



# College and Career Readiness Standards-in-Action

## **GUIDE TO EFFECTIVELY MANAGING HIGHER-LEVEL CONTENT STANDARDS IN MATHEMATICS**

Prepared by StandardsWork, Inc.  
Produced Under U.S. Department of Education Contract No. ED-VAE-13-C-0066

2016

## **ACKNOWLEDGMENTS**

Special recognition is due to Melanie Alkire, who provided ongoing mathematics content expertise to the development of the guide. It reflects her many years of experience working with states and education agencies to implement rigorous mathematics standards effectively. Thanks are also due to Jason Zimba who offered his considerable teaching and content expertise in the demands of college and career readiness (CCR) standards throughout the development process. Finally, Susan Pimentel is due appreciation for lending her expertise and superb guidance to the creation of this guide.

# TABLE OF CONTENTS

Introduction .....	1
How to Use This Guide.....	3
Section 1: Middle Intermediate Level .....	5
Section 2: High Intermediate Level.....	14
Section 3: Adult Secondary Level .....	22

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## INTRODUCTION

The CCR standards in mathematics are ambitious. They reflect, for example, content typically taught in both beginning and more advanced algebra and geometry courses, as well as in data analysis and statistics. It is, therefore, understandable that some educators are daunted by the more demanding mathematics requirements that accompany CCR standards-based education. Beyond the more rigorous content, consider the limited instructional time that many (or most) adult educators have to adequately teach the standards in mathematics. These challenges are particularly acute at the three highest levels of learning: Middle Intermediate, High Intermediate, and Adult Secondary. The standards at those levels can leave teachers overwhelmed, which can create barriers to fully implementing a coherent and effective mathematics program. To address the expressed needs associated with teaching the higher-level standards in mathematics, StandardsWork created this guide. It proposes a way to manage the higher-level math standards that addresses time constraints and other potential impediments to full implementation.

To build this resource, StandardsWork drew on the principles of Understanding by Design, or UbD, a three-stage backward design process. First, the guide’s developers defined the Big Ideas for each of the Middle Intermediate, High Intermediate, and Adult Secondary levels of learning. Next, they subdivided the Big Ideas into Priority Topics. Then, they translated each Priority Topic into a set of specific Instructional Objectives. The information revealed through the analysis proposes the critical content, instructional priorities, and time-on-task that can be covered effectively and efficiently in a systematic fashion. The components connect one to the other but with the necessary flexibility built in so that this resource can be used with any curriculum.

Because the purpose of this guide is to assist educators in meeting expressed challenges in organizing mathematical content, the guide is designed to work specifically with CCR content standards. Therefore, it will be important for instructors to provide opportunities, closely tied to content, for students to also engage in the Standards for Mathematical Practice:

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.



In sum, the *Guide to Effectively Managing Higher-Level Content Standards in Mathematics*:

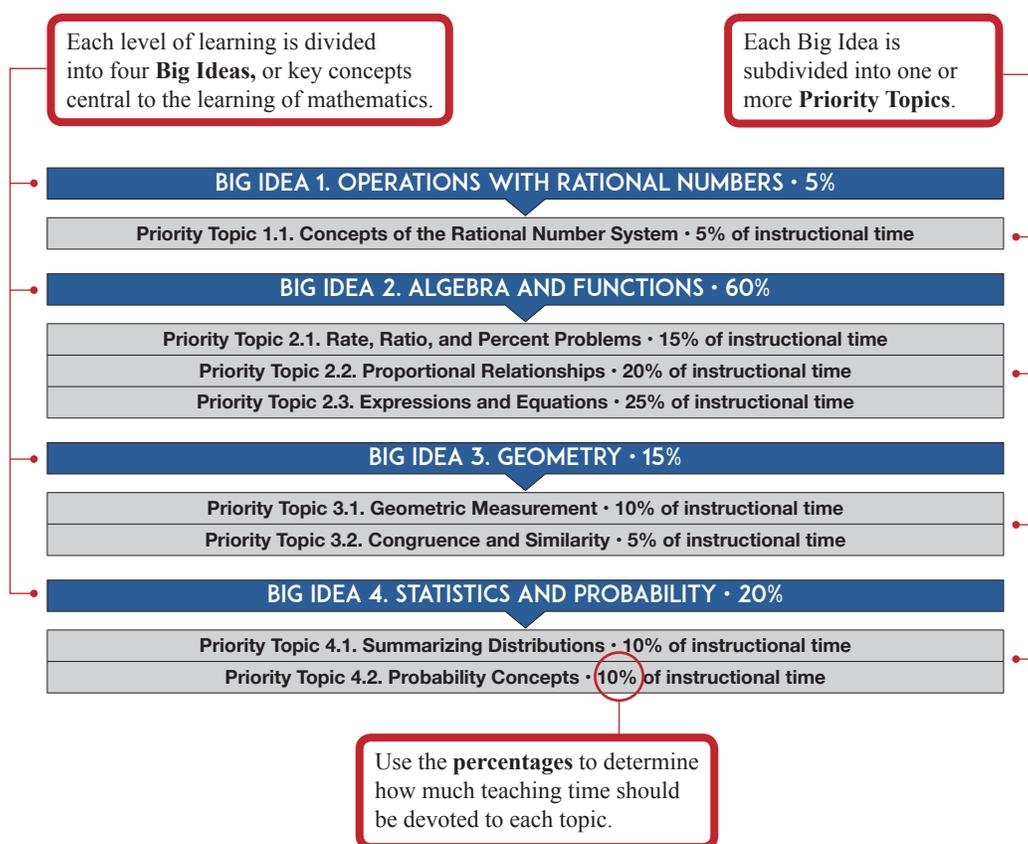
- Proposes which math content deserves the most attention and which can play a supporting role at each of the three highest levels.
- Organizes that content coherently within and across the three levels so that mathematical ideas build logically and connect naturally to one another.
- Prioritizes the content so that students will have opportunities to learn the most critical concepts and hone their mathematical skills through solving well-crafted problems.

