MODULE 3 OVERVIEW

TEKS* Addressed:
7.2A, 7.3A, **7.3B**, **7.4A**, **7.4D**, **7.7A**, 7.10A, 7.10B, 7.10C, **7.11A**, 7.11B

*Bold TEKS = Readiness Standard

Reasoning Algebraically

Sessions: **41** patterns & sense making with expressions & eqs.

Why is this module named *Reasoning Algebraically*?

Reasoning Algebraically continues to build students' facility with formal algebra. Students need to view algebra in terms of patterns and sense-making, not as a set of procedures and rules to follow. Therefore, the primary focus of this module is making sense of and reasoning about expressions and equations. The expressions, equations, and inequalities students encounter in this module are more complex than those studied previously, involving a wide range of rational numbers and requiring two steps rather than one.

Throughout the module, students are expected to reason about quantities, interpret quantities in equations and inequalities, and reason about the connections across representations of equations and inequalities. Although students should also build procedural fluency in operating with expressions, equations, and inequalities with positive and negative rational coefficients and values, reasoning about the algebraic relationships should remain at the forefront.

alg relationships are crucial

The Research Shows . . .

"Effective algebraic thinking sometimes involves reversibility (i.e., being able to undo mathematical processes as well as do them). In effect, it is the capacity not only to use a process to get to a goal, but also to understand the process well enough to work backward from the answer to the starting point."

(*Fostering Algebraic Thinking: A Guide for Teachers Grades 6–10*, pp. 1–2)

What is the mathematics of *Reasoning Algebraically*?

Reasoning Algebraically contains three topics: *Operating with Rational Numbers*, *Two-Step Equations and Inequalities*, and *Multiple Representations of Equations*. Students operate with rational numbers. They equate expressions, solve for unknowns in equations and inequalities, and use graphs and tables to analyze relationships.

3 topics in module 3

1 DAY PACING = 45-MINUTE SESSION

TOPIC 1 *Operating with Rational Numbers*

17 SESSIONS
16 LEARNING • 1 ASSESSMENT

Learning Together: 11 Sessions

TEKS: 7.2A, 7.3A, **7.3B, 7.4D**

Students develop fluency with fraction and decimal operations, along with integer operations, to solve problems involving adding, subtracting, multiplying, and dividing with the full set of rational numbers.

- Students learn that rational numbers are the quotients of integers, with the divisor not equal to 0.
- Students revisit number properties as ways to decompose and compose numbers to ease calculations.
- Students use properties of operations to generate equivalent expressions and solve real-world and mathematical problems using numeric and algebraic expressions.
- Students apply the distributive property to expand and factor linear expressions with rational coefficients and as a strategy to combine like terms.

Learning Individually: 5 Sessions

Targeted Skills Practice for *Operating with Rational Numbers*

- Students add and subtract rational numbers.
- Students solve real-world problems involving operations with rational numbers.
- Students determine quotients of rational numbers.
- Students evaluate expressions for a given value.
- Students use number properties to interpret expressions with signed numbers.
- Students rewrite expressions using the distributive property.

TOPIC 2 *Two-Step Equations and Inequalities*

13 SESSIONS
12 LEARNING • 1 ASSESSMENT

Learning Together: 9 Sessions

TEKS: 7.10A, 7.10B, 7.10C, **7.11A**, 7.11B

Students use bar models to decompose problem situations and algebra tiles and double number lines to reason about solving two-step equations.

- Students reason through solutions and solution sets for equations and inequalities using models.
- Students use inverse operations to solve two-step equations and inequalities and represent solution sets on number lines.
- Students write a corresponding real-world problem situation that can be represented by a given two-step equation or inequality.

Learning Individually: 3 Sessions

Targeted Skills Practice for *Two-Step Equations and Inequalities*

- Students model equations and inequalities using algebra tiles.
- Students solve two-step linear equations and inequalities.
- Students write and solve linear equations and inequalities for real-world problems.

11 SESSIONS
10 LEARNING • 1 ASSESSMENT

TOPIC 3 *Multiple Representations of Equations*

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Learning Together: 7 Sessions

TEKS: **7.4A**, **7.7A**, 7.10A, **7.11A**

Students analyze relationships between variables on a coordinate plane.

- Students engage in problem solving, writing equations and inequalities for problem situations, interpreting the meanings of quantities in the problems, creating tables of values, graphing problem situations, and making connections across the representations.
- Students solve word problems beginning with a table, graph, equation, or verbal description of the problem.

