Standard #: MAFS.7.EE.2.4

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

a. 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?

b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, 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.

Clarifications

Fluency Expectations or Examples of Culminating Standards

In solving word problems leading to one-variable equations of the form $px + q = r$ and $p(x + q) = r$, students solve the equations fluently. This will require fluency with rational number arithmetic (7.NS.1.1–1.3), as well as fluency to some extent with applying properties operations to rewrite linear expressions with rational coefficients (7.EE.1.1).

Examples of Opportunities for In-Depth Focus

Work toward meeting this standard builds on the work that led to meeting 6.EE.2.7 and prepares students for the work that will lead to meeting 8.EE.3.7.

General Information

Subject Area: Mathematics

Domain-Subdomain: Expressions & Equations

Cluster: Solve real-life and mathematical problems using numerical and algebraic expressions and equations. (Major Cluster) -
Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

Content Complexity Rating: Level 2: Basic Application of Skills & Concepts - More Information

Status: State Board Approved

Grade: 7

Cluster: Level 2: Basic Application of Skills & Concepts

Date Adopted or Revised: 02/14

Date of Last Rating: 02/14

Assessed: Yes

Test Item Specifications

N/A
Assessment Limits :
Inequalities must have context. Inequalities may use ≤ or ≥. Inequalities may not be compound inequalities
Calculator :
Yes

Context :
Allowable

Sample Test Items (4)

Test Item #: Sample Item 1
Question:

The perimeter of a rectangular garden is 37.5 feet (ft). The width is x, and the length is 15 ft. What is the width, in feet, of the garden?

Difficulty: N/A
Type: EE: Equation Editor

Test Item #: Sample Item 2

Question: A community is planning to build a rectangular garden. The width of the garden is $\frac{27}{4}$ feet (ft), and the perimeter of the garden is 37.5 ft. The community

planners want to spread mulch on the entire garden.
How many square feet of mulch will be needed?

Difficulty: N/A
Type: EE: Equation Editor

Test Item #: Sample Item 3
Question:

At her job, Jessie earns $9.50 per hour. She also earns a $60 bonus every month.

Jessie needs to earn more than $460 every month.

A. Create an inequality that represents the situation, where h represents the number of hours that Jessie needs to work in a month in order to earn more than $460.

B. Enter the minimum whole number of hours Jessie would have to work to earn $460 in a month.

Difficulty: N/A
Type: EE: Equation Editor

Test Item #: Sample Item 4
Question:

This question has **three** parts.

Vanessa has added 40 gallons of water to her new fish pond in her backyard and wants to add more water. Her pond can hold a maximum of 256 gallons. Her garden hose can add 48 gallons of water in 2 minutes.

Part A. Create an inequality to represent the number of minutes, m, Vanessa could run the garden hose to add more water to the pond without adding the maximum amount in case of rain.

Part B. Drag the appropriate arrow and circle to the number line to graph the solution to the inequality from Part A.

Part C. Select all the amounts of time, in minutes, that Vanessa could leave the house running.

Difficulty: N/A
Type: GRID: Graphic Response Item Display

Related Courses

Course Number	Course Title
1205040:	M/J Grade 7 Mathematics (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1205050:	M/J Accelerated Mathematics Grade 7 (Specifically in versions: 2014 - 2015, 2015 - 2020 (current), 2020 and beyond)
1204000:	M/J Intensive Mathematics (MC) (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200410:	Mathematics for College Success (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200700:	Mathematics for College Readiness (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7812020:	Access M/J Grade 7 Mathematics (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 - 2019, 2019 and beyond (current))
7912115:	Fundamental Explorations in Mathematics 2 (Specifically in versions: 2013 - 2015, 2015 - 2017 (course terminated))

Related Access Points

Access Points Number	Access Points Title
MAFS.7.EE.2.AP.4a:	Set up equations with one variable based on real-world problems.
MAFS.7.EE.2.AP.4b:	Solve equations with one variable based on real-world problems.