In creating this guide, StandardsWork envisioned adult educators using it in conjunction with their math curriculum to organize content topics and balance the time spent on each. It illustrates how to prioritize mathematical ideas and topics and calculate how much instructional time to give to each.



## HOW TO USE THIS GUIDE

Begin by familiarizing yourself with the overview provided in the first table for your particular level, which identifies the percentage of time to be spent on each Big Idea and its associated Priority Topics. Using the total in-class instructional time available<sup>1</sup>, the percentages can help you determine approximately how much of the available teaching time should be devoted to each topic. For example, in the table below, the suggested percentage of in-class instructional time in Middle Intermediate Level for Big Idea 2 (Algebra and Functions) is 60%. That time is parceled among three Priority Topics: 15% for rate, ratio, and percent problems; 20% for proportional relationships; and 25% for expressions and equations. This means that if a total of 80 hours of in-class instructional time is planned, approximately 48 hours would be devoted to Algebra and Functions. Those 48 hours would be subdivided into approximately 12-, 16-, and 20-hour segments of time, respectively, for the three Priority Topics.



<sup>1</sup>For best results, 80 to 100 hours of in-class instructional time for each level is suggested.



# College and Career Readiness Standards-in-Action

Consult the next table for a detailed analysis representing standards pertinent to each Priority Topic. The Instructional Objectives provide student-focused explanations of concepts to be addressed and show how they could fit into a curriculum plan. Then, to help create a coherent experience for the student, the last column of this table provides a series of notes about connections to other content that should be made during instruction.

This column provides standards that relate to the Priority Topic. Clear connections should be made between the Major Work of the Level (shown in boldface type) and the supporting standards (shown in plain text).

This column provides information about important connections within and across levels of learning.

BIG IDEA 1. OPERATIONS WITH RATIONAL NUMBERS		
Priority Topic 1.1. Concepts of the Rational Number System • 5% of instructional time		
CCR Content Standards <sup>2</sup>	Instructional Objectives	Connections To Other Content
<b>6.NS.7</b> 6.NS.5 6.NS.6 6.NS.6a 6.NS.6b 6.NS.6c 6.NS.7a 6.NS.7b 6.NS.7c 6.NS.7d 6.NS.8  <b>6.RP.3a</b> 8.EE.1 8.EE.2 8.EE.3 8.EE.4	<b>Students understand and learn how to:</b> <ul style="list-style-type: none"> <li>Order and compare negative rational numbers</li> <li>Place rational numbers on a number line and find ordered pairs of rational numbers on the coordinate plane</li> <li>Work with absolute value</li> <li>Interpret numerical statements of inequality for all rational numbers</li> <li>Find equivalent ratios</li> <li>Use numerical expressions with integer exponents, including numbers expressed in scientific notation</li> <li>Use square roots and cube roots in numerical expressions</li> </ul>	<b>Connections to content students have learned previously:</b> <ul style="list-style-type: none"> <li>Students build on their previous understanding of operational fluency with positive whole numbers, fractions, and decimals.</li> </ul> <p><b>Note:</b> Time is needed to ensure fluency (facility and efficiency in solving problems that involve rational numbers), particularly with fraction operations. Time spent on dedicated fluency drills can be helpful at key points, but dedicated fluency drills should be occasional. Practice distributed throughout the curriculum should be used to continually reinforce fluency.</p> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>Students' understanding of irrational numbers in the form of square roots and <math>\pi</math> is applied in geometry, with measurements on a circle and in a right triangle.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>At the Adult Secondary Level, the number system will be extended to include all real numbers and expressions with rational exponents, making a connection between exponential and radical expressions.</li> <li>Absolute value is not a prioritized concept at this level, but it supports geometric understanding of the magnitude of negative numbers and the idea of distance on a coordinate plane. That concept will be extended to work with directional vectors in higher-level mathematics.</li> </ul>

This column provides student-focused explanations of concepts to be addressed.

