

# MP1a-Solving Equations and Inequalities

Content Area: **Math**  
Course(s): **Math 8 Algebra 1**  
Time Period: **Marking Period 1**  
Length: **enVision Chapter 1, Weeks 2-4**  
Status: **Not Published**

## Essential Questions

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- What general strategies can you use to solve simple equations and inequalities?

## Big Ideas

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- Properties of equality
- Using inverse operations to solve equations containing variables
- Writing equations to represent situations
- Simplify equations before solving
- Solve equations and proportions

## Career Education Integration

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9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.

9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

Connection:

Students are expected to apply ration and proportions to real world situations – this can be applied to a variety of career choices. Students can create equations based upon different labor market trends and career path decisions.

## Enduring Understandings

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### Expressions and Equations

8.EE.8 Analyze and solve linear equations and pairs of simultaneous linear equations.

### Reasoning with Equations & Inequalities

A.REI.A1 [M] 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.

- Solving Equations by Adding or Subtracting
- Solving Equations by Multiplying or Dividing

- Solving Two-Step and Multi-Step Equations
- Solving Equations with Variables on Both Sides

## Reasoning with Equations & Inequalities

A.REI.B3 [M] Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

- Graphing and Writing Inequalities
- Solving Inequalities by Adding or Subtracting
- Solving Inequalities by Multiplying or Dividing
- Solving Two-Step and Multi-Step Inequalities
- Solving Inequalities with Variables on Both Sides
- Solving Compound Inequalities
- Solving Absolute-Value Inequalities

## Quantities

N.Q.A1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

- Rates, Ratios, and Proportions
- Applications of Proportions

N.Q.A2 Define appropriate quantities for the purpose of descriptive modeling.

N.Q.A3 Choose a level of accuracy appropriate to limitations on measurement when reporting qualities.

- Precision and Accuracy

N.RN.B.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

## Creating Equations

A.CED.A4 [M] Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .

- Solving for a Variable

A.CED.A1 [M] Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

- Solving Absolute-Value Equations

## **Mathematical Practices Focus**

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1. Make sense of problems and persevere in solving them. Pages 15, 17, 19, 25, 31
2. Reason abstractly and quantitatively. Pages 9, 17, 25, 29, 31
3. Construct viable arguments and critique the reasoning of others. Pages 7, 11, 15, 23, 27
4. Model with mathematics. Pages 33, 20-21
5. Use appropriate tools strategically. Pages 20-21, 27
6. Attend to precision. Pages 6-7, 13, 27
7. Look for and make use of structure. Pages 14, 22, 26, 27
8. Look for and express regularity in repeated reasoning. Pages 14, 24

# MP1b-Linear Equations

Content Area: **Math**  
Course(s): **Math 8 Algebra 1**  
Time Period: **Marking Period 1**  
Length: **enVision Chapter 2, Weeks 5-6**  
Status: **Not Published**

## Essential Questions

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- Why is it useful to have different forms of linear equations?

## Big Ideas

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- Write and graph linear functions.
- Identify and interpret the components of linear graphs, including slope and intercepts.
- Slope-intercept and point-slope forms.
- Parallel and perpendicular lines.

## Technology Integration

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8.1.8.E.1 Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

8.1.8.A.2 Create a document (e.g. newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.

8.1.8.A.4 Graph and calculate data within a spreadsheet and present a summary of the results

8.1.8.A.5 Create a database query, sort and create a report and describe the process, and explain the report results.

Activity:

The [Algebra College Slope Project](#) encourages students to learn about college choices and decisions. Students have to opportunity to research colleges and universities, and select one based on possible majors they would be interested in, as well as a budget. Students then research possible high school jobs in an effort to earn money to use for college tuition. Students create electronic descriptions of their research, spreadsheets on the computer, and develop linear functions electronically.

## Cross-Curricular Integration

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**Integration Area: Language Arts**

LA.8.W.8.2.A Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia).

LA.8.W.8.2.B Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.

LA.8.W.8.2.C Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.

LA.8.W.8.2.D Use precise language and domain-specific vocabulary to inform about or explain the topic.

