, which can be approached through the analysis of two-way tables.

Technology plays an important role in statistics and probability by making it possible to generate plots, regression functions, and correlation coefficients, and to simulate many possible outcomes in a short amount of time.

Connections to Functions and Modeling. Functions may be used to describe data; if the data suggest a linear relationship, the relationship can be modeled with a regression line, and its strength and direction can be expressed through a correlation coefficient.

Statistics and Probability Overview

Interpreting Categorical and Quantitative Data

- Summarize, represent, and interpret data on a single count or measurement variable
- Summarize, represent, and interpret data on two categorical and quantitative variables
- Interpret linear models

Making Inferences and Justifying Conclusions

- Understand and evaluate random processes underlying statistical experiments
- Make inferences and justify conclusions from sample surveys, experiments and observational studies

Conditional Probability and the Rules of Probability

- Understand independence and conditional probability and use them to interpret data
- Use the rules of probability to compute probabilities of compound events in a uniform probability model

Using Probability to Make Decisions

- Calculate expected values and use them to solve problems
- Use probability to evaluate outcomes of decisions

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Interpreting Categorical and Quantitative Data S-ID

Summarize, represent, and interpret data on a single count or measurement variable

1. Represent data with plots on the real number line (dot plots, histograms, and box plots).
2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

Summarize, represent, and interpret data on two categorical and quantitative variables

5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

   a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.*

   b. Informally assess the fit of a function by plotting and analyzing residuals.

   c. Fit a linear function for a scatter plot that suggests a linear association.

Interpret linear models

7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
8. Compute (using technology) and interpret the correlation coefficient of a linear fit.
9. Distinguish between correlation and causation.

Making Inferences and Justifying Conclusions S-IC

Understand and evaluate random processes underlying statistical experiments

1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
6. Evaluate reports based on data.

Conditional Probability and the Rules of Probability S-CP

Understand independence and conditional probability and use them to interpret data

1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").
2. Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
3. Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.
4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*
5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

Use the rules of probability to compute probabilities of compound events in a uniform probability model

6. Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model.
7. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.
8. (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.
9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

Using Probability to Make Decisions S-MD

Calculate expected values and use them to solve problems

1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.
2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*
4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?*

Use probability to evaluate outcomes of decisions

5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

   a. Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fastfood restaurant.*

   b. Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.*

6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

S.C. Science Academic Standards

CORE AREA STANDARDS
PHYSICAL SCIENCE

Scientific Inquiry

The skills of scientific inquiry, including a knowledge of the use of tools, will be assessed cumulatively on statewide tests. Students will therefore be responsible for the scientific inquiry indicators from all of their earlier grade levels.

Standard PS-1: The student will demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.

Indicators

PS-1.1 Generate hypothesis on the basis of credible, accurate, a appropriate metric units that reflect the precision and accuracy of each particular instrument.

PS-1.2 Use appropriate laboratory apparatuses, technology, and techniques safely and accurately when conducting a scientific investigation.

PS-1.3 Use scientific instruments to record measurement data in appropriate metric units that reflect the precision and accuracy of each particular instrument.

PS-1.4 Design a scientific investigation with appropriate methods of control to test a hypothesis (including independent ad dependent variables), and evaluate the designs of sample investigations.

PS-1.5 Organize and interpret the data from a controlled scientific investigation by using mathematics (including formulas and dimensional analysis), graphs, models, and/or technology.

PS-1.6 Evaluate the results of a controlled scientific investigation in terms of whether they refute or verify the hypothesis.

PS-1.7 Evaluate a technological design or product on the basis of designated criteria (including cost, time, and materials)

PS-1.8 Compare the processes of scientific investigation and technological design.

PS-1.9 Use appropriate safety procedures wen conducting investigations.

Chemistry: Structure and Properties of Matter

Standard PS-2: The student will demonstrate an understanding of the structure and properties of atoms.

Indicators

PS-2.1 Compare the subatomic particles (protons, neutrons, electrons) of an atom with regard to mass, location, and charge, and explain how these particles affect the properties of an atom (including identity, mass, volume, and reactivity).

PS-2.2 Illustrate the fact that the atoms of elements exist as stable or unstable isotopes.

PS-2.3 Explain the trends of the periodic table based on the elements' valence electrons and atomic numbers.

PS-2.4 Use the atomic number and the mass number to calculate the number of protons, neutrons, and/or electrons for a given isotope of an element.

PS-2.5 Predict the charge that a representative element will acquire according to the arrangement of electrons in its outer energy level.

PS-2.6 Compare fission and fusion (including the basic processes and the fact that both fission and fusion convert a fraction of the mass of interacting particles into energy and release a great amount of energy)

PS-2.7 Explain the consequences that the use of nuclear applications (including medical technologies, nuclear power plants, ad nuclear weapons) can have.

Chemistry: Structure and Properties of Matter

Standard PS-3: The student will demonstrate an understanding of various properties and classifications of matter.

Indicators

PS-3.1 Distinguish chemical properties of matter (including reactivity) from physical properties of matter (including boiling point, freezing/melting point, density [with density calculations], solubility, viscosity, and conductivity).

PS-3.2 Infer the practical applications of organic and inorganic substances on the basis of their chemical and physical properties.
PS-3.3 Illustrate the difference between a molecule and an atom.
PS-3.4 Classify matter as a pure substance (either an element or a compound) or as a mixture (either homogeneous or heterogeneous) on the basis of its structure and/or composition.
PS-3.5 Explain the effects of temperature, particle size, and agitation on the rate at which a solid dissolves in a liquid.
PS-3.6 Compare the properties of the four states of matter-solid, liquid, gas, and plasma-in terms of the arrangement and movement of particles.
PS-3.7 Explain the processes of phase change in terms of temperature, heat transfer, and particle arrangement.
PS-3.8 Classify various solutions as acids or bases according to their physical properties, chemical properties (including neutralization and reaction with metals), generalized formulas, and pH (using pH meters, pH paper, and litmus paper).

Chemistry: Structure and Properties of Matter
Standard PS-4: The student will demonstrate an understanding of chemical reactions and the classifications, structures, and properties of chemical compounds.
Indicators
PS-4.1 Explain the role of bonding in achieving chemical stability.
PS-4.2 Explain how the process of covalent bonding provides chemical stability through the sharing of electrons.
PS-4.3 Illustrate the fact that ions attract ions of opposite charge from all directions and form crystal lattices.
PS-4.4 Classify compounds as crystalline (containing ionic bonds) or molecular (containing covalent bonds) based on whether their outer electrons are transferred or shared.
PS-4.5 Predict the ratio by which the representative elements combine to form binary ionic compounds, and represent that ratio in a chemical formula.
PS-4.6 Distinguish between chemical changes (including the formation of gas or reactivity with acids) and physical changes (including changes in size, shape, color, and/or phase).
PS-4.7 Summarize characteristics of balanced chemical equations (including conservation of mass and changes in energy in the form of heat-that is, exothermic or endothermic reactions).
PS-4.8 Summarize evidence (including the evolution of gas; the formation of a precipitate; and/or changes in temperature, color, and/or odor) that a chemical reaction has occurred.
PS-4.9 Apply a procedure to balance equations for a simple synthesis or decomposition reaction.
PS-4.10 Recognize simple chemical equations (including single replacement and double replacement) as being balanced or not balanced.
PS-4.11 Explain the effects of temperature, concentration, surface area, and the presence of a catalyst on reaction rates.

Physics: The Interactions of Matter and Energy
Standard PS-5: The student will demonstrate an understanding of the nature of forces and motion.
Indicators
PS-5.1 Explain the relationship among distance time, direction, and the velocity of an object.
PS-5.2 Use the formula v = d/t to solve problems related to average speed or velocity.
PS-5.3 Explain how changes in velocity and time affect the acceleration of an object.
PS-5.4 Use the formula a = (vfvi)/t to determine the acceleration of an object.
PS-5.5 Explain how acceleration due to gravity affects the velocity of an object as it falls.
PS-5.6 Represent the linear motion of objects on distance-time graphs.
PS-5.7 Explain the motion of objects on the basis of Newton's three laws of motion: inertia; the relationship among force, mass, and acceleration; and action and reaction forces.
PS-5.8 Use the formula F = ma to solve problems related to force.
PS-5.9 Explain the relationship between mass and weight by using the formula FW = mag.
PS-5.10 Explain how the gravitational force between two objects is affected by the mass of each object and the distance between them.

Physics: The Interactions of Matter and Energy
Standard PS-6: The student will demonstrate an understanding of the nature, conservation, and transformation of energy.
Indicators
PS-6.1 Explain how the law of conservation of energy applies to the transformation of various forms of energy (including mechanical energy, electrical energy, chemical energy, light energy, sound energy, and thermal energy).
PS-6.2 Explain the factors that determine potential and kinetic energy and the transformation of one to the other.
PS-6.3 Explain work in terms of the relationship among the force applied to an object, the displacement of the object, and the energy transferred to the object.
PS-6.4 Use the formula W = Fd to solve problems related to work done on an object.
PS-6.5 Explain how objects can acquire a static electric charge through friction, induction, and conduction.
PS-6.6 Explain the relationships among voltage, resistance, and current in Ohm's law.
PS-6.7 Use the formula V = IR to solve problems related to electric circuits.
PS-6.8 Represent an electric circuit by drawing a circuit diagram that includes the symbols for a resistor, switch, and voltage source.
PS-6.9 Compare the functioning of simple series and parallel electrical circuits.
PS-6.10 Compare alternating current (AC) and direct current (DC) in terms of the production of electricity and the direction of current flow.
PS-6.11 Explain the relationship of magnetism to the movement of electric charges in electromagnets, simple motors, and generators.

Physics: The Interactions of Matter and Energy
Standard PS-7: The student will demonstrate an understanding of the nature and properties of mechanical and electromagnetic waves.
Indicators
PS-7.1 Illustrate ways that the energy of waves is transferred by interaction with matter (including transverse and longitudinal/compressional waves).
PS-7.2 Compare the nature and properties of transverse and longitudinal/compressional mechanical waves.
PS-7.3 Summarize characteristics of waves (including displacement, frequency, period, amplitude, wavelength, and velocity as well as the relationships among these characteristics).
PS-7.4 Use the formulas v = f2 and v = d/t to solve problems related to the velocity of waves.
PS-7.5 Summarize the characteristics of the electromagnetic spectrum (including range of wavelengths, frequency, energy, and propagation without a medium).
PS-7.6 Summarize reflection and interference of both sound and light waves and the refraction and diffraction of light waves.
PS-7.7 Explain the Doppler effect conceptually in terms f the frequency of the waves and the pitch of the sound.