On the following pages of this guide, you will find an overview of the most critical content that students need to learn in the Middle Intermediate, High Intermediate, and Adult Secondary levels. The sections are broken down as follows:

- Section 1: Middle Intermediate Level
- Section 2: High Intermediate Level
- Section 3: Adult Secondary Level



## SECTION 1: MIDDLE INTERMEDIATE LEVEL

### **BIG IDEA 1. OPERATIONS WITH RATIONAL NUMBERS • 5%**

**Priority Topic 1.1. Concepts of the Rational Number System • 5% of instructional time**

### **BIG IDEA 2. ALGEBRA AND FUNCTIONS • 60%**

**Priority Topic 2.1. Rate, Ratio, and Percent Problems • 15% of instructional time**

**Priority Topic 2.2. Proportional Relationships • 20% of instructional time**

**Priority Topic 2.3. Expressions and Equations • 25% of instructional time**

### **BIG IDEA 3. GEOMETRY • 15%**

**Priority Topic 3.1. Geometric Measurement • 10% of instructional time**

**Priority Topic 3.2. Congruence and Similarity • 5% of instructional time**

### **BIG IDEA 4. STATISTICS AND PROBABILITY • 20%**

**Priority Topic 4.1. Summarizing Distributions • 10% of instructional time**

**Priority Topic 4.2. Probability Concepts • 10% of instructional time**



**BIG IDEA 1. OPERATIONS WITH RATIONAL NUMBERS**

**Priority Topic 1.1. Concepts of the Rational Number System • 5% of instructional time**

CCR Content Standards <sup>2</sup>	Instructional Objectives	Connections to Other Content
<p><b>6.NS.7</b>                      6.NS.5                      6.NS.6                      6.NS.6a                      6.NS.6b                      6.NS.6c                      6.NS.7a                      6.NS.7b                      6.NS.7c                      6.NS.7d                      6.NS.8</p> <p><b>6.RP.3a</b>                      8.EE.1                      8.EE.2                      8.EE.3                      8.EE.4</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>Order and compare negative rational numbers</li> <li>Place rational numbers on a number line and find ordered pairs of rational numbers on the coordinate plane</li> <li>Work with absolute value</li> <li>Interpret numerical statements of inequality for all rational numbers</li> <li>Find equivalent ratios</li> <li>Use numerical expressions with integer exponents, including numbers expressed in scientific notation</li> <li>Use square roots and cube roots in numerical expressions</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>Students build on their previous understanding of operational fluency with positive whole numbers, fractions, and decimals.</li> </ul> <p><b>Note:</b> Time is needed to ensure fluency (facility and efficiency in solving problems that involve rational numbers), particularly with fraction operations. Time spent on dedicated fluency drills can be helpful at key points, but dedicated fluency drills should be occasional. Practice distributed throughout the curriculum should be used to continually reinforce fluency.</p> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>Students' understanding of irrational numbers in the form of square roots and <math>\pi</math> is applied in geometry, with measurements on a circle and in a right triangle.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>At the Adult Secondary Level, the number system will be extended to include all real numbers and expressions with rational exponents, making a connection between exponential and radical expressions.</li> <li>Absolute value is not a prioritized concept at this level, but it supports geometric understanding of the magnitude of negative numbers and the idea of distance on a coordinate plane. That concept will be extended to work with directional vectors in higher-level mathematics.</li> </ul>

<sup>2</sup> Clear connections should be made between the **Major Work of the Level** (shown in boldface type) and the supporting standards (shown in plain text).



## BIG IDEA 2. ALGEBRA AND FUNCTIONS

### Priority Topic 2.1. Rate, Ratio, and Percent Problems • 15% of instructional time

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p>6.RP.3* 6.RP.3b 6.RP.3c 6.RP.3d</p> <p>7.RP.1 7.RP.3</p> <p>*Emphasis is on reasoning using strategies other than equations: ratio tables, number lines, and tape diagrams</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>• Calculate with percentages</li> <li>• Compute with unit rates</li> <li>• Convert units within and between systems</li> <li>• Solve problems involving rates, ratios, and percentages</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>• Students extend their knowledge of fractions to applications involving rates, unit rates, and percentages.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>• Students apply what they know about ratios to geometric similarity, ratios of length, area, or other measurement quantities.</li> <li>• Students use what they know about geometric measurement when working with units.</li> <li>• Ratios and percentages are applied in the study of probability.</li> <li>• Students make the connection between numerical and algebraic thinking through this topic. Working with rates and ratios will improve fluency with rational number operations.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>• In the Adult Secondary Level, students will use reasoning with unit ratios and density to help solve problems.</li> </ul>



**BIG IDEA 2. ALGEBRA AND FUNCTIONS**

**Priority Topic 2.2. Proportional Relationships • 20% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p>6.RP.3* 7.RP.2 7.RP.2a 7.RP.2b 7.RP.2c 7.RP.2d 7.RP.3 8.EE.5</p> <p>*Emphasis is on proportional expressions and equations</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>Recognize a proportional relationship from a context or a graph</li> <li>Represent a proportional relationship with an equation and use it to solve problems</li> <li>Recognize the constant of the proportionality in multiple representations</li> <li>Graph a proportional relationship</li> <li>Solve problems using proportional relationships</li> </ul>	<p><b>Connections to content students have learned previously:</b> Students apply their prior knowledge of:</p> <ul style="list-style-type: none"> <li>Rational numbers in representing slopes of the graphs of these relationships.</li> <li>Basic graphing in a coordinate plane.</li> <li>Writing and solving one-step linear expressions and equations.</li> <li>Using expressions and equations related to proportional reasoning.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>Students apply their understanding of rates and ratios in their work with slope as a rate of change in a proportional relationship.</li> <li>They also make connections to numerical properties of operations when rewriting expressions for functions in equivalent and possibly more useful forms.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>In the Adult Secondary Level, proportional relationships will be applied when students use units as a way of understanding and solving problems.</li> </ul>