Related Resources

Assessments

Name	Description

Sample 3 - Seventh Grade Math State Interim Assessment:	This is a State Interim Assessment for seventh grade.
Sample 4 - Seventh Grade Math State Interim Assessment:	This is a State Interim Assessment for seventh grade.
Sample 2 - Seventh Grade Math State Interim Assessment:	This is a State Interim Assessment for seventh grade.
Sample 1 - Seventh Grade Math State Interim Assessment:	This is a State Interim Assessment for seventh grade.

Formative Assessments

Name	Description
Recycled Inequalities:	Students are asked to solve a real-world problem by writing and solving an inequality.
Solve Equations:	Students are asked to solve two multistep equations involving rational numbers.
Write, Solve and Graph an Inequality:	Students are asked to write, solve, and graph a two-step inequality.
Write and Solve an Equation:	Students are asked to write and solve a two-step equation to model the relationship among variables in a given scenario.
Squares:	Students are asked to write and solve an equation of the form $p(x + q) = r$ in the context of a problem about the perimeter of a square.
Gift Card Inequality:	Students are asked to solve a two-step inequality.
Algebra or Arithmetic?:	Students are asked to compare an arithmetic solution to an algebraic solution of a word problem.

Lesson Plans

Name	Description
Just Right Goldilocks' Café: Temperature & Turbidity:	This is lesson 3 of 3 in the Goldilocks' Café Just Right unit. This lesson focuses on systematic investigation on getting a cup of coffee to be the "just right" temperature and turbidity level. Students will use both the temperature probe and turbidity sensor and code using ScratchX during their investigation.
Just Right Goldilocks' Café: Turbidity:	This is lesson 2 of 3 in the Just Right Goldilocks' Café unit. This lesson focuses on systematic investigation on getting a cup of coffee to be the "just right" level of turbidity. Students will use turbidity sensors and code using ScratchX during their investigation.
Just Right Goldilocks' Café: Temperature:	This is lesson 1 of 3 in the Just Right Goldilocks' Café unit. This lesson focuses on systematic investigation on getting a cup of coffee to be the "just right" temperature. Students will use temperature probes and code using ScratchX during their investigation.
Gather Data For Distribution by Programming an App:	This lesson allow students to gather, calculate, and plot data using both computer code and mathematical equations. In this lesson students will create a pedometer app to demonstrate the understanding of algorithms, components (such as buttons, textboxes, sensors, etc.), and If/Then statements. This lesson uses algebraic equations and random data to access the needed components to store data in a spreadsheet.
Data Sets Represented in Computers:	This lesson shows how data can be represented by computers, in relation to everyday activities we may not be aware that we use computer. It gives an overview of graphing data by creating a histogram based on population data. Using the data collected, students will get a chance to hand write code to show what structure is needed for computers to collect, analyze and distribute such data. This lesson is lesson 1 of the Data Set and Deviation Statistics Unit and bridges statistical concepts of data collection, graphing and analysis with programming a computer using coding language while reinforcing foundational algebraic skills.
Scout Robot: Mass, Density, Volume, Weight:	In this MEA, students must select which material to use in the development of an advanced military scout robot. Students must analyze data about each material's individual properties that would make it a valid choice for military or police service. Students must complete calculations to determine material density as well as the overall mass and weight of the robot. This lesson focuses on the characteristic properties of density, unit conversion, and differentiating between mass and weight.
How Fast Can One Travel on a Bicycle?:	Students investigate how the pedal and rear wheel gears affect the speed of a bicycle. A GeoGebra sketch is included that allows a simulation of the turning of the pedal and the rear wheel. A key goal is to provide an experience for the students to apply and integrate the key concepts in seventh grade mathematics in a familiar context.
HOORAH!! Pizza For Lunch:	The principal of Central Middle School is thinking of adding pizza to the lunch menu on Mondays and Fridays but needs help deciding the costs per slice and what students think is important about the pizza. After the students' initial decision about the pizza the principal remembers that there is a delivery charge.The students must revisit their decision and do additional calculations to see if their original process still works.
Steps to Solving Equations:	This lesson unit is intended to help you assess how well students are able to form and solve linear equations involving factorizing and using the distributive law. In particular, this unit aims to help you identify and assist students who have difficulties in using variables to represent quantities in a real-world or mathematical problem and solving word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$.

