

PLTW Gateway

Automation and Robotics | Unit Outline

Learn how creative thinking and problem solving can change your world!

Build, program, and exercise creative problem solving to innovate and design automated solution prototypes for various users.

Students explore robotics and automation as they take on the role of interns, and work in teams to create prototypes to meet the needs of clients. They build and analyze mechanical systems and automate them with programmed input and output devices.

Automation and Robotics Lesson Summary

Lesson 1	Automating Mechanisms
Lesson 2	Sensors and Systems
Lesson 3	Create and Automate

Lesson 1: Automating Mechanisms

Students explore how gear trains and other mechanisms transfer movement in mechanical systems and design, build, and program automated systems to meet the needs of clients. In the end-of-lesson project, students can choose to design an interactive device to keep pets physically and mentally active, a spinning street sign to warn drivers to slow down and stop, or a high-speed dragster.

Lesson 2: Sensors and Systems

Students investigate the versatility of an optical sensor as a programmed input device. Students extend their knowledge of mechanisms as they design increasingly complex prototypes to serve the needs of users. In the end-of-lesson project, students connect inputs to outputs through programming to create effective solutions that help their communities.

Lesson 3: Create and Automate

Students design solutions using an automated mechanical system and the programming necessary for communication between the sensors, motors, and building components. Students pick their own problems or select problems that highlight their creativity and are of service to others. Throughout the unit students reflect on their growing skills and interests and explore careers in the field.

PLTW Gateway Standards Connection

Design and Modeling



Connections to Standards in PLTW Gateway

PLTW curriculum is designed to empower students to thrive in an evolving world. As a part of the design process when developing and updating our curriculum, we focus on connections to a variety of standards. PLTW Design and Modeling connects to standards in the following:

Table of Contents

Next Generation Science Standards	Page 2
College and Career Readiness Anchor Standards for Reading	Page 5
Common Core State Standards for English Language Arts 6–8 Literacy Standards for History/Social Studies, Science, and Technical Subjects	Page 8
Common Core State Standards for English Language Arts 6th Grade	Page 10
Common Core State Standards for English Language Arts 7th Grade	Page 14
Common Core State Standards for English Language Arts 8th Grade	Page 17
Common Core State Standards for Mathematics 6th Grade	Page 20
Common Core State Standards for Mathematics 7th Grade	Page 25
Common Core State Standards for Mathematics 8th Grade	Page 28
Standards for Technological and Engineering Literacy	Page 29

Engineering Design

NGSS.MS-ETS1-1

Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

NGSS.MS-ETS1-2

Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1
-

Science and Engineering Practices

Asking Questions and Defining Problems

NGSS.P1

Asking questions and defining problems in 6-8 builds on K-5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

NGSS.P1

• to clarify and/or refine a model, an explanation, or an engineering problem.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Asking Questions and Defining Problems - Define a design problem

NGSS.P1

• that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Next Generation Science Standards

Developing and Using Models

NGSS.P2

Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

NGSS.P2

• Evaluate limitations of a model for a proposed object or tool.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

NGSS.P2

• Develop or modify a model - based on evidence - to match what happens if a variable or component of a system is changed.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Using Mathematics and Computational Thinking

NGSS.P5

Use mathematical representations to describe and/or support scientific conclusions and design solutions.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Constructing Explanations and Designing Solutions

NGSS.P6

Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Next Generation Science Standards

NGSS.P6

- Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

NGSS.P6

- Optimize performance of a design by prioritizing criteria, making tradeoffs, testing, revising, and retesting.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

NGSS.P7

- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Obtaining, Evaluating, and Communicating Information

NGSS.P8

- Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

College and Career Readiness Anchor Standards for Reading

© Copyright 2010 National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved.