Learning Individually: 3 Sessions

Targeted Skills Practice for *Multiple Representations of Equations*

- Students identify independent and dependent variables and write equations to represent problems.
- Students create tables, graphs, and equations to represent problem situations.
- Students analyze graphs to estimate solutions and write inequalities to represent scenarios.
- Students use multiple representations to solve problems.

How is *Reasoning Algebraically* connected to prior learning?

Reasoning Algebraically builds on students' experience with evaluating and writing equivalent expressions, writing and solving one-step equations, and graphing inequalities as constraints in a problem situation. They will use their knowledge of equivalent expressions, inverse operations, and graphing equations on a four-quadrant graph and apply these ideas using the set of rational numbers to model two-step equations and inequalities.

- Eval. & write EQ expressions
- write & solve 1step EQs
- Graph INEQs

Repres #1

Math Representation

A store makes a 20% profit on the total price of all the items it sells.
Let t represent the total price of all items sold in dollars, and let p represent the profit in dollars.
You can represent this situation in two different ways.

Total Price and Profit

The ___profit___ depends on the ___total price of the items___.

Equation: $p = 0.2t$

Profit and Total Price

The ___total price of the items___ depends on the ___profit___.

Equation: $t = \frac{p}{0.2}$

When will students use knowledge from *Reasoning Algebraically* in future learning?

This module strengthens students' reasoning and fluency in solving equations. In future courses, students analyze and solve systems of linear equations, which involve equations with variables on both sides and rational coefficients.

Future Learning

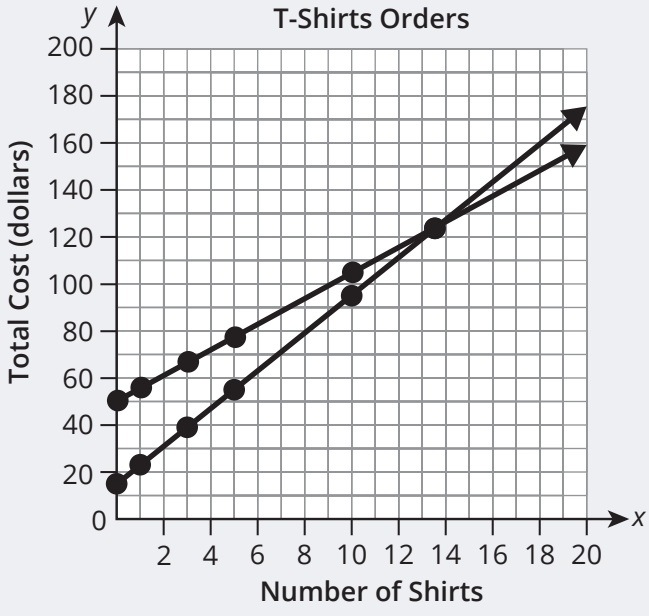
Repres #2

Math Representation

Suppose you are comparing the prices of custom T-shirts sold at two different shops.

Let C represent the total cost in dollars and s represent the number of shirts ordered.

U.S. Shirts charges \$8 per shirt plus a one-time charge of \$15 to set up a T-shirt design. An equation that models this situation is $C = 8s + 15$.



Cool Shirts charges \$5.50 per shirt plus a one-time charge of \$49.95 to set up a T-shirt design. An equation that models this situation is $C = 5.50s + 49.95$.

The total costs are about the same when a customer orders 14 shirts. For T-Shirt orders of less than 14, you should buy from U.S. Shirts. For T-shirt orders greater than 14, you should buy from Cool Shirts.

Using a double number line provides the underpinnings for geometric and algebraic transformations of objects and equations. In Grade 8 and Geometry, students will transform geometric objects and conjecture about the effects on the coordinates of the figures geometric figures. They will also transform linear functions, recognizing that the graph of $y = mx + b$ is a translation of $y = x$.

3 Reasoning Algebraically

MODULE 3 Assessment Summary

Topic	Topic Title	Name	Administered	TEKS*
1	Operating with Rational Numbers	End of Topic Assessment	After Topic 1	7.2A 7.3A **7.3B**
2	Two-Step Equations and Inequalities	End of Topic Assessment	After Topic 2	7.10A 7.10B 7.10C **7.11A** 7.11B
3	Multiple Representations of Equations	End of Topic Assessment	After Topic 3	**7.4A** **7.7A** 7.10A **7.11A** 7.10C

TOPICS

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