BIOLOGY

Scientific Inquiry
The skills of scientific inquiry, including a knowledge of the use of tools, will be assessed cumulatively on statewide tests. Students will therefore be responsible for the scientific inquiry indicators from all of their earlier grade levels.
Standard B-1: The student will demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.
Indicators
B-1.1 Generate hypotheses based on credible, accurate, and relevant sources of scientific information.
B-1.2 Use appropriate laboratory apparatuses, technology, and techniques safely and accurately when conducting a scientific investigation.
B-1.3 Use scientific instruments to record measurement data in

appropriate metric units that reflect the precision and accuracy of each particular instrument.
B-1.4 Design a scientific investigation with appropriate methods of control to test a hypothesis (including independent and dependent variables), and evaluate the designs of sample investigations.
B-1.5 Organize and interpret the data from controlled scientific investigation by using mathematics, graphs, models, and/or technology.
B-1.6 Evaluate the results of a controlled scientific investigation in terms of whether they refute or verify the hypothesis.
B-1.7 Evaluate a technological design or product on the basis of designated criteria (including cost, time, and materials).
B-1.8 Compare the processes of scientific investigation and technological design.
B-1.9 Use appropriate safety procedures when conducting investigations.

Standard B-2: The student will demonstrate an understanding of the structure and function of cells and their organelles.
Indicators
B-2.1 Recall the three major tenets of cell theory (all living things are composed of one or more cells; cells are the basic units of structure and function in living things; and all presently existing cells arose from previously existing cells).
B-2.2 Summarize the structures and functions of organelles found in a eukaryotic cell (including the nucleus, mitochondria, chloroplasts, lysosomes, vacuoles, ribosomes, endoplasmic reticulum [ER], Golgi apparatus, cilia, flagella, cell membrane, nuclear membrane, cell wall, and cytoplasm).
B-2.3 Compare the structures and organelles of prokaryotic and eukaryotic cells.
B-2.4 Explain the process of cell differentiation as the basis for the hierarchical organization of organisms (including cells, tissues, organs, and organ systems).
B-2.5 Explain how active, passive, and facilitated transport serve to maintain the homeostasis of the cell.
B-2.6 Summarize the characteristics of the cell cycle: interphase (called G1, S, G2); the phases of mitosis (called prophase, metaphase, anaphase, and telophase); and plant and animal cytokinesis.
B-2.7 Summarize how cell regulation controls and coordinates cell growth and division and allows cells to respond to the environment, and recognize the consequences of uncontrolled cell division.
B-2.8 Explain the factors that affect the rates of biochemical reactions (including pH, temperature, and the role of enzymes as catalysts).

Standard B-3: The student will demonstrate an understanding of the flow of energy within and between living systems.
Indicators
B-3.1 Summarize the overall process by which photosynthesis converts solar energy into chemical energy and interpret the chemical equation for the process.
B-3.2 Summarize the basic aerobic and anaerobic processes of cellular respiration and interpret the chemical equation for cellular respiration.
B-3.3 Recognize the overall structure of adenosine triphosphate (ATP)-namely, adenine, the sugar ribose, and three phosphate groups-and summarize its function (including the ATP-ADP [adenosine diphosphate] cycle).
B-3.4 Summarize how the structures of organic molecules (including proteins carbohydrates, and fats) are related to their relative caloric values.
B-3.5 Summarize the functions of proteins, carbohydrate, and fats in the human body.
B-3.6 Illustrate the flow of energy through ecosystems (including food chains, food webs, energy pyramids, number pyramids, and biomass pyramids).

Standard B-4: The student will demonstrate an understanding of the molecular basis of heredity.
Indicators
B-4.1 Compare DNA and RNA in terms of structure, nucleotides, and base pairs.
B-4.2 Summarize the relationship among DNA, genes, and chromosomes.
B-4.3 Explain how DNA functions as the code of life and the blueprint for proteins.
B-4.4 Summarize the basic processes involved in protein synthesis (including transcription and translation).
B-4.5 Summarize the characteristics of the phases of meiosis I and II.
B-4.6 Predict inherited traits by using the principles f Mendelian genetics (including segregation, independent assortment, and dominance).
B-4.7 Summarize the chromosome theory of inheritance and relate that theory to Gregory Mendel's principles of genetics.
B-4.8 Compare the consequences of mutations in bod cells with those in gamete.
B-4.9 Exemplify ways that introduce new genetic characteristics into an organism or a population by applying the principles of modern genetics.

Standard B-5: The student will demonstrate an understanding of biological evolution and the diversity of life.
Indicators
B-5.1 Summarize the process of natural selection.
B-5.2 Explain how genetic processes result in the continuity of life-forms over time.
B-5.3 Explain how diversity within a species increases the chances of its survival.
B-5.4 Explain how genetic variability and environmental factors lead to biological evolution.
B-5.5 Exemplify scientific evidence in the fields of anatomy, embryology, biochemistry, and paleontology that underlies the theory of biological evolution.
B-5.6 Summarize ways that scientists use data from a variety of sources to investigate and critically analyze aspects of evolutionary theory.
B-5.7 Use a phylogenetic tree to identify the evolutionary relationships among different groups of organisms.

Standard B-6: The student will demonstrate an understanding of the interrelationships among organisms and the biotic and abiotic components of their environments.
Indicators
B-6.1 Explain how the interrelationships among organisms (including predation, competition, parasitism, mutualism, and commensalism) generate stability within ecosystems.
B-6.2 Explain how populations are affected by limiting factors (including density-dependent, density-independent, abiotic, and biotic actors).
B-6.3 Illustrate the processes of succession in ecosystems.
B-6.4 Exemplify the role of organisms in the geochemical cycles (including the cycles of carbon, nitrogen, and water).
B-6.5 Explain how ecosystems maintain themselves through natural occurring processes (including maintaining the quality of the atmosphere, generating soils, controlling the hydrologic cycle, disposing of wastes, and recycling nutrients).
B-6.6 Explain how human activities (including population growth, technology, and consumption of resources) affect the physical and chemical cycles and processes of Earth.

CHEMISTRY

Scientific Inquiry
The skills of scientific inquiry, including a knowledge of the use o tools, will be assessed cumulatively on statewide tests. Students will therefore be responsible for the scientific inquiry indicators from all of their earlier grade levels.
Standard C-1: The student will demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.
Indicators
C-1.1 Apply established rules for significant digits, both in reading a scientific instrument and in calculating a derived quantity from measurement.

C-1.2 Use appropriate laboratory apparatuses, technology, and techniques safely and accurately when conducting a scientific investigation.
C-1.3 Use scientific instruments to record measurement data in appropriate metric units that reflect the precision and accuracy of each particular instrument.
C-1.4 Design a scientific investigation with appropriate methods of control to test a hypothesis (including independent and dependent variables), and evaluate the designs of sample investigations.
C-1.5 Organize and interpret the data from a controlled scientific investigation by using mathematics (including formulas, scientific notation, and dimensional analysis), graphs, models, and/or technology.
C-1.6 Evaluate the results of a scientific investigation in terms of whether they verify or refute the hypothesis and what the possible sources of error are.
C-1.7 Evaluate a technological design or product on the basis of designated criteria.
C-1.8 Use appropriate safety procedures when conducting investigations.

Standard C-2: Students will demonstrate an understanding of atomic structure and nuclear processes.
Indicators
C-2.1 Illustrate electron configurations by using orbital notation for representative elements.
C-2.2 Summarize atomic properties (including electron configuration, ionization energy, electron affinity, atomic size, and ionic size).
C-2.3 Summarize the periodic table's property trends (including electron configuration, ionization energy, electron affinity, atomic size, ionic size, and reactivity).
C-2.4 Compare the nuclear reactions of fission and fusion to chemical reactions (including the arts of the atom involved and the relative amounts of energy released).
C-2.5 Compare alpha, beta, and gamma radiation in term of mass, charge, penetrating power, and the release of these particles from the nucleus.
C-2.6 Explain the concept of half-lie, its use in determining the age of materials, and its significance to nuclear waste disposal.
The following indicators should be selected as appropriate to a particular course for additional content and depth:
C-2.7 Apply the predictable rate of nuclear decay (half-life) to determine the age of materials.
C-2.8 Analyze a decay series chart to determine the products of successive nuclear reactions and write nuclear equations for disintegration of specified nucleides.
C-2.9 Use the equation E = mc2 to determine the amount of energy released during nuclear reactions.

Standard C-3: The student will demonstrate an understanding of the structures and classifications of chemical compounds.
Indicators
C-3.1 Predict the type of bonding (ionicore covalent) and the shape of simple compounds by using Lewis dot structures and oxidation numbers.
C-3.2 Interpret the names ad formulas for ionic and covalent compounds.
C-3.3 Explain how the types of intermolecular forces present in a compound affect the physical properties of compounds (including polarity and molecular shape).
C-3.4 Explain the unique bonding characteristic of carbon that have resulted in the formation of a large variety of organic structures.
C-3.5 Illustrate the structural formulas and names of simple hydrocarbons (including alkalines and their isomers and benzene rings).
The following indicators should be selected as appropriate to a particular course for additional content and depth:
C-3.6 Identify the basic structure of common polymers (including proteins, nucleic acids, plastics, and starches).
C-3.7 Classify organic compounds in terms of their functional group.
C-3.8 Explain the effect of electronegativity and ionization energy on the type of bonding in a molecule.
C-3.9 Classify polymerization reactions as addition or condensation.
C-3.10 Classify organic reactions as addition, elimination, or condensation.

Standard C-4: The student will demonstrate an understanding of the types, the causes, and the effects of chemical reactions.
Indicators
C-4.1 Analyze and balance equations for simple synthesis, decomposition, single replacement,double replacement, and combustion reactions.
C-4.2 Predict the products of acid-base neutralization and combustion reactions.
C-4.3 Analyze the energy changes (endothermic or exothermic) associated with chemical reactions.
C-4.4 Apply the concept of mores to determine the number of particles of a substance in a chemical reaction, the percent composition of a representative compound, the mass proportions, and the mole-mass relationships.
C-4.5 Predict the percent yield, the mass of excess, and the limiting reagent in chemical reactions.

C-4.6 Explain the role of activation energy and the effects of temperature, particle size, stirring, concentration, and catalysts in reaction rates.

The following indicators should be selected as appropriate to a particular course for additional content and depth:

C-4.7 Summarize the oxidation and reduction processes (including oxidizing and reducing agents).

C-4.8 Illustrate the uses of electrochemistry (including electrolytic cells, voltaic cells, and the production of metals from ore by electrolysis).

C-4.9 Summarize the concept of chemical equilibrium and Le Châtelier's principle.

C-4.10 Explain the role of collision frequency, the energy of collisions, and the orientation of molecules in reaction rates.

Standard C-5: The student will demonstrate an understanding of the structure and behavior of the different phases of matter.

Indicators

C-5.1 Explain the effects of the intermolecular forces on the different phases of matter.

