STATE MATCH

New York State Common Core Learning Standards

English Language Arts & Literacy and Mathematics

New York State Learning Standards

Science

Grades 8–12

and

EXPLORE®, PLAN®, and the ACT®

January 2012

ACT®

About This Report

EXECUTIVE SUMMARY
(pp. 1–4)

This portion summarizes the findings of the alignment between New York's Learning Standards and ACT's Educational Planning and Assessment System (EPAS®) tests—EXPLORE® (8th and 9th grades), PLAN® (10th grade), and the ACT® (11th and 12th grades). It also presents ACT's involvement in meeting NCLB requirements and includes additional information about the unique programs and services ACT can provide to New York.

SECTION A
(pp. 5–8)

This section provides tables by content area (English Language Arts & Literacy, Mathematics, and Science), listing the precise number of New York State Learning Standards measured by ACT's EPAS tests by grade level.

SECTION B
(pp. 9–50)

All New York State Learning Standards are listed here; each one highlighted is measured by ACT's EPAS tests. Underlined science content indicates that the content topics are included in, but not directly measured by, ACT's EPAS Science tests. New York standards listed here are from the New York State Learning Standards as presented on the New York Department of Education website in January 2012:

New York State Learning Standards	Version
English Language Arts & Literacy (Common Core)	2011
Mathematics (Common Core)	2011
Science	1996

SECTION C
(pp. 51–62)

ACT's College Readiness Standards™ appear here. Highlighting indicates that a statement reflects one or more statements in the New York State Learning Standards. College Readiness Standards not highlighted are not addressed in the New York State Learning Standards.

A supplement that identifies the specific ACT College Readiness Standard(s) corresponding to each New York State Standard in a side-by-side format is available at **www.act.org/education/statematch**.

Executive Summary

We at ACT believe our programs offer many advantages to New York students and educators, and this report offers strong evidence for this belief. This alignment analysis clearly answers three critical questions:

1. To what extent do ACT's Educational Planning and Assessment System (EPAS®) tests—EXPLORE® (8th and 9th grades), PLAN® (10th grade), and the ACT® (11th and 12th grades)—measure New York's Learning Standards?
2. Can the results from ACT's testing programs be used to meet New York's NCLB requirement?
3. Why should New York choose EPAS?

ACT'S TESTS MEASURE MANY IMPORTANT NEW YORK STATE LEARNING STANDARDS IN ENGLISH LANGUAGE ARTS & LITERACY, MATHEMATICS, AND SCIENCE.

1. Match Results: Comparisons conducted by our content specialists show that ACT's English, Reading, Writing, Mathematics, and Science tests measure many important New York State English Language Arts & Literacy and Mathematics Common Core Learning Standards and New York State Science Learning Standards.

- English Language Arts & Literacy Grade 8: 2 out of 4 Strands
  Grades 9–10: 2 out of 4 Strands
  Grades 11–12: 3 out of 4 Strands

  Many important New York State English Language Arts & Literacy Common Core Learning Standards in Reading, Writing, and Language are covered by ACT's English, Reading, and Writing tests.

- Mathematics Mathematical Practice: 7 out of 8 Standards
  Grade 8: 5 out of 5 Strands
  High School: 5 out of 5 Strands

  Almost all New York State Mathematics Common Core Learning Standards are covered by ACT's Mathematics tests.

- Science: Intermediate Standards: 4 out of 6
  Commencement Standards: 4 out of 6

  Most New York State Science Learning Standards are covered by ACT's Science tests.

  (A note about science content: ACT's Science tests present content from biology, chemistry, physics, and Earth/space sciences. Although content knowledge in these content areas is needed to answer some of the test questions, the test questions emphasize scientific reasoning and are based in experimental science contexts. Factual content knowledge, although needed to answer some of the test questions, is not systematically sampled from the full content knowledge domain. Therefore, each ACT Science Test covers some, but not all, of the discrete science content knowledge specifically described in the New York State Science Learning Standards.

  To emphasize the point that content is included, but not necessarily covered in its entirety on every test form, science content match results appear in parentheses in Section A of this document (which describes the number of New York standards measured by ACT's tests), and are underlined rather than highlighted in Section B. Our goal here is to clearly communicate that

science content will be included, but each specific content topic will not be covered consistently enough for inferences to be made about student proficiency in all areas.)

Most exceptions to a match between ACT's tests and the New York State Learning Standards arise from standards not being assessable in group settings, standards that are personal in nature, and standards requiring measurement over extended time. If additional testing is deemed necessary, ACT would be interested in working with New York on developing any necessary augmentation.

2. NCLB requirement? Yes; states such as Illinois and Michigan use ACT's tests as integral components of their statewide academic assessment systems under NCLB for Grade 11 students and submit evidence of compliance with NCLB to the U.S. Department of Education (ED) for approval. Through the peer review process, the ED determines whether such evidence demonstrates that a given state's assessment system meets NCLB requirements. The more closely a state's standards align with its assessments, the more likely it is that the outcome of the NCLB peer review will be favorable. With so much at stake, states must be rigorous both in developing their academic standards and in choosing assessment instruments that will help achieve the common goal of preparing students for life after high school.

3. Why implement EXPLORE, PLAN and the ACT? ACT's EPAS tests provide a longitudinal, systematic approach to educational and career planning, assessment, instructional support, and evaluation. The system focuses on the integrated, higher-order thinking skills students develop in grades K–12 that are important for success both during and after high school.

Unlike many other large-scale assessments of academic ability, EXPLORE, PLAN, and the ACT are first and foremost achievement tests. They are measures whose tasks correspond to recognized high school learning experiences, but which at the same time do not precisely duplicate the high school curriculum. EXPLORE, PLAN, and the ACT measure not an abstract quality, such as intelligence or aptitude, but rather what students are able to do with what they have learned in school.

States and school districts choose the EPAS system because student motivation is high, and EPAS is the *only curriculum-based assessment system that measures student readiness along a continuum of empirically derived college readiness benchmarks*. ACT's College Readiness Standards are precise descriptors of the essential skills and knowledge that students need to become ready for college and career, beginning in grade 8 and continuing through grade 12. Various groups claim to describe what students truly need to know and be able to do for college and/or workplace readiness. Such groups typically ask individual experts in education to gather and discuss what they feel is important for students to understand. Not surprisingly, the answers vary. In contrast, ACT defines college readiness through a unique and rigorous empirical process:

STATES CHOOSE ACT BECAUSE:

- **STUDENT MOTIVATION IS HIGH.**
- **ACT'S IS THE ONLY CURRICULUM-BASED ASSESSMENT SYSTEM THAT MEASURES STUDENT READINESS ALONG A CONTINUUM OF EMPIRICALLY DERIVED COLLEGE READINESS BENCHMARKS.**
- **EPAS DATA PROVIDE HELPFUL FEEDBACK FOR TEACHERS, STUDENTS, AND POLICYMAKERS TO MAKE EDUCATIONAL DECISIONS AND IDENTIFY WAYS TO IMPROVE.**

ACT BUILDS ITS DEFINITION OF COLLEGE READINESS ON A SOUND EMPIRICAL BASE:

1. **THE ACT NATIONAL CURRICULUM SURVEY**
2. **ACT'S COLLEGE READINESS BENCHMARK SCORES**
3. **ACT'S COLLEGE READINESS STANDARDS**

- **The knowledge and skills necessary for students to be ready for college-level work are empirically identified via the ACT National Curriculum Survey®.**

  ACT surveys thousands of secondary and postsecondary instructors across the nation to determine which skills and knowledge are most important at each course level and for college and work readiness. The responses drive the test specifications for EXPLORE, PLAN, and the ACT.

- **The empirically derived performance levels necessary for students to be ready to succeed in college-level work are defined in ACT's College Readiness Benchmark Scores.**

  ACT analyzed thousands of student records to identify the ACT scores associated with success in postsecondary coursework (i.e., a 50% chance of earning a B or better in credit-bearing first-year college courses): 18 for English, 22 for Math, 21 for Reading, and 24 for Science.

- **Skills and knowledge a student currently has and areas for improvement can be identified by the empirically derived ACT College Readiness Standards.**

  Using thousands of student records and responses, content and measurement experts at ACT have developed detailed statements that describe what students typically know and are able to do at different levels of test performance. These data-driven, empirically derived score descriptors articulate student achievement within various score ranges on the English, Reading, Writing, Mathematics, and Science tests on EXPLORE, PLAN, and the ACT. These statements provide specific details about students' college readiness and can be used to identify next steps for improvement.

ACT research has shown that, whether planning to enter college or workforce training programs after graduation, high school students need to be educated to a comparable level of readiness in reading and mathematics. Graduates need this level of readiness if they are to succeed in college-level courses without remediation and to enter workforce training programs ready to learn job-specific skills.

Early planning based on sound information is a key factor in helping students reach their academic and career goals. **EXPLORE** provides baseline information on the academic preparation of students that can be used to plan high school coursework. ACT's research has shown that eighth-grade academic achievement is the best predictor of college and career readiness by high school graduation. Further, improvement in eighth-grade academic achievement and being on target for college and career readiness in eighth grade are more beneficial than any high school-level achievement enhancement.

PLAN helps tenth-grade students build a foundation for future academic and career success and provides information needed to address school districts' high-priority issues. It is a comprehensive guidance resource that helps students measure their current academic development, explore career/training options,

ACT

and make plans for the remaining years of high school and post-graduation years. PLAN provides a midpoint review of students' progress toward their education and career goals while there is still time to make necessary interventions.

The ACT test assesses high school students' general educational development and provides unparalleled information about a student's readiness for entry-level college coursework and ability to make successful transitions to college and work after high school.

Each test in ACT's EPAS system also includes noncognitive measures and surveys that allow students to build relationships between their academic development, their backgrounds, and their plans.

If the goal of high school education is to prepare students for college and career readiness, then we should be educating all high school students according to a common academic expectation, one that prepares them for both postsecondary education and the workforce. Only then—whether they are among the two-thirds who enter college directly after graduation or those who enter workforce training programs—will they be ready for life after high school.

ACT's EPAS system would not only provide important information regarding students' academic achievement relative to the New York State Learning Standards, but EPAS offers what no other testing program can: an empirically based, time-honored measure of college and career readiness that can help New York students reach their educational and career goals and help provide New York High Schools with the information they need to prepare their students for college and career.

Section A: Number of New York State Learning Standards Measured by EXPLORE, PLAN, and the ACT

Table A-1. Number of New York English Language Arts & Literacy Standards Measured by EXPLORE, PLAN, and the ACT

	New York Strands*	Number of New York Standards Measured by ACT's tests	Aspects of New York Standards that are Not Measured
Reading	Anchor	11 out of 11	Cite specific textual evidence when writing or speaking to support conclusions drawn from the text
	Literature	Gr 8: 4 out of 10 Gr 9–10: 5 out of 10 Gr 11–12: 6 out of 10	Cite strong and thorough textual evidence to support analysis Analyze multiple interpretations Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature
	Informational Text	Gr 8: 8 out of 10 Gr 9–10: 7 out of 10 Gr 11–12: 6 out of 10	Analyze how style and content contribute to the power, persuasiveness, or beauty of the text Delineate and evaluate the reasoning in seminal U.S. texts Analyze seventeenth-, eighteenth-, and nineteenth-century foundational U.S. documents of historical and literary significance
	Literacy in History/ Social Studies	Gr 8: 7 out of 10 Gr 9–10: 5 out of 10 Gr 11–12: 3 out of 10	Cite specific textual evidence to support analysis of primary and secondary sources Evaluate various explanations for actions or events Analyze how a complex primary source is structured Evaluate authors' differing points of view Integrate and evaluate multiple sources of information presented in diverse formats and media
	Literacy in Science and Technical Subjects	Gr 8: 10 out of 10 Gr 9–10: 10 out of 10 Gr 11–12: 10 out of 10	

(table continued on next page)

Table A-1. Number of New York English Language Arts & Literacy Standards Measured by EXPLORE, PLAN, and the ACT

	New York Strands*	Number of New York Standards Measured by ACT's tests	Aspects of New York Standards that are Not Measured
Writing	Anchor	5 out of 11	Use technology to produce writing Conduct research projects Gather relevant information from multiple sources Draw evidence from literary or informational texts to support analysis, reflection, and research
	Writing	Gr 8: 1 out of 11 Gr 9–10: 1 out of 11 Gr 11–12: 5 out of 11	Write narratives Use technology to produce writing Conduct research projects Gather relevant information from multiple sources Draw evidence from literary or informational texts to support analysis, reflection, and research
	Literacy in History/Social Studies, Science, and Technical Subjects	Gr 8: 1 out of 9 Gr 9–10: 1 out of 9 Gr 11–12: 1 out of 9	Write arguments focused on discipline-specific content Use technology to produce writing Conduct research projects Gather relevant information from multiple sources Draw evidence from informational texts to support analysis, reflection, and research Write routinely over extended time frames
Speaking, Viewing, Listening, Media Literacy			
Language	Language	Anchor: 6 out of 6 Gr 8: 6 out of 6 Gr 9–10: 6 out of 6 Gr 11–12: 6 out of 6 Progr. Skills 17 out of 17	
	TOTALS 3 out of 4 Strands	Anchor: 11 out of 11 Gr 8: 37 out of 66 Gr 9–10: 35 out of 66 Gr 11–12: 37 out of 66 Progr. Skills 17 out of 17	

*Refer to New York's English Language Arts & Literacy Common Core Learning Standards on pages 9–28

= EPAS tests do not assess this material.