**BIG IDEA 2. ALGEBRA AND FUNCTIONS**

**Priority Topic 2.3. Expressions and Equations • 25% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p>Expressions, equations, and inequalities:  <b>7.EE.1</b>                      7.EE.2  <b>8.EE.7</b>  <b>8.EE.7a</b>  <b>8.EE.7b</b></p> <p>Systems of linear equations:  <b>8.EE.8</b>  <b>8.EE.8a</b></p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>Operate with linear expressions</li> <li>Write linear equations and inequalities to represent problem situations and to solve problems</li> <li>Apply properties to transform expressions and equations to equivalent forms</li> <li>Solve one-variable linear equations and inequalities and problems involving both</li> <li>Graph linear equations and inequalities in a coordinate plane</li> <li>Recognize the graphic solution for a system of two linear equations</li> <li>Solve pairs of simultaneous linear equations</li> </ul>	<p><b>Connections to content students have learned previously:</b>                      Students build on their previous understanding of:</p> <ul style="list-style-type: none"> <li>Writing and evaluating expressions and recognizing equivalent expressions.</li> <li>Proportional relationships leading to linear equations that are not proportional.</li> <li>Graphing in a coordinate plane.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>Students use expressions and equations to solve problems in geometry and statistics.</li> <li>They also learn to relate linear expressions to the linear functions they represent.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>In the High Intermediate Level, students will extend their understanding of linear expressions and equations to include nonlinear equations.</li> <li>In the Adult Secondary Level, they will extend their understanding to systems of three linear equations and systems involving nonlinear equations.</li> </ul>



**BIG IDEA 3. GEOMETRY**

**Priority Topic 3.1. Geometric Measurement • 10% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p>Circle measures: <b>7.G.4</b></p> <p>Triangle measures: <b>8.G.7</b></p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>• Use formulas to find the area and circumference of circles</li> <li>• Use the Pythagorean Theorem to find missing side lengths in a right triangle</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>• Students use their prior knowledge of the coordinate plane when they work with the placement of circles on the plane.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>• Students make the connection between the area and circumference of circles to understand and approximate irrational numbers, specifically <math>\pi</math>.</li> <li>• They also connect solving equations involving squares and square roots with their previous work with solving linear equations.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>• The work with circle measures will extend to triangles in the High Intermediate Level. There, students will apply coordinate plane distances on a circle to finding the distance between any two points.</li> <li>• In the Adult Secondary Level, students will use precise definitions to find measurements and justify conjectures. This includes definitions for angle, circle, perpendicular and parallel lines and the undefined terms, point, line, and plane.</li> </ul>



**BIG IDEA 3. GEOMETRY**

**Priority Topic 3.2. Congruence and Similarity • 5% of instructional time**

<b>CCR Content Standards</b>	<b>Instructional Objectives</b>	<b>Connections to Other Content</b>
<b>7.G.1</b> <b>8.G.2</b> <b>8.G.4</b>	<b>Students understand and learn how to:</b> <ul style="list-style-type: none"><li>• Understand congruence and similarity in terms of a transformation or a combination of transformations</li><li>• Solve problems involving scale, including those involving similarity</li></ul>	<b>Connections to content students have learned previously:</b> <ul style="list-style-type: none"><li>• Students apply their understanding of the features and characteristics of two-dimensional figures in their work with transformations.</li><li>• They also use their understanding of the coordinate plane for both transformations and scale problems.</li></ul> <b>Connections to other content within this level:</b> <ul style="list-style-type: none"><li>• Students use multiplication and division of rational numbers in matters of scale.</li><li>• They use proportional relationships in problems involving similarity.</li></ul> <b>Connections to content in higher levels of learning:</b> <ul style="list-style-type: none"><li>• In the High Intermediate Level, students will apply their knowledge of similar and congruent figures to their understanding of angle relationships.</li></ul>



**BIG IDEA 4. STATISTICS AND PROBABILITY**

**Priority Topic 4.1. Summarizing Distributions • 10% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p>6.SP.5 7.SP.3 7.SP.4 8.SP.1 8.SP.2</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>Summarize data using measures of center and variability</li> <li>Interpret and informally compare two data sets based on their measures of center and variability</li> <li>Construct scatter plots for bivariate data</li> <li>Informally fit data to a line</li> <li>Use a linear model to answer questions and solve problems related to data</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>Students apply their understanding of the definition of measures of center as a single number that summarizes data and data displays, including histograms and line, dot, and box plots.</li> <li>They also apply their knowledge about creating box plots and, by extension, finding a median.</li> <li>This level extends students' basic understanding of data to include mode and mean and also measures of variability.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>Students use their understanding of operations with rational numbers, particularly with data sets that include signed quantities but also for the operations required for calculating the mean.</li> <li>Students relate statistical trends to their work with linear functions in algebra.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>In the High Intermediate Level, students will extend their understanding of data analysis to include making predictions based on frequencies and two-way tables and the need to consider sampling techniques.</li> <li>They will also build on their understanding of the informal fit of data to a line to a deeper understanding of linear associations.</li> <li>In the Adult Secondary Level, students will use patterns of association to recognize trends and interpret differences between data sets based on measures of center and spread that are addressed here.</li> </ul>



