

# CURRICULUM FRAMEWORKS CONNECTIONS

At Heritage Museums & Gardens, we are committed to helping you meet the demands of Education Standards. Each of our programs may be used to fulfill a multitude of standards across several disciplines. Listed below are examples of how the *Math Adventure* program can be used to meet current Massachusetts Curriculum Frameworks, Common Core Standards and the Next Generation Science Standards.

## Math Adventure *Adventure Workshop*

### Massachusetts Frameworks 2011: Mathematics

Domain: Standards for Mathematical Practice:

MP1- Make Sense of problems and persevere in solving them

MP2- Reason abstractly and quantitatively

MP5- Use appropriate tools strategically

MP6- Attend to precision

Domain: Expressions and Equations:

8.EE.A.4- Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

8.EE.B.6- Use similar triangles to explain why the slope  $m$  is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation  $y = mx$  for a line through the origin and the equation  $y = mx + b$  for a line intercepting the vertical axis at  $b$ .

7.EE.B.3- Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

7.EE.B.4a- Solve word problems leading to equations of the form  $px + q = r$  and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.

6.EE.B.6- Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.B.7- Solve real-world and mathematical problems by writing and solving equations of the form  $x + p = q$  and  $px = q$  for cases in which  $p$ ,  $q$  and  $x$  are all nonnegative rational numbers.

6.EE.C.9- Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

Domain: Functions:

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

Domain: Geometry:

8.G.B.7- Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

7.G.A.1- Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

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.

7.G.A.4- Know the formulas for the area and circumference of a circle and solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

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.

6.G.A.1a- Use the relationships among radius, diameter, and center of a circle to find its circumference and area.

6.G.A.1b- Solve real-world and mathematical problems involving the measurements of circles.

Domain: Statistics and Probability:

8.SP.A.1- Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.A.4- Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

7.SP.A.1- Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

7.SP.B.3- Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.

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.

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.

6.SP.B.5- Summarize numerical data sets in relation to their context.

Domain: The Number System:

7.NS.A.2- Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

7.NS.A.3- Solve real-world and mathematical problems involving the four operations with rational numbers.

### **Massachusetts Frameworks 2004: Mathematics**

Strand: Data Analysis, Statistics, and Probability:

8.D.1- Describe the characteristics and limitations of a data sample. Identify different ways of selecting a sample, e.g., convenience sampling, responses to a survey, random sampling.

8.D.3- Find, describe, and interpret appropriate measures of central tendency (mean, median, and mode) and spread (range) that represent a set of data. Use these notions to compare different sets of data.

8.D.2- Select, create, interpret, and utilize various tabular and graphical representations of data, e.g., circle graphs, Venn diagrams, scatterplots, stem-and-leaf plots, box-and-whisker plots, histograms, tables, and charts.

Differentiate between continuous and discrete data and ways to represent them.

7.D.1- Select, create, interpret, and utilize the following tabular and graphical representations of data: circle graphs, Venn diagrams, stem-and-leaf plots, tables, and charts.

6.D.4- Predict the probability of outcomes of simple experiments (e.g., tossing a coin, rolling a die) and test the predictions. Use appropriate ratios between 0 and 1 to represent the probability of the outcome and associate the probability with the likelihood of the event.

Strand: Geometry:

8.G.2/7.G.2- Classify figures in terms of congruence and similarity, and apply these relationships to the solution of problems.

8.G.3/7.G.3- Demonstrate an understanding of the relationships of angles formed by intersecting lines, including parallel lines cut by a transversal.

8.G.4- Demonstrate an understanding of the Pythagorean theorem. Apply the theorem to the solution of problems.

8.G.5- Use a straight-edge, compass, or other tools to formulate and test conjectures, and to draw geometric figures.

8.G.7/7.G.7- Identify three-dimensional figures (e.g., prisms, pyramids) by their physical appearance, distinguishing attributes, and spatial relationships such as parallel faces.

8.G.8- Recognize and draw two-dimensional representations of three-dimensional objects, e.g., nets, projections, and perspective drawings

Strand: Measurement:

8.M.1/7.M.1- Select, convert (within the same system of measurement), and use appropriate units of measurement or scale.

8.M.3/ 7.M.3- Demonstrate an understanding of the concepts and apply formulas and procedures for determining measures, including those of area and perimeter/circumference of parallelograms, trapezoids, and circles. Given the formulas, determine the surface area and volume of rectangular prisms and cylinders. Use technology as appropriate.

8.M.4-Use ratio and proportion (including scale factors) in the solution of problems, including problems involving similar plane figures and indirect measurement.

6.M.2-Identify, measure, describe, classify, and construct various angles, triangles, and quadrilaterals.

6.M.5-Identify, measure, and describe circles and the relationships of the radius, diameter, circumference, and area (e.g.,  $d = 2r$ ,  $p = C/d$ ), and use the concepts to solve problems.

Strand: Number Sense and Operations:

8.N.11-Determine when an estimate rather than an exact answer is appropriate and apply in problem situations.

8.N.12-Select and use appropriate operations—addition, subtraction, multiplication, division, and positive integer exponents—to solve problems with rational numbers (including negatives).