Table A-2. Number of New York Mathematics Standards Measured by EXPLORE, PLAN, and the ACT						
New York Strands*	**Number of New York Standards Measured by ACT's tests**					**Aspects of New York Standards that are Not Measured**
Standards for Mathematical Practice	Total	7	out of	8		Use appropriate tools strategically
The Number System/Number and Quantity	Gr 8: HS:	2 27	out of out of	2 27		
Expressions and Equations/Algebra	Gr 8: HS:	8 27	out of out of	8 27		
Functions	Gr 8: HS:	5 28	out of out of	5 28		
Geometry	Gr 8: HS:	8 43	out of out of	9 43		Know the formulas for the volumes of cones, cylinders, and spheres
Statistics and Probability	Gr 8: HS:	4 31	out of out of	4 31		
TOTALS Gr 8: 5 out of 5 Strands HS: 5 out of 5 Strands	Practice Gr 8: HS:	7 27 156	out of out of out of	8 28 156		

*Refer to New York's Mathematics Common Core Learning Standards on pages 29–40

Table A-2. Number of New York Science Standards Measured by EXPLORE, PLAN, and the ACT		
New York Standards*	**Number of New York Key Ideas Measured by ACT's tests**	**Aspects of New York Standards that are Not Measured**
1. Analysis, Inquiry, Design	Intermed: 6 out of 7 Commence: 6 out of 7	Engineering design as an iterative process
2. Information Systems		
3. Mathematics [superseded]		
4. Science	Intermed: 12 out of 12 Commence: 12 out of 12	
5. Technology		
6. Interconnectedness: Common Themes	Intermed: 4 out of 6 Commence: 5 out of 6	Describe differences between dynamic systems
7. Interdisciplinary Problem Solving	Intermed: 0 out of 2 Commence: 0 out of 2	Analyze science/technology/society problems Design solutions Solve interdisciplinary problems Effective work habits
TOTALS Intermed: 4 out of 6 Standards Commence: 4 out of 6 Standards	Intermed: 22 out of 27 Commence: 23 out of 27	

*Refer to New York's Science Learning Standards on pages 41–50

= EPAS tests do not assess this material.

Section B: New York State Grades 8–12 Learning Standards Measured by EXPLORE, PLAN, and the ACT

English Language Arts & Literacy

NEW YORK English Language Arts & Literacy
Common Core Learning Standards*****
Anchor Standards

Reading

Key Ideas and Details

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, and ideas develop and interact over the course of a text.

Craft and Structure

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.

Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.
8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

Range of Reading and Level of Text Complexity

10. Read and comprehend complex literary and informational texts independently and proficiently.

Responding to Literature

11. Respond to literature by employing knowledge of literary language, textual features, and forms to read and comprehend, reflect upon, and interpret literary texts from a variety of genres and a wide spectrum of American and world cultures.

Writing

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.
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

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.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

Research to Build and Present Knowledge

7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

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.

Responding to Literature

11. Develop personal, cultural, textual, and thematic connections within and across genres as they respond to texts through written, digital, and oral presentations, employing a variety of media and genres.

***Bolder** text = Material added by New York to Common Core State Standards

Speaking and Listening

Comprehension and Collaboration

1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

Presentation of Knowledge and Ideas

4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
6. Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

Language

Conventions of Standard English

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

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.

Vocabulary Acquisition and Use

4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.
5. Demonstrate understanding of figurative language, word relationships**,** and nuances in word meanings.
6. Acquire and use accurately a range of 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.

NEW YORK English Language Arts & Literacy
Common Core Learning Standards*
Grade 8

Reading

Reading Benchmarks: Literature [RL]

Key Ideas and Details

1. Cite the textual evidence that most strongly supports an 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 its development over the course of the text, including its relationship to the characters, setting, and plot; provide an objective summary of the text.
3. Analyze how particular lines of dialogue or incidents in a story or drama propel the action, reveal aspects of a character, or provoke a decision.

Craft and Structure

4. Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.
5. Compare and contrast the structure of two or more texts and analyze how the differing structure of each text contributes to its meaning and style.
6. Analyze how differences in the points of view of the characters and the audience or reader (e.g., created through the use of dramatic irony) create such effects as suspense or humor.
   a. Analyze full-length novels, short stories, poems, and other genres by authors who represent diverse world cultures.

Integration of Knowledge and Ideas

7. Analyze the extent to which a filmed or live production of a story or drama stays faithful to or departs from the text or script, evaluating the choices made by the director or actors.
8. (Not applicable to literature)
9. Analyze how a modern work of fiction draws on themes, patterns of events, or character types from myths, traditional stories, or religious works such as the Bible, including describing how the material is rendered new.

Range of Reading and Level of Text Complexity

10. By the end of the year, read and comprehend literature, including stories, dramas, and poems, at the high end of grades 6–8 text complexity band independently and proficiently.

Responding to Literature

11. Interpret, analyze, and evaluate narratives, poetry, and drama, artistically and ethically by making connections to: other texts, ideas, cultural perspectives, eras, personal events, and situations.
   a. Self-select text to develop personal preferences.
   b. Establish and use criteria to classify, select, and evaluate texts to make informed judgments about the quality of the pieces.

Reading Benchmarks: Informational Text [RI]

Key Ideas and Details

1. Cite the textual evidence that most strongly supports an 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 its relationship to supporting ideas; provide an objective summary of the text.
3. Analyze how a text makes connections among and distinctions between individuals, ideas, or events (e.g., through comparisons, analogies, or categories).

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 impact of specific word choices on meaning and tone, including analogies or allusions to other texts.
5. Analyze in detail the structure of a specific paragraph in a text, including the role of particular sentences in developing and refining a key concept.
6. Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints.

Integration of Knowledge and Ideas

7. Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea.
8. Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.
9. Analyze a case in which two or more texts provide conflicting information on the same topic and identify where the texts disagree on matters of fact or interpretation.
   a. Use their experience and their knowledge of language and logic, as well as culture, to think analytically, address problems creatively, and advocate persuasively.

Range of Reading and Level of Text Complexity

10. By the end of the year, read and comprehend literary nonfiction at the high end of the grades 6–8 text complexity band independently and proficiently.

= Measured by EXPLORE English and/or Reading tests
(Some Reading benchmarks under "Science & Technical Subjects" are covered by EXPLORE Science Test)

*__Bolder__ text = Material added by New York to Common Core State Standards

Reading Benchmarks: Literacy in History/Social Studies [RH]

Key Ideas and Details

1. Cite specific textual evidence to support analysis of primary and secondary sources.
2. Determine the central ideas or information of a primary or secondary source; provide an accurate summary of the source distinct from prior knowledge or opinions.
3. Identify key steps in a text's description of a process related to history/social studies (e.g., how a bill becomes law, how interest rates are raised or lowered).

Craft and Structure

4. Determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history/social studies.
5. Describe how a text presents information (e.g., sequentially, comparatively, causally).
6. Identify aspects of a text that reveal an author's point of view or purpose (e.g., loaded language, inclusion or avoidance of particular facts).

Integration of Knowledge and Ideas

7. Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.
8. Distinguish among fact, opinion, and reasoned judgment in a text.
9. Analyze the relationship between a primary and secondary source on the same topic.

Range of Reading and Level of Text Complexity

10. By the end of grade 8, read and comprehend history/social studies texts in the grades 6–8 text complexity band independently and proficiently.

Reading Benchmarks: Literacy in Science and Technical Subjects [RST]

Key Ideas and Details

1. Cite specific textual evidence to support analysis of science and technical texts.
2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Craft and Structure

4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.
5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

Integration of Knowledge and Ideas

7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Range of Reading and Level of Text Complexity

10. By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.

Writing [W]

Text Types and Purposes

1. Write arguments to support claims with clear reasons and relevant evidence.
   a. Introduce claim(s), acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
   b. Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.
   c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
   d. Establish and maintain a formal style.
   e. Provide a concluding statement or section that follows from and supports the argument presented.
2. Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
   a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
   b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
   c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
   d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
   e. Establish and maintain a formal style.
   f. Provide a concluding statement or section that follows from and supports the information or explanation presented.

= Measured by EXPLORE English and/or Reading tests
(Some Reading benchmarks under "Science & Technical Subjects" are covered by EXPLORE Science Test)

*__Bolder__ text = Material added by New York to Common Core State Standards

3. Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences.
   a. Engage and orient the reader by establishing a context and point of view and introducing a narrator and/or characters; organize an event sequence that unfolds naturally and logically.
   b. Use narrative techniques, such as dialogue, pacing, description, and reflection, to develop experiences, events, and/or characters.
   c. Use a variety of transition words, phrases, and clauses to convey sequence, signal shifts from one time frame or setting to another, and show the relationships among experiences and events.
   d. Use precise words and phrases, relevant descriptive details, and sensory language to capture the action and convey experiences and events.
   e. Provide a conclusion that follows from and reflects on the narrated experiences or events.

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.
   a. Produce text (print or nonprint) that explores a variety of cultures and perspectives.
5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.

Research to Build and Present Knowledge

7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while 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 grade 8 Reading standards to literature (e.g., "Analyze how a modern work of fiction draws on themes, patterns of events, or character types from myths, traditional stories, or religious works such as the Bible, including describing how the material is rendered new").
   b. Apply grade 8 Reading standards to literary nonfiction (e.g., "Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced").

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 discipline-specific tasks, purposes, and audiences.

Responding to Literature

11. Create a presentation, art work, or text in response to a literary work with a commentary that identifies connections and explains divergences from the original.
   a. Make well-supported personal, cultural, textual, and thematic connections across genres.
   b. Create poetry, stories, plays, and other literary forms (e.g., videos, art work).

Writing Benchmarks: Literacy in History/Social Studies, Science, and Technical Subjects [WHST]

Text Types and Purposes

1. Write arguments focused on discipline-specific content.
   a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
   b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
   c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
   d. Establish and maintain a formal style.
   e. Provide a concluding statement or section that follows from and supports the argument presented.
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
   a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
   b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
   c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
   d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

= Measured by EXPLORE English and/or Reading tests
(Some Reading benchmarks under "Science & Technical Subjects" are covered by EXPLORE Science Test)

*__Bolder__ text = Material added by New York to Common Core State Standards

e. Establish and maintain a formal style and objective tone.

f. Provide a concluding statement or section that follows from and supports the information or explanation presented.

3. (Not applicable as a separate requirement)

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.

5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

Research to Build and Present Knowledge

7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

9. Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing

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

Speaking and Listening [SL]

Comprehension and Collaboration

1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

   a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.

   b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.

   c. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.

   d. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.

   e. Seek to understand other perspectives and cultures and communicate effectively with audiences or individuals from varied backgrounds.

2. Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation.

   a. Use their experience and their knowledge of language and logic, as well as culture, to think analytically, address problems creatively, and advocate persuasively.

3. Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.

Presentation of Knowledge and Ideas

4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

5. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

6. Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.

Language [L]

Conventions of Standard English

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

   a. Explain the function of verbals (gerunds, participles, infinitives) in general and their function in particular sentences.

   b. Form and use verbs in the active and passive voice.

   c. Form and use verbs in the indicative, imperative, interrogative, conditional, and subjunctive mood.

   d. Recognize and correct inappropriate shifts in verb voice and mood.

2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

   a. Use punctuation (comma, ellipsis, dash) to indicate a pause or break.

   b. Use an ellipsis to indicate an omission.