Reading

Key Ideas and Details

CCSS.ELA-LITERACY.CCRA.R.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.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.CCRA.R.10

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

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Writing

Text Types and Purposes

CCSS.ELA-LITERACY.CCRA.W.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.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.CCRA.W.4

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Speaking and Listening

Comprehension and Collaboration

CCSS.ELA-LITERACY.CCRA.SL.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.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.CCRA.SL.2

Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.CCRA.SL.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.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.CCRA.SL.5

Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.CCRA.SL.6

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

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Language

Vocabulary Acquisition and Use

CCSS.ELA-LITERACY.CCRA.L.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.

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

CCSS.ELA-LITERACY.CCRA.L.5

Demonstrate understanding of word relationships and nuances in word meanings.

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

CCSS.ELA-LITERACY.CCRA.L.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.

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

Common Core State Standards for English Language Arts 6–8 Literacy Standards for History/Social Studies, Science, and Technical Subjects

© Copyright 2010 National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved.

Reading Science/Technical

Key Ideas and Details

CCSS.ELA-LITERACY.RST.6-8.2

Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.RST.6-8.3

Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Craft and Structure

CCSS.ELA-LITERACY.RST.6-8.4

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.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Range of Reading and Level of Text Complexity

CCSS.ELA-LITERACY.RST.6-8.10

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

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Writing in Hisotry/social Studies, Science, and Technical Subjects

Text Types and Purposes

CCSS.ELA-LITERACY.WHST.6-8.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.WHST.6-8.2.d

Use precise language and domain-specific vocabulary to inform about or explain the topic.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Production and Distribution of Writing

CCSS.ELA-LITERACY.WHST.6-8.4

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.WHST.6-8.9

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

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Reading Informational

Key Ideas and Details

CCSS.ELA-LITERACY.RI.6.2

Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Craft and Structure

CCSS.ELA-LITERACY.RI.6.4

Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Writing

Text Types and Purposes

CCSS.ELA-LITERACY.W.6.2.d

Use precise language and domain-specific vocabulary to inform about or explain the topic.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.W.6.3.d

Use precise words and phrases, relevant descriptive details, and sensory language to convey experiences and events.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Common Core State Standards for English Language Arts 6th Grade

Production and Distribution of Writing

CCSS.ELA-LITERACY.W.6.4

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3.)

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.W.6.9

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

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

Speaking and Listening

Comprehension and Collaboration

CCSS.ELA-LITERACY.SL.6.1

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

CCSS.ELA-LITERACY.SL.6.1.a

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

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

Common Core State Standards for English Language Arts 6th Grade

CCSS.ELA-LITERACY.SL.6.1.b

Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.SL.6.1.c

Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.SL.6.2

Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Presentation of Knowledge and Ideas

CCSS.ELA-LITERACY.SL.6.5

Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.SL.6.6

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

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Language

Vocabulary Acquisition and Use

CCSS.ELA-LITERACY.L.6.4

Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 6 reading and content, choosing flexibly from a range of strategies.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.L.6.6

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.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Common Core State Standards for English Language Arts 7th Grade

© Copyright 2010 National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved.

Reading Literature

Key Ideas and Details

CCSS.ELA-LITERACY.RL.7.1

Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Writing

Text Types and Purposes

CCSS.ELA-LITERACY.W.7.2.d

Use precise language and domain-specific vocabulary to inform about or explain the topic.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.W.7.3.d

Use precise words and phrases, relevant descriptive details, and sensory language to capture the action and convey experiences and events.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Production and Distribution of Writing

CCSS.ELA-LITERACY.W.7.4

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 7.w.1–3)

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Speaking and Listening

Comprehension and Collaboration

CCSS.ELA-LITERACY.SL.7.1

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.ELA-LITERACY.SL.7.1.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.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.ELA-LITERACY.SL.7.1.b

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

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.ELA-LITERACY.SL.7.1.c

Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.ELA-LITERACY.SL.7.1.d

Acknowledge new information expressed by others and, when warranted, modify their own views.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Common Core State Standards for English Language Arts 7th Grade