7.N.2-Use ratios and proportions in the solution of problems involving unit rates, scale drawings, and reading of maps.

Strand: Patterns, Relations, and Algebra:

8.P.10-Use tables and graphs to represent and compare linear growth patterns. In particular, compare rates of change and x- and y-intercepts of different linear patterns.

6.P.7-Identify and describe relationships between two variables with a constant rate of change. Contrast these with relationships where the rate of change is not constant.

### **Massachusetts Frameworks 2006: Science and Technology/Engineering**

Strand: Life Science:

10-Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.

16-Recognize that producers (plants that contain chlorophyll) use the energy from sunlight to make sugars from carbon dioxide and water through a process called photosynthesis. This food can be used immediately, stored for later use, or used by other organisms.

Strand: Technology/Engineering:

3.2-Identify and explain the appropriate tools, machines, and electronic devices (e.g., drawing tools, computer-aided design, and cameras) used to produce and/or reproduce design solutions (e.g., engineering drawings, prototypes, and reports).

2.1-Identify and explain the steps of the engineering design process, i.e., identify the need or problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.

## **Massachusetts Frameworks 2008: Technology Literacy Standards and Expectations**

Strand: Research, Problem Solving and Communication:

3.4-Independently use appropriate technology tools (e.g., graphic organizer) to define problems and propose hypotheses.

3.6-Develop and use guidelines to evaluate the content, organization, design, use of citations, and presentation of technologically enhanced projects.

Strand: Use of Computers and Applications:

1.10-Perform simple operations in a database (i.e., browse, sort, filter, search on selected criteria, delete data, enter data).

1.11-Plan and develop database reports to organize and display information.

1.13-Create an original spreadsheet, using formulas.

1.15-Produce simple charts and graphs from a spreadsheet.

1.16-Distinguish among different types of charts and graphs, and choose the most appropriate type to represent given data.

## **Massachusetts Frameworks 2011: English and Language Arts**

Domain: College and Career readiness Anchor Standards for Language: CCRA.L.1-

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

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

CCRA.L.3- Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening

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.

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.

Domain: College and Career readiness Anchor Standards for Speaking and Listening:

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.

CCRA.SL.2- Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

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.

Domain: College and Career readiness Anchor Standards for Writing:

CCRA.W.1- Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

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.

CCRA.W.4- Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCRA.W.7- Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

Domain: Reading Standards for Literacy in Science and Technical Subjects: 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.  
RST.6-8.3- Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.  
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.  
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.

Domain: Language Standards:

L.8.1/L.7.1/L.6.1- Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.  
L.8.2/L.7.2/L.6.2- Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.  
L.8.3/L.7.3/L.6.3- Use knowledge of language and its conventions when writing, speaking, reading, or listening.  
L.8.6/L.7.6- Determine an author's point of view or purpose in a text and analyze how the author distinguishes his or her position from that of others.  
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.

Domain: Standards for Speaking and Listening:

SL.8.4/SL.7.4- Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.  
SL.8.1/SL.7.1/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.

Domain: Writing Standards:

W.8.1/W.7.1/W.6.1- Write arguments to support claims with clear reasons and relevant evidence.  
W.8.4/W.7.4/W.6.4- Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  
W.8.7/W.7.7/W.6.7- Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

### **Common Core: Mathematics**

Expressions & Equations:

8.EE.B.5- Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.  
8.EE.C.7- Solve linear equations in one variable

7.EE.B.4- Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

6.EE.B.6- Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

Functions:

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

Geometry:

8.G.B.7- Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

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.

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.

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.

Statistics & Probability:

8.SP.A.1- Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.A.4- Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

7.SP.A.1- Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

7.SP.A.2- Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.

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.

6.SP.B.4- Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

6.SP.B.5- Summarize numerical data sets in relation to their context

### **Common Core: English and Language Arts**

#### **Speaking & Listening:**

SL.8.1/ SL.7.1/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

SL.8.4/SL.7.4/SL.6.4- Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

#### **Science and Technical Subjects:**

RST.6-8.1- Cite specific textual evidence to support analysis of science and technical texts

RST.6-8.3- Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks

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.

RST.6-8.7- Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

RST.6-8.8- Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

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.

#### **Writing:**

WHST.6-8.1.A- Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.

WHST.6-8.1.B- Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

WHST.6-8.1.C- Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.

WHST.6-8.1.E- Provide a concluding statement or section that follows from and supports the argument presented.

WHST.6-8.2.D- Use precise language and domain-specific vocabulary to inform about or explain the topic.

WHST.6-8.4- Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.6-8.7- Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

## Next Generation Science Standards

Energy: MS-PS3-4- Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

Structure and Properties of Matter:

MS-PS1-3- Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

Growth, Development, and Reproduction of Organisms:

MS-LS1-4- Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

MA-LS1-5- Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MS-LS4-5- Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

Natural Selection and Adaptations:

MS-LS4-4- Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

MS-LS4-6- Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Matter and Energy in Organisms and Ecosystems:

MS-LS1-6- Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

MS-LS2-1- Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-4- Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Earth and Human Activity:

MS-ESS3-4- Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

MS-ESS3-3- Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Engineering Design:

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.

MS-ETS1-2- Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.