LA.8.W.8.2.E Establish and maintain a formal style/academic style, approach, and form.

LA.8.W.8.2.F Provide a concluding statement or section that follows from and supports the information or explanation presented.

LA.8.W.8.4 Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

LA.8.W.8.5 With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

LA.8.W.8.6 Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.

LA.8.W.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.

LA.8.W.8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

LA.8.W.8.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

LA.8.W.8.10 Write routinely over extended time frames (time for research, reflection, metacognition/self-correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

A.REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

Activity:

Slope/College/Savings project. Students will research various colleges and their tuition costs. Students will search for a job that will be able to assist in paying for a portion of the college tuition. Students will create tables and linear representations of the collected data and then discuss the data in an explanatory essay.

## **Enduring Understandings**

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### **Creating Equations**

A.CED.A4 [M] Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .

- Solving for a Variable

A.CED.A1 [M] Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

- Solving Absolute-Value Equations

A.CED.A2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

### **Interpret Linear Models**

S.ID.C.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. 8. Compute (using technology) and interpret the correlation coefficient of a linear fit. 9. Distinguish between correlation and causation.

S.ID.C.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.

S.ID.C.9 Distinguish between correlation and causation.

### **Mathematical Practices Focus**

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1. Make sense of problems and persevere in solving them. Pages 97, 109, 115, 120, 131
2. Reason abstractly and quantitatively. Pages 97, 104, 109, 115, 120, 122, 127, 129, 131
3. Construct viable arguments and critique the reasoning of others. Pages 95, 99, 105, 113, 117, 120, 124, 127
4. Model with mathematics. Pages 94, 102-103, 105, 110-111, 112, 123
5. Use appropriate tools strategically. Pages 95, 99, 102, 105, 110, 119, 123, 127
6. Attend to precision. Pages 95, 98, 104, 113, 117, 120, 126
7. Look for and make use of structure. Pages 94, 95, 133
8. Look for and express regularity in repeated reasoning. Pages 97, 103, 107, 115

# MP1c-Linear Functions

Content Area: **Math**  
Course(s): **Math 8 Algebra 1**  
Time Period: **Marking Period 1**  
Length: **enVision Chapter 3, Weeks 8-10**  
Status: **Not Published**

## Essential Questions

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- How can linear functions be used to model situations and solve problems?

## Big Ideas

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Relationships between variables.

- Determine whether a relation is a function.
- Use function notation.
- Use trend lines on scatter plots to make predictions.
- Arithmetic sequences.
- Transform linear functions.
- Determine the line of best fit.

## Technology Integration

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8.1.8.A.5 Create a database query, sort and create a report and describe the process, and explain the report results.

8.1.8.B.1 Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).

8.1.8.E.1 Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

8.1.8.C.1 Collaborate to develop and publish work that provides perspectives on a global problem for discussions with learners from other countries.

Activity:

The ant game is used during Arithmetic Sequence practice in station rotation. Students are given the opportunity to practice solving arithmetic sequences in a game to meet the learning objective of solving arithmetic sequences.

## Enduring Understandings

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### Interpreting Functions

F.LE.A1a Linear, quadratic, and exponential models. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

F.LE.A1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

- Relations and Functions

F.IF.A2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

- Writing Functions

F.IF.A3 [M] Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by  $f(0) = f(1) = 1$ ,  $f(n+1) = f(n) + f(n-1)$  for  $n \geq 1$ .

- Arithmetic Sequences

F.IF.B4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

- Graphing Relationships

F.IF.B5[M] Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function.

- Graphing Functions

## Functions

8.F.A1 [M] Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

8.F.A2 [M] Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*

8.F.A3 [M] Interpret the equation  $y = mx + b$  as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function  $A = s^2$  giving the area of a square as a function of its side length is not linear because its graph contains the points  $(1,1)$ ,  $(2,4)$  and  $(3,9)$ , which are not on a straight line.*

8.F.B4 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.

8.F.B5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

## Interpreting Categorical and Quantitative Data

S.ID.B6 Represent data on two quantitative variables on a scatter plot, and describe how the variables

are related.