**BIG IDEA 4. STATISTICS AND PROBABILITY**

**Priority Topic 4.2. Probability Concepts • 10% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p><b>7.SP.5</b> <b>7.SP.6</b></p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>Calculate and approximate probabilities of chance events</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>Students apply their prior understanding of fractions as quantities.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>Students apply their understanding of ratios to include those that arise in the context of probability, and use rational expressions to represent probabilities.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>In the High Intermediate Level, students will extend their conceptual understanding of probability to include compound probabilities and probability distributions.</li> <li>They will also use properties of rational number operations in determining compound probabilities.</li> </ul>

## SECTION 2: HIGH INTERMEDIATE LEVEL

### **BIG IDEA 1. OPERATIONS WITH RATIONAL NUMBERS • 5%**

**Priority Topic 1.1. Fluency With Rational Number Operations • 5% of instructional time**

### **BIG IDEA 2. ALGEBRA AND FUNCTIONS • 50%**

**Priority Topic 2.1. Equations and Inequalities • 25% of instructional time**

**Priority Topic 2.2. Understanding Linear Functions • 25% of instructional time**

### **BIG IDEA 3. GEOMETRY • 15%**

**Priority Topic 3.1. Geometric Measurement (Area, Surface Area, Volume) • 10% of instructional time**

**Priority Topic 3.2. Angle Relationships • 5% of instructional time**

### **BIG IDEA 4. STATISTICS AND PROBABILITY • 30%**

**Priority Topic 4.1. Interpreting Bivariate Data • 15% of instructional time**

**Priority Topic 4.2. Probability Distributions • 15% of instructional time**



## BIG IDEA 1. OPERATIONS WITH RATIONAL NUMBERS

### Priority Topic 1.1. Fluency With Rational Number Operations • 5% of instructional time

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p><b>7.NS.1</b> 7.NS.1a <b>7.NS.1b</b> <b>7.NS.1c</b> <b>7.NS.1d</b> <b>7.NS.2</b> <b>7.NS.2a</b> <b>7.NS.2b</b> <b>7.NS.2c</b> <b>7.NS.2d</b> <b>7.NS.3</b> 8.NS.2</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>• Interpret rational number addition and subtraction using a number line and in contexts</li> <li>• Convert a rational number to a decimal</li> <li>• Solve problems that require operations with positive and negative rational numbers, including those involving ratios, rates, decimals, and percent</li> <li>• Recognize irrational numbers as quantities that can be approximated as a position on the number line</li> <li>• Use decimal or fraction approximations of irrational numbers</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>• Students build on their prior understanding and operational fluency with positive whole numbers, fractions, and decimals.</li> <li>• Operations with negative rational numbers are used throughout this and subsequent levels.</li> <li>• Fluency with rational number operations is a goal for the end of this level. Students work toward fluency by encountering rational number operations in work in other domains and through individual practice or homework.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>• While the standard for irrational numbers is not prioritized, students are asked in algebra and geometry to solve equations involving squares, cubes, and square and cube roots.</li> <li>• Solving simple quadratic equations related to the Pythagorean Theorem helps students recognize the need for irrational numbers.</li> <li>• Students also find the area and circumference of a circle, from which the numerical definition of <math>\pi</math> emerges.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>• Building understanding of irrational numbers will be essential to a deep understanding of the real number system, introduced in the Adult Secondary Level.</li> </ul>



**BIG IDEA 2. ALGEBRA AND FUNCTIONS**

**Priority Topic 2.1. Equations and Inequalities • 25% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p>Linear equations and inequalities:  <b>7.EE.3</b>  <b>7.EE.4</b>  <b>7.EE.4a</b>  <b>7.EE.4b</b></p> <p>Linear systems of equations:  <b>8.EE.8b</b>  <b>8.EE.8c</b></p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>Operate with linear expressions</li> <li>Write linear equations and inequalities to represent problem situations and to solve the problem</li> <li>Apply properties to transform expressions and equations into equivalent forms</li> <li>Solve one-variable linear equations and inequalities and problems involving both</li> <li>Graph linear equations and inequalities in a coordinate plane</li> <li>Create and solve a system of two linear equations</li> <li>Represent a problem situation with a system of two linear equations</li> <li>Graphically represent a system of two linear equations</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>Students' understanding about proportional relationships leads to their understanding of linear equations that are not proportional.</li> <li>Students' previous knowledge of writing and evaluating expressions and recognition of equivalent expressions extend to writing linear equations.</li> <li>They also apply their understanding of linear equations and of graphing in a coordinate plane.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>Students apply their understanding of expressions and equations to the study of linear functions.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>In the Adult Secondary Level, students will extend their understanding of linear expressions and equations to include nonlinear equations, systems of three linear equations, and systems involving nonlinear equations.</li> </ul>



**BIG IDEA 2. ALGEBRA AND FUNCTIONS**

**Priority Topic 2.2. Understanding Linear Functions • 25% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p>8.F.1 8.F.3* 8.F.4 8.F.5</p> <p>*Emphasis is on linear functions</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>Describe the functional relationship between two quantities</li> <li>Construct a linear function to model a situation</li> <li>Determine and interpret the rate of change and initial value for a linear function</li> <li>Graph a linear function in the coordinate plane and analyze the graph</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>Students' prior knowledge of rates and ratios is useful in their work with slopes (rates of change) in linear functions.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>Work in this topic expands on proportional relationships to include other linear equations and functions.</li> <li>Proportions are used when students solve problems involving similarity in Geometry.</li> <li>They also continue to use properties of operations when rewriting expressions for functions in equivalent, but possibly more useful, forms.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>In the Adult Secondary Level, students will extend their understanding of function concepts and linear functions to include some that are nonlinear.</li> </ul>



