CCSS:Math

Standards for Mathematical Practice

Mathematical Practice 1

Make sense of problems and persevere in solving them.

CCSS:Math

Standards for Mathematical Practice

Mathematical Practice 2

Reason abstractly and quantitatively.

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Standards for Mathematical Practice

Mathematical Practice 3

Construct viable arguments and critique the reasoning of others.

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Mathematical Practice 4

Model with mathematics.

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Standards for Mathematical Practice
Mathematical Practice 5

Use appropriate tools strategically.

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Standards for Mathematical Practice
Mathematical Practice 6

Attend to precision.

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Standards for Mathematical Practice
Mathematical Practice 7

Look for and make use of structure.

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Standards for Mathematical Practice
Mathematical Practice 8

Look for and express regularity in repeated reasoning.

SMP 2

- Make sense of quantities and their relationships.
- Are able to decontextualize (represent a situation symbolically and manipulate the symbols) and contextualize (make meaning of the symbols in a problem) quantitative relationships.
- Understand the meaning of quantities and are flexible in the use of operations and their properties.
- Create a logical representation of the problem.
- Attends to the meaning of quantities, not just how to compute them.

SMP 1

- Interpret and make meaning of the problem looking for starting points. Analyze what is given to explain to themselves the meaning of the problem.
- Plan a solution pathway instead of jumping to a solution.
- Can monitor their progress and change the approach if necessary.
- See relationships between various representations.
- Relate current situations to concepts or skills previously learned and connect mathematical ideas to one another.
- Can understand various approaches to solutions.
- Continually ask themselves: “Does this make sense?”

SMP 4

- Understand this is a way to reason quantitatively and abstractly (able to decontextualize and contextualize).
- Apply the math they know to solve problems in everyday life.
- Are able to simplify a complex problem and identify important quantities to look at relationships.
- Represent mathematics to describe a situation either with an equation or a diagram and interpret the results of a mathematical situation.
- Reflect on whether the results make sense, possibly improving or revising the model.
- Ask themselves, “How can I represent this mathematically?”

SMP 3

- Analyze problems and use stated mathematical assumptions, definitions, and established results in constructing arguments.
- Justify conclusions with mathematical ideas.
- Listen to the arguments of others and ask useful questions to determine if an argument makes sense.
- Ask clarifying questions or suggest ideas to improve/revise the argument.
- Compare two arguments and determine correct or flawed logic.

SMP 6

- Communicate precisely with others and try to use clear mathematical language when discussing their reasoning.
- Understand meanings of symbols used in mathematics and can label quantities appropriately.
- Express numerical answers with a degree of precision appropriate for the problem context.
- Calculate efficiently and accurately.

SMP 5

- Use available tools recognizing the strengths and limitations of each.
- Use estimation and other mathematical knowledge to detect possible errors.
- Identify relevant external mathematical resources to pose and solve problems.
- Use technological tools to deepen their understanding of mathematics.

SMP 8

- See repeated calculations and look for generalizations and shortcuts.
- See the overall process of the problem and still attend to the details.
- Understand the broader application of patterns and seethe structure in similar situations.
- Continually evaluate the reasonableness of their intermediate results.

SMP 7

- Apply general mathematical rules to specific situations.
- Look for the overall structure and patterns in mathematics.
- See complicated things as single objects or as being composed of several objects.

NGSS

Science and Engineering Practices
SEP1

Asking questions (for science) and defining problems (for engineering).

NGSS

Science and Engineering Practices
SEP2

Developing and using models.

NGSS

Science and Engineering Practices
SEP3

Planning and carrying out investigations.

NGSS

Science and Engineering Practices
SEP4

Analyzing and interpreting data.

NGSS

Science and Engineering Practices
SEP5

Using mathematics and computational thinking.

NGSS

Science and Engineering Practices
SEP6

Constructing explanations (for science) and designing solutions (for engineering).

NGSS

Science and Engineering Practices
SEP7

Engaging in argument from evidence.

NGSS

Science and Engineering Practices
SEP8

Obtaining, evaluating, and communicating information.

SEP2

Modeling can begin in the earliest grades, with students' models progressing from concrete "pictures" and/or physical scale models (e.g., a toy car) to more abstract representations of relevant relationships in later grades, such as a diagram representing forces on a particular object in a system. (NRC Framework, 2012, p. 58)

SEP1

Students at any grade level should be able to ask questions of each other about the texts they read, the features of the phenomena they observe, and the conclusions they draw from their models or scientific investigations. For engineering, they should ask questions to define the problem to be solved and to elicit ideas that lead to the constraints and specifications for its solution. (NRC Framework 2012, p. 56)

SEP4

Once collected, data must be presented in a form that can reveal any patterns and relationships and that allows results to be communicated to others. Because raw data as such have little meaning, a major practice of scientists is to organize and interpret data through tabulating, graphing, or statistical analysis. Such analysis can bring out the meaning of data—and their relevance—so that they may be used as evidence.