C-5.2 Explain the behaviors of gas; the relationship among pressure, volume, and temperature; and the significance of the Kelvin (absolute temperature) scale, using the kinetic-molecular theory as a model.

C-5.3 Apply the gas laws to problems concerning changes in pressure, volume, or temperature (including Charles's law, Boyle's law, and the combined gas law).

C-5.4 Illustrate and interpret heating nd cooling curves (including how boiling and melting points can be identified and how boiling points vary with changes in pressure).

The following indicators should be selected as appropriate to a particular course for additional content and depth:

C-5.5 Analyze the energy changes involved in calorimetry by using the law of conservation of energy as it applies to temperature, eat, and phase changes (including the use of the formulas q = mc^T [temperature change] and q = mLv and q = mLf [phase change] o solve calorimetry problems).

C-5.6 Use density to determine the mass, volume, or number of particles of a gas in a chemical reaction.

C-5.7 Apply the ideal gas law (pV = nRT) to solve problems.

C-5.8 Analyze a product for purity by following the appropriate assay procedures.

C-5.9 Analyze a chemical process to account for the weight of all reagents and solvents by following th appropriate material balance procedures.

Standard C-6: The student will demonstrate an understanding of the nature and properties of various types of chemical solutions.

Indicators

C-6.1 Summarize the process by which solutes dissolve in solvents, the dynamic equilibrium that occurs in saturated solutions, and the effects of varying pressure and temperature of solubility.

C-6.2 Compare solubility of various substances in different solvents (including polar and non-polar solvents and organic and inorganic substances).

C-6.3 Illustrate the colligative properties of solutions (including freezing point depression and boiling point elevation and their practical uses).

C-6.4 Carry out calculations to find the concentration of solutions in terms of molarity and percent weight (mass).

C-6.5 Summarize the properties of salts, acids, and bases.

C-6.6 Distinguish between strong and weak common acids and bases.

C-6.7 Represent common acids and bases by their names and formulas.

The following indicators should be selected as appropriate to a particular course for additional content and depth:

C-6.8 Use the hydronium orhydroxide ion concentration to determine the pH and pOH of aqueous solutions.

C-6.9 Explain how the use of a titration can determine the concentration of acid and base solutions

C-6.10 Interpret solubility curves to determine saturation at different temperatures.

C-6.11 Use a variety of procedures for separating mixtures (including distillation, crystallization filtration, paper chromatography, and centrifuge).

C-6.12 Use solubility rules to write net ionic equations for precipitation reactions in aqueous solution.

C-6.13 Use the calculated molality of a solution to calculate the freezing point depression and the boiling point elevation of a solution.

C-6.14 Represent neutralization reactions and reactions between common acids and metals by using chemical equations.

C-6.15 Analyze the composition of a chemical sample by using gas chromatography.

PHYSICS

Scientific Inquiry

The skills of scientific inquiry, including a knowledge of the use of tools, will be assessed cumulatively on statewide tests. Students will therefore be responsible for he scientific inquiry indicators from all of their earlier grade levels.

Standard P-1: The student will demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.

Indicators

P-1.1 Apply established rules for significant digits, both in reading scientific instruments and in calculating derived quantities from measurement.

P-1.2 Use appropriate laboratory apparatuses, technology, and techniques safely ad accurately when conducting a scientific investigation.

P-1.3 Use scientific instruments to record measurement data in appropriate metric units that reflect the precision and accuracy of each particular instrument.

P-1.4 Design a scientific investigation with appropriate methods of control to test a hypothesis (including independent and dependent variables), and evaluate the deigns of sample investigations.

P-1.5 Organize and interpret the data from a controlled scientific investigation by using (including calculations in scientific notation, formulas, and dimensional analysis), graphs, tables, models, diagrams, and/or technology.

P-1.6 Evaluate the results of a controlled scientific investigation in terms of whether they refute or verify the hypothesis.

P-1.7 Evaluate conclusions based on qualitative and quantitative data (including the impact of parallax, instrument malfunction, or human error) on experimental results.

P-1.8 Evaluate a technological design or product on the basis of designated criteria (including cost, time, and materials).

P-1.9 Communicate and defend a scientific argument or conclusion.

P-1.10 Use appropriate safety procedures when conducting investigations.

Standard P-2: The student will demonstrate an understanding of the principles of force and motion and relationships between them.

Indicators

P-2.1 Represent vector quantities (including displacement, velocity, acceleration, and force) and use vector addition.

P-2.2 Apply formulas for velocity or speed and acceleration to one and two-dimensional problems.

P-2.3 Interpret the velocity or speed and acceleration of one and two-dimensional motion on distance-time, velocity-time or speed-time, and acceleration-time graphs.

P-2.4 Interpret the resulting motion of objects by applying Newton's three laws of motion: inertia; the relationship among net force, mass, and acceleration (using F = ma); an action and reaction forces.

P-2.5 Explain the factors that influence the dynamics of falling objects and projectiles.

P-2.6 Apply formulas for velocity and acceleration to solve problems related to projectile motion.

P-2.7 Use a free-body diagram to determine the net force and component forces acting upon an object.

P-2.8 Distinguish between static and kinetic friction and the factors that affect the motion of objects.

P-2.9 Explain how torque is affected by the magnitude, direction, and point of application of force.
P-2.10 Explain the relationships among speed, velocity, acceleration, and force in rotational systems.

Standard P-3: The student will demonstrate an understanding of the conservation, transfer, and transformation of mechanical energy.
Indicators
P-3.1 Apply energy formulas to determine potential and kinetic energy and explain the transformation from one to the other.
P-3.2 Apply the law of conservation of energy to the transfer of mechanical energy through work.
P-3.3 Explain both conceptually and quantitatively, how energy can transfer from one system to another (including work, power, and efficiency).
P-3.4 Explain, both conceptually and quantitatively, the factors that influence periodic motion.
P-3.5 Explain the factors involved in producing a change in momentum (including impulse and the law of conservation of momentum in both linear and rotary systems).
P-3.6 Compare elastic and inelastic collisions in terms of conservation laws.

Standard P-4: The student will demonstrate an understanding of the properties of electricity and magnetism and the relationships between them.
Indicators
P-4.1 Recognize the characteristics of static charge and explain how a static charge is generated.
P-4.2 Use diagrams to illustrate an electric field (including point charges and electric field lines).
P-4.3 Summarize current, potential difference, and resistance in terms of electrons.
P-4.4 Compare how current, voltage, and resistance are measured in a series and in a parallel electric circuit and identify the appropriate units of measurement.
P-4.5 Analyze the relationships among voltage, resistance, nd current in a complex circuit by using Ohm's law to calculate voltage, resistance, and current at each resistor, any branch, and the overall circuit.
P-4.6 Differentiate between alternating current (AC) and direct current (DC) in electrical circuits.
P-4.7 Carry out calculations for electric power and electric energy for circuits.
P-4.8 Summarize the function of electrical safety components (including fuses, surge protectors, and breakers).
P-4.9 Explain the effects of magnetic forces on the production of electrical currents and on current carrying wires and moving charges.
P-4.10 Distinguish between the function of motors an generators on the basis of the use of electricity and magnetism by each.
P-4.11 Predict the cost of operating an electrical device by determining the amount of electrical power and electrical energy in the circuit.

Standard P-5: The student will demonstrate an understanding of the properties and behaviors of mechanical and electromagnetic waves.
Indicators
P-5.1 Analyze the relationships among the properties of waves (including energy, frequency, amplitude, wavelength, period, phase, and speed).
P-5.2 Compare the properties of electromagnetic and mechanical waves.
P-5.3 Analyze wave behaviors (including reflection, refraction, diffraction, and constructive and destructive interference).
P-5.4 Distinguish the different properties of wave across the range of the electromagnetic spectrum.
P-5.5 Illustrate the interaction of light waves with optical lenses and mirrors by using Snell's law and ray diagrams.
P-5.6 Summarize the operation of lasers and compare them to incandescent light.

Two of physics standards 6 through 10 must be taught in addition to standards 1 through 5.
Standard P-6: The student will demonstrate an understanding of the properties and behaviors of sound.
Indicators
P-6.1 Summarize the production of sound and its speed and transmission through various media.
P-6.2 Explain how frequency and intensity affect the parts of the sonic spectrum.
P-6.3 Explain pitch, loudness, and tonal quality in terms of wave characteristics that determine what is heard.
P-6.4 Compare intensity and loudness.
P-6.5 Apply formulas to determine the relative intensity of sound.
P-6.6 Apply formulas in order to solve for resonant wavelengths in problems involving open and closed tubes.
P-6.7 Explain the relationship among frequency,fundamental tones, and harmonics in producing music.
P-6.8 Explain how musical instruments produce resonance and standing waves
P-6.9 Explain how the variables of length, width, tension, and density affect the resonant frequency, harmonics, and pitch of vibrating string.

Two of physics standards 6 through 10 must be taught in addition to standards 1 through 5.
Standard P-7: The student will demonstrate an understanding of the properties and behaviors of light and optics.
Indicators
P7.1 Explain the particulate nature of light as evidenced in the photoelectric effect.
P-7.2 Use the inverse square law to determine the change in intensity of light with distance.
P-7.3 Illustrate the polarization of light.
P-7.4 Summarize the operation o fiber optics in terms of total internal reflection.
P-7.5 Summarize image formation in microscopes and telescopes (including reflecting and refracting).
P-7.6 Summarize the production of continuous, emission, or absorption spectra.
P-7.7 Compare color y transmission to color by reflection.
P-7.8 Compare color mixing in pigments to color mixing in light.
P-7.9 Illustrate the diffraction and interference of light.
P-7.10 Identify the parts of the eye and explain their function in image formation.

Two of physics standards 6 through 10 must be taught in addition to standards 1 through 5.
Standard P-8: The student will demonstrate an understanding of nuclear physics and modern physics.
Indicators
P-8.1 Compare the strong and weak nuclear force in terms of their roles in radioactivity.
P-8.2 Compare the nuclear binding energy to the energy released during a nuclear reaction, given the atomic masses of the constituent particles.
P-8.3 Predict the resulting isotope of a given alpha, beta, or gamma emission.
P-8.4 Apply appropriate procedures to balance nuclear equations (including fusion, fission, alpha decay, beta decay, and electron capture).
P-8.5 Interpret a representative nuclear decay series.
P-8.6 Explain the relationship between mass an energy that is represented in the equation E = mc2 according to Einstein's special theory of relativity.
P-8.7 Compare the vale of time, length, and momentum in the reference frame of an object moving at relativistic velocity to those values measured in the reference frame of an observer by applying Einstein's special theory of relativity.

Two of physics standards 6 through 10 must be taught in addition to standards 1 through 5.

Standard P-9: The student will demonstrate an understanding of he principles of fluid mechanics.

