

Main Criteria: Forward Education
Secondary Criteria: Connecticut State Standards
Subjects: Mathematics, Science, Technology Education
Grades: 11, 12, Key Stage 4

Forward Education

Autonomous Electric Vehicles of the Future

Connecticut State Standards
Mathematics
Grade 11 - Adopted: 2010

DOMAIN / CONTENT STANDARD	CT.CC.M.P.	Mathematical Practices
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STATE FRAMEWORK	MP-1.	Make sense of problems and persevere in solving them.
STATE FRAMEWORK	MP-2.	Reason abstractly and quantitatively.
STATE FRAMEWORK	MP-3.	Construct viable arguments and critique the reasoning of others.
STATE FRAMEWORK	MP-4.	Model with mathematics.
STATE FRAMEWORK	MP-8.	Look for and express regularity in repeated reasoning.

DOMAIN / CONTENT STANDARD	CT.CC.A.	Algebra
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STATE FRAMEWORK	A-CED.	Creating Equations
GRADE LEVEL EXPECTATION		Create equations that describe numbers or relationships.

INDICATOR	A-CED.2.	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
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DOMAIN / CONTENT STANDARD	CT.CC.A.	Algebra
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STATE FRAMEWORK	A-REI.	Reasoning with Equations and Inequalities
GRADE LEVEL EXPECTATION		Understand solving equations as a process of reasoning and explain the reasoning.

INDICATOR	A-REI.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.
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DOMAIN / CONTENT STANDARD	CT.CC.F.	Functions
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STATE FRAMEWORK	F-IF.	Interpreting Functions
GRADE LEVEL EXPECTATION		Analyze functions using different representations.
INDICATOR	F-IF.7.	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

INDICATOR F-IF.7(a) Graph linear and quadratic functions and show intercepts, maxima, and minima.

DOMAIN / CONTENT STANDARD	CT.CC.F.	Functions
STATE FRAMEWORK	F-LE.	Linear, Quadratic, & Exponential Models
GRADE LEVEL EXPECTATION		Construct and compare linear and exponential models and solve problems.
INDICATOR	F-LE.1.	Distinguish between situations that can be modeled with linear functions and with exponential functions.

INDICATOR F-LE.1(a) Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

DOMAIN / CONTENT STANDARD	CT.CC.G.	Geometry
STATE FRAMEWORK	G-GPE.	Expressing Geometric Properties with Equations
GRADE LEVEL EXPECTATION		Use coordinates to prove simple geometric theorems algebraically

INDICATOR G-GPE.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).

**Connecticut State Standards
Mathematics
Grade 12 - Adopted: 2010**

DOMAIN / CONTENT STANDARD	CT.CC.M.P.	Mathematical Practices
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STATE FRAMEWORK MP-1. Make sense of problems and persevere in solving them.

STATE FRAMEWORK MP-2. Reason abstractly and quantitatively.

STATE FRAMEWORK MP-3. Construct viable arguments and critique the reasoning of others.

STATE FRAMEWORK MP-4. Model with mathematics.

STATE FRAMEWORK MP-8. Look for and express regularity in repeated reasoning.

DOMAIN / CONTENT STANDARD	CT.CC.A.	Algebra
STATE FRAMEWORK	A-CED.	Creating Equations
GRADE LEVEL EXPECTATION		Create equations that describe numbers or relationships.

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

DOMAIN / CONTENT STANDARD	CT.CC.A.	Algebra
STATE FRAMEWORK	A-REI.	Reasoning with Equations and Inequalities
GRADE LEVEL EXPECTATION		Understand solving equations as a process of reasoning and explain the reasoning.

INDICATOR A-REI.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.

DOMAIN / CONTENT STANDARD	CT.CC.F.	Functions
STATE FRAMEWORK	F-IF.	Interpreting Functions
GRADE LEVEL EXPECTATION		Analyze functions using different representations.

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

INDICATOR F-IF.7(a) Graph linear and quadratic functions and show intercepts, maxima, and minima.

DOMAIN / CONTENT STANDARD	CT.CC.F.	Functions
STATE FRAMEWORK	F-LE.	Linear, Quadratic, & Exponential Models
GRADE LEVEL EXPECTATION		Construct and compare linear and exponential models and solve problems.