= Measured by EXPLORE English and/or Reading tests
(Some Reading benchmarks under "Science & Technical Subjects" are covered by EXPLORE Science Test)

*__Bolder__ text = Material added by New York to Common Core State Standards

c. Spell correctly.

Knowledge of Language

3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.
   a. Use verbs in the active and passive voice and in the conditional and subjunctive mood to achieve particular effects (e.g., emphasizing the actor or the action; expressing uncertainty or describing a state contrary to fact).

Vocabulary Acquisition and Use

4. Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, choosing flexibly from a range of strategies.
   a. Use context (e.g., the overall meaning of a sentence or paragraph; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.
   b. Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word (e.g., *precede*, *recede*, *secede*).
   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 or its part of speech.
   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., verbal irony, puns) in context.
   b. Use the relationship between particular words to better understand each of the words.
   c. Distinguish among the connotations (associations) of words with similar denotations (definitions) (e.g., *bullheaded*, *willful*, *firm*, *persistent*, *resolute*).
6. Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

= Measured by EXPLORE English and/or Reading tests
(Some Reading benchmarks under "Science & Technical Subjects" are covered by EXPLORE Science Test)

*__Bolder__ text = Material added by New York to Common Core State Standards

Reading

Reading Benchmarks: Literature [RL]

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*).
   - **a. Analyze works by authors or artists who represent diverse world cultures.**
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.

Responding to Literature

11. **Interpret, analyze, and evaluate narratives, poetry, and drama, aesthetically and ethically by making connections to: other texts, ideas, cultural perspectives, eras, personal events and situations.**
    - **a. Self-select text to respond and develop innovative perspectives.**
    - **b. Establish and use criteria to classify, select, and evaluate texts to make informed judgments about the quality of the pieces.**

Reading Benchmarks: Informational Text [RI]

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.
   - **a. Develop factual, interpretive, and evaluative questions for further exploration of the topic(s).**
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.

= Measured by EXPLORE and/or PLAN English and/or Reading tests
(Some Reading benchmarks under "Science & Technical Subjects" are covered by EXPLORE and/or PLAN Science tests)

*__Bolder__ text = Material added by New York to Common Core State Standards

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.

   a. Read, annotate, and analyze informational texts on topics related to diverse and non-traditional cultures and viewpoints.

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.

Reading Benchmarks: Literacy in History/Social Studies [RH]

Key Ideas and Details

1. Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.
2. Determine the central ideas or information of a primary or secondary source; provide an accurate summary of how key events or ideas develop over the course of the text.
3. Analyze in detail a series of events described in a text; determine whether earlier events caused later ones or simply preceded them.

Craft and Structure

4. Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social studies.
5. Analyze how a text uses structure to emphasize key points or advance an explanation or analysis.
6. Compare the point of view of two or more authors for how they treat the same or similar topics, including which details they include and emphasize in their respective accounts.

Integration of Knowledge and Ideas

7. Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text.
8. Assess the extent to which the reasoning and evidence in a text support the author's claims.
9. Compare and contrast treatments of the same topic in several primary and secondary sources.

Range of Reading and Level of Text Complexity

10. By the end of grade 10, read and comprehend history/social studies texts in the grades 9–10 text complexity band independently and proficiently.

Reading Benchmarks: Literacy in Science and Technical Subjects [RST]

Key Ideas and Details

1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Craft and Structure

4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force*, *friction*, *reaction force*, *energy*).
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

Integration of Knowledge and Ideas

7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
8. Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

Range of Reading and Level of Text Complexity

10. By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Writing [W]

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. **Explore and inquire into areas of interest to formulate an argument.**

   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.

= Measured by EXPLORE and/or PLAN English and/or Reading tests (Some Reading benchmarks under "Science & Technical Subjects" are covered by EXPLORE and/or PLAN Science tests)

*__Bolder__ text = Material added by New York to Common Core State Standards

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.

f. Adapt voice, awareness of audience, and use of language to accommodate a variety of cultural contexts.

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.

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.

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.

a. Explore topics dealing with different cultures and world viewpoints.

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.

= Measured by EXPLORE and/or PLAN English and/or Reading tests (Some Reading benchmarks under "Science & Technical Subjects" are covered by EXPLORE and/or PLAN Science tests)

*__Bolder__ text = Material added by New York to Common Core State Standards

Responding to Literature

11. Create literary texts that demonstrate knowledge and understanding of a wide variety of texts of recognized literary merit.

- **a. Engage in a wide range of prewriting experiences, such as using a variety of visual representations, to express personal, social, and cultural connections and insights.**
- **b. Identify, analyze, and use elements and techniques of various genres of literature.**
- **c. Develop critical and interpretive texts from more than one perspective, including historical and cultural.**
- **d. Create poetry, stories, plays, and other literary forms (e.g., videos, art work).**

Writing Benchmarks: Literacy in History/Social Studies, Science, and Technical Subjects [WHST]

Text Types and Purposes

1. Write arguments focused on discipline-specific content.
   a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
   b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and 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 or supports the argument presented.
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
   a. Introduce a topic and organize 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 varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.
   d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
   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. (Not applicable as a separate requirement)

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.
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.
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 informational texts to support analysis, reflection, and research.

Range of Writing

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

= Measured by EXPLORE and/or PLAN English and/or Reading tests (Some Reading benchmarks under "Science & Technical Subjects" are covered by EXPLORE and/or PLAN Science tests)

*__Bolder__ text = Material added by New York to Common Core State Standards

Speaking and Listening [SL]

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.
   e. Seek to understand other perspectives and cultures and communicate effectively with audiences or individuals from varied backgrounds.
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.

Language [L]

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., euphemism, oxymoron) in context and analyze their role in the text.

= Measured by EXPLORE and/or PLAN English and/or Reading tests (Some Reading benchmarks under "Science & Technical Subjects" are covered by EXPLORE and/or PLAN Science tests)

*__Bolder__ text = Material added by New York to Common Core State Standards

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.

= Measured by EXPLORE and/or PLAN English and/or Reading tests (Some Reading benchmarks under "Science & Technical Subjects" are covered by EXPLORE and/or PLAN Science tests)

*__Bolder__ text = Material added by New York to Common Core State Standards

NEW YORK English Language Arts & Literacy
Common Core Learning Standards*
Grades 11–12

Reading

Reading Benchmarks: Literature [RL]

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.)
   a. **Analyze multiple interpretations of full-length works by authors who represent diverse world cultures.**
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.

Responding to Literature

11. **Interpret, analyze, and evaluate narratives, poetry, and drama, aesthetically and philosophically by making connections to: other texts, ideas, cultural perspectives, eras, personal events, and situations.**
    a. **Self-select text to respond and develop innovative perspectives.**
    b. **Establish and use criteria to classify, select, and evaluate texts to make informed judgments about the quality of the pieces.**

Reading Benchmarks: Informational Text [RI]

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.
   a. **Develop factual, interpretive, and evaluative questions for further exploration of the topic(s).**
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.

= Measured by ACT English, Reading, and/or Writing tests
(Some Reading benchmarks under "Science & Technical Subjects" are covered by ACT Science Test)

*__Bolder__ text = Material added by New York to Common Core State Standards

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.
    a. **Read, annotate, and analyze informational texts on topics related to diverse and non-traditional cultures and viewpoints.**

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.

Reading Benchmarks: Literacy in History/Social Studies [RH]

Key Ideas and Details

1. Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole.
2. Determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas.
3. Evaluate various explanations for actions or events and determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain.

Craft and Structure

4. Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines *faction* in *Federalist* No. 10).
5. Analyze in detail how a complex primary source is structured, including how key sentences, paragraphs, and larger portions of the text contribute to the whole.
6. Evaluate authors' differing points of view on the same historical event or issue by assessing the authors' claims, reasoning, and evidence.

Integration of Knowledge and Ideas

7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.
8. Evaluate an author's premises, claims, and evidence by corroborating or challenging them with other information.
9. Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.

Range of Reading and Level of Text Complexity

10. By the end of grade 12, read and comprehend history/social studies texts in the grades 11–CCR text complexity band independently and proficiently.

Reading Benchmarks: Literacy in Science and Technical Subjects [RST]

Key Ideas and Details

1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Reading Benchmarks: Literacy in Science and Technical Subjects [RST]

Craft and Structure

4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.
5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

Integration of Knowledge and Ideas

7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

*__Bolder__ text = Material added by New York to Common Core State Standards

= Measured by ACT English, Reading, and/or Writing tests
(Some Reading benchmarks under "Science & Technical Subjects" are covered by ACT Science Test)

Range of Reading and Level of Text Complexity

10. By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.

Writing [W]

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. **Explore and inquire into areas of interest to formulate an argument.**
   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.
   f. Adapt voice, awareness of audience, and use of language to accommodate a variety of cultural contexts.

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.
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.
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.
   a. Explore topics dealing with different cultures and world viewpoints.

= Measured by ACT English, Reading, and/or Writing tests (Some Reading benchmarks under "Science & Technical Subjects" are covered by ACT Science Test)

*__Bolder__ text = Material added by New York to Common Core State Standards

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.

Responding to Literature

11. Create interpretive and responsive texts to demonstrate knowledge and a sophisticated understanding of the connections between life and the literary work.
    a. Engage in using a wide range of prewriting strategies, such as visual representations and the creation of factual and interpretive questions, to express personal, social and cultural connections and insights.
    b. Identify, analyze, and use elements and techniques of various genres of literature, such as allegory, stream of consciousness, irony, and ambiguity, to affect meaning.
    c. Develop innovative perspectives on texts, including historical, cultural, sociological, and psychological contexts.
    d. Create poetry, stories, plays, and other literary forms (e.g., videos, art work).

Writing Benchmarks: Literacy in History/Social Studies, Science, and Technical Subjects [WHST]

Text Types and Purposes

1. Write arguments focused on discipline-specific content.
    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 the claim(s), counterclaims, reasons, and evidence.
    b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form 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 or supports the argument presented.
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
    a. Introduce a topic and 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 varied transitions and sentence structures 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; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
    e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).
3. (Not applicable as a separate requirement)

= Measured by ACT English, Reading, and/or Writing tests (Some Reading benchmarks under "Science & Technical Subjects" are covered by ACT Science Test)

*__Bolder__ text = Material added by New York to Common Core State Standards

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.
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.
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.

Writing Benchmarks: Literacy in History/Social Studies, Science, and Technical Subjects [WHST]

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 specific 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 informational texts to support analysis, reflection, and research.

Range of Writing

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

Speaking and Listening [SL]

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.
    e. Seek to understand other perspectives and cultures and communicate effectively with audiences or individuals from varied backgrounds.
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 command of formal English when indicated or appropriate.

Language [L]

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.

= Measured by ACT English, Reading, and/or Writing tests (Some Reading benchmarks under "Science & Technical Subjects" are covered by ACT Science Test)

*__Bolder__ text = Material added by New York to Common Core State Standards

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.

Vocabulary Acquisition and Use

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., 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 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.

= Measured by ACT English, Reading, and/or Writing tests (Some Reading benchmarks under "Science & Technical Subjects" are covered by ACT Science Test)

*__Bolder__ text = Material added by New York to Common Core State Standards

Language [L]

The following skills, introduced in Grades 3–9, are particularly likely to require continued attention in higher grades as they are applied to increasingly sophisticated writing and speaking.

L.3.1f. (MN 3.10.1.1.f) Ensure subject-verb and pronoun-antecedent agreement.

L.3.3a. (MN 3.10.3.3.f) Choose words and phrases for effect.

L.4.1f. (MN 4.10.1.1.f) Produce complete sentences, recognizing and correcting inappropriate fragments and run-ons.

L.4.1g. (MN 4.10.1.1.g) Correctly use frequently confused words (e.g., *to*/*too*/*two*; *there*/*their*).

L.4.3b. (MN 4.10.3.3.b) Choose punctuation for effect.

L.5.1d. (MN 5.10.1.1.d) Recognize and correct inappropriate shifts in verb tense.

L.5.2a. (MN 5.10.2.2.a) Use punctuation to separate items in a series.

L.6.1c. (MN 6.11.1.1.c) Recognize and correct inappropriate shifts in pronoun number and person.

L.6.1d. (MN 6.11.1.1.d) Recognize and correct vague pronouns (i.e., ones with unclear or ambiguous antecedents).

L.6.1e. (MN 6.11.1.1.e) Recognize variations from standard English in their own and others' writing and speaking, and identify and use strategies to improve expression in conventional language.

