
Radius

MATH &
CODING

Curriculum Guide

Radius – Math and Coding™

While today's teens are surrounded by technology, we face a stark and imminent shortage of graduates pursuing careers in **Science, Technology, Engineering, and Math (STEM)** related fields. In fact, data shows that U.S. students are falling behind their global peers in these technical skills – and in their likelihood of pursuing STEM careers.

EverFi, Inc.'s latest digital learning platform, **Radius – Math & Coding™**, is a 10-hour, 16-module online curriculum that addresses these challenges by:

- Providing students with foundations of Science, Technology, Engineering and Math
- Teaching students basic fundamentals of computer science and coding
- Sparking student interest in STEM careers – and providing them with the educational foundation they need to pursue them

Radius immerses middle and high school students in a **stimulating learning environment** where they assume a secret agent identity and are responsible for delivering a package to the president.

Along the way, students will **learn and apply math skills to solve real-world challenges**, such as repairing a bridge using linear equations and decoding encrypted messages. Each mission includes basic coding and HTML exercises that build upon one another.

Upon completing each module, **students are assessed in their new skill areas and exposed to a variety of potential career opportunities** that leverage the lessons the student has just learned.

- Designed for a **1:1 student computer experience**. Each student has a unique username and password and proceeds through the online course individually.
- **16 modules**, each 30-45 minutes long. Cumulative course time is estimated to be between **8 to 10 hours** of computer seat time.
- **Maps to key math Common Core** standards, as well as to select ELA common core standards.
- **Modules generally structured as follows:**
 - Explanation/learning of new concepts
 - Hands-on activity to reinforce the new concepts
 - Matching/recognition activity
 - Computer science lesson to reinforce how to automate the concept
 - Assessment
 - Presentation of relevant STEM careers

- Features elements of computer science while teaching **students to be “makers” and to practice algorithmic thinking.**
- Throughout the course, the students will also **develop an online learning journal using HTML**, detailing what they have learned. The students’ amassed online journals comprise an **ePortfolio**, the final deliverable at the end of the course (and the “package” they deliver to the President).
- The ePortfolio also contains relevant information such as tailored **STEM careers** that are likely of interest to the student, based on their work on the course, and **digital achievement badges** earned throughout the platform.

Common Core State Standards Reinforced Within *Radius*:

- 1) **Mathematics Grade 8.** Specific standards are listed throughout this document with the associated *Radius* learning modules.
- 2) Literacy in History/Social Studies, Science and Technical Subjects 6-10.

2.1) Reading Standards for Literacy in Science and Technical Subjects 6-10

- Key Ideas and Details
 - **Grades 6-8: CCSS.ELA-Literacy.RST.6-8.3** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
 - **Grades 9-10: CCSS.ELA-Literacy.RST.9-10.3** 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
 - **Grades 6-8: 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.
 - **Grades 9-10: CCSS.ELA-Literacy.RST.9-10.4** 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.
- Integration of Knowledge and Ideas
 - **Grades 6-8: CCSS.ELA-Literacy.RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

2.2) Writing Standards for Literacy in Science and Technical Subjects 6-10

- Production and Distribution of Writing
 - **Grades 6-8: 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.
 - **Grades 9-10: CCSS.ELA-Literacy.WHST.9-10.4** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- Research to Build and Present Knowledge
 - **Grades 6-8: CCSS.ELA-Literacy.WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research.
 - **Grades 9-10: CCSS.ELA-Literacy.WHST.9-10.9** Draw evidence from informational texts to support analysis, reflection, and research.
- Range of Writing
 - **Grades 6-8: CCSS.ELA-Literacy.WHST.6-8.10** 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.
 - **Grades 9-10: CCSS.ELA-Literacy.WHST.9-10.10** 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.

Mission 1: Introduction to Binary Numbers

- Overview:
 - Students will be welcomed to the world of RADIUS & will design their secret agent avatar for use during course
- Learning Objectives:
 - Compare and contrast place value systems of numeration.
 - Use point and click selection functions.
 - Identify basic STEM vocabulary in selected domains.
- Performance-Based Activities and Assessments:
 - Design a custom secret agent avatar.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.

Mission 2: Working with Binary Numbers

- Overview:
 - Students convert numbers between base 10 and base 2 and perform binary addition and multiplication.
- Learning Objectives:

- Understand binary numbers and how to manipulate them and apply them to real-world scenarios
- Compare and contrast place value systems of numeration
- Write code to automate conversion of decimal and binary numbers
- Performance-Based Activities and Assessments:
 - Apply knowledge of binary numbers to plan a truck convoy and determine the minimum number of trucks required to carry different cargo weights.
 - Generate code to automate conversion of decimal and binary numbers.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.