INDICATOR F-LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

INDICATOR F-LE.1(a) Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

DOMAIN / CONTENT STANDARD	CT.CC.G.	Geometry
STATE FRAMEWORK	G-GPE.	Expressing Geometric Properties with Equations
GRADE LEVEL EXPECTATION		Use coordinates to prove simple geometric theorems algebraically

INDICATOR	G-GPE.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).
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Connecticut State Standards

Science

Grade 11 - Adopted: 2015

DOMAIN / CONTENT STANDARD	NGSS.HS-PS.	PHYSICAL SCIENCE
STATE FRAMEWORK	HS-PS1.	Matter and Its Interactions
GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:

INDICATOR	HS-PS1-4.	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
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DOMAIN / CONTENT STANDARD	NGSS.HS-PS.	PHYSICAL SCIENCE
STATE FRAMEWORK	HS-PS3.	Energy
GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:

INDICATOR	HS-PS3-3.	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
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DOMAIN / CONTENT STANDARD	NGSS.HS-PS.	PHYSICAL SCIENCE
STATE FRAMEWORK	HS-PS4.	Waves and Their Applications in Technologies for Information Transfer
GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:

INDICATOR	HS-PS4-2.	Evaluate questions about the advantages of using a digital transmission and storage of information.
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DOMAIN / CONTENT STANDARD	NGSS.HS-LS.	LIFE SCIENCE
STATE FRAMEWORK	HS-LS2.	Ecosystems: Interactions, Energy, and Dynamics
GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:

INDICATOR	HS-LS2-7.	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
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DOMAIN / CONTENT STANDARD	NGSS.HS-ESS.	EARTH AND SPACE SCIENCE
STATE FRAMEWORK	HS-ESS2.	Earth's Systems

GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:
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INDICATOR HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

DOMAIN / CONTENT STANDARD	NGSS.HS-ESS.	EARTH AND SPACE SCIENCE
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STATE FRAMEWORK	HS-ESS3.	Earth and Human Activity
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GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:
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INDICATOR HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

INDICATOR HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

INDICATOR HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

INDICATOR HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

INDICATOR HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

DOMAIN / CONTENT STANDARD	NGSS.HS-ETS.	ENGINEERING DESIGN
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STATE FRAMEWORK	HS-ETS1.	Engineering Design
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GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:
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INDICATOR HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

INDICATOR HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

INDICATOR HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Connecticut State Standards

Science

Grade 12 - Adopted: 2015

DOMAIN / CONTENT STANDARD	NGSS.HS-PS.	PHYSICAL SCIENCE
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STATE FRAMEWORK	HS-PS1.	Matter and Its Interactions
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GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:
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INDICATOR HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

DOMAIN / CONTENT STANDARD	NGSS.HS-PS.	PHYSICAL SCIENCE
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STATE FRAMEWORK	HS-PS3.	Energy
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GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:
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INDICATOR HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

DOMAIN / CONTENT STANDARD	NGSS.HS-PS.	PHYSICAL SCIENCE
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STATE FRAMEWORK	HS-PS4.	Waves and Their Applications in Technologies for Information Transfer
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GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:
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INDICATOR HS-PS4-2. Evaluate questions about the advantages of using a digital transmission and storage of information.

DOMAIN / CONTENT STANDARD	NGSS.HS-LS.	LIFE SCIENCE
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STATE FRAMEWORK	HS-LS2.	Ecosystems: Interactions, Energy, and Dynamics
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GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:
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INDICATOR HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

DOMAIN / CONTENT STANDARD	NGSS.HS-ESS.	EARTH AND SPACE SCIENCE
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STATE FRAMEWORK	HS-ESS2.	Earth's Systems
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GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:
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INDICATOR HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

DOMAIN / CONTENT STANDARD	NGSS.HS-ESS.	EARTH AND SPACE SCIENCE
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STATE FRAMEWORK	HS-ESS3.	Earth and Human Activity
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GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:
INDICATOR	HS-ESS3-1.	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
INDICATOR	HS-ESS3-2.	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
INDICATOR	HS-ESS3-3.	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
INDICATOR	HS-ESS3-4.	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
INDICATOR	HS-ESS3-6.	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

DOMAIN / CONTENT STANDARD	NGSS.HS-ETS.	ENGINEERING DESIGN
STATE FRAMEWORK	HS-ETS1.	Engineering Design
GRADE LEVEL EXPECTATION		Students who demonstrate understanding can:

INDICATOR	HS-ETS1-1.	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
INDICATOR	HS-ETS1-2.	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
INDICATOR	HS-ETS1-3.	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

**Connecticut State Standards
Technology Education
Grade 11 - Adopted: 2017**

DOMAIN / CONTENT STANDARD		CSTA K-12 Computer Science Standards
STATE FRAMEWORK	CSTA.3 B.	Level 3B (Ages 17-18)
GRADE LEVEL EXPECTATION	3B-AP.	Algorithms & Programming

INDICATOR		Algorithms
INDICATOR	3B-AP-09.	Implement an artificial intelligence algorithm to play a game against a human opponent or solve a problem. (P5.3)
INDICATOR	3B-AP-10.	Use and adapt classic algorithms to solve computational problems. (P4.2)