Understanding Equations Using Perimeter:	This is an introductory lesson in writing and solving equations in the form p(x + q) = r using the perimeter of rectangles.
Pennies and Post-its:	Students will look at balancing linear equations using pennies as constants and Post-its as the coefficient of the linear term.
Gummy vs. Gum (Number Pattern):	"In this lesson, students use gummy bears and sticks of gum to discover a number pattern and write an equation that describes it. This lesson should be conducted after students have worked with patterns and one- and two-step equations." from the Beacon Learning Center.
Inequal-tile-ies:	In this lesson, students will work with Algebra Tiles to solve inequalities. This lesson builds upon student experience with solving equalities, as well as identifying inequalities and representing them on the number line. This lesson is an introduction to solving inequalities. (This lesson addresses part a of the standard)

Original Student Tutorials

Name	Description
Professor E. Qual Part 2: Two-Step Equations & Rational Numbers:	Practice solving and checking two-step equations with rational numbers in this interactive tutorial. This is part 2 of the two-part series on two-step equations. **Click HERE to open Part 1.**
Professor E. Qual Part 1: 2 Step Equations:	Professor E. Qual will teach you how to solve and check two-step equations in this interactive tutorial. This is part 1 of a two-part series about solving 2-step equations. **Click HERE to open Part 2.**
Balancing the Machine:	Use models to solve balance problems on a space station in this interactive, math and science tutorial.

Perspectives Video: Experts

Name	Description
Improving Hurricane Scales:	Meteorologist, Michael Kozar, discusses the limitations to existing hurricane scales and how he is helping to develop an improved scale. Download the CPALMS Perspectives video student note taking guide.
Water Flow Modeling for Archeology Research:	Submerge yourself in math as a hydrogeologist describes calculations used to investigate water flow questions related to ancient shell rings. Download the CPALMS Perspectives video student note taking guide.

Perspectives Video: Teaching Idea

Name	Description
Programming Mathematics: Algebra, Matrices, and Variables to control Open-source Hardware:	If you are having trouble understanding variables, this video might help you see the light. Download the CPALMS Perspectives video student note taking guide.

Problem-Solving Tasks

Name	Description
Smiles:	In this online problem-solving challenge, students apply algebraic reasoning to determine the "costs" of individual types of faces from sums of frowns, smiles, and neutral faces. This page provides three pictorial problems involving solving systems of equations along with tips for thinking through the problem, the solution, and other similar problems.
Fishing Adventures 2:	Students are asked to write and solve an inequality to determine the number of people that can safely rent a boat.
Sports Equipment Set:	The student is asked to write and solve an inequality to match the context.
Gotham City Taxis:	The purpose of this task is to give students an opportunity to solve a multi-step ratio problem that can be approached in many ways. This can be done by making a table, which helps illustrate the pattern of taxi rates for different distances traveled and with a little persistence leads to a solution which uses arithmetic. It is also possible to calculate a unit rate (dollars per mile) and use this to find the distance directly without making a table.
Log Ride:	Students are asked to solve an inequality in order to answer a real-world question.

Teaching Ideas

Name	Description
Students Collaborate to Solve Compound Inequalities:	In this activity, the student teacher role is reversed using the "jigsaw activity." This is where there is an original group, and they are separated into different groups. They are then given a particular case, and solve it as a group until they understand it enough to be able to go back to their original group and teach their case to the rest of the students. Each student coming from a different group, they will all have the opportunity to do some teaching.
Translating Word Problems into Equations:	This site shows students how to translate word problems into equations. It gives seven steps, from reading the problem carefully to checking the solution, to creating equations. The lesson moves on to a few simple exercises in which a natural language sentence is translated to an algebraic equation. It then moves on to more elaborate word problems which require students to identify the important data and follows the given seven steps to create and solve the equation. The more complex questions draw on student understanding of geometric formulae. There are six questions at the end for students to test their new knowledge of how to create and solve equations.
True, False, and Open Sentences:	"Students first explore arithmetic sentences to decide whether they are true or false. The lesson then introduces students to sentences that are neither true nor false but are algebraic equations, also called open sentences, such as x + 3 = 7 or 2 x = 12." from Math Solutions.