Engineers, too, make decisions based on evidence that a given design will work; they rarely rely on trial and error. Engineers often analyze a design by creating a model or prototype and collecting extensive data on how it performs, including under extreme conditions. Analysis of this kind of data not only informs design decisions and enables the prediction or assessment of performance but also helps define or clarify problems, determine economic feasibility, evaluate alternatives, and investigate failures. (NRC Framework, 2012, p. 61-62)

SEP3

Students should have opportunities to plan and carry out several different kinds of investigations during their K-12 years. At all levels, they should engage in investigations that range from those structured by the teacher -- in order to expose an issue or question that they would be unlikely to explore on their own (e.g., measuring specific properties of materials) -- to those that emerge from students' own questions. (NRC Framework, 2012, p. 61)

SEP6

“The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories.” (NRC Framework, 2012, p. 52)

“Asking students to demonstrate their own understanding of the implications of a scientific idea by developing their own explanations of phenomena, whether based on observations they have made or models they have developed, engages them in an essential part of the process by which conceptual change can occur.

In engineering, the goal is a design rather than an explanation. The process of developing a design is iterative and systematic, as is the process of developing an explanation or a theory in science. Engineers’ activities, however, have elements that are distinct from those of scientists. These elements include specifying constraints and criteria for desired qualities of the solution, developing a design plan, producing and testing models or prototypes, selecting among alternative design features to optimize the achievement of design criteria, and refining design ideas based on the performance of a prototype or simulation.” (NRC Framework, 2012, p. 68-69)

SEP5

Although there are differences in how mathematics and computational thinking are applied in science and in engineering, mathematics often brings these two fields together by enabling engineers to apply the mathematical form of scientific theories and by enabling scientists to use powerful information technologies designed by engineers. Both kinds of professionals can thereby accomplish investigations and analyses and build complex models, which might otherwise be out of the question. (NRC Framework, 2012, p. 65)

SEP8

Any education in science and engineering needs to develop students’ ability to read and produce domain-specific text. As such, every science or engineering lesson is in part a language lesson, particularly reading and producing the genres of texts that are intrinsic to science and engineering. (NRC Framework, 2012, p. 76)

SEP7

The study of science and engineering should produce a sense of the process of argument necessary for advancing and defending a new idea or an explanation of a phenomenon and the norms for conducting such arguments. In that spirit, students should argue for the explanations they construct, defend their interpretations of the associated data, and advocate for the designs they propose. (NRC Framework, 2012, p. 73)

CCSS:ELA

Habits of Mind

ELA1

Demonstrate independence in reading complex texts, and writing and speaking about them.

CCSS:ELA

Habits of Mind

ELA2

Build a strong base of knowledge through content rich tasks.

CCSS:ELA

Habits of Mind

ELA3

Obtain, synthesize, and report findings clearly and effectively in response to task and purpose.

CCSS:ELA

Habits of Mind

ELA4

Construct arguments and critique reasoning based on evidence.

CCSS:ELA

Habits of Mind

ELA5

Read, write, and speak grounded in evidence.

CCSS:ELA

Habits of Mind

ELA6

Use technology and digital media strategically and capably.

CCSS:ELA

Habits of Mind

ELA7

Come to understand other perspectives and cultures through reading, listening, and collaborations.

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ELA2

Students establish a base of knowledge across a wide range of subject matter by engaging with works of quality and substance. They become proficient in new areas through research and study. They read purposefully and listen attentively to gain both general knowledge and discipline-specific expertise. They refine and share their knowledge through writing and speaking.

ELA1

Without significant scaffolding, students can comprehend and evaluate complex texts across a range of types and disciplines, and they can construct effective arguments and convey intricate or multifaceted information. Likewise, students are able independently to discern a speaker's key points, request clarification, and ask relevant questions. They build on others' ideas, articulate their own ideas, and confirm they have been understood. Without prompting, they demonstrate command of standard English and acquire and use a wide-ranging vocabulary. More broadly, they become self-directed learners, effectively seeking out and using resources to assist them, including teachers, peers, and print and digital reference materials.

ELA4

Students are engaged and open-minded -- but discerning -- readers and listeners. They work diligently to understand precisely what an author or speaker is saying, but they also question an author's or speaker's assumptions and premises and assess the veracity of claims and the soundness of reasoning.

ELA3

Students adapt their communication in relation to audience, task, purpose, and discipline. They set and adjust purpose for reading, writing, speaking, listening, and language use as warranted by the task. They appreciate nuances, such as how the composition of an audience should affect tone when speaking and how the connotations of words affect meaning. They also know that different disciplines call for different types of evidence (e.g., documentary evidence in history, experimental evidence in science).

ELA6

Students employ technology thoughtfully to enhance their reading, writing, speaking, listening, and language use. They tailor their searches online to acquire useful information efficiently, and they integrate what they learn using technology with what they learn offline. They are familiar with the strengths and limitations of various technological tools and mediums and can select and use those best suited to their communication goals.

ELA5

Students cite specific evidence when offering an oral or written interpretation of a text. They use relevant evidence when supporting their own points in writing and speaking, making their reasoning clear to the reader or listener, and they constructively evaluate others' use of evidence.

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ELA7

Students appreciate that the twenty-first-century classroom and workplace are settings in which people from often widely divergent cultures and who represent diverse experiences and perspectives must learn and work together. Students actively seek to understand other perspectives and cultures through reading and listening, and they are able to communicate effectively with people of varied backgrounds. They evaluate other points of view critically and constructively. Through reading great classic and contemporary works of literature representative of a variety of periods, cultures, and worldviews, students can vicariously inhabit worlds and have experiences much different than their own.