Indicators

P-9.1 Predict the behavior of fluids (including changing forces) in pneumatic ad hydraulic systems.
P-9.2 Apply appropriate procedures to solve problems involving pressure, force, volume, and area.
P-9.3 Explain the factors that affect buoyancy.
P-9.4 Explain how the rate of flow of a fluid is affected by the size of the pipe, friction, and the viscosity of the fluid.
P-9.5 Explain how depth and fluid density affect pressure.
P-9.6 Apply fluid formulas to solve problems involving work and power.
P-9.7 Exemplify the relationship between velocity and pressure by using Bernoulli's principle.

Two of physics standards 6 through 10 must be taught in addition to standards 1 through 5.

Standard P-10: The student will demonstrate an understanding of the principles of thermodynamics.

Indicators

P-10.1 Summarize the first and second laws of thermodynamics.
P-10.2 Explain the relationship among internal energy, heat, and work.
P-10.3 Exemplify he concept of entropy.
P-10.4 Explain thermal expansion in solids, liquids, and gases in terms of kinetic theory and the unique behavior of water.
P-10.5 Differentiate heat and temperature in terms of molecular motion.
P-10.6 Summarize the concepts involved in phase change.
P-10.7 Apply the concepts of heat capacity, specific heat, and heat exchange to solve calorimetry problems.
P-10.8 Summarize the functioning of heat transfer mechanisms (including engines and refrigeration systems).

EARTH SCIENCE

Scientific Inquiry

The skills of scientific inquiry, including a knowledge of the use of tools, will be assessed cumulatively on statewide tests. Students will therefore be responsible for the scientific inquiry indicators from all of their earlier grade levels.

Standard ES-1: The student will demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.

Indicators

ES-1.1 Apply established rules for significant digits, both in reading scientific instruments and in calculating derived quantities from measurement.
ES-1.2 Use appropriate laboratory apparatuses, technology, and techniques safely and accurately when conducting a scientific investigation.
ES-1.3 Use scientific instruments to record measurement data in appropriate metric units that reflect the precision and accuracy of each particular instrument.
ES-1.4 design a scientific investigation with appropriate methods of control to test a hypothesis (including independent and dependent variables), and evaluate the designs of sample investigations.
ES-1.5 Organize and interpret the data from a controlled scientific investigation by using mathematics (including calculations in scientific notation, formulas, and dimensional analysis), graphs, tables, models, diagrams, and/or technology.
ES-1.6 Evaluate the results of a controlled scientific investigation in terms of wether they refute or verify the hypothesis.
ES-1.7 Evaluate conclusions based on qualitative and quantitative data (including the impact of parallax, instrument malfunction, or human error) on experimental results.
ES-1.8 Evaluate a technological design o product on the basis of designated criteria (including cost, time, and materials).
ES-1.9 Communicate and defend a scientific argument or conclusion.
ES-1.10 Use appropriate safety procedures when conducting investigations.

Astronomy

Standard ES-2: Students will demonstrate an understanding of the structure and properties of the universe.

Indicators

ES-2.1 Summarize the properties of the solar system that support the theory of its formation along with the planets.
ES-2.2 Identify properties and features of the Moon that make it unique among other moons in the solar system.
ES-2.3 Summarize the evidence that supports the big bang theory and the expansion of the universe (including the red shift of light from distant galaxies and the comic background radiation).
ES-2.4 Explain the formation of elements that results from nuclear fusion occurring within stars or supernova explosions.
ES-2.5 Classify stars by using the Hertzsprung-Russell diagram.
ES-2.6 Compare the information obtained through the use of x-ray, radio, and visual (reflecting and refracting) telescopes.
ES-2.7 Summarize the life cycles of stars.
ES-2.8 Explain how gravity and motion affect the formation and shapes of galaxies (including the Milky Way).
ES-2.9 Explain ho technology and computer modeling have increased our understanding of the universe.

Solid Earth

Standard ES-3: Students will demonstrate an understanding of the internal and external dynamics of solid Earth.

Indicators

ES-3.1 Summarize theories and evidence of the origin and formation of Earth's systems by using the concepts of gravitational force and heat production.
ES-3.2 Explain the differentiation of the structure of Earth's layers into a core, mantle, and crust based on the production of internal heat from the decay of isotopes and the role of gravitational energy.
ES-3.3 Summarize theory of plate tectonics (including the role of convection currents, the action at plate boundaries, and the scientific evidence for the theory).
ES-3.4 Explain how forces due to plate tectonics cause crustal changes as evidenced in earthquake activity, volcanic eruptions, and mountain building.
ES-3.5 Analyze surface features of Earth in order to identify geologic processes (including weathering, erosion, deposition, and glaciation) that are likely to have been responsible for their formation.
ES-3.6 Explain how the dynamic nature of the rock cycle accounts for the interrelationships among igneous, sedimentary, and metamorphic rocks.
ES-3.7 Classify minerals and rocks on the basis of their physical and chemical properties and the environment in which they were formed.
ES-3.8 Summarize the formation of ores and fossil fuels and the impact on the environment that the use of these fuels has had.

Earth's Atmosphere

Standard ES-4: The student will demonstrate an understanding of the dynamics of Earth's atmosphere.

Indicators

ES-4.1 Summarize the thermal structures, the gaseous composition, and the location of the layers of Earth's atmosphere.
ES-4.2 Summarize the changes in Earth's atmosphere over geologic time (including the importance of photosynthesizing organisms to the atmosphere).
ES-4.3 Summarize the cause and effects of convection within Earth's atmosphere.
ES-4.4 Attribute global climate patterns to geographic influences (including latitude, topography, elevation, and proximity to water).
ES-4.5 Explain the relationship between the rotation of Earth and the pattern of wind belts.
ES-4.6 Summarize possible causes of and evidence for past and present global climate changes.

ES-4.7 Summarize the evidence for the likely impact of human activities on th atmosphere (including ozone holes, greenhouse gases, acid rain, and photochemical smog).
ES-4.8 Predict weather conditions an storms (including thunderstorms, hurricanes, and tornados) on the basis of the relationship among the movement of air masses, high and low pressure systems, and frontal boundaries.

Earth's Hydrosphere
Standard ES-5: The student will demonstrate an understanding of Earth's freshwater and ocean systems.
Indicators
ES-5.1 Summarize the location, movement, and energy transfers involved in the movement of water on Earth's surface (including lakes, surface-water drainage basins [watersheds], freshwater wetlands, and groundwater zones).
ES-5.2 Illustrate the characteristics of the succession of river systems.
ES-5.3 Explain how karst topography develops as a result of groundwater processes.
ES-5.4 Compare the physical and chemical properties o seawater and freshwater.
ES-5.5 Explain the results of the interaction of the shore with waves and currents.
ES-5.6 Summarize he advantages and disadvantages of devices used to control and prevent coastal erosion and flooding.
ES-5.7 Explain the effects of the transfer of solar energy and geothermal energy on the oceans of Earth (including the circulation of ocean currents and cemosynthesis).
ES-5.8 Analyze environments to determine possible sources of water pollution (including industrial waste, agriculture, domestic waste, and transportation devices).

The Paleobiosphere
Standard ES-6: Students will demonstrate an understanding of the dynamic relationship between Earth's conditions over geologic time and the diversity of its organisms.
Indicators
ES-6.1 Summarize the conditions of Earth that enable the planet to support life.
ES-6.2 Recall the divisions of the geologic time scale and illustrate the changes (in complexity and/or diversity) of organisms that have existed across these time units.
ES-6.3 Summarize how fossil evidence reflects the changes in environmental conditions on Earth over time.
ES-6.4 Match dating methods (including index fossils, ordering of rock layers, and radiometric dating) with the most appropriate application for estimating geologic time.
ES-6.5 Infer explanations concerning the age of the universe and the age of Earth on the basis of scientific evidence.

S.C. Social Studies Academic Standards

ACADEMIC STANDARDS
WORLD GEOGRAPHY
(Elective)

The focus of World Geography is the physical and cultural characteristics of Earth. The course is organized systematically around the topics of region, physical earth dynamics, population, **culture**, economic systems, urban systems, political systems, and the environment. The course standards are not meant to be taught in order or in isolation. Critical thinking should be emphasized in this course, with stress placed on the development of spatial thinking skills and competency related to the five themes of geography: location, place, regions, movement, and human-environment interaction. Conceptual in nature rather than place-specific, the course may be taught from either a systematic or a regional perspective. For this reason, an example is included in each indicator, giving the teacher insight into the intent of the indicator. Map-reading skills and the use of geographic models and geographic information systems should be an integral part of this course.

WORLD GEOGRAPHY

Standard WG-1: The student will demonstrate an understanding of the physical and human characteristics of places, including the creation of regions and the ways that **culture** and experience influence the perception of place.

Enduring Understanding

Physical and human characteristics define or give meaning to places, and geographers use and analyze regions to manage and interpret Earth's complexity. To analyze and synthesize information to solve problems and answer questions about the complexity of Earth, the student will utilize the knowledge and skills set in the following indicators:

Indicators

WG-1.1 Analyze physical characteristics of the environment that result in opportunities and obstacles for people (e.g., the role of climate in agriculture, site characteristics that limit development).

WG-1.2 Analyze human characteristics of places, including the ways places change with innovation and the diffusion of people and ideas (e.g., the spread of religion and **democracy**).

WG-1.3 Explain how physical environment and human characteristics can be used to organize a region and how regions change over time (e.g., from heavy manufacturing belts to "rust belts").

WG-1.4 Differentiate the ways in which people change their views of places and regions as a result of physical, cultural, economic and political conditions (e.g., views of the Middle East after Sept. 11, 2001).

WG-1.5 Explain how individuals view places and regions on the basis of their particular stage of life, gender, social class, ethnicity, values, and access to technology (e.g., how retirees have changed the cultural landscape and available human services in Florida).

Standard WG-2: The student will demonstrate an understanding of the physical processes that shape the patterns of Earth's surface, including the dynamics of the atmosphere, biosphere, hydrosphere, and lithosphere.

Enduring Understanding

Through the interactions within and between the atmosphere, biosphere, hydrosphere, and lithosphere, Earth serves as the home of all living things. To understand the interconnections among these systems, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

WG-2.1 Explain the ways in which Earth's physical systems and processes (the atmosphere, biosphere, hydrosphere, and lithosphere) are dynamic and interactive (e.g., conditions that cause changes in climate).

WG-2.2 Explain how variability in Earth-Sun relationships affects Earth's physical processes over time (e.g., glaciation).

WG-2.3 Infer the resulting change produced by a specific physical process operating on Earth's surface (e.g., the role of plate tectonics in mountain building).

WG-2.4 Explain how a physical event or process can influence an ecosystem in terms of its characteristics and its ability to withstand stress (e.g., the response of forest flora to a fire).

WG-2.5 Infer how physical processes can cause change over time in the distribution and characteristics of ecosystems and biomes (e.g., how changes in temperature and moisture can drive desertification).