- Scatter-Plots and Trend Lines

### **Mathematical Practices Focus**

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1. Make sense of problems and persevere in solving them. Pages 15, 17, 19, 25, 31
2. Reason abstractly and quantitatively. Pages 9, 17, 25, 29, 31
3. Construct viable arguments and critique the reasoning of others. Pages 7, 11, 15, 23, 27
4. Model with mathematics. Pages 33, 20-21
5. Use appropriate tools strategically. Pages 20-21, 27
6. Attend to precision. Pages 6-7, 13, 27
7. Look for and make use of structure. Pages 14, 22, 26, 27
8. Look for and express regularity in repeated reasoning. Pages 14, 24

# MP2a-Systems Of Equations and Inequalities

Content Area: **Math**  
Course(s): **Math 8 Algebra 1**  
Time Period: **Marking Period 2**  
Length: **enVision Chapter 4, Weeks 1-5**  
Status: **Not Published**

## Essential Questions

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- How do you use systems of linear equations and inequalities to model situations and solve problems?

## Big Ideas

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- Find a solution that satisfies two linear equations.
- Graph one or more linear inequalities in the coordinate plane.
- Find solutions that satisfy two linear inequalities.

## Technology Integration

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8.1.8.A.4 Graph and calculate data within a spreadsheet and present a summary of the results

8.1.8.B.1 Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).

8.1.8.C.1 Collaborate to develop and publish work that provides perspectives on a global problem for discussions with learners from other countries.

Activity:

To enhance and deepen understanding of linear systems, students play a game of Polygraph Linear Systems. Students are given the opportunity to work with classmates virtually, exploring communication through the computer to describe and answer questions regarding linear systems. Students must use algebraic terms and knowledge to successfully get their partner to select the correct graph based on questions that have been asked.

## Cross-Curricular Integration

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LA.8.W.8.2.A Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia).

LA.8.W.8.2.B Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.

LA.8.W.8.2.C Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.

LA.8.W.8.2.D Use precise language and domain-specific vocabulary to inform about or explain the topic.

LA.8.W.8.2.E Establish and maintain a formal style/academic style, approach, and form.

LA.8.W.8.2.F Provide a concluding statement or section that follows from and supports the information or explanation presented.

LA.8.W.8.4 Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

LA.8.W.8.5 With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

LA.8.W.8.6 Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.

LA.8.W.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.

LA.8.W.8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

LA.8.W.8.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

LA.8.W.8.10 Write routinely over extended time frames (time for research, reflection, metacognition/self-correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

A.REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

Activity:

Slope/College/Savings project. Students will research various colleges and their tuition costs. Students will search for a job that will be able to assist in paying for a portion of the college tuition. Students will create tables and linear representations of the collected data and then discuss the data in an explanatory essay.

## **Enduring Understandings**

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### **Reasoning with Equations & Inequalities**

A.REI.A.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.

A.REI.C.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A.REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

A.REI.C.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line  $y = -3x$  and the circle  $x^2 + y^2 = 3$ .

A.REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

- Identifying Linear Functions

A.REI.D.11 Explain why the x-coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★

A.REI.D.12 Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

### Creating Equations

A.CED.A3 [M] Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods

A.CED.A2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

### Mathematical Practices Focus

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1. Make sense of problems and persevere in solving them. Pages 220, 253, 259, 273
2. Reason abstractly and quantitatively. Pages 246, 263, 266, 273
3. Construct viable arguments and critique the reasoning of others. Pages 247, 251, 255, 261, 266, 269
4. Model with mathematics. Pages 245, 254, 260, 265, 268-269
5. Use appropriate tools strategically. Pages 243, 259, 260, 268
6. Attend to precision. Pages 251, 255, 261, 273
7. Look for and make use of structure. Pages 254, 264, 268-269
8. Look for and express regularity in repeated reasoning. Pages 253, 269

# MP2b-Piecewise Functions

Content Area: **Math**  
Course(s): **Math 8 Algebra 1**  
Time Period: **Marking Period 2**  
Length: **enVision Chapter 5, Weeks 6-8**  
Status: **Not Published**

## Essential Questions

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- How do you use piecewise-defined functions to model situations and solve problems?