Mission 3: Rational and Irrational Numbers & Estimation

- Overview:
 - Students distinguish rational numbers from irrational numbers and practice estimation and determining measurement error.
- Learning Objectives:
 - Identify rational and irrational numbers and estimate rational approximations of irrational numbers.
 - Define and identify errors in measurement including absolute error, relative error and percentage error.
 - Create code to automate finding the value of an irrational number to a specified accuracy.
- Performance-Based Activities and Assessments:
 - Calculate irrational number approximations to determine the length of the new steel beams needed to fix a broken bridge.
 - Generate code to approximate irrational numbers.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.
- Reinforcement of CCSS Mathematics Grade 8: The Number System
 - **CCSS.Math.Content.8.NS.A.1** “Know that there are numbers that are not rational, and approximate them by rational numbers.”

Mission 4: Linear Equations, Functions & Graphs

- Overview:
 - Students learn about linear equations and apply linear equations to solve real world problems.
- Learning Objectives:
 - Analyze and solve linear equations with one variable and multiple variables.

- Graph linear equations on a coordinate plane.
- Interpret slope-intercept form of a linear equation.
- Performance-Based Activities and Assessments:
 - Solve linear equations to determine how many feet of surfacing is needed to patch up the gap in the broken bridge.
 - Generate code to automate and solve linear equations in form $y = mx + b$.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.
- Reinforcement of CCSS Mathematics Grade 8: Expressions & Equations
 - **CCSS.Math.Content.8.EE.C.7** "Analyze and solve linear equations and pairs of simultaneous linear equations."
- Reinforcement of CCSS Mathematics Grade 8: Statistics & Probability
 - **CCSS.Math.Content.8.SP.A.3** "Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept."

Mission 5: HTML Part 1

- Overview:
 - Students learn key terms related to computer networks and are introduced to HTML tags, which they must apply for the first time in their online Agent Report.
- Learning Objectives:
 - Recall and apply HTML tag conventions and best design practices for web-page display.
 - Construct interface design for basic readability (color/font/size) and avoiding cognitive overload.
 - Compare and contrast HTML and programming language.
 - Populate Agent Report journal using HTML code.
- Performance-Based Activities and Assessments:
 - Produce HTML to design the first phase of the Agent Report.
 - There are five practice questions (*recognition*) with feedback after each answer.
 - Each mission poses two optional open response questions.

Mission 6: Ratios, Rational Numbers, Rates & Unit Conversion

- Overview:
 - Students learn about different types of unit measurements and how to perform conversions.
- Learning Objectives:
 - Discover the relationships between ratios, rational numbers and unit rates.
 - Evaluate functions that involve rational numbers, ratios, proportions and unit rates.

- Perform unit conversion and dimensional analysis (going from one set of units to another) using code.
- Performance-Based Activities and Assessments:
 - Match answers with different units of measurement to the appropriate problems.
 - Generate code to automate conversions between different units of measurement.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.

Mission 7: Circuits and Paths

- Overview:
 - Students are introduced to basic network models, circuits and paths and discover how they relate to STEM in the real-world.
- Learning Objectives:
 - Apply graph theory to determine network flow.
 - Identify and manipulate Euler and Hamilton paths and circuits.
 - Determine an optimal route through a network by assessing paths, circuits, edges, nodes and points of failure.
- Performance-Based Activities and Assessments:
 - Analyze three network graphs to determine how to map the shortest route possible while still reaching all of the necessary nodes.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.

Mission 8: Cryptography

- Overview:
 - Students are given a history of cryptography and learn how to use binary numbers to solve basic encryption and decryption problems.
- Learning Objectives:
 - Understand why encryption and decryption of information is important, both historically and in modern day.
 - Synthesize binary coding scheme to encode and decode messages.
 - Modify code for specific encryption and decryption algorithms using a template.
- Performance-Based Activities and Assessments:
 - Decode secret messages by applying basic decryption methods and knowledge of binary numbers.
 - Modify code for a specific encryption/decryption algorithm.

- There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
- Each mission poses two optional open response questions.