L.6.2a. (MN 6.11.2.2.a) Use punctuation (commas, parentheses, dashes) to set off nonrestrictive/parenthetical elements.

L.6.3a. (MN 6.11.3.3.a) Vary sentence patterns for meaning, reader/listener interest, and style.

L.6.3b. (MN 6.11.3.3.b) Maintain consistency in style and tone.

L.7.1c. (MN 7.11.1.1.c) Place phrases and clauses within a sentence, recognizing and correcting misplaced and dangling modifiers.

L.7.3a. (MN 7.11.3.3.a) Choose language that expresses ideas precisely and concisely, recognizing and eliminating wordiness and redundancy.

L.8.1d. (MN 8.11.1.1.d) Recognize and correct inappropriate shifts in verb voice and mood.

L.9–10.1a. (MN 9.11.1.1.a) Use parallel structure.

NEW YORK Mathematics
Common Core Learning Standards
Standards for Mathematical Practice

1. **Make sense of problems and persevere in solving them.**

   Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2. **Reason abstractly and quantitatively.**

   Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3. **Construct viable arguments and critique the reasoning of others.**

   Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, standards for mathematical practice communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4. **Model with mathematics.**

   Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

8. Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1,2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

The Number System [8.NS]

Know that there are numbers that are not rational, and approximate them by rational numbers.

1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*

Expressions and Equations [8.EE]

Work with radicals and integer exponents.

1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.*
2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9, and determine that the world population is more than 20 times larger.*
4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Understand the connections between proportional relationships, lines, and linear equations.

5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*
6. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.

Expressions and Equations [8.EE]

Analyze and solve linear equations and pairs of simultaneous linear equations.

7. Solve linear equations in one variable.
   a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
   b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
8. Analyze and solve pairs of simultaneous linear equations.
   a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
   b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.*
   c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*

Functions [8.F]

Define, evaluate, and compare functions.

1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*
3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*

Use functions to model relationships between quantities.

4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x,y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

Functions [8.F]

Use functions to model relationships between quantities.

5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Geometry [8.G]

Understand congruence and similarity using physical models, transparencies, or geometry software.

1. Verify experimentally the properties of rotations, reflections, and translations:
   a. Lines are taken to lines, and line segments to line segments of the same length.
   b. Angles are taken to angles of the same measure.
   c. Parallel lines are taken to parallel lines.
2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*

Understand and apply the Pythagorean Theorem.

6. Explain a proof of the Pythagorean Theorem and its converse.
7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Geometry [8.G]

Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Statistics and Probability [8.SP]

Investigate patterns of association in bivariate data.

1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*
4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*

Number and Quantity

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 $i^2 = –1$, and every complex number has the form $a + bi$ with a and b real.
2. Use the relation $i^2 = –1$ 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 $x^2 + 4$ 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.

Vector and Matrix Quantities [N-VM]

Perform operations on matrices and use matrices in applications.

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 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

Algebra

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 $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ 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 and 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.

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-REI]

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 $x^2 + y^2 = 3$.*
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 × 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).

Reasoning with Equations and Inequalities [A-REI]

Represent and solve equations and inequalities graphically

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.

Functions

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.★

Interpreting Functions [F-IF]

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 calculate trigonometric ratios.

9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Geometry

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.

Congruence [G-CO]

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.

Similarity, Right Triangles, and Trigonometry [G-SRT]

Apply trigonometry to general triangles

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 $(1,\sqrt{3})$ 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.★

Geometric Measurement and Dimension [G-GMD]

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).★

Statistics and Probability★

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 $P(A \text{ and } B)/P(B)$, 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.*

Conditional Probability and the Rules of Probability [S-CP]

Understand independence and conditional probability and use them to interpret data

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, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.
8. (+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, 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?*

Using Probability to Make Decisions [S-MD]

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 fast-food 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).

Science

NEW YORK Mathematics, Science, & Technology
Learning Standards
Intermediate

Standard 1—Analysis, Inquiry, and Design

Mathematical Analysis

1. Abstraction and symbolic representation are used to communicate mathematically.
   - extend mathematical notation and symbolism to include variables and algebraic expressions in order to describe and compare quantities and express mathematical relationships.
2. Deductive and inductive reasoning are used to reach mathematical conclusions.
   - use inductive reasoning to construct, evaluate, and validate conjectures and arguments, recognizing that patterns and relationships can assist in explaining and extending mathematical phenomena.
3. Critical thinking skills are used in the solution of mathematical problems.
   - apply mathematical knowledge to solve real-world problems and problems that arise from the investigation of mathematical ideas, using representations such as pictures, charts, and tables.

Scientific Inquiry

1. The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.
   - formulate questions independently with the aid of references appropriate for guiding the search for explanations of everyday observations.
   - construct explanations independently for natural phenomena, especially by proposing preliminary visual models of phenomena.
   - represent, present, and defend their proposed explanations of everyday observations so that they can be understood and assessed by others.
   - seek to clarify, to assess critically, and to reconcile with their own thinking the ideas presented by others, including peers, teachers, authors, and scientists.
2. Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.
   - use conventional techniques and those of their own design to make further observations and refine their explanations, guided by a need for more information.
   - develop, present, and defend formal research proposals for testing their own explanations of common phenomena, including ways of obtaining needed observations and ways of conducting simple controlled experiments.
   - carry out their research proposals, recording observations and measurements (e.g., lab notes, audio tape, computer disk, video tape) to help assess the explanation.
3. The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena.
   - design charts, tables, graphs and other representations of observations in conventional and creative ways to help them address their research question or hypothesis.
   - interpret the organized data to answer the research question or hypothesis and to gain insight into the problem.
   - modify their personal understanding of phenomena based on evaluation of their hypothesis.

Engineering Design

1. Engineering design is an iterative process involving modeling and optimization finding the best solution within given constraints which is used to develop technological solutions to problems within given constraints.

Students engage in the following steps in a design process:

- identify needs and opportunities for technical solutions from an investigation of situations of general or social interest.
- locate and utilize a range of printed, electronic, and human information resources to obtain ideas.

= Measured by EXPLORE Science Test
_____ = Content sampled by EXPLORE Science Test

- consider constraints and generate several ideas for alternative solutions, using group and individual ideation techniques (group discussion, brainstorming, forced connections, role play); defer judgment until a number of ideas have been generated; evaluate (critique) ideas; and explain why the chosen solution is optimal.
- develop plans, including drawings with measurements and details of construction, and construct a model of the solution, exhibiting a degree of craftsmanship.
- in a group setting, test their solution against design specifications, present and evaluate results, describe how the solution might have been modified for different or better results, and discuss tradeoffs that might have to be made.

Standard 2—Information Systems

Information Systems

1. Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.
   - use a range of equipment and software to integrate several forms of information in order to create good quality audio, video, graphic, and text-based presentations.
   - use spreadsheets and database software to collect, process, display, and analyze information. Students access needed information from electronic databases and on-line telecommunication services.
   - systematically obtain accurate and relevant information pertaining to a particular topic from a range of sources, including local and national media, libraries, museums, governmental agencies, industries, and individuals.
   - collect data from probes to measure events and phenomena.
   - use simple modeling programs to make predictions.
2. Knowledge of the impacts and limitations of information systems is essential to its effective and ethical use.
   - understand the need to question the accuracy of information displayed on a computer because the results produced by a computer may be affected by incorrect data entry.
   - identify advantages and limitations of data-handling programs and graphics programs.
   - understand why electronically stored personal information has greater potential for misuse than records kept in conventional form.
3. Information technology can have positive and negative impacts on society, depending upon how it is used.
   - use graphical, statistical, and presentation software to present projects to fellow classmates.
   - describe applications of information technology in mathematics, science, and other technologies that address needs and solve problems in the community.
   - explain the impact of the use and abuse of electronically generated information on individuals and families.

Standard 3—Mathematics

[Superseded]

Standard 4—Science

Physical Setting

1. The Earth and celestial phenomena can be described by principles of relative motion and perspective.
   - explain daily, monthly, and seasonal changes on earth.
2. Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.
   - explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.
   - describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
3. Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.
   - observe and describe properties of materials, such as density, conductivity, and solubility.
   - distinguish between chemical and physical changes.
   - develop their own mental models to explain common chemical reactions and changes in states of matter.
4. Energy exists in many forms, and when these forms change energy is conserved.
   - describe the sources and identify the transformations of energy observed in everyday life.
   - observe and describe heating and cooling events.
   - observe and describe energy changes as related to chemical reactions.
   - observe and describe the properties of sound, light, magnetism, and electricity.
   - describe situations that support the principle of conservation of energy.
5. Energy and matter interact through forces that result in changes in motion.
   - describe different patterns of motion of objects.
   - observe, describe, and compare effects of forces (gravity, electric current, and magnetism) on the motion of objects.

The Living Environment

1. Living things are both similar to and different from each other and nonliving things.
   - compare and contrast the parts of plants, animals, and one-celled organisms.

= Measured by EXPLORE Science Test

_____ = Content sampled by EXPLORE Science Test

- explain the functioning of the major human organ systems and their interactions.

2. Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.
   - describe sexual and asexual mechanisms for passing genetic materials from generation to generation.
   - describe simple mechanisms related to the inheritance of some physical traits in offspring.
3. Individual organisms and species change over time.
   - describe sources of variation in organisms and their structures and relate the variations to survival.
   - describe factors responsible for competition within species and the significance of that competition.
4. The continuity of life is sustained through reproduction and development.
   - observe and describe the variations in reproductive patterns of organisms, including asexual and sexual reproduction.
   - explain the role of sperm and egg cells in sexual reproduction.
   - observe and describe developmental patterns in selected plants and animals (e.g., insects, frogs, humans, seed-bearing plants).
   - observe and describe cell division at the microscopic level and its macroscopic effects.
5. Organisms maintain a dynamic equilibrium that sustains life.
   - compare the way a variety of living specimens carry out basic life functions and maintain dynamic equilibrium.
   - describe the importance of major nutrients, vitamins, and minerals in maintaining health and promoting growth and explain the need for a constant input of energy for living organisms.
6. Plants and animals depend on each other and their physical environment.
   - describe the flow of energy and matter through food chains and food webs.
   - provide evidence that green plants make food and explain the significance of this process to other organisms.
7. Human decisions and activities have had a profound impact on the physical and living environment.
   - describe how living things, including humans, depend upon the living and nonliving environment for their survival.
   - describe the effects of environmental changes on humans and other populations.

Standard 5—Technology

Engineering Design

1. Engineering design is an iterative process involving *modeling* and *optimization* used to develop technological solutions to problems within given constraints.
   - identify needs and opportunities for technical solutions from an investigation of situations of general or social interest.
   - locate and utilize a range of printed, electronic, and human information resources to obtain ideas.
   - consider constraints and generate several ideas for alternative solutions, using group and individual ideation techniques (group discussion, brainstorming, forced connections, role play); defer judgment until a number of ideas have been generated; evaluate (critique) ideas; and explain why the chosen solution is optimal.
   - develop plans, including drawings with measurements and details of construction, and construct a model of the solution, exhibiting a degree of craftsmanship.
   - in a group setting, test their solution against design specifications, present and evaluate results, describe how the solution might have been modified for different or better results, and discuss tradeoffs that might have to be made.

Tools, Resources, and Technological Processes

2. Technological tools, materials, and other resources should be selected on the basis of safety, cost, availability, appropriateness, and environmental impact; technological processes change energy, information, and material resources into more useful forms.
   - choose and use resources for a particular purpose based upon an analysis and understanding of their properties, costs, availability, and environmental impact.
   - use a variety of hand tools and machines to change materials into new forms through forming, separating, and combining processes, and processes which cause internal change to occur.
   - combine manufacturing processes with other technological processes to produce, market, and distribute a product.
   - process energy into other forms and information into more meaningful information.

Computer Technology

3. Computers, as tools for design, modeling, information processing, communication, and system control, have greatly increased human productivity and knowledge.
   - assemble a computer system including keyboard, central processing unit and disc drives, mouse, modem, printer, and monitor.
   - use a computer system to connect to and access needed information from various Internet sites.

= Measured by EXPLORE Science Test

_____ = Content sampled by EXPLORE Science Test

- use computer hardware and software to draw and dimension prototypical designs.
- use a computer as a modeling tool.
- use a computer system to monitor and control external events and/or systems.