WG-2.6 Evaluate ecosystems in terms of their biodiversity and productivity

(e.g., how both characteristics vary across space and in their value to all living things).

Standard WG-3: The student will demonstrate an understanding of the characteristics, distribution, and migration of human populations on Earth's surface.

Enduring Understanding

Social, political, and ecological issues require an understanding of the characteristics, distribution, and movement of human population. To make complex choices and decisions about these factors regarding the human population, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

WG-3.1 Evaluate demographic patterns to predict trends in the spatial distribution of population using graphs, maps, and other models (e.g., Hispanic population growth in the United States).

WG-3.2 Analyze population issues and policies, including pro-natal and anti-natal policies of different countries and their effects on population characteristics (e.g., China's one-child policy).

WG-3.3 Explain the cultural, economic, political, and environmental push and pull factors that contribute to human migration (e.g., residents evacuating from a natural disaster like Hurricane Katrina).

WG-3.4 Evaluate the impact of human migration on physical and human systems including changes in population density, the use of resources, and the provision of services (e.g., the environmental costs of refugee settlement camps in Africa).

WG-3.5 Compare the response of different groups and governments to migration, including national migration policies and differing responses by local communities (e.g., the requirement that immigrants adopt the new language).

Standard WG-4: The student will demonstrate an understanding of the characteristics of culture, the patterns of culture, and cultural change.

Enduring Understanding

There are many diverse expressions of culture in the world. To be open and responsive to new and diverse cultural perspectives, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

WG-4.1 Identify the characteristics of **culture** and the impacts of cultural beliefs on gender roles and the perception of race and **ethnicity** as they vary from one region to another (e.g., legal rights for women in the Middle East and South Asia).

WG-4.2 Compare and contrast the consequences of differing cultural views of nature and the use of natural resources including the development of a built environment from a natural environment (e.g., the former Soviet Union's disregard for the environment).

WG-4.3 Compare the roles that cultural factors such as religious, linguistic, and **ethnic** differences play in cooperation and conflict within and among societies.

WG-4.4 Explain the spatial processes of cultural convergence (e.g., American-based fast-food franchises in the developing world).

WG-4.5 Explain how a blending of **cultures** can alter cultural solidarity (e.g., the blurring sense of nationality stemming from the creation of the European Union).

Standard WG-5: The student will demonstrate an understanding of the role that geography plays in economic development.

Enduring Understanding

Earth's economic, transportation, and communication systems are spatially organized and are undergoing alteration as a consequence of global interdependence. To understand the interconnections among these systems, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

WG-5.1 Summarize the changes in the spatial distribution and the patterns of production and consumption of selected goods and services as they vary from one region of the world to another (e.g., the manufacturing shift away from the United States).

WG-5.2 Classify and describe the spatial distribution of major economic systems, including traditional, command, and market economic systems (e.g., North Korea's command economy as opposed to Germany's **market economy**).

WG-5.3 Explain the spatial relationships between various economic activities (e.g., the integrated relationship between farms and markets in agriculture).

WG-5.4 Summarize the factors that influence the location and spatial distribution of economic activities, including the factors of site and situation (e.g., Singapore's deep-water ports and their locations relative to markets).

WG-5.5 Explain the consequences of the current global trade systems for economic and environmental sustainability in both importing and exporting countries (e.g., the impacts of overfishing on local ecosystems to meet foreign product **demand**).

WG-5.6 Explain the connection between the delivery of goods and services and the transportation and communications networks that are needed to provide them (e.g., the hub-and-spoke systems used by airfreight companies).

Standard WG-6: The student will demonstrate an understanding of the processes, patterns, and functions of human settlement.

Enduring Understanding

Human settlements, both urban and rural, vary in their type, pattern, settlement process, and function. To understand the interconnections among these systems, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

WG-6.1 Compare the changing functions, sizes, and spatial patterns of rural and urban regions (e.g., the concentration of shopping services in suburbs).

WG-6.2 Explain how the structure of rural and urban places is impacted by economic, social, political, and environmental transitions, including gains or losses by industries and the outsourcing or offshoring of labor (e.g., the shift from textiles to automobile manufacturing in the American South).

WG-6.3 Explain how **globalization** has changed the function of cities (e.g., the role of technology that has reduced logistics related to distance).

WG-6.4 Explain the advantages and disadvantages of daily life in rural and urban locations (e.g., transportation systems, zoning, congestion, **population density**, cultural opportunities, cost of living).

WG-6.5 Compare different urban models to explain the structures and patterns in cities that vary from one region to another (e.g., the spine in Latin American cities).

WG-6.6 Summarize the physical and human impacts of emerging urban forms in the world (e.g., the environmental challenges posed by increasing urbanization and sprawl).

Standard WG-7: The student will demonstrate an understanding of how cooperation and conflict among people influence the division and control of Earth's surface.

Enduring Understanding

Earth is globally interdependent and locally controlled. Its territorial divisions are capable of cooperation or conflict. To analyze the reasons for and the results of Earth's territorial divisions, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

WG-7.1 Explain how cooperation and/or conflict can lead to the control of Earth's surface (e.g., the establishment of new social, political, or economic divisions).

WG-7.2 Explain the causes of boundary conflicts and internal disputes between **culture** groups (e.g., the ongoing Israeli-Palestinian conflict).

WG-7.3 Explain why political boundaries such as national borders or political districts change (e.g., those of historic imperial powers).

WG-7.4 Explain how the size, shape, and relative location of a country or a nation can be an advantage or a disadvantage to it (e.g., the natural-resource potential of Russia as opposed to its ability to protect its immense landmass from outside aggression).

WG-7.5 Explain how a country's ambition to obtain foreign markets and resources can cause fractures and disruptions in the world (e.g., the energy needs of China in its emerging role in Africa).

WG-7.6 Analyze how **globalization** affects different functions of citizenship (e.g., the need for only one passport for members of the European Union).

Standard WG-8: The student will demonstrate an understanding of how human actions modify the physical environment; how physical systems affect human systems; and how resources change in meaning, use, distribution, and importance.

Enduring Understanding

Human modifications to the environment result in consequences that often have ethical, physical, and political implications. To analyze and synthesize information to solve such problems and answer questions related to them, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

WG-8.1 Evaluate the ways in which technology has expanded the human capability to modify the physical environment both locally and globally (e.g., the risks and benefits associated with how the petroleum industry uses offshore drilling).

WG-8.2 Compare how human modification of the physical environment varies from one region to another and may require different human responses (e.g., the resettlement of Chinese villages in response to the Three Gorges Dam).

WG-8.3 Explain the ways in which individuals and societies mitigate the effects of hazards and adapt to them as part of their environment (e.g., the earthquake and subsequent nuclear disaster in Japan).

WG-8.4 Analyze the relationships between the spatial distribution of humans and resources (e.g., the positive and negative consequences of resource use as exemplified by the shrinking of the Aral Sea).

WG-8.5 Analyze policy decisions regarding the use of resources in different regions of the world, including how the demand for resources impacts economies, **population distribution**, and the environment.

WORLD HISTORY FROM 1300: THE MAKING OF THE MODERN WORLD

(Elective)

World History from 1300: The Making of the Modern World is designed to assist students in understanding how people and countries of the world have become increasingly interconnected. In the last six hundred years, population growth, **demand** for resources, curiosity, and technology have converged to draw the distant corners of the world closer together. Critical thinking is focal to this course, which emphasizes why and how people, ideas, and technology have made an impact on diverse groups of people.

WORLD HISTORY FROM 1300

Standard MWH-1: The student will demonstrate an understanding of the major factors that facilitated exchanges among groups of people and how exchanges influenced those people in the fourteenth and fifteenth centuries.

Enduring Understanding

Physical geography, ideas, warfare, and financial institutions have shaped the interaction within and among regions around the world. To understand how the interaction of these forces in the fourteenth and fifteenth centuries led to the development of modern societies, the student will utilize the knowledge and skills set forth in the following indicators:

Indicator

MWH-1.1 Describe the diffusion of people and goods between Europe, Asia, and Africa during the fourteenth and fifteenth centuries to show the networks of economic interdependence and cultural interactions.

MWH-1.2 Explain the impact of the **Crusades** and the Renaissance on European exploration, including the significance of **humanism**, the revival of learning, and the transfer of knowledge about sailing and ancient philosophy from the Arabs to the Europeans.

MWH-1.3 Analyze the reasons for European interest in Africa, including the significance of the struggle between Muslim and Christian leaders in the Mediterranean and European interest in finding new trade routes to Asia.

MWH-1.4 Evaluate the impact of the collapse of European feudal institutions and the spread of towns on the transmission of goods, people, and ideas in Europe.

MWH-1.5 Explain how the development of banks in Europe influenced the transfer of goods throughout Europe.

MWH-1.6 Evaluate the role the Ming emperors played in extending Chinese influence over East Asia.

Standard MWH-2: The student will demonstrate an understanding of the benefits and costs of the growth of kingdoms into empires from the fourteenth through the sixteenth centuries.

Enduring Understanding

As rulers consolidate their power, they often expand their territory, creating empires that have an impact on both the mother country and its colonies. To understand the impact of the creation of empires on the development of modern societies, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

MWH -2.1. Evaluate the consequences of the changing boundaries of kingdoms in Europe, Asia, the Americas, and Africa.

MWH -2.2 Describe the principle routes of exploration and trade between Europe, Asia, Africa, and the Americas from the late fifteenth century through the sixteenth century.

MWH -2.3 Explain the competition between European kingdoms for space and resources, including the Hundred Years' War between France and England, the rise of the Holy Roman Empire in Central Europe, and the response to Islam on the Iberian Peninsula.

MWH -2.4 Analyze the influence of the Mughal empire on the development of India, including the influence of Persian **culture** and the Muslim religion on the Hindu **culture**.

MWH -2.5 Evaluate the impact of the expansion of the Ottoman Empire into Eastern Europe.

MWH -2.6 Describe the impact of the competition among European countries on the various kingdoms of the Americas and Africa, including the **Columbian Exchange** and the slave trade.

Standard MWH-3: The student will demonstrate an understanding of the impact of religious movements throughout the world in the fourteenth through the sixteenth centuries.

Enduring Understanding

Religion shaped (and continues to shape) the values and priorities of people, thus influencing political, economic, social, and aesthetic elements of **culture**. To understand the continuing role that religion plays in modern political, economic, and social issues, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

MWH-3.1 Describe the proliferation of religious ideas, including the expansion of Islam, the competition between Protestants and Catholics throughout Europe, and the spread of Buddhism through East and Southeast Asia.

MWH-3.2 Evaluate the impact of religious dissent on the development of European kingdoms during the sixteenth century, including the warfare between peasants and feudal lords in German principalities, the conflict between the nobility of the Holy Roman Empire and the Hapsburg emperors, the creation of the Church of England, and the dynastic and religious competition in France.