## BIG IDEA 3. GEOMETRY

### Priority Topic 3.1. Geometric Measurement (Area, Surface Area, Volume) • 10% of instructional time

CCR Content Standards	Instructional Objectives	Connections to Other Content
7.G.6	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"><li>Solve problems involving the volume and surface area of figures composed of triangles, polygons, cubes and right prism</li></ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"><li>Students apply their understanding of areas of two-dimensional figures and volumes of right rectangular prisms.</li><li>They use prior knowledge of the coordinate plane when finding the distance between two points on a plane.</li></ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"><li>Students practice rational number operations in the calculations for geometric measurement (working toward fluency).</li><li>They may use equations to find solutions when some measurements in a geometric figure are unknown.</li></ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"><li>In the Adult Secondary Level, students will find the volume and surface area of cylinders, pyramids, cones, and spheres.</li></ul>



**BIG IDEA 3. GEOMETRY**

**Priority Topic 3.2. Angle Relationships • 5% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p>8.G.8 7.G.5 8.G.5</p> <p>8.F.3*</p> <p>*Emphasis is on nonlinear examples</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>• Use new vocabulary and facts about angles to solve problems (supplementary, complementary, vertical, adjacent)</li> <li>• Understand the relationships between the angles of a right triangle and of two similar triangles</li> <li>• Understand the relationships between angles formed by parallel lines intersected by a transversal</li> <li>• Apply the Pythagorean Theorem</li> <li>• Find the distance between two points</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>• Students apply their understanding of angles as additive. This concept is extended at this level to include supplementary and complementary angles and angles captured by a transversal in its crossing of parallel lines.</li> <li>• Students apply their prior knowledge of two-dimensional figures to this study of angle relationships.</li> <li>• They use knowledge of solving linear equations in solving problems involving squares and square roots.</li> <li>• They also apply previous understandings of irrational numbers in some problem solutions.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>• Students should make the connection between solving equations involving squares and square roots with their previous work with solving linear equations.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>• In the Adult Secondary Level, students will know and use precise definitions to find measurements and justify conjectures. This includes definitions for angle, circle, perpendicular and parallel lines and the undefined terms, point, line, and plane.</li> </ul>



**BIG IDEA 4. STATISTICS AND PROBABILITY**

**Priority Topic 4.1. Interpreting Bivariate Data • 15% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p>7.SP.1 7.SP.2</p> <p>8.SP.1 8.SP.3 8.SP.4</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>• Use data from a random sample to answer questions or make predictions</li> <li>• Investigate and interpret patterns of linear association in data displayed in scatter plots</li> <li>• Use two-way tables showing frequencies and relative frequencies to display, summarize, describe, and interpret possible associations between two variables</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>• Students extend their understanding of data displays (histograms and line, dot, and box plots) to include scatter plots for data with a linear association.</li> <li>• They apply their knowledge of measures of center and spread to compare two data sets.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>• Students relate statistical trends to their work with linear functions.</li> </ul> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>• In the Adult Secondary Level, students will use patterns of association to recognize trends and interpret differences between data sets based on measures of center and spread that are addressed here.</li> <li>• They will also determine associations between variables that are nonlinear.</li> </ul>



**BIG IDEA 4. STATISTICS AND PROBABILITY**

**Priority Topic 4.2. Probability Distributions • 15% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p>7.SP.7 7.SP.7a 7.SP.7b 7.SP.8a 7.SP.8b</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>• Develop and use probability models</li> <li>• Use two-way tables to answer questions about a set of categorical data</li> <li>• Understand and compute compound probabilities</li> <li>• Use organized lists, tables, tree diagrams to represent sample spaces for compound events</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>• Students apply their understanding of probability concepts from the Middle Intermediate Level.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>• Students use rational number operations for probability calculations.</li> </ul> <p><b>Note:</b> The concepts addressed in this topic are introduced to students for the first time but are important enough to deserve their own topic. They play a supporting role in the CCR standards and should be connected to priority standards for the level.</p> <p><b>Connections to content in higher levels of learning:</b></p> <ul style="list-style-type: none"> <li>• In the Adult Secondary Level, students will use two-way tables to summarize categorical data and interpret relative frequencies.</li> <li>• They extend the logical reasoning used here in the organized counting techniques when making and proving geometric conjectures in the Adult Secondary Level.</li> </ul>

## SECTION 3: ADULT SECONDARY LEVEL

### BIG IDEA 1. QUANTITATIVE REASONING • 10%

Priority Topic 1.1. Real Number Operations • 5% of instructional time

Priority Topic 1.2. Using Appropriate Quantities in Graphs and Problems • 5% of instructional time

### BIG IDEA 2. ALGEBRA AND FUNCTIONS • 60%

Priority Topic 2.1. Expressions, Equations, and Inequalities • 25% of instructional time

Priority Topic 2.2. Function Concepts • 10% of instructional time

Priority Topic 2.3. Nonlinear Functions • 25% of instructional time

### BIG IDEA 3. GEOMETRY • 20%

Priority Topic 3.1. Geometric Measurement and Modeling • 20% of instructional time