## Big Ideas

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- Explore the key features of the absolute value graph such as the vertex and axis of symmetry and interpret domain and range
- Describe and graph piecewise defined functions over given intervals of the domain
- Use graphs and equations of the functions as well as the rate of change on a given interval to solve real-world problems
- Relate step functions to piecewise defined functions
- Use ceiling and floor functions to model and solve real-world problems
- Represent transformations of piecewise defined functions both algebraically and graphically

## Enduring Understanding

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### Interpreting Functions

F.IF.A.3 [M] Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by  $f(0) = f(1) = 1$ ,  $f(n+1) = f(n) + f(n-1)$  for  $n \geq 1$ .

- Geometric Sequence

F.IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. ★

F.IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★

F.IF.C.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

- Exponential Functions

F.IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

- Comparing Functions

# MP2c-Exponents and Exponential Functions

Content Area: **Math**  
Course(s): **Math 8 Algebra 1**  
Time Period: **Marking Period 2**  
Length: **Chapter 6, Weeks 10-11**  
Status: **Not Published**

## Essential Questions

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- How do you use exponential functions to model situations and solve problems?

## Big Ideas

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- Determine all properties of exponents.
- Add, subtract, and multiply polynomials by using properties of exponents and combining like terms.
- Closure of polynomials.

## Enduring Understandings

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### The Real Number System

N.RN.A.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define  $5^{1/3}$  to be the cube root of 5 because we want  $(5^{1/3})^3 = 5(1/3)^3$  to hold, so  $(5^{1/3})^3$  must equal 5.

- Integer Exponents
- Rational Exponents

N.RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

### Interpreting Functions

F.IF.A.3 [M] Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by  $f(0) = f(1) = 1$ ,  $f(n+1) = f(n) + f(n-1)$  for  $n \geq 1$ .

- Geometric Sequence

F.IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. ★

F.IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function. ★

F.IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

## Building Functions

F.BF.B.1 Write a function that describes a relationship between two quantities. ★ a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. c. (+) Compose functions. For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.

F.BF.B.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★

F.BF.B.3 Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

## Construct and compare linear and exponential models and solve problems

F.LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F.LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

## Interpret expressions for functions in terms of the situation they model

F.LE.B.5 Interpret the parameters in a linear or exponential function in terms of a context.

## Seeing Structure in Expressions

A.SSE.A.1a[M] Interpret parts of an expression, such as terms, factors, and coefficients.

- Polynomials

A.SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. c. Use the properties of exponents to transform expressions for exponential functions. For example the expression  $1.15t$  can be rewritten as  $(1.151/12)^{12t} \approx 1.012^{12t}$  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

## Creating Equations

A.CED.A2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Reason quantitatively and use units to solve problems.

N.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

## **Geometry- Understand and apply the Pythagorean Theorem**

8.G.B6 [M] Explain a proof of the Pythagorean Theorem and its converse.

8.G.B7 [M] Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

8.G.B8 [M] Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

## **Mathematical Practices Focus**

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1. Make sense of problems and persevere in solving them. Pages 295, 305, 307, 312, 322-323, 327
2. Reason abstractly and quantitatively. Pages 301, 302, 305, 312, 319, 325
3. Construct viable arguments and critique the reasoning of others. Pages 285, 287, 291, 296, 303, 310, 314, 319, 323
4. Model with mathematics. Pages 287, 295, 298, 302, 308, 319
5. Use appropriate tools strategically. Pages 298, 300-301, 322
6. Attend to precision. Pages 287, 305, 312, 314, 321
7. Look for and make use of structure. Pages 295, 298, 308, 313, 318
8. Look for and express regularity in repeated reasoning. Pages 290-291, 293, 298, 309

# MP3a-Polynomials and Factoring

Content Area: **Math**  
Course(s): **Math 8 Algebra 1**  
Time Period: **Marking Period 3**  
Length: **enVision Chapter 7, Weeks 1-2**  
Status: **Not Published**

## Essential Questions

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- How do you work with polynomials to rewrite expressions and solve problems?

## Big Ideas

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- Find greatest common factors.
- Factor polynomials.
- Factor perfect-square trinomials and differences of squares.
- Choosing a factoring method.