Technological Systems

4. Technological systems are designed to achieve specific results and produce outputs, such as products, structures, services, energy, or other systems.
   - select appropriate technological systems on the basis of safety, function, cost, ease of operation, and quality of post-purchase support.
   - assemble, operate, and explain the operation of simple open- and closed-loop electrical, electronic, mechanical, and pneumatic systems.
   - describe how subsystems and system elements (inputs, processes, outputs) interact within systems.
   - describe how system control requires sensing information, processing it, and making changes.

History and Evolution of Technology

5. Technology has been the driving force in the evolution of society from an agricultural to an industrial to an information base.
   - describe how the evolution of technology led to the shift in society from an agricultural base to an industrial base to an information base.
   - understand the contributions of people of different genders, races, and ethnic groups to technological development.
   - describe how new technologies have evolved as a result of combining existing technologies (e.g., photography combined optics and chemistry; the airplane combined kite and glider technology with a lightweight gasoline engine).

Impacts of Technology

6. Technology can have positive and negative impacts on individuals, society, and the environment and humans have the capability and responsibility to constrain or promote technological development.
   - describe how outputs of a technological system can be desired, undesired, expected, or unexpected.
   - describe through examples how modern technology reduces manufacturing and construction costs and produces more uniform products.

Management of Technology

7. Project management is essential to ensuring that technological endeavors are profitable and that products and systems are of high quality and built safely, on schedule, and within budget.
   - manage time and financial resources in a technological project.
   - provide examples of products that are well (and poorly) designed and made, describe their positive and negative attributes, and suggest measures that can be implemented to monitor quality during production.
   - assume leadership responsibilities within a structured group activity.

Standard 6—Interconnectedness: Common Themes

Systems Thinking

1. Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.
   - describe the differences between dynamic systems and organizational systems.
   - describe the differences and similarities between engineering systems, natural systems, and social systems.
   - describe the differences between open- and closed-loop systems.
   - describe how the output from one part of a system (which can include material, energy, or information) can become the input to other parts.

Models

2. Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.
   - select an appropriate model to begin the search for answers or solutions to a question or problem.
   - use models to study processes that cannot be studied directly (e.g., when the real process is too slow, too fast, or too dangerous for direct observation).
   - demonstrate the effectiveness of different models to represent the same thing and the same model to represent different things.

Magnitude and Scale

3. The grouping of magnitudes of size, time, frequency, and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems.
   - cite examples of how different aspects of natural and designed systems change at different rates with changes in scale.
   - use powers of ten notation to represent very small and very large numbers.

= Measured by EXPLORE Science Test

_____ = Content sampled by EXPLORE Science Test

Equilibrium and Stability

4. Equilibrium is a state of stability due either to a lack of changes (static equilibrium) or a balance between opposing forces (dynamic equilibrium).
   - describe how feedback mechanisms are used in both designed and natural systems to keep changes within desired limits.
   - describe changes within equilibrium cycles in terms of frequency or cycle length and determine the highest and lowest values and when they occur.

Patterns of Change

5. Identifying patterns of change is necessary for making predictions about future behavior and conditions.
   - use simple linear equations to represent how a parameter changes with time.
   - observe patterns of change in trends or cycles and make predictions on what might happen in the future.

Optimization

6. In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.
   - determine the criteria and constraints and make tradeoffs to determine the best decision.
   - use graphs of information for a decision making problem to determine the optimum solution.

Standard 7—Interdisciplinary Problem Solving

Connections

1. The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems, especially those relating to issues of science/technology/society, consumer decision making, design, and inquiry into phenomena.
   - analyze science/technology/society problems and issues at the local level and plan and carry out a remedial course of action.
   - make informed consumer decisions by seeking answers to appropriate questions about products, services, and systems; determining the cost/benefit and risk/benefit tradeoffs; and applying this knowledge to a potential purchase.
   - design solutions to real-world problems of general social interest related to home, school, or community using scientific experimentation to inform the solution and applying mathematical concepts and reasoning to assist in developing a solution.
   - describe and explain phenomena by designing and conducting investigations involving systematic observations, accurate measurements, and the identification and control of variables; by inquiring into relevant mathematical ideas; and by using mathematical and technological tools and procedures to assist in the investigation.

Strategies

2. Solving interdisciplinary problems involves a variety of skills and strategies, including effective work habits; gathering and processing information; generating and analyzing ideas; realizing ideas; making connections among the common themes of mathematics, science, and technology; and presenting results.
   - work effectively
   - gather and process information
   - generate and analyze ideas
   - observe common themes
   - realize ideas
   - present results

= Measured by EXPLORE Science Test

_____ = Content sampled by EXPLORE Science Test

Standard 1—Analysis, Inquiry, and Design

Mathematical Analysis

1. Abstraction and symbolic representation are used to communicate mathematically.
   - use algebraic and geometric representations to describe and compare data.
2. Deductive and inductive reasoning are used to reach mathematical conclusions.
   - use deductive reasoning to construct and evaluate conjectures and arguments, recognizing that patterns and relationships in mathematics assist them in arriving at these conjectures and arguments.
3. Critical thinking skills are used in the solution of mathematical problems.
   - apply algebraic and geometric concepts and skills to the solution of problems.

Scientific Inquiry

1. The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.
   - elaborate on basic scientific and personal explanations of natural phenomena, and develop extended visual models and mathematical formulations to represent their thinking.
   - hone ideas through reasoning, library research, and discussion with others, including experts.
   - work toward reconciling competing explanations; clarifying points of agreement and disagreement.
   - coordinate explanations at different levels of scale, points of focus, and degrees of complexity and specificity and recognize the need for such alternative representations of the natural world.
2. Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.
   - devise ways of making observations to test proposed explanations.
   - refine their research ideas through library investigations, including electronic information retrieval and reviews of the literature, and through peer feedback obtained from review and discussion.
   - develop and present proposals including formal hypotheses to test their explanations, i.e., they predict what should be observed under specified conditions if the explanation is true.
   - carry out their research plan for testing explanations, including selecting and developing techniques, acquiring and building apparatus, and recording observations as necessary.
3. The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena.
   - use various means of representing and organizing observations (e.g., diagrams, tables, charts, graphs, equations, matrices) and insightfully interpret the organized data.
   - apply statistical analysis techniques when appropriate to test if chance alone explains the result.
   - assess correspondence between the predicted result contained in the hypothesis and the actual result and reach a conclusion as to whether or not the explanation on which the prediction was based is supported.
   - based on the results of the test and through public discussion, they revise the explanation and contemplate additional research.
   - develop a written report for public scrutiny that describes their proposed explanation, including a literature review, the research they carried out, its result, and suggestions for further research.

Engineering Design

1. Engineering design is an iterative process involving modeling and optimization finding the best solution within given constraints which is used to develop technological solutions to problems within given constraints.

Students engage in the following steps in a design process:

- initiate and carry out a thorough investigation of an unfamiliar situation and identify needs and opportunities for technological invention or innovation.
- identify, locate, and use a wide range of information resources, and document through notes and sketches how findings relate to the problem.
- generate creative solutions, break ideas into significant functional elements, and explore possible refinements; predict possible outcomes using mathematical and functional modeling techniques; choose the optimal solution to the problem, clearly documenting ideas against design criteria and constraints; and explain how human understands, economics, ergonomics, and environmental considerations have influenced the solution.

- develop work schedules and working plans which include optimal use and cost of materials, processes, time, and expertise; construct a model of the solution, incorporating developmental modifications while working to a high degree of quality (craftsmanship).
- devise a test of the solution according to the design criteria and perform the test; record, portray, and logically evaluate performance test results through quantitative, graphic, and verbal means. Use a variety of creative verbal and graphic techniques effectively and persuasively to present conclusions, predict impacts and new problems, and suggest and pursue modifications.

Standard 2—Information Systems

Information Systems

1. Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.
   - understand and use the more advanced features of word processing, spreadsheets, and database software.
   - prepare multimedia presentations demonstrating a clear sense of audience and purpose.
   - access, select, collate, and analyze information obtained from a wide range of sources such as research databases, foundations, organizations, national libraries, and electronic communication networks, including the Internet.
   - students receive news reports from abroad and work in groups to produce newspapers reflecting the perspectives of different countries.
   - utilize electronic networks to share information.
   - model solutions to a range of problems in mathematics, science, and technology using computer simulation software.
2. Knowledge of the impacts and limitations of information systems is essential to its effective and ethical use.
   - explain the impact of the use and abuse of electronically generated information on individuals and families.
   - evaluate software packages relative to their suitability to a particular application and their ease of use.
   - discuss the ethical and social issues raised by the use and abuse of information systems.
3. Information technology can have positive and negative impacts on society, depending upon how it is used.
   - work with a virtual community to conduct a project or solve a problem using the network.
   - discuss how applications of information technology can address some major global problems and issues.
   - discuss the environmental, ethical, moral, and social issues raised by the use and abuse of information technology.

Standard 3—Mathematics

[Superseded]

Standard 4—Science

Physical Setting

1. The Earth and celestial phenomena can be described by principles of relative motion and perspective.
   - explain complex phenomena, such as tides, variations in day length, solar insolation, apparent motion of the planets, and annual traverse of the constellations.
   - describe current theories about the origin of the universe and solar system.
2. Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.
   - use the concepts of density and heat energy to explain observations of weather patterns, seasonal changes, and the movements of the Earth's plates.
   - explain how incoming solar radiations, ocean currents, and land masses affect weather and climate.
3. Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.
   - explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.
   - use atomic and molecular models to explain common chemical reactions.
   - apply the principle of conservation of mass to chemical reactions.
   - use kinetic molecular theory to explain rates of reactions and the relationships among temperature, pressure, and volume of a substance.
4. Energy exists in many forms, and when these forms change energy is conserved.
   - observe and describe transmission of various forms of energy.
   - explain heat in terms of kinetic molecular theory.
   - explain variations in wavelength and frequency in terms of the source of the vibrations that produce them, e.g., molecules, electrons, and nuclear particles.
   - explain the uses and hazards of radioactivity.
5. Energy and matter interact through forces that result in changes in motion.
   - explain and predict different patterns of motion of objects (e.g., linear and angular motion, velocity and acceleration, momentum and inertia).
   - explain chemical bonding in terms of the motion of electrons.

= Measured by PLAN and/or ACT Science tests

_____ = Content sampled by PLAN and/or ACT Science tests

- compare energy relationships within an atom's nucleus to those outside the nucleus.

The Living Environment

1. Living things are both similar to and different from each other and nonliving things.
   - explain how diversity of populations within ecosystems relates to the stability of ecosystems.
   - describe and explain the structures and functions of the human body at different organizational levels (e.g., systems, tissues, cells, organelles).
   - explain how a one-celled organism is able to function despite lacking the levels of organization present in more complex organisms.
2. Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.
   - explain how the structure and replication of genetic material result in offspring that resemble their parents.
   - explain how the technology of genetic engineering allows humans to alter the genetic makeup of organisms.
3. Individual organisms and species change over time.
   - explain the mechanisms and patterns of evolution.
4. The continuity of life is sustained through reproduction and development.
   - explain how organisms, including humans, reproduce their own kind.
5. Organisms maintain a dynamic equilibrium that sustains life.
   - explain the basic biochemical processes in living organisms and their importance in maintaining dynamic equilibrium.
   - explain disease as a failure of homeostasis.
   - relate processes at the system level to the cellular level in order to explain dynamic equilibrium in multicelled organisms.
6. Plants and animals depend on each other and their physical environment.
   - explain factors that limit growth of individuals and populations.
   - explain the importance of preserving diversity of species and habitats.
   - explain how the living and nonliving environments change over time and respond to disturbances.
7. Human decisions and activities have had a profound impact on the physical and living environment.
   - describe the range of interrelationships of humans with the living and nonliving environment.
   - explain the impact of technological development and growth in the human population on the living and nonliving environment.
   - explain how individual choices and societal actions can contribute to improving the environment.

Standard 5—Technology

Engineering Design

1. Engineering design is an iterative process involving *modeling* and *optimization* used to develop technological solutions to problems within given constraints.
   - initiate and carry out a thorough investigation of an unfamiliar situation and identify needs and opportunities for technological invention or innovation.
   - identify, locate, and use a wide range of information resources including subject experts, library references, magazines, videotapes, films, electronic databases and on-line services, and discuss and document through notes and sketches how findings relate to the problem.
   - generate creative solution ideas, break ideas into the significant functional elements, and explore possible refinements; predict possible outcomes using mathematical and functional modeling techniques; choose the optimal solution to the problem, clearly documenting ideas against design criteria and constraints; and explain how human values, economics, ergonomics, and environmental considerations have influenced the solution.
   - develop work schedules and plans which include optimal use and cost of materials, processes, time, and expertise; construct a model of the solution, incorporating developmental modifications while working to a high degree of quality (craftsmanship).
   - in a group setting, devise a test of the solution relative to the design criteria and perform the test; record, portray, and logically evaluate performance test results through quantitative, graphic, and verbal means; and use a variety of creative verbal and graphic techniques effectively and persuasively to present conclusions, predict impacts and new problems, and suggest and pursue modifications.

