Eureka Acceleration Tool: Algebra I
Module 1, Topic D

To become mathematically proficient, students **must** access on-grade-level content. This document aims to help teachers who use the Eureka curriculum to ensure readiness for students before and during on-grade-level work, creating opportunities for timely support directly connected to the new learning.

About this Topic

Focus Standards:

A1: A-CED.A.1: Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear, quadratic, and exponential functions.*

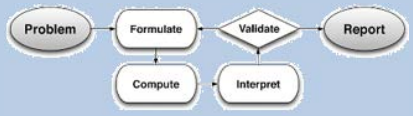
A1: A-CED.A.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

A1: A-REI.B.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Topic Overview per the Eureka Curriculum

This topic introduces students to the modeling cycle (see page 61 of the Common Core Learning Standards) through problems that can be solved using equations and inequalities in one variable, systems of equations, and graphing. From the CCLS (page 61):

> Modeling links classroom mathematics and statistics to everyday life, work, and decision-making.



> The basic modeling cycle is summarized in the diagram. It involves (1) identifying variables in the situation and selecting those that represent essential features; (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables; (3) analyzing and performing operations on these relationships to draw conclusions; (4) interpreting the results of the mathematics in terms of the original situation; (5) validating the conclusions by comparing them with the situation and then either improving the model; (6) or, if it is acceptable, reporting on the conclusions and the reasoning behind them. Choices, assumptions, and approximations are present throughout this cycle. The first lesson introduces parts of the modeling cycle using problems and situations that students have encountered before: creating linear equations, tape diagrams, rates, systems of linear equations, graphs of systems, etc.

The next lesson, *The Double and Add 5 Game*, employs the modeling cycle in a mathematical context. In this 2-day lesson, students formulate a model and build an equation to represent the model (in this case, converting a sequence defined recursively to an explicit formula). After they play the game in a specific case, *double and add 5,* they have to interpret the results of the mathematics in terms of the original model and validate whether their model is acceptable. Then they use the model to analyze and report on a problem that is too difficult to do *by hand* without the model.

Finally, Lesson 28 serves as a signature lesson on modeling as students take on the very real-life example of understanding federal marginal income tax rates (i.e., the progressive income tax brackets). Students are provided the current standard deduction tables per dependent or marital status and the marginal income tax table per marital filing status. For a specific household situation (e.g., married filing jointly with two dependents), students determine equations for the total Federal Income Tax for different income intervals, graph the piecewise-defined equations, and answer specific questions about the total effective rate for different income levels. All elements of the modeling cycle occur as students analyze the information to find, for example, roughly how much their favorite famous performer paid in federal taxes the previous year.

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Overview

Eureka Acceleration Tools include:

1. a diagnostic assessment to help teachers determine the misunderstandings or gaps in mathematical knowledge related to a specific Topic in the Eureka curriculum
2. guidance for teachers to analyze student work on the diagnostic assessment
3. suggested materials for targeted remedial instruction

Note: The use of this guidance is not intended to delay students' engagement with on-grade-level learning. On-grade-level learning should be the focus of instructional time and be treated as an opportunity for students to "finish" learning previous skills and deepen conceptual understanding.

Diagnostic Assessment

The diagnostic assessment is designed to be administered to targeted students prior to beginning instruction on the given Topic. When appropriate, it is broken into parts (Part A, Part B, and so on); each part addresses a different prerequisite standard and contains three problems. If a student correctly answers at least 2 out of the 3 problems, it can be assumed that he/she is ready to engage with the new content of the Topic with little to no support needed prior to engaging with the Topic. The diagnostic assessment is designed in this way so that teachers can determine the "entry point" to remedial instruction and/or opportunities for unfinished learning within the context of the new learning. The entry points and opportunities for unfinished learning will vary between students.

Guidance for Acceleration

The Acceleration Guidance is designed for teacher use. It is also broken into parts (Part A, Part B, and so on) and correlates to the parts on the diagnostic assessment. Each part contains the following:

1. **The focus standard**: The focus standards are strategically chosen to address prerequisite skills and are purposefully arranged in the order that students typically master the skills and knowledge.
2. **Why this is important for current grade level work**: This section describes how the work of the prerequisite standard relates to the standard(s) addressed in the Topic of instruction.
3. **Using the diagnostic assessment to identify gaps**: This section identifies common errors students make on the diagnostic assessment items.
4. **Acceleration Resources for Targeted Instruction**: The resources pinpoint specific Eureka lessons and parts of lessons for teachers to use to address gaps in mathematical knowledge. Using Eureka materials to address acceleration ensures alignment to the standards, consistency in approach to learning, and similarities in strategies for solving problems.

Part A: 6.EE.B.7

For each problem below, write and solve an equation to answer the question.

1. Nikolas makes $40 per day to work a booth at the arts market and $3.50 as commission for each piece of art he sells. He would like to earn $124 in one day. How many pieces of art must Nikolas sell to meet his goal?

2. Ramona and Ripley are playing a card game. Ramona has five points less than double the number of points Ripley has. If Ramona has 33 points, how many points does Ripley have?

3. At a game store, collectible figures are on sale for $2 less than the normal sales price. If you buy five figures, it will cost $62.50. What is the normal sales price of each figure?