MWH-3.3 Explain the role of Islam on the **cultures** of the Middle East, North Africa, and Asia, including its methods of expansion, its impact on religious diversity, and reactions to its expansion.

MWH-3.4 Explain the role of Buddhism and its impact on the cultures throughout East and Southeast Asia, including Buddhism's basic tenets, the impact of the local rulers on religious conversion, and the religion's enduring traditions.

MWH-3.5 Compare the spread of religion and the development of trade routes and diplomatic connections, including Christian missionary work, Buddhist and Islamic pilgrimages, and the competition between Muslims and Christians for territory.

MWH-3.6 Analyze various indigenous religions practiced in Africa and the Americas and their impact on the **culture** of the region, including animism and polytheism.

Standard MWH-4: The student will demonstrate an understanding of the conflicts of the seventeenth and eighteenth centuries in Europe, America, Africa, and Asia.

Enduring Understanding

Competition for imperial conquest met with varying degrees of success and resistance in the 1600s and 1700s. To understand the significant role that imperialism played in the development of many modern **nation-states** during this time period, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

MWH-4.1 Explain the changing boundaries in Europe and Asia as a result of the competition between **nation-states** during the

seventeenth and eighteenth centuries.

MWH-4.2 Explain the changes in European overseas empires during this period, including the waning of the Spanish and Portuguese empires and the struggle between empires and colonists.

MWH-4.3 Explain the similarities between the Qin and Ming dynasties in China, including foreign relations, **culture**, and economic practices.

MWH-4.4 Evaluate the success of the Ming dynasty in sustaining a prosperous Chinese empire and strengthening Chinese hegemony in Asia.

MWH-4.5 Analyze the factors that contributed to the collapse of the Mughal empire in India, including the role of religious intolerance.

MWH-4.6 Analyze the trade policy of **mercantilism** and its influence on the relationship between imperial centers and their peripheries.

MWH-4.7 Explain the disruption within West African kingdoms as a result of the competition between European countries over slave trade.

Standard MWH-5: The student will demonstrate an understanding of the influence of ideas and technology on the development of **nation-states** and empires in the sixteenth through the nineteenth centuries.

Enduring Understanding

New ideas and technological developments during this period led to changes in how people viewed the world and how people, in turn, changed their social, economic, and political circumstances. To understand how ideas and technology led to the development of modern society, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

MWH-5.1 Explain how the scientific revolution in Europe led to the questioning of orthodox ideas.

MWH-5.2 Analyze the ideas of social equality, democracy, **constitutionalism**, and nationalism brought about by the **Enlightenment** and their effects on institutions.

MWH-5.3 Identify the major technological and social characteristics of the Industrial Revolution.

MWH-5.4 Analyze the relationship between the expanding world **market economy** and the development of industrialization in Great Britain, the United States, Germany, and Japan, including shifts in world demography and urbanization and changing class and race relations.

MWH-5.5 Compare capitalism with other forms of political and economic ideologies, including **socialism**, **communism**, and anarchism.

MWH-5.6 Analyze Asia's relationship with European states through 1800, including Japan's policy of limiting contacts with foreigners.

Standard MWH-6: The student will demonstrate an understanding of the creation of **nation-states** in Europe and the struggle by non-European nations to gain and/or maintain sovereignty.

Enduring Understanding

The self-determination of national groups became an ideal in Western Europe that expanded gradually to Central and Eastern Europe and eventually to colonized peoples. To understand the development of **democracy** across the globe and the continuing struggle for this ideal in many nations, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

MWH-6.1 Explain the impact of English political institutions and attitudes on their North American colonies, and the American Revolution.

MWH-6.2 Analyze the reasons for independence movements as exemplified by the French and Haitian revolutions and eighteenth-century South American rebellions.

MWH-6.3 Analyze various movements for individual rights, including worldwide abolitionism, the end of slave trade movements in England and Latin America, the liberation of serfs in Russia, and the growing movement for women's rights.

MWH-6.4 Explain the causes of the revolutions of 1820, 1830, and 1848 and the reasons why these revolutions failed to achieve nationalist and democratic objectives.

MWH-6.5 Analyze the successes and limitations of movements for national unity, including the unification of Germany and Italy and the American Civil War.

MWH-6.6 Describe the reactions in Asian kingdoms to the Western ideas of nationalism, including the Indian nationalist movement, the Meiji era in Japan, and the Manchu dynasty in China.

MWH-6.7 Explain the causes of the Russian Revolution of 1917, including the reasons that the revolutionary government progressed from moderate to radical.

Standard MWH-7: The student will demonstrate an understanding of the causes and consequences of global warfare in the first half of the twentieth century.

Enduring Understanding

World War I (the Great War) and World War II resulted in the destruction of long-standing empires and the realignment of the relationships between former colonies and former empires. To understand the impact of global warfare on the development of social, economic, and political institutions in modern times, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

MWH-7.1 Analyze the relative importance of economic and political rivalries, **ethnic** and ideological conflicts, social class, militarism, and **imperialism** as underlying causes of World War I and World War II, including the role of nationalism and propaganda in mobilizing civilian populations around the world to support the two world wars.

MWH-7.2 Analyze the ways that the responses of the governments of Britain, France, Germany, and Italy to the economic and political challenges of the 1920s and 1930s contributed to the renewal of international hostilities in the years leading to World War II.

MWH-7.3 Describe major shifts in world geopolitics between 1900 and 1945, including the changing role of the United States in international affairs and the move from **isolationism** to an increased role as a world power.

MWH-7.4 Explain the origins of the conflict in the Middle East as a result of the collapse of the German, Habsburg, and Ottoman empires after World War I and the creation of the state of Israel after World War II.

MWH-7.5 Explain the impact of collapsing imperial regimes and growing nationalist movements in India, Africa, and Southeast Asia, including Pan-Africanism and the emerging civil rights movement in the United States.

Standard MWH-8: The student will demonstrate an understanding of the causes and consequences of decolonization in the second half of the twentieth century and the beginning of the twenty-first century.

Enduring Understanding

Newly independent countries sought partners for economic and political alliances as technological developments of the past sixty years made the world more interconnected. To understand the effects of the economic, political, social, and technological changes that shape his or her place in the world, the student will utilize the knowledge and skills set forth in the following indicators

Indicators

MWH-8.1 Evaluate the relative importance of factors such as world war, economic **depression**, nationalist ideology, labor organizations, **communism**, and **liberal** democratic ideals in the emergence of movements for national self-rule or sovereignty in Africa and Asia.

MWH-8.2 Explain the rationale for the development of supranational organizations (e.g., the United Nations, the European Union, the African Union, the Organization of American States).

MWH-8.3 Illustrate the impact of the **Cold War** on developing and newly independent countries, including Soviet, United States, and Chinese involvement in the domestic and foreign affairs of countries such as Egypt, Iran, Iraq, Vietnam, Korea, Chile, Cuba, Guatemala, and the Congo.

MWH-8.4 Describe the diffusion of aspects of popular **cultures**, including music, film, art forms, and foodways.

MWH-8.5 Analyze the impact of movements for equality in the United States, Africa, and Southeast Asia as well as the varying reactions around the world to equity issues.

MWH-8.6 Analyze the impact that the collapse of the Soviet Union and communist governments in Eastern Europe had on the people

and geopolitics of Eurasia, including the **balkanization** of Yugoslavia, the reunification of Germany, and the creation of the new republics in Central Asia.

MWH-8.7 Evaluate the benefits and costs of increasing worldwide trade and technological growth, including the movement of people and products, the growth of multi- national corporations, the increase in environmental concerns, and the increase in cultural exchanges.

UNITED STATES HISTORY AND THE CONSTITUTION

(Required)

The focus of United States History and the Constitution is the story of the American people from the period of the colonial settlement to the present day – the establishment of the British colonies and the transfer of English political traditions, the creation of the United States as a new nation, westward expansion, the American Civil War and Reconstruction, the response to industrialization and urbanization of the late nineteenth century, and the nation's developing role in world affairs in the twentieth and twenty-first centuries. United States History and the Constitution is generally taught in grade eleven.

UNITED STATES HISTORY AND THE CONSTITUTION

Standard USHC-1: The student will demonstrate an understanding of the conflicts between regional and national interest in the development of **democracy** in the United States.

Enduring Understanding

Contemporary democratic ideals originated in England, were transplanted to North America by English settlers, and have evolved in the United States as a result of regional experiences. To understand this evolution of **democracy** and the conflict between local and national interests, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USHC-1.1 Summarize the distinct characteristics of each colonial region in the settlement and development of British North America, including religious, social, political, and economic differences.

USHC-1.2 Analyze the early development of representative government and political rights in the American colonies, including the influence of the British political system and the **rule of law** as written in the Magna Carta and the English Bill of Rights, and the conflict between the colonial legislatures and the British **Parliament** over the right to tax that resulted in the American Revolutionary War.

USHC-1.3 Analyze the impact of the Declaration of Independence and the American Revolution on establishing the ideals of a democratic republic.

USHC-1.4 Analyze how dissatisfactions with the government under the Articles of Confederation were addressed with the writing of the Constitution of 1787, including the debates and compromises reached at the Philadelphia Convention and the ratification of the Constitution.

USHC-1.5 Explain how the fundamental principle of **limited government** is protected by the Constitution and the Bill of Rights, including **democracy**, **republicanism**, federalism, the **separation of powers**, the system of **checks and balances**, and individual rights.

USHC-1.6 Analyze the development of the two-party system during the presidency of George Washington, including controversies over domestic and foreign policies and the regional interests of the Democratic-Republicans and the Federalists.

USHC-1.7 Summarize the expansion of the power of the national government as a result of Supreme Court decisions under Chief Justice John Marshall, such as the establishment of judicial review in *Marbury v. Madison* and the impact of political party affiliation on the Court.

Standard USHC-2: The student will demonstrate an understanding of how economic developments and the westward movement impacted regional differences and **democracy** in the early nineteenth century.

Enduring Understanding

Political conflict is often the result of competing social values and economic interests. To understand how different perspectives based on differing interests and backgrounds led to political conflict in the **antebellum** United States, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USHC-2.1 Summarize the impact of the westward movement on nationalism and **democracy**, including the expansion of the franchise, the displacement of Native Americans from the southeast and conflicts over states' rights and federal power during the era of Jacksonian **democracy** as the result of major land acquisitions such as the Louisiana Purchase, the Oregon Treaty, and the Mexican Cession.

USHC-2.2 Explain how the Monroe Doctrine and the concept of Manifest Destiny affected the United States' relationships with foreign powers, including the role of the United States in the Texan Revolution and the Mexican War.

USHC-2.3 Compare the economic development in different regions (the South, the North, and the West) of the United States during the early nineteenth century, including ways that economic policy contributed to political controversies.