Tools, Resources, and Technological Processes

2. Technological tools, materials, and other resources should be selected on the basis of safety, cost, availability, appropriateness, and environmental impact; technological processes change energy, information, and material resources into more useful forms.
   - test, use, and describe the attributes of a range of material (including synthetic and composite materials), information, and energy resources.
   - select appropriate tools, instruments, and equipment and use them correctly to process materials, energy, and information.
   - explain tradeoffs made in selecting alternative resources in terms of safety, cost, properties, availability, ease of processing, and disposability.
   - describe and model methods (including computer-based methods) to control system processes and monitor system outputs.

= Measured by PLAN and/or ACT Science tests
_____ = Content sampled by PLAN and/or ACT Science tests

Computer Technology

3. Computers, as tools for design, modeling, information processing, communication, and system control, have greatly increased human productivity and knowledge.
   - understand basic computer architecture and describe the function of computer subsystems and peripheral devices.
   - select a computer system that meets personal needs.
   - attach a modem to a computer system and telephone line, set up and use communications software, connect to various on-line networks, including the Internet, and access needed information using e-mail, telnet, gopher, ftp, and web searches.
   - use computer-aided drawing and design (CADD) software to model realistic solutions to design problems.
   - develop an understanding of computer programming and attain some facility in writing computer programs.

Technological Systems

4. Technological systems are designed to achieve specific results and produce outputs, such as products, structures, services, energy, or other systems.
   - explain why making tradeoffs among characteristics, such as safety, function, cost, ease of operation, quality of post-purchase support, and environmental impact, is necessary when selecting systems for specific purposes.
   - model, explain, and analyze the performance of a feedback control system.
   - explain how complex technological systems involve the confluence of numerous other systems.

History and Evolution of Technology

5. Technology has been the driving force in the evolution of society from an agricultural to an industrial to an information base.
   - explain how technological inventions and innovations have caused global growth and interdependence, stimulated economic competitiveness, created new jobs, and made other jobs obsolete.

Impacts of Technology

6. Technology can have positive and negative impacts on individuals, society, and the environment and humans have the capability and responsibility to constrain or promote technological development.
   - explain that although technological effects are complex and difficult to predict accurately, humans can control the development and implementation of technology.
   - explain how computers and automation have changed the nature of work.
   - explain how national security is dependent upon both military and nonmilitary applications of technology.

Management of Technology

7. Project management is essential to ensuring that technological endeavors are profitable and that products and systems are of high quality and built safely, on schedule, and within budget.
   - develop and use computer-based scheduling and project tracking tools, such as flow charts and graphs.
   - explain how statistical process control helps to ensure high-quality output.
   - discuss the role technology has played in the operation of successful U.S. businesses and under what circumstances they are competitive with other countries.
   - explain how technological inventions and innovations stimulate economic competitiveness and how, in order for an innovation to lead to commercial success, it must be translated into products and services with marketplace demand.
   - describe new management techniques (e.g., computer-aided engineering, computer-integrated manufacturing, total quality management, just-in-time manufacturing), incorporate some of these in a technological endeavor, and explain how they have reduced the length of design-to-manufacture cycles, resulted in more flexible factories, and improved quality and customer satisfaction.
   - help to manage a group engaged in planning, designing, implementation, and evaluation of a project to gain understanding of the management dynamics.

Standard 6—Interconnectedness: Common Themes

Systems Thinking

1. Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.
   - explain how positive feedback and negative feedback have opposite effects on system outputs.
   - use an input-process-output-feedback diagram to model and compare the behavior of natural and engineered systems.
   - define boundary conditions when doing systems analysis to determine what influences a system and how it behaves.

Models

2. Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.
   - revise a model to create a more complete or improved representation of the system.

= Measured by PLAN and/or ACT Science tests
= Content sampled by PLAN and/or ACT Science tests

- collect information about the behavior of a system and use modeling tools to represent the operation of the system.
- find and use mathematical models that behave in the same manner as the processes under investigation.
- compare predictions to actual observations using test models.

Magnitude and Scale

3. The grouping of magnitudes of size, time, frequency, and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems.
   - describe the effects of changes in scale on the functioning of physical, biological, or designed systems.
   - extend their use of powers of ten notation to understanding the exponential function and performing operations with exponential factors.

Equilibrium and Stability

4. Equilibrium is a state of stability due either to a lack of changes (static equilibrium) or a balance between opposing forces (dynamic equilibrium).
   - describe specific instances of how disturbances might affect a system's equilibrium, from small disturbances that do not upset the equilibrium to larger disturbances (threshold level) that cause the system to become unstable.
   - cite specific examples of how dynamic equilibrium is achieved by equality of change in opposing directions.

Patterns of Change

5. Identifying patterns of change is necessary for making predictions about future behavior and conditions.
   - use sophisticated mathematical models, such as graphs and equations of various algebraic or trigonometric functions.
   - search for multiple trends when analyzing data for patterns, and identify data that do not fit the trends.

Optimization

6. In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.
   - use optimization techniques, such as linear programming, to determine optimum solutions to problems that can be solved using quantitative methods.
   - analyze subjective decision making problems to explain the trade-offs that can be made to arrive at the best solution.

Standard 7—Interdisciplinary Problem Solving

Connections

1. The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems, especially those relating to issues of science/technology/society, consumer decision making, design, and inquiry into phenomena.
   - analyze science/technology/society problems and issues on a community, national, or global scale and plan and carry out a remedial course of action.
   - analyze and quantify consumer product data, understand environmental and economic impacts, develop a method for judging the value and efficacy of competing products, and discuss cost/benefit and risk/benefit tradeoffs made in arriving at the optimal choice.
   - design solutions to real-world problems on a community, national, or global scale using a technological design process that integrates scientific investigation and rigorous mathematical analysis of the problem and of the solution.
   - explain and evaluate phenomena mathematically and scientifically by formulating a testable hypothesis, demonstrating the logical connections between the scientific concepts guiding the hypothesis and the design of an experiment, applying and inquiring into the mathematical ideas relating to investigation of phenomena, and using (and if needed, designing) technological tools and procedures to assist in the investigation and in the communication of results.

Strategies

2. Solving interdisciplinary problems involves a variety of skills and strategies, including effective work habits; gathering and processing information; generating and analyzing ideas; realizing ideas; making connections among the common themes of mathematics, science, and technology; and presenting results.
   - work effectively
   - gather and process information
   - generate and analyze ideas
   - observe common themes
   - realize ideas
   - present results

= Measured by PLAN and/or ACT Science tests

_____ = Content sampled by PLAN and/or ACT Science tests

Section C: ACT's College Readiness Standards Included in New York State Grade 8–12 Learning Standards

In recent years ACT has brought a distinctive voice to the debate on what it means to be truly ready for college. Using a wealth of longitudinal data—data that no one else possesses—ACT has pioneered empirical approaches to assessing students' college readiness. Using thousands of student records and responses, content and measurement experts at ACT have developed detailed statements that describe what students typically know and are able to do at different levels of test performance. These data-driven, empirically derived score descriptors, known as ACT's College Readiness Standards, describe student achievement within various score ranges on the English, Reading, Writing, Mathematics, and Science tests on EXPLORE, PLAN, and the ACT.

How ACT College Readiness Standards Work with ACT College Readiness Benchmarks

The ACT College Readiness Benchmarks are the minimum ACT test scores required for students to have a high probability of success in first-year, credit-bearing college courses—English Composition, Algebra, social sciences courses, or Biology. EXPLORE and PLAN Benchmarks provided minimum score targets for eighth- and tenth-grade students to gauge their progress in becoming college ready by the time they graduate from high school.

ACT's College Readiness Benchmarks				
Test	**College Course**	**ACT Test Score**	**PLAN Test Score**	**EXPLORE Test Score**
English	English Composition	18	15	13
Mathematics	College Algebra	22	19	17
Reading	College Social Studies/Humanities	21	17	15
Science	College Biology	24	21	20

Students who meet a Benchmark on the ACT have approximately a 50 percent chance of earning a B or better and approximately a 75 percent chance or better of earning a C or better in the corresponding entry-level college course or courses. Students who meet a Benchmark on EXPLORE or PLAN have a high chance of meeting the College Readiness Benchmarks for the ACT and of being ready for the corresponding college course(s) by the time they graduate from high school.

The knowledge and skills in the score ranges that include these Benchmark scores are shown in the tables on the following pages. Students who master these standards are more likely than those who do not to persist to the second year at the same institution; achieve a grade of B or higher in first-year college courses; achieve a first-year college GPA of 2.5 or higher; progress toward a college degree; and complete a college degree.

Research shows that the academic quality and intensity of the high school curriculum is a key determinant of success in postsecondary education. *States should ensure that high school coursework be of sufficient rigor to prepare their graduates for postsecondary education and workforce training.*

This section (Section C) provides information about the New York Learning Standards as they relate to ACT's College Readiness Standards. The ACT College Readiness Standards included in the New York Learning Standards are highlighted. College Readiness Standards not highlighted are those that include specific content, complexity, and/or proficiency level descriptors that ACT content experts determined were not included in the New York Learning Standards.

Score Ranges	Table C-1. ACT's College Readiness Standards — English		
Bench-marks	**Topic Development in Terms of Purpose and Focus**	**Organization, Unity, and Coherence**	**Word Choice in Terms of Style, Tone, Clarity, and Economy**
13–15 ***EXPL: 13*** ***PLAN: 15***		Use conjunctive adverbs or phrases to show time relationships in simple narrative essays (e.g., *then*, *this time*)	Revise sentences to correct awkward and confusing arrangements of sentence elements Revise vague nouns and pronouns that create obvious logic problems
16–19 ***ACT: 18***	Identify the basic purpose or role of a specified phrase or sentence Delete a clause or sentence because it is obviously irrelevant to the essay	Select the most logical place to add a sentence in a paragraph	Delete obviously synonymous and wordy material in a sentence Revise expressions that deviate from the style of an essay
20–23	Identify the central idea or main topic of a straightforward piece of writing Determine relevancy when presented with a variety of sentence-level details	Use conjunctive adverbs or phrases to express straightforward logical relationships (e.g., *first*, *afterward*, *in response*) Decide the most logical place to add a sentence in an essay Add a sentence that introduces a simple paragraph	Delete redundant material when information is repeated in different parts of speech (e.g., "alarmingly startled") Use the word or phrase most consistent with the style and tone of a fairly straightforward essay Determine the clearest and most logical conjunction to link clauses
24–27	Identify the focus of a simple essay, applying that knowledge to add a sentence that sharpens that focus or to determine if an essay has met a specified goal Delete material primarily because it disturbs the flow and development of the paragraph Add a sentence to accomplish a fairly straightforward purpose such as illustrating a given statement	Determine the need for conjunctive adverbs or phrases to create subtle logical connections between sentences (e.g., *therefore*, *however*, *in addition*) Rearrange the sentences in a fairly uncomplicated paragraph for the sake of logic Add a sentence to introduce or conclude the essay or to provide a transition between paragraphs when the essay is fairly straightforward	Revise a phrase that is redundant in terms of the meaning and logic of the entire sentence Identify and correct ambiguous pronoun references Use the word or phrase most appropriate in terms of the content of the sentence and tone of the essay
28–32	Apply an awareness of the focus and purpose of a fairly involved essay to determine the rhetorical effect and suitability of an existing phrase or sentence, or to determine the need to delete plausible but irrelevant material Add a sentence to accomplish a subtle rhetorical purpose such as to emphasize, to add supporting detail, or to express meaning through connotation	Make sophisticated distinctions concerning the logical use of conjunctive adverbs or phrases, particularly when signaling a shift between paragraphs Rearrange sentences to improve the logic and coherence of a complex paragraph Add a sentence to introduce or conclude a fairly complex paragraph	Correct redundant material that involves sophisticated vocabulary and sounds acceptable as conversational English (e.g., "an aesthetic viewpoint" versus "the outlook of an aesthetic viewpoint") Correct vague and wordy or clumsy and confusing writing containing sophisticated language
33–36	Determine whether a complex essay has accomplished a specific purpose Add a phrase or sentence to accomplish a complex purpose, often expressed in terms of the main focus of the essay	Consider the need for introductory sentences or transitions, basing decisions on a thorough understanding of both the logic and rhetorical effect of the paragraph and essay	Delete redundant material that involves subtle concepts or that is redundant in terms of the paragraph as a whole