## Enduring Understandings

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### Seeing Structure in Expressions

A.SSE.A1 Interpret expressions that represent a quantity in terms of its context. ★ a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret  $P(1+r)^n$  as the product of  $P$  and a factor not depending on  $P$

A.SSE.A2 Use the structure of an expression to identify ways to rewrite it. For example, see  $x^4 - y^4$  as  $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as  $(x^2 - y^2)(x^2 + y^2)$ .

- Factors and the Greatest Common Factors
- Factoring by GCF
- Factoring  $x^2 + bx + c$
- Factoring  $ax^2 + bx + c$
- Factoring Special Products
- Choosing a Factoring Method

### Arithmetic with Polynomials & Rational Expressions

A.APR.A.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

- Adding and Subtracting Polynomials
- Multiplying Polynomials
- Special Products of Polynomials

# MP3b-Quadratic Functions

Content Area: **Math**  
Course(s): **Math 8 Algebra 1**  
Time Period: **Marking Period 3**  
Length: **enVision Chapter 8, Weeks 3-6**  
Status: **Not Published**

## Essential Questions

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- How can you use sketches and equations of quadratic functions to model situations and make predictions?

## Big Ideas

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- Identify and graph quadratic functions.
- Transform quadratic functions.
- Use various methods to solve quadratic equations, systems with one linear and one quadratic equation, and nonlinear systems.

## Technology Integration

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- 8.1.8.A.5 Create a database query, sort and create a report and describe the process, and explain the report results.
- 8.1.8.A.3 Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
- 8.1.8.C.1 Collaborate to develop and publish work that provides perspectives on a global problem for discussions with learners from other countries.

### Activity:

Students complete the interactive lab activity, “Quadratic Functions- [Desmos- Will it Hit the Hoop?](#)” independently during station rotation. The lab challenges students to take knowledge of how a basketball is shot and transfer it to the terms in a quadratic formula. At the end, students are able to view other responses from classmates, and hold a classroom discussion on the methods and strategies used to successfully complete the lab through a shared Google Doc.

## Enduring Understandings

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### Interpreting Functions

F.IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F.IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F.IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a

table) over a specified interval. Estimate the rate of change from a graph.

F.IF.C7a Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.IF.C7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

- Identifying Quadratic Functions
- Characteristics of Quadratic Functions
- Graphing Quadratic Functions

F.IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{12t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.

F.IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

### **Building Functions**

F.BF.A1 Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. c. (+) Compose functions. For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.

F.BF.B3 Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

- Transforming Quadratic Functions

### **Interpreting Categorical & Quantitative Data**

S.ID.B6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.

### **Linear, Quadratic, & Exponential Models**

F.LE.A.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

## **Reasoning with Equations & Inequalities**

A.REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

- Identifying Linear Functions

## **Creating Equations**

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

## **Mathematical Practices Focus**

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1. Make sense of problems and persevere in solving them. Pages 397, 403, 407, 417
2. Reason abstractly and quantitatively. Pages 393, 399, 403, 407, 409
3. Construct viable arguments and critique the reasoning of others. Pages 391, 393, 397, 405, 409, 413
4. Model with mathematics. Pages 392
5. Use appropriate tools strategically. Pages 392, 403
6. Attend to precision. Pages 400, 407
7. Look for and make use of structure. Pages 396, 400
8. Look for and express regularity in repeated reasoning. Pages 412-413

# MP4a-Solving Quadratic Equations

Content Area: **Math**  
Course(s): **Math 8 Algebra 1**  
Time Period: **Marking Period 4**  
Length: **enVision Chapter 9, Weeks 3-4**  
Status: **Not Published**

## Essential Questions

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- How do you use quadratic equations to model situations and solve problems?

## Big Ideas

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- Use various methods to solve quadratic equations, systems with one linear and one quadratic equation, and nonlinear systems.
- Identify and graph quadratic functions.
- Solving linear quadratic systems of equations

## Essential Questions

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### Interpreting Functions

F.IF.C7c Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

F.IF.C8a Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

### Creating Equations

A.CED.A1 [M] Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

- Solving Absolute-Value Equations

A.CED.A2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A.CED.A3 [M] Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

### Reasoning with Equations & Inequalities

A.REI.B4 Solve quadratic equations in one variable.