### BIG IDEA 4. STATISTICS AND DATA ANALYSIS • 10%

Priority Topic 4.1. Interpreting Data • 10% of instructional time



**BIG IDEA 1. QUANTITATIVE REASONING**

**Priority Topic 1.1. Real Number Operations • 5% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p><b>N-RN.2</b></p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>• Use rational exponents to rewrite numerical expressions involving radicals</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>• Students apply their knowledge from the previous levels to increase their fluency with operations with real numbers.</li> <li>• Students need to continue to practice operations with numerical expressions, including those involving fractions, decimals, negative real numbers, radicals, and exponents.</li> <li>• Previous work with the Pythagorean Theorem and surface areas and volumes of three-dimensional figures involving squares, cubes, and square and cube roots reinforces the skill of rewriting exponential or radical expressions.</li> <li>• Students also apply their prior knowledge of scientific notation.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>• When solving equations involving nonlinear functions, students apply their knowledge of irrational numbers.</li> <li>• In Geometry, students find areas and volumes for figures involving circle measures (cones, cylinders, spheres) and use their knowledge of solving equations involving irrational numbers.</li> </ul> <p><b>Connections to content in college and technical training programs:</b></p> <ul style="list-style-type: none"> <li>• In advanced mathematics studies, students will extend their knowledge of the number system to include imaginary numbers and the set of complex numbers.</li> </ul>



**BIG IDEA 1. QUANTITATIVE REASONING**

**Priority Topic 1.2. Using Appropriate Quantities in Graphs and Problems • 5% of instructional time**

<b>CCR Content Standards</b>	<b>Instructional Objectives</b>	<b>Connections to Other Content</b>
<p><b>N-Q.1</b> <b>N-Q.3</b></p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>• Choose and interpret units</li> <li>• Use units as a way to understand and solve problems</li> <li>• Correctly use and interpret scale and the origin in graphic displays</li> <li>• Choose a level of precision appropriate for a measurement situation</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>• Students apply their understanding of rates and ratios to this topic's requirements related to units and scale.</li> <li>• They use rounding skills in measurement precision.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>• When solving problems that require algebraic reasoning, students apply their numerical understanding of units and scale.</li> <li>• In the geometry domain of this level, students use their understanding of units when solving problems of density.</li> </ul>



**BIG IDEA 2. ALGEBRA AND FUNCTIONS**

**Priority Topic 2.1. Expressions, Equations, and Inequalities • 25% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p> <b>A-SSE.1*</b>  <b>A-SSE.1a*</b>  <b>A-SSE.2*</b>  <b>A-SSE.3</b>  <b>A-SSE.3a</b>    <b>A-APR.1</b>  <b>A-APR.6</b>    <b>A-CED.1</b>  <b>A-CED.2</b>  <b>A-CED.3*</b>  <b>A-REI.3</b>  <b>A-REI.4</b>    A-CED.4*  A-REI.1  A-REI.2  A-REI.6  A-REI.10    *Emphasis is on quadratic, exponential, polynomial, and simple rational equations </p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>Interpret quadratic, exponential, polynomial, and simple rational expressions and, using their structure, rewrite them in equivalent forms to serve a purpose</li> <li>Create and solve quadratic, exponential, polynomial, and simple rational equations and linear inequalities to solve problems, both algebraically and graphically</li> <li>Rearrange formulas involving quadratic, exponential, polynomial, and simple rational expressions to highlight specific quantities</li> <li>Operate with polynomial and rational expressions</li> <li>Interpret extraneous solutions for rational and radical equations</li> </ul>	<p><b>Connections to content students have learned previously:</b></p> <ul style="list-style-type: none"> <li>Students use their prior knowledge of the structure of numerical expressions and writing and solving linear equations to create algebraic expressions and solve nonlinear equations and inequalities.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>Students apply their understanding of real numbers and numerical expressions involving exponents and radicals to solve nonlinear equations, including those with radicals and exponents.</li> <li>Students also apply their skills with creating and manipulating expressions and equations to their work with functions and statistics.</li> </ul> <p><b>Connections to content in college and technical training programs:</b></p> <ul style="list-style-type: none"> <li>The skills learned here will be extended and applied in advanced mathematics to include logarithmic and trigonometric equations.</li> </ul>



## BIG IDEA 2. ALGEBRA AND FUNCTIONS

### Priority Topic 2.2. Function Concepts • 10% of instructional time

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p><b>F-IF.4</b> <b>F-IF.5</b> <b>F-IF.7</b> <b>F-IF.8b</b> <b>F-IF.9</b> <b>F-BF.1*</b></p> <p>F-IF.1 F-IF.2</p> <p><b>F-LE.1</b> <b>F-LE.1b</b> <b>F-LE.1c</b> <b>F-LE.5</b></p> <p>*Emphasis is on building and comparing linear and exponential functions</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>• Use function notation</li> <li>• Write a function that describes a relationship</li> <li>• Graph a function and interpret key features</li> <li>• Differentiate between and compare situations that can be modeled by linear and exponential functions</li> <li>• Compare key features of the graphs of various functions</li> </ul> <p><b>NOTE:</b> In this topic, students focus on a known function type (linear) to understand the similarities and differences when compared with other types of functions. For this introduction we limit instruction to exponential functions. Other nonlinear functions will be addressed in Priority Topic 2.3.</p>	<p><b>Connections to content students have learned previously:</b> Students apply their prior understanding of:</p> <ul style="list-style-type: none"> <li>• Linear functions to compare and interpret exponential functions.</li> <li>• Graphing and analyzing data that can be represented by a linear relationship to exponential functions.</li> <li>• Expressions to include those that can be used to represent a function.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>• When applying and modeling with nonlinear functions, students apply their knowledge of linear and exponential functions to other nonlinear functions (quadratic, polynomial, and simple rational).</li> </ul> <p><b>Connections to content in college and technical training programs:</b></p> <ul style="list-style-type: none"> <li>• Advanced mathematics students will use their understanding of quadratic, exponential, polynomial, and simple rational functions to extend their function library to include logarithmic and trigonometric functions.</li> </ul>