USHC-2.4 Compare the social and cultural characteristics of the North, the South, and the West during the **antebellum** period, including the lives of African Americans and social reform movements such as **abolition** and women's rights.

Standard USHC-3: The student will demonstrate an understanding of how regional and ideological differences led to the Civil War and an understanding of the impact of the Civil War and Reconstruction on **democracy** in America.

Enduring Understanding

Democracy is based on the balance between majority rule and the protection of minority rights. To understand the impact of conflicting interests on the rights of minority groups, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USHC-3.1 Evaluate the relative importance of political events and issues that divided the nation and led to civil war, including the compromises reached to maintain the balance of free and slave states, the abolitionist movement, the Dred Scott case, conflicting views on states' rights and federal authority, the emergence of the Republican Party, and the formation of the Confederate States of America.

USHC-3.2 Summarize the course of the Civil War and its impact on **democracy**, including the major turning points; the impact of the Emancipation Proclamation; the unequal treatment afforded to African American military units; the geographic, economic, and political factors in the defeat of the Confederacy; and the ultimate defeat of the idea of secession.

USHC-3.3 Analyze the effects of Reconstruction on the southern states and on the role of the federal government, including the impact of the thirteenth, fourteenth, and fifteenth amendments on opportunities for African Americans.

USHC-3.4 Summarize the end of Reconstruction, including the role of anti–African American factions and competing national interests in undermining support for Reconstruction; the impact of the removal of federal protection for freedmen; and the impact of **Jim Crow laws** and voter restrictions on African American rights in the post-Reconstruction era.

USHC-3.5 Evaluate the varied responses of African Americans to the restrictions imposed on them in the post-Reconstruction period, including the leadership and strategies of Booker T. Washington, W. E. B. DuBois, and Ida B. Wells-Barnett.

Standard USHC-4: The student will demonstrate an understanding of the industrial development and the consequences of that development on society and politics during the second half of the nineteenth and the early twentieth centuries.

Enduring Understanding

Political **democracy** depends upon the active participation of individuals working through political and economic-interest groups to protect their welfare. To understand how groups in the past have protected their rights, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USHC 4.1 Summarize the impact that government policy and the construction of the transcontinental railroads had on the develop-

ment of the national market and on the **culture** of Native American peoples.

USHC-4.2 Analyze the factors that influenced the economic growth of the United States and its emergence as an industrial power, including the abundance of natural resources; government support and protection in the form of railroad **subsidies**, tariffs, and labor policies; and the expansion of international markets.

USHC-4.3 Evaluate the role of **capitalism** and its impact on **democracy**, including the ascent of new industries, the increasing availability of consumer goods and the rising standard of living, the role of **entrepreneurs**, the rise of business through monopoly and the influence of business ideologies.

USHC-4.4 Explain the impact of industrial growth and **business cycles** on farmers, workers, immigrants, labor unions, and the Populist movement and the ways that these groups and the government responded to the economic problems caused by industry and business.

USHC-4.5 Explain the causes and effects of urbanization in late nineteenth-century America, including the movement from farm to city, the changing immigration patterns, the rise of **ethnic** neighborhoods, the role of **political machines**, and the migration of African Americans to the North, Midwest, and West.

USHC-4.6 Compare the accomplishments and limitations of the women's **suffrage** movement and the Progressive Movement in affecting social and political reforms in America, including the roles of the media and of reformers such as Carrie Chapman Catt, Alice Paul, Jane Addams, and presidents Theodore Roosevelt and Woodrow Wilson.

Standard USHC-5: The student will demonstrate an understanding of domestic and foreign developments that contributed to the emergence of the United States as a world power in the twentieth century.

Enduring Understanding

The American belief in political **democracy** led the United States to support natural rights and political **democracy** for others, especially when it benefitted American interests. The willingness of the United States to intervene politically and economically in other parts of the world began its emergence as a world power. To evaluate the role of the United States in world affairs in the past and present, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USHC-5.1 Analyze the development of American expansionism, including the change from **isolationism** to intervention and the rationales for **imperialism** based on Social Darwinism, expanding **capitalism**, and domestic tensions.

USHC-5.2 Explain the influence of the Spanish-American War on the emergence of the United States as a world power, including the role of yellow journalism in the American declaration of war against Spain, United States interests and expansion in the South Pacific, and the debate between pro- and anti-imperialists over annexation of the Philippines.

USHC-5.3 Summarize United States foreign policies in different regions of the world during the early twentieth century, including the purposes and effects of the Open Door policy with China, the United States role in the Panama Revolution, Theodore Roosevelt's "big stick diplomacy," William Taft's "dollar diplomacy," and Woodrow Wilson's "moral diplomacy" and changing worldwide perceptions of the United States.

USHC-5.4 Analyze the causes and consequences of United States involvement in World War I, including the failure of neutrality and the reasons for the declaration of war, the role of propaganda in creating a unified war effort, the limitation of individual liberties, and Woodrow Wilson's leadership in the Treaty of Versailles and the creation of the League of Nations.

USHC-5.5 Analyze the United States rejection of internationalism, including postwar disillusionment, the Senate's refusal to ratify the Versailles Treaty, the election of 1920, and the role of the United States in international affairs in the 1920s.

Standard USHC-6: The student will demonstrate an understanding of the conflict between traditionalism and progressivism in the 1920s and the economic collapse and the political response to the economic crisis in the 1930s.

Enduring Understanding

The role of government in a **democracy** is to protect the rights and well-being of the people. Government's role in regulating the economy and promoting economic growth, however, is controversial. To understand the consequences of economic cycles and to make informed economic choices and political decisions about government policies, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USHC-6.1 Explain the impact of the changes in the 1920s on the economy, society, and **culture**, including the expansion of mass production techniques, the invention of new home appliances, the introduction of the installment plan, the role of transportation in changing urban life, the effect of radio and movies in creating a national mass **culture**, and the cultural changes exemplified by the Harlem Renaissance.

USHC-6.2 Explain the causes and effects of the social change and conflict between traditional and modern **culture** that took place during the 1920s, including the role of women, the "Red Scare", the resurgence of the Ku Klux Klan, immigration quotas, Prohibition, and the Scopes trial.

USHC-6.3 Explain the causes and consequences of the Great Depression, including the disparities in income and wealth distribution; the collapse of the farm economy and the effects of the Dust Bowl; limited governmental regulation; taxes, investment; and stock market speculation; policies of the federal government and the Federal Reserve System; and the effects of the Depression on the people.

USHC-6.4 Analyze President Franklin Roosevelt's New Deal as a response to the economic crisis of the Great Depression, including the effectiveness of New Deal programs in relieving suffering and achieving economic recovery, in protecting the rights of women and minorities, and in making significant reforms to protect the economy such as Social Security and labor laws.

Standard USHC-7: The student will demonstrate an understanding of the impact of World War II on the United States and the nation's subsequent role in the world.

Enduring Understanding

In defense of **democracy**, a government may need to confront aggression and ask its citizens for sacrifice in wars and providing foreign aid that, in turn, affects the practice of **democracy** at home. To make informed political decisions about when and how government should go to war, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USHC-7.1 Analyze the decision of the United States to enter World War II, including the nation's movement from a policy of **isolationism** to international involvement and the Japanese attack on Pearl Harbor.

USHC-7.2 Evaluate the impact of war mobilization on the home front, including consumer sacrifices, the role of women and minorities in the workforce, and limits on individual rights that resulted in the internment of Japanese Americans.

USHC-7.3 Explain how controversies among the Big Three Allied leaders over war strategies led to post-war conflict between the United States and the USSR, including delays in the opening of the second front in Europe, the participation of the Soviet Union in the war in the Pacific, and the dropping of atomic bombs on Hiroshima and Nagasaki.

USHC-7.4 Summarize the economic, humanitarian, and diplomatic effects of World War II, including the end of the Great Depression, the Holocaust, the war crimes trials, and the creation of Israel.

USHC-7.5 Analyze the impact of the **Cold War** on national security and individual freedom, including the **containment** policy and the role of military alliances, the effects of the "Red Scare" and McCarthyism, the conflicts in Korea and the Middle East, the Iron Curtain and the Berlin Wall, the Cuban missile crisis, and the nuclear arms race.

USHC-7.6 Analyze the causes and consequences of social and cultural changes in postwar America, including educational programs, the consumer **culture** and expanding suburbanization, the advances in medical and agricultural technology that led to changes in the standard of living and **demographic patterns**,

and the roles of women in American society.

Standard USHC-8: The student will demonstrate an understanding of social, economic and political issues in contemporary America.

Enduring Understanding

In the recent past, political views in the United States have embraced both **conservative** and **liberal** perspectives. To make informed political decisions about contemporary issues, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USHC-8.1 Analyze the African American Civil Rights Movement, including initial strategies, landmark court cases and legislation, the roles of key civil rights advocates and the media, and the influence of the Civil Rights Movement on other groups seeking equality.

USHC-8.2 Compare the social and economic policies of presidents Lyndon Johnson and Richard Nixon, including support for civil rights legislation, programs for the elderly and the poor, environmental protection, and the impact of these policies on politics.

USHC-8.3 Explain the development of the war in Vietnam and its impact on American government and politics, including the Gulf of Tonkin Resolution and the policies of the Johnson administration, protests and opposition to the war, the role of the media, the policies of the Nixon administration, and the growing credibility gap that culminated in the Watergate scandal.

USHC-8.4 Analyze the causes and consequences of the resurgence of the **conservative** movement, including social and cultural changes of the 1960s and 1970s, Supreme Court decisions on integration and abortion, the economic and social policies of the Reagan administration, and the role of the media.

USHC-8.5 Summarize key political and economic issues of the last twenty-five years, including continuing dependence on foreign oil; trade agreements and **globalization**; health and education reforms; increases in **economic disparity** and **recession**; tax policy; the national surplus, debt, and deficits; immigration; presidential resignation/impeachment; and the elections of 2000 and 2008.

USHC-8.6 Summarize America's role in the changing world, including the dissolution of the Soviet Union, the expansion of the European Union, the continuing crisis in the Middle East, and the rise of global terrorism.

UNITED STATES GOVERNMENT

(Required)

In United States Government, students examine the theory and practice of American government. The course is designed to provide a comprehensive introduction to fundamental political concepts that will provide students with the knowledge and skills they need in order to understand and participate wisely in the American political system. United States Government examines basic political theory and governmental systems, American political development theory, the constitutional basis and structure of American government, and citizen involvement in the political system.

UNITED STATES government

Standard USG-1: The student will demonstrate an understanding of foundational political theory, concepts, and application.

Enduring Understanding

To appreciate the governmental system of the United States, citizens must understand the nature and purpose of government in general. An understanding of basic political ideas allows nations to organize and structure the institutions of government in the most effective, logical manner. To understand and evaluate basic governmental function, organization, and effectiveness, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USG-1.1 Analyze political theories related to the existence, necessity, and purpose of government, including natural rights, balance of the public and private interests, and physical and economic security.