Score Ranges	Table C-1. ACT's College Readiness Standards — English (continued)		
Bench-marks	**Sentence Structure and Formation**	**Conventions of Usage**	**Conventions of Punctuation**
13–15 ***EXPL: 13*** ***PLAN: 15***	Use conjunctions or punctuation to join simple clauses Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences	Solve such basic grammatical problems as how to form the past and past participle of irregular but commonly used verbs and how to form comparative and superlative adjectives	Delete commas that create basic sense problems (e.g., between verb and direct object)
16–19 ***ACT: 18***	Determine the need for punctuation and conjunctions to avoid awkward-sounding sentence fragments and fused sentences Decide the appropriate verb tense and voice by considering the meaning of the entire sentence	Solve such grammatical problems as whether to use an adverb or adjective form, how to ensure straightforward subject-verb and pronoun-antecedent agreement, and which preposition to use in simple contexts Recognize and use the appropriate word in frequently confused pairs such as *there* and *their*, *past* and *passed*, and *led* and *lead*	Provide appropriate punctuation in straightforward situations (e.g., items in a series) Delete commas that disturb the sentence flow (e.g., between modifier and modified element)
20–23	Recognize and correct marked disturbances of sentence flow and structure (e.g., participial phrase fragments, missing or incorrect relative pronouns, dangling or misplaced modifiers)	Use idiomatically appropriate prepositions, especially in combination with verbs (e.g., *long for*, *appeal to*) Ensure that a verb agrees with its subject when there is some text between the two	Use commas to set off simple parenthetical phrases Delete unnecessary commas when an incorrect reading of the sentence suggests a pause that should be punctuated (e.g., between verb and direct object clause)
24–27	Revise to avoid faulty placement of phrases and faulty coordination and subordination of clauses in sentences with subtle structural problems Maintain consistent verb tense and pronoun person on the basis of the preceding clause or sentence	Ensure that a pronoun agrees with its antecedent when the two occur in separate clauses or sentences Identify the correct past and past participle forms of irregular and infrequently used verbs and form present-perfect verbs by using *have* rather than *of*	Use punctuation to set off complex parenthetical phrases Recognize and delete unnecessary commas based on a careful reading of a complicated sentence (e.g., between the elements of a compound subject or compound verb joined by *and*) Use apostrophes to indicate simple possessive nouns Recognize inappropriate uses of colons and semicolons
28–32	Use sentence-combining techniques, effectively avoiding problematic comma splices, run-on sentences, and sentence fragments, especially in sentences containing compound subjects or verbs Maintain a consistent and logical use of verb tense and pronoun person on the basis of information in the paragraph or essay as a whole	Correctly use reflexive pronouns, the possessive pronouns *its* and *your*, and the relative pronouns *who* and *whom* Ensure that a verb agrees with its subject in unusual situations (e.g., when the subject-verb order is inverted or when the subject is an indefinite pronoun)	Use commas to set off a nonessential/nonrestrictive appositive or clause Deal with multiple punctuation problems (e.g., compound sentences containing unnecessary commas and phrases that may or may not be parenthetical) Use an apostrophe to show possession, especially with irregular plural nouns Use a semicolon to indicate a relationship between closely related independent clauses
33–36	Work comfortably with long sentences and complex clausal relationships within sentences, avoiding weak conjunctions between independent clauses and maintaining parallel structure between clauses	Provide idiomatically and contextually appropriate prepositions following verbs in situations involving sophisticated language or ideas Ensure that a verb agrees with its subject when a phrase or clause between the two suggests a different number for the verb	Use a colon to introduce an example or an elaboration

Score Ranges	Table C-2. ACT's College Readiness Standards — Reading	
Bench-marks	**Main Ideas and Author's Approach**	**Supporting Details**
13–15 *EXPL: 15*	Recognize a clear intent of an author or narrator in uncomplicated literary narratives	Locate basic facts (e.g., names, dates, events) clearly stated in a passage
16–19 *PLAN: 17*	Identify a clear main idea or purpose of straightforward paragraphs in uncomplicated literary narratives	Locate simple details at the sentence and paragraph level in uncomplicated passages Recognize a clear function of a part of an uncomplicated passage
20–23 *ACT: 21*	Infer the main idea or purpose of straightforward paragraphs in uncomplicated literary narratives Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in uncomplicated passages	Locate important details in uncomplicated passages Make simple inferences about how details are used in passages
24–27	Identify a clear main idea or purpose of any paragraph or paragraphs in uncomplicated passages Infer the main idea or purpose of straightforward paragraphs in more challenging passages Summarize basic events and ideas in more challenging passages Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in more challenging passages	Locate important details in more challenging passages Locate and interpret minor or subtly stated details in uncomplicated passages Discern which details, though they may appear in different sections throughout a passage, support important points in more challenging passages
28–32	Infer the main idea or purpose of more challenging passages or their paragraphs Summarize events and ideas in virtually any passage Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in virtually any passage	Locate and interpret minor or subtly stated details in more challenging passages Use details from different sections of some complex informational passages to support a specific point or argument
33–36	Identify clear main ideas or purposes of complex passages or their paragraphs	Locate and interpret details in complex passages Understand the function of a part of a passage when the function is subtle or complex

Descriptions of the ACT Reading Passages

Uncomplicated Literary Narratives refers to excerpts from essays, short stories, and novels that tend to use simple language and structure, have a clear purpose and a familiar style, present straightforward interactions between characters, and employ only a limited number of literary devices such as metaphor, simile, or hyperbole.

More Challenging Literary Narratives refers to excerpts from essays, short stories, and novels that tend to make moderate use of figurative language, have a more intricate structure and messages conveyed with some subtlety, and may feature somewhat complex interactions between characters.

Complex Literary Narratives refers to excerpts from essays, short stories, and novels that tend to make generous use of ambiguous language and literary devices, feature complex and subtle interactions between characters, often contain challenging context-dependent vocabulary, and typically contain messages and/or meanings that are not explicit but are embedded in the passage.

Score Ranges	Table C-2. ACT's College Readiness Standards — Reading (continued)		
Bench-marks	**Sequential, Comparative, and Cause-Effect Relationships**	**Meanings of Words**	**Generalizations and Conclusions**
13–15 *EXPL: 15*	Determine when (e.g., first, last, before, after) or if an event occurred in uncomplicated passages Recognize clear cause-effect relationships described within a single sentence in a passage	Understand the implication of a familiar word or phrase and of simple descriptive language	Draw simple generalizations and conclusions about the main characters in uncomplicated literary narratives
16–19 *PLAN: 17*	Identify relationships between main characters in uncomplicated literary narratives Recognize clear cause-effect relationships within a single paragraph in uncomplicated literary narratives	Use context to understand basic figurative language	Draw simple generalizations and conclusions about people, ideas, and so on in uncomplicated passages
20–23 *ACT: 21*	Order simple sequences of events in uncomplicated literary narratives Identify clear relationships between people, ideas, and so on in uncomplicated passages Identify clear cause-effect relationships in uncomplicated passages	Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in uncomplicated passages	Draw generalizations and conclusions about people, ideas, and so on in uncomplicated passages Draw simple generalizations and conclusions using details that support the main points of more challenging passages
24–27	Order sequences of events in uncomplicated passages Understand relationships between people, ideas, and so on in uncomplicated passages Identify clear relationships between characters, ideas, and so on in more challenging literary narratives Understand implied or subtly stated cause-effect relationships in uncomplicated passages Identify clear cause-effect relationships in more challenging passages	Use context to determine the appropriate meaning of virtually any word, phrase, or statement in uncomplicated passages Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in more challenging passages	Draw subtle generalizations and conclusions about characters, ideas, and so on in uncomplicated literary narratives Draw generalizations and conclusions about people, ideas, and so on in more challenging passages
28–32	Order sequences of events in more challenging passages Understand the dynamics between people, ideas, and so on in more challenging passages Understand implied or subtly stated cause-effect relationships in more challenging passages	Determine the appropriate meaning of words, phrases, or statements from figurative or somewhat technical contexts	Use information from one or more sections of a more challenging passage to draw generalizations and conclusions about people, ideas, and so on
33–36	Order sequences of events in complex passages Understand the subtleties in relationships between people, ideas, and so on in virtually any passage Understand implied, subtle, or complex cause-effect relationships in virtually any passage	Determine, even when the language is richly figurative and the vocabulary is difficult, the appropriate meaning of context-dependent words, phrases, or statements in virtually any passage	Draw complex or subtle generalizations and conclusions about people, ideas, and so on, often by synthesizing information from different portions of the passage Understand and generalize about portions of a complex literary narrative

Uncomplicated Informational Passages refers to materials that tend to contain a limited amount of data, address basic concepts using familiar language and conventional organizational patterns, have a clear purpose, and are written to be accessible.

More Challenging Informational Passages refers to materials that tend to present concepts that are not always stated explicitly and that are accompanied or illustrated by more—and more detailed—supporting data, include some difficult context-dependent words, and are written in a somewhat more demanding and less accessible style.

Complex Informational Passages refers to materials that tend to include a sizable amount of data, present difficult concepts that are embedded (not explicit) in the text, use demanding words and phrases whose meaning must be determined from context, and are likely to include intricate explanations of processes or events.

Score Ranges	Table C-3. ACT's College Readiness Standards — Writing*		
	Expressing Judgments	**Focusing on the Topic**	**Developing a Position**
3–4	Show a little understanding of the persuasive purpose of the task but neglect to take or to maintain a position on the issue in the prompt Show limited recognition of the complexity of the issue in the prompt	Maintain a focus on the general topic in the prompt through most of the essay	Offer a little development, with one or two ideas; if examples are given, they are general and may not be clearly relevant; resort often to merely repeating ideas Show little or no movement between general and specific ideas and examples
5–6	Show a basic understanding of the persuasive purpose of the task by taking a position on the issue in the prompt but may not maintain that position Show a little recognition of the complexity of the issue in the prompt by acknowledging, but only briefly describing, a counterargument to the writer's position	Maintain a focus on the general topic in the prompt throughout the essay	Offer limited development of ideas using a few general examples; resort sometimes to merely repeating ideas Show little movement between general and specific ideas and examples
7–8	Show understanding of the persuasive purpose of the task by taking a position on the issue in the prompt Show some recognition of the complexity of the issue in the prompt by • acknowledging counterarguments to the writer's position • providing some response to counter-arguments to the writer's position	Maintain a focus on the general topic in the prompt throughout the essay and attempt a focus on the specific issue in the prompt Present a thesis that establishes focus on the topic	Develop ideas by using some specific reasons, details, and examples Show some movement between general and specific ideas and examples
9–10	Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a broad context for discussion Show recognition of the complexity of the issue in the prompt by • partially evaluating implications and/or complications of the issue, and/or • posing and partially responding to counter-arguments to the writer's position	Maintain a focus on discussion of the specific topic and issue in the prompt throughout the essay Present a thesis that establishes a focus on the writer's position on the issue	Develop most ideas fully, using some specific and relevant reasons, details, and examples Show clear movement between general and specific ideas and examples
11–12	Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a critical context for discussion Show understanding of the complexity of the issue in the prompt by • examining different perspectives, and/or • evaluating implications or complications of the issue, and/or • posing and fully discussing counter-arguments to the writer's position	Maintain a clear focus on discussion of the specific topic and issue in the prompt throughout the essay Present a critical thesis that clearly establishes the focus on the writer's position on the issue	Develop several ideas fully, using specific and relevant reasons, details, and examples Show effective movement between general and specific ideas and examples

*The shaded row in this table shows the minimum level of writing skills needed by students to be ready for college-level writing assignments.