**BIG IDEA 2. ALGEBRA AND FUNCTIONS**

**Priority Topic 2.3. Nonlinear Functions • 25% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p><b>F-IF.4</b>  <b>F-IF.5</b>  <b>F-IF.7</b>  <b>F-IF.9</b>            F-IF.6</p> <p><b>F-BF.1*</b></p> <p>*Emphasis is on quadratic, exponential, polynomial, and simple rational functions</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>• Write a function that describes a quadratic, exponential, polynomial, or simple rational relationship</li> <li>• Graph quadratic, exponential, polynomial, or simple rational functions, and interpret key features</li> <li>• Calculate and interpret the average rate of change for a function</li> </ul>	<p><b>Connections to content students have learned previously:</b>            Students apply their prior knowledge of:</p> <ul style="list-style-type: none"> <li>• Linear and exponential functions and interpreting their graphs to polynomial and simple rational functions.</li> <li>• Slope of a linear function to the average rate of change for a nonlinear function.</li> <li>• Linear and exponential functions to graphing and interpreting the graphs of polynomial and simple rational functions.</li> <li>• Operations with fractions when rewriting rational expressions.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>• When creating and graphing polynomial functions, students apply what they know about evaluating numerical expressions involving exponents and radicals.</li> </ul> <p><b>Connections to content in college and technical training programs:</b></p> <ul style="list-style-type: none"> <li>• Students will use their understanding of quadratic, exponential, polynomial, and simple rational functions to extend their function library to include logarithmic and trigonometric functions.</li> <li>• They will also use graphing and algebraic manipulation to solve real-world problems involving nonlinear equations that are not functions, such as the conic sections.</li> </ul>



**BIG IDEA 3. GEOMETRY**

**Priority Topic 3.1. Geometric Measurement and Modeling • 20% of instructional time**

CCR Content Standards	Instructional Objectives	Connections to Other Content
<p><b>G-GMD.3</b> <b>G-SRT.5</b></p> <p>G-CO.1 G-MG.2</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>• Apply similarity in right triangle relationships</li> <li>• Solve problems involving right triangles</li> <li>• Use precise definitions related to points, lines, angles, and distance</li> <li>• Present logical arguments to prove conjectures about geometric figures</li> <li>• Use formulas to find volumes of cylinders, cones, spheres, and pyramids to solve problems</li> <li>• Apply the concept of density as a geometric model</li> </ul>	<p><b>Connections to content students have learned previously:</b> Students use their understanding of:</p> <ul style="list-style-type: none"> <li>• Two-dimensional figures in making and proving conjectures, including those involving the volumes of right rectangular prisms.</li> <li>• Triangles to address the special relationships that exist in right triangles.</li> <li>• Rates, ratios, and proportions.</li> <li>• Units and volumes of three-dimensional figures.</li> <li>• Rational estimations of irrational numbers.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>• When using volume formulas, students calculate with irrational numbers and use appropriate levels of precision in reporting their results.</li> <li>• When applying those formulaic equations to measurement situations, students solve nonlinear algebraic equations.</li> <li>• Proving geometric conjectures connects to solving algebraic equations and showing the steps in their solutions.</li> <li>• When solving density problems, students perform real number operations and they should link to using appropriate levels of precision in reporting their results.</li> </ul> <p><b>Connections to content in college and technical training programs:</b></p> <ul style="list-style-type: none"> <li>• Students will extend their work with right triangle relationships to include trigonometric functions.</li> </ul>



**BIG IDEA 4. STATISTICS AND DATA ANALYSIS**

Priority Topic 4.1. Interpreting Data • 10% of instructional time		
CCR Content Standards	Instructional Objectives	Connections to Other Content
<p><b>S-ID.3</b> <b>S-ID.5</b> <b>S-ID.7</b></p> <p>S-ID.1 S-ID.9</p>	<p><b>Students understand and learn how to:</b></p> <ul style="list-style-type: none"> <li>Interpret differences in shape, center, and spread when comparing data sets</li> <li>Use two-way frequency tables to summarize data</li> <li>Distinguish between correlation and causation</li> <li>Interpret slope and intercept in terms of a data set in its context</li> </ul>	<p><b>Connections to content students have learned previously:</b> Students use their prior knowledge of:</p> <ul style="list-style-type: none"> <li>Data representations, including plots and histograms.</li> <li>Parameters of linear functions when interpreting the slope and intercept of a data set's linear representation.</li> <li>Nonlinear trends in data to understand linear functions.</li> </ul> <p><b>Connections to other content within this level:</b></p> <ul style="list-style-type: none"> <li>Students relate nonlinear trends to work with nonlinear algebraic equations and functions.</li> <li>Students' work with nonlinear trends in data connects to their understanding and interpretation of nonlinear equations.</li> </ul>