Presentation of Knowledge and Ideas

CCSS.ELA-LITERACY.SL.7.5

Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.ELA-LITERACY.SL.7.6

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

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Language

Knowledge of Language

CCSS.ELA-LITERACY.L.7.3.a

Choose language that expresses ideas precisely and concisely, recognizing and eliminating wordiness and redundancy.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Vocabulary Acquisition and Use

CCSS.ELA-LITERACY.L.7.4

Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 7 reading and content, choosing flexibly from a range of strategies.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.ELA-LITERACY.L.7.6

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.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Writing

Text Types and Purposes

CCSS.ELA-LITERACY.W.8.2.d

Use precise language and domain-specific vocabulary to inform about or explain the topic.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.ELA-LITERACY.W.8.3.d

Use precise words and phrases, relevant descriptive details, and sensory language to capture the action and convey experiences and events.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Production and Distribution of Writing

CCSS.ELA-LITERACY.W.8.4

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3.)

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.W.8.9

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

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Speaking and Listening

Comprehension and Collaboration

CCSS.ELA-LITERACY.SL.8.1

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.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.ELA-LITERACY.SL.8.1.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.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.ELA-LITERACY.SL.8.1.b

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

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.ELA-LITERACY.SL.8.1.d

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

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Presentation of Knowledge and Ideas

CCSS.ELA-LITERACY.SL.8.5

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

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Language

Vocabulary Acquisition and Use

CCSS.ELA-LITERACY.L.8.6

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.

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

Common Core State Standards for Mathematics 6th Grade

© Copyright 2010 National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved.

Ratios And Proportional Relationships

Understand Ratio Concepts And Use Ratio Reasoning To Solve Problems.

CCSS.MATH.CONTENT.6.RP.A.3

Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.MATH.CONTENT.6.RP.A.3.b

Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.MATH.CONTENT.6.RP.A.3.d

Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

The Number System

Apply And Extend Previous Understandings Of Multiplication And Division To Divide Fractions By Fractions.

CCSS.MATH.CONTENT.6.NS.A.1

Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for $(2/3) \div (3/4)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $(2/3) \div (3/4) = 8/9$ because $3/4$ of $8/9$ is $2/3$. (In general, $(a/b) \div (c/d) = ad/bc$.) How much chocolate will each person get if 3 people share $1/2$ lb of chocolate equally? How many $3/4$ -cup servings are in $2/3$ of a cup of yogurt? How wide is a rectangular strip of land with length $3/4$ mi and area $1/2$ square mi?

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Common Core State Standards for Mathematics 6th Grade

CCSS.MATH.CONTENT.6.NS.B.2

Fluently divide multi-digit numbers using the standard algorithm.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.MATH.CONTENT.6.NS.B.3

Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Apply And Extend Previous Understandings Of Numbers To The System Of Rational Numbers.

CCSS.MATH.CONTENT.6.NS.C.6

Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.MATH.CONTENT.6.NS.C.6.a

Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$, and that 0 is its own opposite.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.MATH.CONTENT.6.NS.C.6.b

Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Common Core State Standards for Mathematics 6th Grade

CCSS.MATH.CONTENT.6.NS.C.6.c

Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.MATH.CONTENT.6.NS.C.8

Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Geometry

Solve Real-World And Mathematical Problems Involving Area, Surface Area, And Volume.

CCSS.MATH.CONTENT.6.G.A.1

Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.MATH.CONTENT.6.G.A.2

Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l w h$ and $V = b h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Common Core State Standards for Mathematics 6th Grade

CCSS.MATH.CONTENT.6.G.A.3

Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

CCSS.MATH.CONTENT.6.G.A.4

Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

Statistics And Probability

Develop Understanding Of Statistical Variability.

CCSS.MATH.CONTENT.6.SP.A.1

Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, “How old am I?” is not a statistical question, but “How old are the students in my school?” is a statistical question because one anticipates variability in students’ ages.