USG-1.2 Analyze components of government and the governing process, including politics, power, authority, sovereignty, legitimacy, public institutions, efficacy, and civic life.

USG-1.3 Evaluate the role and relationship of the citizen to government in **democratic**, **republican**, **authoritarian**, and **totalitarian** systems.

USG-1.4 Analyze the institutional and organizational structure of government that allows it to carry out its purpose and function effectively, including the branches of government and legitimate bureaucratic institutions.

USG-1.5 Evaluate **limited government** and **unlimited government** with regard to governance, including **rule of law**, the role of **constitutions**, civil rights, political freedom, economic freedom, and the ability of citizens to impact or influence the governing process.

USG-1.6 Evaluate the organization of government in **confederal**, federal, and **unitary** systems, including the distribution of power and the advantages and disadvantages of each system.

Standard USG-2: The student will demonstrate an understanding of foundational American political principles and the historical events and philosophical ideas that shaped the development and application of these principles.

Enduring Understanding

As it exists today, the United States Constitution is a product of numerous influences that were critical not only to its inception but also to its evolution over time. The principles set forth in the Constitution serve as the framework upon which United States government was established and on which it operates today. To understand the advancement of the principles, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USG-2.1 Summarize core principles of United States government, including **limited government**, federalism, **checks and balances**, **separation of powers**, **rule of law**, **popular sovereignty**, **republicanism**, individual rights, freedom, equality, and self-government.

USG-2.2 Analyze developmental influences on the core political principles of American government, including Greek **democracy**, Roman **republicanism**, the Judeo- Christian heritage, and the European philosophers John Locke, Charles de Montesquieu, and William Blackstone.

USG-2.3 Analyze the British heritage that fostered development of the core political principles of American government, including the Magna Carta, the Petition of Right (1628), the Glorious Revolution, the English Bill of Rights, and the Mayflower Compact.

USG-2.4 Evaluate significant American founding documents in relation to core political principles, including the Declaration of Independence, the Articles of Confederation, state **constitutions**, the United States Constitution, *The Federalist* papers, and the Bill of Rights.

USG-2.5 Evaluate significant American historical documents in relation to the application of core principles (e.g., the Virginia and Kentucky Resolutions, the **Ordinance of Nullification**, the Seneca Falls Declaration, the Emancipation Proclamation, Martin Luther King Jr.'s "Letter from a Birmingham Jail"), the eleventh through the twenty- seventh amendments to the Constitution, and critical Supreme Court cases.

Standard USG-3: The student will demonstrate an understanding of the basic organization and function of United States government on national, state, and local levels and the role of federalism in addressing the distribution of power.

Enduring Understanding

The organization and structure of government at national, state, and local levels in the United States is based upon principles established in the U.S. Constitution. The most fundamental aspects of organized government within the United States are the distribution of power, oversight, and responsibilities that function to limit the ability of any one institution of that government to concentrate power. To understand the structure and organization of United States government as the embodiment of constitutional principles, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USG-3.1 Evaluate the Constitution as the written framework of the United States government, including expression of the core principles of **limited government**, federalism, **checks and balances**, **separation of powers**, **rule of law**, **popular sovereignty**, **republicanism**, individual rights, freedom, equality, and self-government.

USG-3.2 Evaluate the formal and informal structure, role, responsibilities, and authority of the legislative, executive, and judicial branches

of the national government as the embodiments of constitutional principles.

USG-3.3 Analyze federalism and its application in the United States, including the concepts of **enumerated**, **concurrent**, and **reserved** powers; the meaning of the ninth and tenth amendments; the principle of states' rights; the promotion of **limited government**; the protection of individual rights; and the potential for conflict among the levels of government.

USG-3.4 Analyze the organization and responsibilities of local and state governments in the United States federal system, including the role of state **constitutions**, the limitations on state governments, the typical organization of state governments, the relationship between state and local governments, and the major responsibilities of state governments.

Standard USG-4: The student will demonstrate an understanding of civil rights and civil liberties, the role of American citizens in the American political system, and distinctive expressions of American political **culture**.

Enduring Understanding

An informed, participatory citizenry is essential to the American political process. To understand what it means to be an American citizen, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

USG-4.1 Evaluate the role of the citizen in the American political process, including civic responsibilities and the interaction between the citizen and government.

USG-4.2 Analyze the process of political socialization and its relation to political participation.

USG-4.3 Evaluate the role and function of common avenues utilized by citizens in political participation, including political parties, voting, polls, interest groups, and community service.

USG-4.4 Analyze the process through which citizens monitor and influence public policy, including **political parties**, interest groups, the media, lobbying, donations, issue advocacy, and candidate support.

USG-4.5 Evaluate the importance of civil rights and civil liberties for citizens in American political **culture** and the protective role of the national government through the Bill of Rights, the judicial system, and the Fourteenth Amendment.

USG-4.6 Explain how fundamental values, principles, and rights often conflict within the American political system; why these conflicts arise; and how these conflicts are and can be addressed.

ECONOMICS

(Required)

Economics is a social science. The science of economics uses data to analyze, interpret, and predict the behavior of individuals and institutions based upon incentives. The goal of a study of economics is to teach a student how to evaluate choices. Scarcity forces all entities—individuals, communities, and nations—to choose from available resources to meet their needs. Students will learn to use vocabulary specific to economics to explain, describe, and predict how the interaction of **supply** and **demand** sets prices for goods and services in product markets and wage prices in factor markets. Intervention in free markets decreases efficiency but is sometimes necessary in order to safeguard individuals and societies from undue exploitation. Markets allocate goods, services, and labor and government regulates markets and purchases goods and services for the common good. Current choices impact future outcomes that are theoretically predictable.

The choices that societies make affect the well-being of all citizens. The consequences of these choices are evaluated through the numerical measurements of the gross domestic product (GDP) and the consumer price index (CPI) as well as through the use of other quantitative measurements. A relationship between investment and growth exists, and increased investment leads to more rapid growth that may be uneven and erratic. The role and abilities of the Federal Reserve in managing these economic cycles is evolutionary, with real-life results whose predictability is affected by volatile circumstances. Increased **globalization** has altered trade patterns and greatly expanded markets, as has technological change.

Citizens as consumers and producers are the fundamental actors in our mixed-market economic system. The choices made by government, institutions, and individuals have predictable outcomes, and the well-being of all groups is impacted by these choices.

ECONOMICS

Standard ECON-1: The student will demonstrate an understanding of how scarcity and choice impact the decisions of families, businesses, communities, and nations.

Enduring Understanding

Economics is the science of choice. The study of economics equips a student with the knowledge to evaluate the benefits versus the costs of goods and services. To make informed decisions about benefits versus costs, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

ECON-1.1 Explain that the practice of economic decision making is an evaluation process that measures additional benefits versus additional costs.

ECON-1.2 Explain why the productive resources of land, labor, and capital are limited.

ECON-1.3 Apply the concept that people respond to positive and negative incentives to past and current economic decisions.(P)

Standard ECON-2: The student will demonstrate an understanding of how markets facilitate exchange and how market regulation costs both consumers and producers.

Enduring Understanding

Markets arise in order to allow people and institutions to trade items of value for something else of value. Markets are efficient when they are unrestricted. The prices in a market send signals and provide incentives to buyers and sellers. To understand how markets function, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

ECON-2.1 Illustrate how markets are created when voluntary exchanges occur between buyers and sellers.

ECON-2.2 Explain how efficient markets allocate goods, services, and the factors of production in a market-based economy.

ECON-2.3 Illustrate how competition among sellers lowers costs and prices.

ECON-2.4 Illustrate how an economically efficient market allocates goods and services to the buyers who are willing to pay for them.

ECON-2.5 Explain how **business cycles**, market conditions, government policies, and inequalities affect the living standards of individuals and other economic entities.

ECON-2.6 Explain how market power enables some market structures to affect their situations to varying degrees and to use this market power to increase prices and reduce output.

Standard ECON-3: The student will demonstrate an understanding of how government policies, **business cycles**, inflation, deflation, savings rates, and employment affect all economic entities.

Enduring Understanding

Macroeconomics examines the aggregate behavior of the economy: price levels, **business cycles**, Federal Reserve policies, and inflation and deflation, as well as the ways that changes in these aggregate levels affect individual economic entities. To understand economic behavior, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

ECON-3.1 Explain that institutions in a **market economy** help individuals and groups accomplish their goals.

ECON-3.2 Illustrate how money and the consequent banking system facilitate trade, historically and currently.

ECON-3.3 Explain how real interest rates adjust savings with borrowing, thus affecting the allocation of scarce resources between present and future users.

ECON-3.4 Use a circular flow diagram to explain how changes in economic activity affect households and businesses.

ECON-3.5 Explain how the federal government regulates the American economy in order to provide economic security, full employment, and economic equity.

ECON-3.6 Explain how economic indicators are used to evaluate changes in economic activity.

ECON-3.7 Illustrate the relationships among **business cycles** and unemployment, growth, price levels, wage rates, and investment.

ECON-3.8 Explain how the Federal Reserve regulates the amount of cash

that banks can acquire and retain and therefore helps to provide a foundation for economic stability.

ECON-3.9 Exemplify how government, in a **market economy**, provides for services that private markets fail to provide and thus the costs of government policies often exceed benefits.

Standard ECON-4: The student will demonstrate an understanding of how trade among nations affects markets, employment, economic growth, and other activity in the domestic economy.

Enduring Understanding

The economy of the United States is but one system operating within an increasingly global arena. All institutions and individuals in the United States are impacted in varying degrees by global commerce. To understand the implications of the global economy, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

ECON-4.1 Summarize how differing factor endowments—such as geography, the development of technology, and the abundance of labor—affect the goods and services in which a nation specializes.

ECON-4.2 Explain how the United States specializes in the production of those goods and services in which it has a comparative advantage.

ECON-4.3 Explain how the rise of a global marketplace contributes to the well-being of all societies but the benefits derived from **globalization** are unequal.

ECON-4.4 Explain how a global marketplace influences domestic labor markets, wage rates, unemployment levels, and disparities in earning potentials.

Standard ECON-5: The student will demonstrate an understanding of how personal financial decisions affect an individual's present and future economic status.

Enduring Understanding

Individuals are impacted by the financial choices they make and the careers they choose. Wise and informed personal financial decisions can benefit individuals in both the immediate and the distant future. To understand the impact of personal financial decisions, the student will utilize the knowledge and skills set forth in the following indicators:

Indicators

ECON-5.1 Explain how individuals make personal economic decisions and how current spending and acquisition of debt can impact future income.

ECON-5.2 Explain that income for most people is determined by the market value of the productive resources they sell.

ECON-5.3 Explain how wage rates for most workers depend upon the market value of what the workers produce for the marketplace.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