Score Ranges	Table C-3. ACT's College Readiness Standards — Writing* (continued)	
	Organizing Ideas	**Using Language**
3–4	Provide a discernible organization with some logical grouping of ideas in parts of the essay Use a few simple and obvious transitions Present a discernible, though minimally developed, introduction and conclusion	Show limited control of language by • correctly employing some of the conventions of standard English grammar, usage, and mechanics, but with distracting errors that sometimes significantly impede understanding • using simple vocabulary • using simple sentence structure
5–6	Provide a simple organization with logical grouping of ideas in parts of the essay Use some simple and obvious transitional words, though they may at times be inappropriate or misleading Present a discernible, though underdeveloped, introduction and conclusion	Show a basic control of language by • correctly employing some of the conventions of standard English grammar, usage, and mechanics, but with distracting errors that sometimes impede understanding • using simple but appropriate vocabulary • using a little sentence variety, though most sentences are simple in structure
7–8	Provide an adequate but simple organization with logical grouping of ideas in parts of the essay but with little evidence of logical progression of ideas Use some simple and obvious, but appropriate, transitional words and phrases Present a discernible introduction and conclusion with a little development	Show adequate use of language to communicate by • correctly employing many of the conventions of standard English grammar, usage, and mechanics, but with some distracting errors that may occasionally impede understanding • using appropriate vocabulary • using some varied kinds of sentence structures to vary pace
9–10	Provide unity and coherence throughout the essay, sometimes with a logical progression of ideas Use relevant, though at times simple and obvious, transitional words and phrases to convey logical relationships between ideas Present a somewhat developed introduction and conclusion	Show competent use of language to communicate ideas by • correctly employing most conventions of standard English grammar, usage, and mechanics, with a few distracting errors but none that impede understanding • using some precise and varied vocabulary • using several kinds of sentence structures to vary pace and to support meaning
11–12	Provide unity and coherence throughout the essay, often with a logical progression of ideas Use relevant transitional words, phrases, and sentences to convey logical relationships between ideas Present a well-developed introduction and conclusion	Show effective use of language to clearly communicate ideas by • correctly employing most conventions of standard English grammar, usage, and mechanics, with just a few, if any, errors • using precise and varied vocabulary • using a variety of kinds of sentence structures to vary pace and to support meaning

Score Ranges *Bench-marks*	Table C-4. ACT's College Readiness Standards — Mathematics			
	Basic Operations & Applications	**Probability, Statistics, & Data Analysis**	**Numbers: Concepts & Properties**	**Expressions, Equations, & Inequalities**
13–15	Perform one-operation computation with whole numbers and decimals Solve problems in one or two steps using whole numbers Perform common conversions (e.g., inches to feet or hours to minutes)	Calculate the average of a list of positive whole numbers Perform a single computation using information from a table or chart	Recognize equivalent fractions and fractions in lowest terms	Exhibit knowledge of basic expressions (e.g., identify an expression for a total as $b + g$) Solve equations in the form $x + a = b$, where a and b are whole numbers or decimals
16–19 ***EXPL: 17*** ***PLAN: 19***	Solve routine one-step arithmetic problems (using whole numbers, fractions, and decimals) such as single-step percent Solve some routine two-step arithmetic problems	Calculate the average of a list of numbers Calculate the average, given the number of data values and the sum of the data values Read tables and graphs Perform computations on data from tables and graphs Use the relationship between the probability of an event and the probability of its complement	Recognize one-digit factors of a number Identify a digit's place value	Substitute whole numbers for unknown quantities to evaluate expressions Solve one-step equations having integer or decimal answers Combine like terms (e.g., $2x + 5x$)
20–23 ***ACT: 22***	Solve routine two-step or three-step arithmetic problems involving concepts such as rate and proportion, tax added, percentage off, and computing with a given average	Calculate the missing data value, given the average and all data values but one Translate from one representation of data to another (e.g., a bar graph to a circle graph) Determine the probability of a simple event Exhibit knowledge of simple counting techniques	Exhibit knowledge of elementary number concepts including rounding, the ordering of decimals, pattern identification, absolute value, primes, and greatest common factor	Evaluate algebraic expressions by substituting integers for unknown quantities Add and subtract simple algebraic expressions Solve routine first-degree equations Perform straightforward word-to-symbol translations Multiply two binomials
24–27	Solve multistep arithmetic problems that involve planning or converting units of measure (e.g., feet per second to miles per hour)	Calculate the average, given the frequency counts of all the data values Manipulate data from tables and graphs Compute straightforward probabilities for common situations Use Venn diagrams in counting	Find and use the least common multiple Order fractions Work with numerical factors Work with scientific notation Work with squares and square roots of numbers Work problems involving positive integer exponents Work with cubes and cube roots of numbers Determine when an expression is undefined Exhibit some knowledge of the complex numbers	Solve real-world problems using first-degree equations Write expressions, equations, or inequalities with a single variable for common pre-algebra settings (e.g., rate and distance problems and problems that can be solved by using proportions) Identify solutions to simple quadratic equations Add, subtract, and multiply polynomials Factor simple quadratics (e.g., the difference of squares and perfect square trinomials) Solve first-degree inequalities that do not require reversing the inequality sign
28–32	Solve word problems containing several rates, proportions, or percentages	Calculate or use a weighted average Interpret and use information from figures, tables, and graphs Apply counting techniques Compute a probability when the event and/or sample space are not given or obvious	Apply number properties involving prime factorization Apply number properties involving even/odd numbers and factors/multiples Apply number properties involving positive/negative numbers Apply rules of exponents Multiply two complex numbers	Manipulate expressions and equations Write expressions, equations, and inequalities for common algebra settings Solve linear inequalities that require reversing the inequality sign Solve absolute value equations Solve quadratic equations Find solutions to systems of linear equations
33–36	Solve complex arithmetic problems involving percent of increase or decrease and problems requiring integration of several concepts from pre-algebra and/or pre-geometry (e.g., comparing percentages or averages, using several ratios, and finding ratios in geometry settings)	Distinguish between mean, median, and mode for a list of numbers Analyze and draw conclusions based on information from figures, tables, and graphs Exhibit knowledge of conditional and joint probability	Draw conclusions based on number concepts, algebraic properties, and/or relationships between expressions and numbers Exhibit knowledge of logarithms and geometric sequences Apply properties of complex numbers	Write expressions that require planning and/or manipulating to accurately model a situation Write equations and inequalities that require planning, manipulating, and/or solving Solve simple absolute value inequalities

Score Ranges	Table C-4. ACT's College Readiness Standards — Mathematics (continued)			
Bench-marks	**Graphical Representations**	**Properties of Plane Figures**	**Measurement**	**Functions**
13–15	Identify the location of a point with a positive coordinate on the number line		Estimate or calculate the length of a line segment based on other lengths given on a geometric figure	
16–19 *EXPL: 17* *PLAN: 19*	Locate points on the number line and in the first quadrant	Exhibit some knowledge of the angles associated with parallel lines	Compute the perimeter of polygons when all side lengths are given Compute the area of rectangles when whole number dimensions are given	
20–23 *ACT: 22*	Locate points in the coordinate plane Comprehend the concept of length on the number line Exhibit knowledge of slope	Find the measure of an angle using properties of parallel lines Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°)	Compute the area and perimeter of triangles and rectangles in simple problems Use geometric formulas when all necessary information is given	Evaluate quadratic functions, expressed in function notation, at integer values
24–27	Identify the graph of a linear inequality on the number line Determine the slope of a line from points or equations Match linear graphs with their equations Find the midpoint of a line segment	Use several angle properties to find an unknown angle measure Recognize Pythagorean triples Use properties of isosceles triangles	Compute the area of triangles and rectangles when one or more additional simple steps are required Compute the area and circumference of circles after identifying necessary information Compute the perimeter of simple composite geometric figures with unknown side lengths	Evaluate polynomial functions, expressed in function notation, at integer values Express the sine, cosine, and tangent of an angle in a right triangle as a ratio of given side lengths
28–32	Interpret and use information from graphs in the coordinate plane Match number line graphs with solution sets of linear inequalities Use the distance formula Use properties of parallel and perpendicular lines to determine an equation of a line or coordinates of a point Recognize special characteristics of parabolas and circles (e.g., the vertex of a parabola and the center or radius of a circle)	Apply properties of 30°-60°-90°, 45°-45°-90°, similar, and congruent triangles Use the Pythagorean theorem	Use relationships involving area, perimeter, and volume of geometric figures to compute another measure	Evaluate composite functions at integer values Apply basic trigonometric ratios to solve right-triangle problems
33–36	Match number line graphs with solution sets of simple quadratic inequalities Identify characteristics of graphs based on a set of conditions or on a general equation such as $y = ax^2 + c$ Solve problems integrating multiple algebraic and/or geometric concepts Analyze and draw conclusions based on information from graphs in the coordinate plane	Draw conclusions based on a set of conditions Solve multistep geometry problems that involve integrating concepts, planning, visualization, and/or making connections with other content areas Use relationships among angles, arcs, and distances in a circle	Use scale factors to determine the magnitude of a size change Compute the area of composite geometric figures when planning or visualization is required	Write an expression for the composite of two simple functions Use trigonometric concepts and basic identities to solve problems Exhibit knowledge of unit circle trigonometry Match graphs of basic trigonometric functions with their equations

Table C-5. ACT's College Readiness Standards — Science

	Interpretation of Data	Scientific Investigation	Evaluation of Models, Inferences, and Experimental Results
13–15	Select a single piece of data (numerical or nonnumerical) from a simple data presentation (e.g., a table or graph with two or three variables; a food web diagram) Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels)		
16–19	Select two or more pieces of data from a simple data presentation Understand basic scientific terminology Find basic information in a brief body of text Determine how the value of one variable changes as the value of another variable changes in a simple data presentation	Understand the methods and tools used in a simple experiment	
20–23	Select data from a complex data presentation (e.g., a table or graph with more than three variables; a phase diagram) Compare or combine data from a simple data presentation (e.g., order or sum data from a table) Translate information into a table, graph, or diagram	Understand the methods and tools used in a moderately complex experiment Understand a simple experimental design Identify a control in an experiment Identify similarities and differences between experiments	Select a simple hypothesis, prediction, or conclusion that is supported by a data presentation or a model Identify key issues or assumptions in a model
24–27	Compare or combine data from two or more simple data presentations (e.g., categorize data from a table using a scale from another table) Compare or combine data from a complex data presentation Interpolate between data points in a table or graph Determine how the value of one variable changes as the value of another variable changes in a complex data presentation Identify and/or use a simple (e.g., linear) mathematical relationship between data Analyze given information when presented with new, simple information	Understand the methods and tools used in a complex experiment Understand a complex experimental design Predict the results of an additional trial or measurement in an experiment Determine the experimental conditions that would produce specified results	Select a simple hypothesis, prediction, or conclusion that is supported by two or more data presentations or models Determine whether given information supports or contradicts a simple hypothesis or conclusion, and why Identify strengths and weaknesses in one or more models Identify similarities and differences between models Determine which model(s) is(are) supported or weakened by new information Select a data presentation or a model that supports or contradicts a hypothesis, prediction, or conclusion
28–32	Compare or combine data from a simple data presentation with data from a complex data presentation Identify and/or use a complex (e.g., nonlinear) mathematical relationship between data Extrapolate from data points in a table or graph	Determine the hypothesis for an experiment Identify an alternate method for testing a hypothesis	Select a complex hypothesis, prediction, or conclusion that is supported by a data presentation or model Determine whether new information supports or weakens a model, and why Use new information to make a prediction based on a model
33–36	Compare or combine data from two or more complex data presentations Analyze given information when presented with new, complex information	Understand precision and accuracy issues Predict how modifying the design or methods of an experiment will affect results Identify an additional trial or experiment that could be performed to enhance or evaluate experimental results	Select a complex hypothesis, prediction, or conclusion that is supported by two or more data presentations or models Determine whether given information supports or contradicts a complex hypothesis or conclusion, and why

Science College Readiness Standards are measured in the context of science topics students encounter in science courses. These topics may include:

Life Science/Biology	Physical Science/Chemistry, Physics	Earth & Space Science
• Animal behavior • Animal development and growth • Body systems • Cell structure and processes • Ecology • Evolution • Genetics • Homeostasis • Life cycles • Molecular basis of heredity • Origin of life • Photosynthesis • Plant development, growth, structure • Populations • Taxonomy	• Atomic structure • Chemical bonding, equations, nomenclature, reactions • Electrical circuits • Elements, compounds, mixtures • Force and motions • Gravitation • Heat and work • Kinetic and potential energy • Magnetism • Momentum • The Periodic Table • Properties of solutions • Sound and light • States, classes, and properties of matter • Waves	• Earthquakes and volcanoes • Earth's atmosphere • Earth's resources • Fossils and geological time • Geochemical cycles • Groundwater • Lakes, rivers, oceans • Mass movements • Plate tectonics • Rocks, minerals • Solar system • Stars, galaxies, and the universe • Water cycle • Weather and climate • Weathering and erosion