ZEARN Math

MISSION OVERVIEW

GRADE 7

M6 Expressions, Equations, and Inequalities

Introduction

In this Mission, students solve equations of the forms $px + q = r$ and $p(x + q) = r$ where p, q, and r are rational numbers. They draw, interpret, and write equations in one variable for balanced "hanger diagrams," and write expressions for sequences of instructions, e.g., "number puzzles." They use tape diagrams together with equations to represent situations with one unknown quantity. They learn algebraic methods for solving equations. Students solve linear inequalities in one variable and represent their solutions on the number line. They understand and use the terms "less than or equal to" and "greater than or equal to," and the corresponding symbols. They generate expressions that are equivalent to a given numerical or linear expression. Students formulate and solve linear equations and inequalities that represent real-world situations.

Overview of Topics and Lesson Objectives

Each mission is broken down into topics. A topic is a group of lessons that teach the same concept. There is a balance of Independent Digital Lessons and Concept Explorations in each topic of a mission to ensure every student learns with a mix of modalities, feedback, and support while engaging in grade-level content. Throughout each mission, students work on grade-level content with embedded remediation to address unfinished learnings.

	Objective	INDEPENDENT DIGITAL LESSON	CONCEPT EXPLORATION
Topic A	**Representing Situations of the Form $px + q = r$ and $p(x + q) = r$**		
Lesson 1	Find unknown values in relationships, and interpret them as proportional and not proportional.	✓	✓
Lesson 2	Interpret tape diagrams that represent word problems, and use them to find unknown values.	✓	✓
Lesson 3	Write and match equations and tape diagrams that represent the same situation.	✓	✓
Lesson 4	Coordinate tape diagrams, equations of the form px + q = r, and verbal descriptions of the situations, and reason about and interpret a solution.	✓	✓
Lesson 5	Coordinate tape diagrams, equations of the form $p(x + q) = r$, and verbal descriptions of the situations, and reason about and interpret a solution.	✓	✓
Lesson 6	Write and categorize equations of the forms $px + q = r$ and $p(x + q) = r$ from situations and tape diagrams.	✓	✓
Topic B	**Solving Equations of the Form $px + q = r$ and $p(x + q) = r$ and Problems That Lead to Those Equations**		
Lesson 7	Use a balanced hanger diagram to reason about writing and solving equations in the form $px + q = r$.	✓	✓
Lesson 8	Use a balanced hanger diagram to reason about writing and solving equations in the form $p(x + q) = r$.	✓	✓
Lesson 9	Solve equations of the form $px + q = r$ and $p(x + q) = r$ that involve negative numbers.	✓	✓
Lesson 10	Decide between and use two common approaches for solving an equation of the form $p(x + q) = r$: expanding using the distributive property, or dividing each side by p.	✓	✓
Lesson 11	Use tape diagrams to translate verbal descriptions for situations into an equation of the form $px + q = r$ or $p(x + q) = r$, and solve the resulting equation to determine an unknown quantity in the situation.	✓	✓

	Objective	INDEPENDENT DIGITAL LESSON	CONCEPT EXPLORATION
Lesson 12	Solve word problems about percent increase or decrease by drawing and reasoning about a tape diagram or by writing and solving an equation.	✓	✓
Mid-Mission Assessment: Topics A-B			
Topic C	**Inequalities**		
Lesson 13	Write inequality statements to represent inequality situations, and use substitution to determine whether a given value for a variable makes an inequality true.	✓	✓
Lesson 14	Write inequalities that represent situations, and use substituion or reasoning about the context to find the solution.	✓	✓
Lesson 15	Solve inequalities using the associated equation and testing values to determine the direction of the inequality in the solution.	✓	✓
Lesson 16	Match an inequality to a situation it represents, explain what the parts of the inequality mean, solve it, and then interpret what the solution means in the situation.	✓	✓
Lesson 17	Write and solve an inequality to solve real-world problems and critique the solution to an inequality.	✓	✓
Topic D	**Writing Equivalent Expressions**		
Lesson 18	Extend the distributive property to expressions with negative coefficients.	✓	✓
Lesson 19	Use the distributive property to find equivalent expressions by expanding or factoring.	✓	✓
Lesson 20	Given an expression, write an equivalent expression with fewer terms using properties of operations, and explain why the expressions are equivalent.	✓	✓
Lesson 21	Write expressions with fewer terms that are equivalent to a given expression that includes negative coefficients and parentheses.	✓	✓
Lesson 22	Write equivalent expressions with fewer terms by combining like terms.	✓	✓
End-of-Mission Assessment: Topics C-D			

Foundational Missions

For each mission, Zearn Math highlights the foundational missions, the earlier content where concepts are introduced and developed. Teachers can access foundational missions directly from the mission page of their Teacher Account to address any unfinished learnings. Zearn recommends that teachers assign foundational missions during Flex Day or during additional non-core instruction time. It is important to use a foundational mission to support students who are struggling, rather than an unaligned mission, because the content students learn in each foundational mission supports their Core Day learning.

Foundational Mission(s) for G6M6: G6M6 Topics A-B and G6M7 Topic B

Mission Overview

In this mission, students solve equations of the forms $px + q = r$ and $p(x + q) = r$, and solve related inequalities, e.g., those of the form $px + q > r$ and $px + q \geq r$, where p, q, and r are rational numbers.