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

CCSS.MATH.CONTENT.6.SP.A.2

Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

CCSS.MATH.CONTENT.6.SP.A.3

Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

Common Core State Standards for Mathematics 6th Grade

Summarize And Describe Distributions.

CCSS.MATH.CONTENT.6.SP.B.4

Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.MATH.CONTENT.6.SP.B.5

Summarize numerical data sets in relation to their context.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.MATH.CONTENT.6.SP.B.5.a

Reporting the number of observations.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.MATH.CONTENT.6.SP.B.5.b

Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.MATH.CONTENT.6.SP.B.5.c

Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.MATH.CONTENT.6.SP.B.5.d

Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Common Core State Standards for Mathematics 7th Grade

© Copyright 2010 National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved.

The Number System

Apply And Extend Previous Understandings Of Operations With Fractions To Add, Subtract, Multiply, And Divide Rational Numbers.

CCSS.MATH.CONTENT.7.NS.A.3

Solve real-world and mathematical problems involving the four operations with rational numbers.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Geometry

Draw, Construct, And Describe Geometrical Figures And Describe The Relationships Between Them.

CCSS.MATH.CONTENT.7.G.A.1

Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.MATH.CONTENT.7.G.A.2

Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

CCSS.MATH.CONTENT.7.G.A.3

Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Common Core State Standards for Mathematics 7th Grade

Solve Real-Life And Mathematical Problems Involving Angle Measure, Area, Surface Area, And Volume.

CCSS.MATH.CONTENT.7.G.B.4

Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

CCSS.MATH.CONTENT.7.G.B.6

Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Statistics And Probability

Draw Informal Comparative Inferences About Two Populations.

CCSS.MATH.CONTENT.7.SP.B.4

Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Investigate Chance Processes And Develop, Use, And Evaluate Probability Models.

CCSS.MATH.CONTENT.7.SP.C.8

Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

- 1.1 1.2 1.3 1.4 1.5 1.6
 2.1 2.2 2.3 2.4
 3.1

Common Core State Standards for Mathematics 7th Grade

CCSS.MATH.CONTENT.7.SP.C.8.b

Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.

- 1.1 1.2 1.3 1.4 1.5 1.6
- 2.1 2.2 2.3 2.4
- 3.1

Geometry

Understand Congruence And Similarity Using Physical Models, Transparencies, Or Geometry Software.

CCSS.MATH.CONTENT.8.G.A.1

Verify experimentally the properties of rotations, reflections, and translations.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Solve Real-World And Mathematical Problems Involving Volume Of Cylinders, Cones, And Spheres.

CCSS.MATH.CONTENT.8.G.C.9

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

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Nature and Characteristics of Technology and Engineering

STEL-1J

Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

STEL-1M

Apply creative problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Design in Technology and Engineering Education

STEL-7Q

Apply the technology and engineering design process.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

STEL-7R

Refine design solutions to address criteria and constraints.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

STEL-7U

Evaluate the strengths and weaknesses of different design solutions.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Standards for Technological and Engineering Literacy

STEL-7V

Improve essential skills necessary to successfully design.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

Applying, Maintaining, and Assessing Technological Products and Systems

STEL-8L

Interpret the accuracy of information collected.

1.1 1.2 1.3 1.4 1.5 1.6

2.1 2.2 2.3 2.4

3.1

References

Computer Science Teachers Association. (2019). *CSTA K-12 CS Standards. Revised 2017*. Retrieved from <http://www.csteachers.org/standards>

International Technology and Engineering Educators Association. (2020). *Standards for technological and engineering literacy: The role of technology and engineering in STEM education*. Retrieved from <https://www.iteea.org/STEL.aspx>

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common Core State Standards*. Washington, DC: National Governors Association Center for Best Practices, Council of Chief State School Officers. Retrieved from <http://www.corestandards.org/read-the-standards/>

Next Generation Science Standards: For States, By States. (2019). *Read the Standards*. Retrieved from <https://www.nextgenscience.org/search-standards>