Tutorials

Name	Description
Solving Percentage Problems with Linear Equations:	Many real world problems involve involve percentages. This lecture shows how algebra is used in solving problems of percent change and profit-and-loss.
Solve a consecutive integer problem algebraically:	Students will learn how to solve a consecutive integer problem. Checking the solution will be left to the student.
Age word problem:	This tuptorial shows students how to set up and solve an age word problem. The tutorial also shows how tp check your work using substitution.
Age word problem :	Students will learn how to set up and solve an age word problem.
Factor a Linear Expression by Taking a Common Factor:	This video demonstrates how to factor a linear expression by taking a common factor.
Basic Linear Equation Word Problem:	This video shows how to construct and solve a basic linear equation to solve a word problem.
Combining Like Terms Introduction:	This video teaches about combining like terms in linear equations.
Multiplying and dividing inequalities :	Students will solve the inequality and graph the solution.
How to evaluate an expression using substitution:	In this example we have a formula for converting Celsius temperature to Fahrenheit. Let's substitute the variable with a value (Celsius temp) to get the degrees in Fahrenheit. Great problem to practice with us!
Solving One-Step Equations Using Multiplication and Division:	This tutorial will help you to solve one-step equations using multiplication and division. For practice, take the quiz after the lesson!
Solving Two-Step Equations:	This short video uses both an equation and a visual model to explain why the same steps must be used on both sides of the equation when solving for the value of a variable.
Linear Equations in One Variable:	This lesson introduces students to linear equations in one variable, shows how to solve them using addition, subtraction, multiplication, and division properties of equalities, and allows students to determine if a value is a solution, if there are infinitely many solutions, or no solution at all. The site contains an explanation of equations and linear equations, how to solve equations in general, and a strategy for solving linear equations. The lesson also explains contradiction (an equation with no solution) and identity (an equation with infinite solutions). There are five practice problems at the end for students to test their knowledge with links to answers and explanations of how those answers were found. Additional resources are also referenced.
Solving Equations With the Variable on Both Sides.:	This video models solving equations in one variable with variables on both sides of the equal sign.
Solving Equations with One Variable :	This Khan Academy presentation models solving two-step equations with one variable.

Unit/Lesson Sequences

Name	Description
Drawing to Scale: Designing a Garden:	In this lesson (or series of lessons), students interpret and use scale drawings to plan a garden layout. Students start by producing their own layout and then work together to refine their garden design. The activity requires that students use short rules (rulers), meter rules (meter sticks), string, protractors, scissors, glue, card, plain paper, graph paper, and colored pencils. Students work individually for 20 minutes, engage in a 100-minute lesson (or two 50-minute lessons), and complete a 10-minute follow up lesson or homework.
Variables and Patterns of Change: Translating Words Into Symbols; Linear Equations:	Lesson Plan 1: Miles of Tiles - The Pool Border Problem, students will recognize patterns and represent situations using algebraic notation and variables. Lesson Plan 2: Cups and Chips - Solving Linear Equations Using Manipulatives, students use manipulatives to represent visually the steps they take to obtain a solution to an algebraic equation. They develop an understanding of the connections between the solution involving manipulatives and the symbolic solution. Students work in teams of four. Site includes a Topic Overview, Lesson Plans, Student Work, Teaching Strategies, Resources, and a video of Workshop 1; Part 1.

Video/Audio/Animations

Name	Description
Solving Motion Problems with Linear Equations:	Based upon the definition of speed, linear equations can be created which allow us to solve problems involving constant speeds, time, and distance.
Solving Problems with Linear Equations:	How do we create linear equations to solve real-world problems? The video explains the process.

Virtual Manipulative

Name	Description
Linear Function Machine:	In this activity, students plug values into the independent variable to see what the output is for that function. Then based on that information, they have to determine the coefficient (slope) and constant(y-intercept) for the linear function. This activity allows students to explore linear functions and what input values are useful in determining the linear function rule. This activity includes supplemental materials, including background information about the topics covered, a description of how to use the application, and exploration questions for use with the Java applet.

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Parent Resources

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