In the first section of the mission, students represent relationships of two quantities with tape diagrams and with equations, and explain correspondences between the two types of representations. They begin by examining correspondences between descriptions of situations and tape diagrams, then draw tape diagrams to represent situations in which the variable representing the unknown is specified. Next, they examine correspondences between equations and tape diagrams, then draw tape diagrams to represent equations, noticing that one tape diagram can be described by different (but related) equations. At the end of the section, they draw tape diagrams to represent situations in which the variable representing the unknown is not specified, then match the diagrams with equations. The section concludes with an example of the two main types of situations examined, characterized in terms of whether or not they involve equal parts of an amount or equal and unequal parts of an amount, and as represented by equations of different forms, e.g., $6(x + 8) = 72$ and $6x + 8 = 72$. This initiates a focus on seeing two types of structure in the situations, diagrams, and equations of the mission.

In the second section of the mission, students solve equations of the forms $px + q = r$ and $p(x + q) = r$, then solve problems that can be represented by such equations. They begin by considering balanced and unbalanced "hanger diagrams," matching hanger diagrams with equations, and using the diagrams to understand two algebraic steps in solving equations of the form $px + q = r$: subtract the same number from both sides, then divide both sides by the same number. Like a tape diagram, the same balanced hanger diagram can be described by different (but related) equations, e.g., $3x + 6 = 18$ and $3(x + 2) = 18$. The second form suggests using the same two algebraic steps to solve the equation, but in reverse order: divide both sides by the same number, then subtract the same number from both sides. Each of these algebraic steps and the associated structure of the equation is illustrated by hanger diagrams.

So far, the situations in the section have been described by equations in which p is a whole number, and q and r are positive (and frequently whole numbers). In the remainder of the section, students use the algebraic methods that they have learned to solve equations of the forms $px + q = r$ and $p(x + q) = r$ in which p, q, and r are rational numbers. They use the distributive property to transform an equation of one form into the other and note how such transformations can be used strategically in solving an equation. They write equations in order to solve problems involving percent increase and decrease.

In the third section of the mission, students work with inequalities. They begin by examining values that make an inequality true or false, and using the number line to represent values that make an inequality true. They solve equations, examine values to the left and right of a solution, and use those values in considering the solution of a related inequality. In the last two lessons of the section, students solve inequalities that represent real-world situations.

In the last section of the mission, students work with equivalent linear expressions, using properties of operations to explain equivalence. They represent expressions with area diagrams, and use the distributive property to justify factoring or expanding an expression.

Progression of Disciplinary Language

In this mission, teachers can anticipate students using language for mathematical purposes such as comparing, explaining, and justifying. Throughout the mission, students will benefit from routines designed to grow robust disciplinary language, both for their own sense-making and for building shared understanding with peers. Teachers can formatively assess how students are using language in these ways, particularly when students are using language to:

Compare:

- stories with corresponding tape diagrams (Lesson 2)
- tape diagrams with corresponding equations (Lesson 3)
- hanger diagrams and equations (Lesson 7)
- solution pathways (especially Lesson 10)
- descriptions of situations with corresponding inequalities (Lesson 16)

Explain

- strategies for using hanger diagrams to solve equations (Lesson 8)
- different strategies for solving equations (Lesson 9) and inequalities (Lesson 14)
- reasoning about situations, tape diagrams, and equations (Lesson 12)
- strategies for identifying and writing equivalent expressions (Lesson 22)

Justify

- reasoning about inequalities (Lesson 13)
- reasoning about solutions to inequalities (Lesson 15)
- the need for specific information in order to write and solve inequalities (Lesson 17)
- reasoning about the distributive property (Lesson 19)

In addition, students are expected to interpret solutions to equations, interpret and represent non-proportional situations with constant rates of change, represent non-proportional situations using tape diagrams, describe the structure of equations and tape diagrams, critique reasoning of peers about expressions and corresponding area diagrams, critique reasoning about solving equations, critique reasoning about equivalent expressions, and generalize about solving equations and about when expressions are equivalent.

The table shows lessons where new terminology is first introduced, including when students are expected to understand the word or phrase receptively and when students are expected to produce the word or phrase in their own speaking or writing. Terms from the glossary appear bolded. Teachers should continue to support students' use of a new term in the lessons that follow where it was first introduced.

New Terminology		
Lesson	**Receptive**	**Productive**
2	unknown amount	
3	commutative (property) equivalent expression	
4		unknown amount relationship
6		variable
7	balanced hanger each side (of an equation)	
8		equivalent expression each side (of an equation)
9		operation solve
10	distribute substitute	
13	inequality less than or equal to greater than or equal to open / closed circle	less than greater than
14	solution to an inequality boundary direction (of an inequality)	less than or equal to greater than or equal to substitute
15		open / closed circle
16		solution to an inequality
17		inequality
18	term	
19	factor (an expression) expand (an expression)	
20	combine like terms	commutative (property) term

New Terminology		
21		distribute
22	associative property	factor (an expression) expand (an expression)

Required Materials

Index cards

Sticky notes

Templates

Pre-printed slips, cut from copies of the template

Lesson 6 Activity 1

Lesson 17 Activity 2

Tools for creating a visual display