DOMAIN / CONTENT STANDARD		CSTA K-12 Computer Science Standards
STATE FRAMEWORK	CSTA.3 B.	Level 3B (Ages 17-18)
GRADE LEVEL EXPECTATION	3B-AP.	Algorithms & Programming
INDICATOR		Modularity

INDICATOR 3B-AP-14. Construct solutions to problems using student-created components, such as procedures, modules and/or objects. (P5.2)

DOMAIN / CONTENT STANDARD		CSTA K-12 Computer Science Standards
STATE FRAMEWORK	CSTA.3 B.	Level 3B (Ages 17-18)
GRADE LEVEL EXPECTATION	3B-AP.	Algorithms & Programming
INDICATOR		Program Development

INDICATOR 3B-AP-17. Plan and develop programs for broad audiences using a software life cycle process. (P5.1)

Grade 11 - Adopted: 2016

DOMAIN / CONTENT STANDARD		ISTE for Students (ISTE-S)
STATE FRAMEWORK	CO.IST E-S.3.	Knowledge Constructors: Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others.

GRADE LEVEL EXPECTATION ISTE-S.3.d. Build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.

DOMAIN / CONTENT STANDARD		ISTE for Students (ISTE-S)
STATE FRAMEWORK	CO.IST E-S.4.	Innovative Designers: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.

GRADE LEVEL EXPECTATION ISTE-S.4.a. Know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.

GRADE LEVEL EXPECTATION ISTE-S.4.b. Select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.

DOMAIN / CONTENT STANDARD		ISTE for Students (ISTE-S)
STATE FRAMEWORK	CO.IST E-S.5.	Computational Thinkers: Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.

GRADE LEVEL EXPECTATION ISTE-S.5.a. Formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models, and algorithmic thinking in exploring and finding solutions.

GRADE LEVEL EXPECTATION	ISTE-S.5.b.	Collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.
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GRADE LEVEL EXPECTATION	ISTE-S.5.d.	Understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.
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**Connecticut State Standards
Technology Education
Grade 12 - Adopted: 2017**

DOMAIN / CONTENT STANDARD		CSTA K-12 Computer Science Standards
STATE FRAMEWORK	CSTA.3 B.	Level 3B (Ages 17-18)
GRADE LEVEL EXPECTATION	3B-AP.	Algorithms & Programming
INDICATOR		Algorithms

INDICATOR	3B-AP-09.	Implement an artificial intelligence algorithm to play a game against a human opponent or solve a problem. (P5.3)
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INDICATOR	3B-AP-10.	Use and adapt classic algorithms to solve computational problems. (P4.2)
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DOMAIN / CONTENT STANDARD		CSTA K-12 Computer Science Standards
STATE FRAMEWORK	CSTA.3 B.	Level 3B (Ages 17-18)
GRADE LEVEL EXPECTATION	3B-AP.	Algorithms & Programming
INDICATOR		Modularity

INDICATOR	3B-AP-14.	Construct solutions to problems using student-created components, such as procedures, modules and/or objects. (P5.2)
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DOMAIN / CONTENT STANDARD		CSTA K-12 Computer Science Standards
STATE FRAMEWORK	CSTA.3 B.	Level 3B (Ages 17-18)
GRADE LEVEL EXPECTATION	3B-AP.	Algorithms & Programming
INDICATOR		Program Development

INDICATOR	3B-AP-17.	Plan and develop programs for broad audiences using a software life cycle process. (P5.1)
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Grade 12 - Adopted: 2016

DOMAIN / CONTENT STANDARD		ISTE for Students (ISTE-S)
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STATE FRAMEWORK	CO.IST E-S.3.	Knowledge Constructors: Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others.
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GRADE LEVEL EXPECTATION	ISTE-S.3.d.	Build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.
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DOMAIN / CONTENT STANDARD		ISTE for Students (ISTE-S)
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STATE FRAMEWORK	CO.IST E-S.4.	Innovative Designers: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.
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GRADE LEVEL EXPECTATION	ISTE-S.4.a.	Know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.
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GRADE LEVEL EXPECTATION	ISTE-S.4.b.	Select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.
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DOMAIN / CONTENT STANDARD		ISTE for Students (ISTE-S)
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STATE FRAMEWORK	CO.IST E-S.5.	Computational Thinkers: Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.
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GRADE LEVEL EXPECTATION	ISTE-S.5.a.	Formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models, and algorithmic thinking in exploring and finding solutions.
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GRADE LEVEL EXPECTATION	ISTE-S.5.b.	Collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.
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GRADE LEVEL EXPECTATION	ISTE-S.5.d.	Understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.
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