Part B: 7.EE.B.4a

For each problem below, write and solve an inequality to answer the question.

4. It costs a middle school $300 to rent a dunking booth for the spring festival. The parent association paid $100 toward the cost. Tickets cost $3.00 for ten throws. How many tickets must the school sell to exceed the cost of the dunking booth?

5. In order to qualify for the next level of a game, Joseph needs to earn at least 250 points. He currently has 30 points and can earn 40 points each time he beats an enemy. How many enemies must he beat to qualify for the next level?

6. Kay wants to spend no more than 75 dollars on school supplies. She already bought a backpack for $20, pens for $10 and needs to buy 6 notebooks. What is the maximum price that Kay can spend per notebook?

Solutions:

1. (Sample) Let a represent the number of pieces of art Nikolas sells; $40 + 3.50a = 124$; $a = 24$; Nikolas must sell 24 pieces of art to meet his goal.
2. (Sample) Let p represent the number of points Ripley has; $2p - 5 = 33$; $p = 19$; Ripley currently has 19 points.
3. (Sample) Let p represent the normal price of the figures; $5(p - 2) = 62.50$; $p = 14.50$; Each figure normally costs \$14.50.
4. (Sample) Let t represent the number of tickets; $100 + 3t > 300$; $t > 66\frac{2}{3}$; The school must sell at least 67 tickets to cover the cost of the dunking booth.
5. (Sample) Let e represent the number of enemies to beat; $30 + 40e \geq 250$; $e \geq 5.5$; Joseph must beat at least 6 enemies to qualify for the next level.
6. (Sample) Let c represent the cost of a notebook; $20 + 10 + 6c \leq 75$; $c \leq 7.5$; The notebooks can each cost no more than \$7.50.

Part A Focus: 7.EE.B.4a: Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is* 54 *cm. Its length is* 6 *cm. What is its width?*

Why this is important for current grade level work:
The target Topic focuses solely on modeling and application of equations and inequalities. Students modeling real-world situations by defining the variable(s) and writing math sentences to express the relationships between given constants and variables form the basis for most of the work of Algebra I (this Topic included) and beyond. Students must be able to define variables after reading a word problem, that is, they need to be able to determine what is unknown. As situations become more complex, students must be able to write an equation to solve instead of simply "working backwards." The skills learned in middle school support this work as it becomes more complex in Algebra I. These problems will help determine which students have the ability to model real-world problems with equations and use them to solve problems.

Using the Diagnostic Assessment to identify gaps:

Problem 1:
Look for students who confuse "less than" to mean the problem is represented by an inequality instead of an equation. Such students will need additional supports to understand the language used in equations and inequalities.

Problem 2:
Look for students who incorrectly model "five points less than," leading to a negative solution. Students should recognize that a negative number of points is unreasonable, pushing them to rethink their model. This is a critical part of the modeling process.

Problem 3:
Look for students fail to recognize the discount is applied to each figure, requiring the model to include parenthesis to denote the discounted price of each figure. If a student incorrectly models the situation, it might be difficult to prove the error mathematically. Push such students to consider whether they applied the discount to each figure or to the total bill, helping them realize they modeled the latter which is incorrect.

Acceleration Resources for Targeted Instruction:

7th Grade, Module 3, Topic B, Lesson(s) 9 – 11

Use the Classwork portion of the Lesson and a sampling of problems from the Problem Set that focus on application.

Part B Focus: 7.EE.B.4b: Solve word problems leading to inequalities of the form $px + q > r$, $px + q \geq r$, $px + q < r$ or $px + q \leq r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.*

Why this is important for current grade level work:
In Lesson 28 students will create linear inequalities in one variable and use them to solve real-life problems. Students must be able to define a variable and write an inequality to describe a situation, not as a series of steps that were taken to solve an equation. In other words, the inequality must model the situation, it should not simply be the solution. Students who have up to this point been able to guess a solution or arrive at one arithmetically can no longer do that since inequalities in one-variable typically have infinite solutions. Furthermore, the context often determines what an actual answer is to a real-world situation, rather than simply the mathematical solution to a math sentence. For instance, it may be appropriate to round up or down, given a problem's meaning. These problems will help determine which students have the ability to model real-world problems with inequalities and use them to solve problems.

Using the Diagnostic Assessment to identify gaps:

Problems 4 and 5:
Look for students who do not realize that the answer to their inequality is the answer to the real-world problem. Translating a verbal statement into a mathematical statement is an important part of the modeling process, but students must be able to use a model to appropriately answer a real-world problem.
Inequalities are often more difficult for students as compared to equations, since the answer to the model is rarely the answer to the problem. For students who struggle here, look back to Part A to see if the gap is in the creating appropriate models or in interpreting solutions in the context of the problem.

Problem 6:
Unlike problems 4 and 5, this problem is easier to move from the solution to the model to the answer to the real-world problem. Look for students who fail to recognize the rate language and simply find the overall amount of money to be spent on notebooks as opposed to the amount for each notebook.

Acceleration Resources for Targeted Instruction:

7th Grade, Module 3, Topic B, Lesson(s) 13 – 14

Use the Classwork portion of the Lesson and a sampling of problems from the Problem Set that focus on application.