A.REI.B4a[M] Use the method of completing the square to transform any quadratic equation in  $x$  into an

equation of the form  $(x - p)^2 = q$  that has the same solutions. Derive the quadratic formula from this form.

- Completing the Square

A.REI.B4[M] Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a \pm bi$  for real numbers  $a$  and  $b$ .

- Solving Quadratic Equations by Factoring
- Solving Quadratic Equations by Using Square Roots
- The Quadratic Formula and the Discriminant

A.REI.D11[M] Explain why the  $x$ -coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

- Solving Quadratic Equations by Graphing

A.REI.C7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line  $y = -3x$  and the circle  $x^2 + y^2 = 3$ .

- Nonlinear Systems

### Seeing Structure in Expressions

A.SSE.A2 Use the structure of an expression to identify ways to rewrite it. For example, see  $x^4 - y^4$  as  $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as  $(x^2 - y^2)(x^2 + y^2)$ .

- Factors and the Greatest Common Factors
- Factoring by GCF
- Factoring  $x^2 + bx + c$
- Factoring  $ax^2 + bx + c$
- Factoring Special Products
- Choosing a Factoring Method

A.SSE.B3a Factor a quadratic expression to reveal the zeros of the function it defines.

- Using a Graph to Factor Polynomials (Lab)

### Arithmetic with Polynomials and Rational Expressions

A.APR.B3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

### The Real Number System

N.RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

# MP4b-Working with Functions

Content Area: **Math**  
Course(s): **Math 8 Algebra 1**  
Time Period: **Marking Period 4**  
Length: **enVision Chapter 10, Weeks 5-7**  
Status: **Not Published**

## Essential Questions

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- What are some operations of functions that you can use to create models and solve problems?

## Big Ideas

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- Translate square root and cube root functions
- Graph and analyze translations of absolute value, exponential, quadratic, and radical functions
- Perform operations on functions and determine how the operations affect the domain and range of the new functions
- Find inverse functions and determine the key features of those functions

## Enduring Understandings

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### Interpreting Functions

F.IF.B4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

- Graphing Relationships

F.IF.B5[M] Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function.

- Graphing Functions

F.IF.B6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

- Rate of Change and Slope
- The Slope Formula

F.IF.C7b Graph linear and quadratic functions and show intercepts, maxima, and minima. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

### Building Functions

F.BF.A1 Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. c. (+) Compose functions. For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather

balloon as a function of time.

F.BF.B3 Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

- Transforming Quadratic Functions

F.BF.B4 Find inverse functions. a. Solve an equation of the form  $f(x) = c$  for a simple function  $f$  that has an inverse and write an expression for the inverse. For example,  $f(x) = 2x^3$  or  $f(x) = (x+1)/(x-1)$  for  $x \neq 1$ . b. (+) Verify by composition that one function is the inverse of another. c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. d. (+) Produce an invertible function from a non-invertible function by restricting the domain.

# MP4c-Statistics

Content Area: **Math**  
Course(s): **Math 8 Algebra 1**  
Time Period: **Marking Period 4**  
Length: **enVision Chapter 11, Week 8-10**  
Status: **Not Published**

## Essential Questions

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- How do you use statistics to model situations and solve problems?

## Big Ideas

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- Represent data using box plots, dot plots, and histograms
- Use measures of center and variability to interpret and compare data
- Relate the shape of data displays to measures such as mean, median, and MAD
- Use standard deviation to quantify and analyze the spread of data
- Calculate measures of frequency to analyze and interpret categorical data using two-way frequency tables

## Enduring Understandings

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### Interpreting Categorical & Quantitative Data

S.ID. A1[M] Represent data with plots on the real number line (dot plots, histograms, and box plots).

- Organizing and Displaying Data
- Frequency and Histograms

S.ID.A2[M] Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

- Data Distributions

S.ID.A.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

S.ID.B.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

### Statistics and Probability

8.SP.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.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line.

8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope

of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.

8.SP.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. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have.