Mission 9: Logical Operators & True or False Statements

- Overview:
 - Students learn about logical operators, Boolean logic, truth tables and logical program design.
- Learning Objectives:
 - Evaluate true/false statements with logical connectors *and*, *or*, and *not* and recall the order of logical operations.
 - Translate truth tables into binary code.
 - Understand the steps of logical program design and how you can use the true/false value of logical statements to control the flow of a program.
- Performance-Based Activities and Assessments:
 - Sort the steps of programming a solution into the correct sequencing.
 - Generate code to automate truth tables.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.

Mission 10: HTML Part 2

- Overview:
 - Students discover more common HTML tags as a continuation of Mission 5 and become versed in best practices when creating webpage visuals.
- Learning Objectives:
 - Construct Online Learning Journal using HTML
 - Identify HTML tags as the source of controlling web-page display details
 - Design for basic perceptual readability (color/font/size) and avoiding cognitive overload
 - Compare and contrast HTML and programming language
- Performance-Based Activities and Assessments:
 - Produce HTML code to continue to enhance the Agent Report.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.

Mission 11: Pythagorean Theorem & Distance Formula

- Overview:
 - Students are introduced to the Pythagorean Theorem and learn how to find the distance between two points on a coordinate plane using the Pythagorean Theorem and the Distance Formula.
- Learning Objectives:
 - Apply the Pythagorean Theorem to solve for one side of a right triangle
 - Apply the Pythagorean Theorem and Distance Formula to find the distance between two points on a coordinate plane.
- Performance-Based Activities and Assessments
 - Match mathematical expressions with the corresponding images.
 - Generate code to automate a function template that uses Pythagorean Theorem to find the length between two coordinate points.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.
- Reinforcement of CCSS Mathematics Grade 8: Geometry
 - **CCSS.Math.Content.8.G.B.8** “Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.”

Mission 12: Visual Displays, Trends & Scientific Notation

- Overview:
 - Students learn about scientific notation and different types of visual data displays and how to analyze them.
- Learning Objectives:
 - List numbers in scientific notation in order from least to greatest.
 - Identify different types of visual displays (lists, tables, bar graphs, pie charts, time series graphs, scatterplots) and how to read them.
 - Analyze visual displays to find trends and determine if the display might be misleading and why.
- Performance-Based Activities and Assessments:
 - Match visual displays with the appropriate trend (increasing, decreasing or unchanging).
 - Generate code to create a template that can be used to plot data.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.
- Reinforcement of CCSS Mathematics Grade 8: Statistics & Probability
 - “Investigate patterns of association in bivariate data.”

Mission 13: Probability

- Overview:
 - Students learn about probability and determining probability with diagrams and algebraic statements.
- Learning Objectives:
 - Solve the probability of an event and compound events by applying the rules of probability, including $P(E) = \text{number of times the event occurs} \div \text{total number of outcomes}$.
 - Calculate the complement of $P(E)$.
 - Evaluate and make decisions under uncertainty.
- Performance-Based Activities and Assessments:
 - Analyze Venn diagrams and algebraic statements to calculate simple and compound probabilities for possible outcomes.
 - Modify code to create a custom tool that calculates expected value given a probability distribution.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.

Mission 14: PERT, Project Planning & Critical Paths

- Overview:
 - Students learn how to execute PERT planning techniques and critical path analysis.
- Learning Objectives:
 - Create a project task table.
 - Draw a network diagram from a task table.
 - Identify the critical path from a network diagram.
- Performance-Based Activities and Assessments:
 - Coordinate task management and planning activities.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.

Mission 15: Trees- Rooted, Binary, Expression

- Overview:
 - Students learn how to create and interpret network trees that represent algorithms.

- Learning Objectives:
 - Read and identify rooted trees, binary trees and expression trees and understand how they relate to sorting.
 - Find the value of expression trees.
 - Build expression trees from binary trees.
- Performance-Based Activities and Assessments:
 - Match complex arithmetic expressions with their equivalent tree diagrams.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.

Mission 16: HTML Part 3

- Overview:
 - This final mission reinforces students' understanding of HTML tags and best design practices for webpages as they finalize their Agent Report.
- Learning Objectives:
 - Recall basic HTML tags with solid understanding of how tags function to control webpage display details.
 - Develop strong sense of user interface best practices for basic readability (color/font/size) and avoiding cognitive overload.
- Performance-Based Activities and Assessments:
 - Match types of components with examples in a webpage image.
 - Finalize Agent Report using HTML to format answers and design the report.
 - There are five practice questions (*recognition*) and five summative multiple choice *assessment* questions with feedback after each answer. The first answer selected for each *assessment* question counts toward students' scores.
 - Each mission poses two optional open response questions.