INCLUSION IN TEXAS

Instructional Routines for Mathematics Intervention

The purpose of these mathematics instructional routines is to provide educators with materials to use when providing intervention to students who experience difficulty with mathematics. The routines address content included in the grades 2-8 Texas Essential Knowledge and Skills (TEKS). There are 23 modules that include routines and examples – each focused on different mathematical content. Each of the 23 modules include vocabulary cards and problem sets to use during instruction. These materials are intended to be implemented explicitly with the aim of improving mathematics outcomes for students.

TEA
Texas Education Agency

Instructional Routines for Mathematics Intervention

MODULE 23

Solving Equations

Module 23: Solving Equations
Mathematics Routines

A. Important Vocabulary with Definitions

Term	Definition
base	A number that is multiplied by an exponent.
coefficient	A number that is multiplied by a variable.
constant	A term that does not change; a number on its own.
equation	A mathematical statement that two expressions are the same or equal; must have an equal sign.
exponent	The power to which a number is raised.
expression	A combination of variables, numbers, and/or operations that represents a mathematical relationship; does not have an equal sign.
grouping	A combination of variables, numbers, and/or operations grouped together in parentheses or brackets.
inequality	An algebraic relation showing that a quantity is greater or less than another quantity.
like terms	Terms that have the same variable or constant and can be combined.
operator	A symbol ($+, -, \times, \div$) that represents a mathematical operation.
term	A single number or a variable, or numbers or variables multiplied together .
variable	A symbol for an unknown value, which is usually represented by a letter.

B. Background Information

In this module, we focus on early algebraic concepts:

(1) Solving Single-Step Equations with One Variable
(2) Solving Multi-Step Equations with One Variable
(3) Solving Equations with Variables on Both Sides

C. Routines and Examples

(1) Solving Single-Step Equations with One Variable

Routine

Materials:

- Module 23 Problem Sets
- Module 23 Vocabulary Cards
    - If necessary, review Vocabulary Cards before teaching
- A manipulative like algebra tiles

ROUTINE WITH MANIPULATIVES

Teacher	**Let's solve an equation. What's an equation?**
Students	A mathematical statement with the equal sign.
Teacher	**An equation has numbers and operator symbols. An equation also has an equal sign. What's the symbol that's always in an equation?**
Students	The equal sign.
Teacher	**Let's show different equations and solve them. Let's use these algebra tiles.** (Show manipulatives.)
Teacher	**With the algebra tiles, we'll interpret this unit to represent a constant. What's a constant?**
Students	A number or value that does not change.
Teacher	**Yes. A constant is a number or value that does not change.**
Teacher	**We'll use this unit to show the constant. The unit has a positive side. That's brown. What color is the positive side?**
Students	Brown.
Teacher	**The unit also has a negative side. That's red. What color is the negative side?**
Students	Red.
Teacher	**With the algebra tiles, we'll interpret this rod to represent our variable. What will the rod represent?**
Students	A variable.
Teacher	**And the rod has a positive side. That's green. What color is the positive side?**
Students	Green.
Teacher	**The rod also has a negative side. That's red. What color is the negative side?**
Students	Red.
Teacher	**If this rod is our variable, then this flat represents the variable squared or x^2. What does the flat represent?**
Students	The variable squared.
Teacher	**This flat represents x^2 because we can multiply x times x** (show multiplication) **to create the area of x^2. Why does the flat represent x^2?**
Students	Because the area created by multiplying x times x equals the area of x^2.

Teacher	**The flat has a positive side. That's blue. What color is the positive side?**
Students	Blue.
Teacher	**The rod also has a negative side. That's red. What color is the negative side?**
Students	Red.
Teacher	**Now, let's solve an equation with the algebra tiles. Remember, we have pieces that represent the variable squared** (show)**, the variable** (show)**, and the constant** (show)**. Look at this equation.** (Show problem.)
Teacher	**Read the equation.**
Students	__.
Teacher	**Because we're going to show an equation, let's write an equal sign in the middle of our manipulatives mat.** (Write equal sign.)
Teacher	**We'll show the left side of the equation on left side of the mat. We'll show the right side of the equation on the right side of the mat. How do we use the mat?**
Students	Show the left side of the equation on the left side. Show the right side of the equation on the right side.
Teacher	**Let's show the left side of the equation first. Look at the left side. How would we show the left side of the equation with algebra tiles?**
Students	(Describe manipulatives.)
Teacher	**Yes, on the left side we show __ flats, __ rods, and __ units.** (Show with manipulatives.)
Teacher	**Let's show the right side of the equation. Look at the right side. How would we show the right side of the equation with algebra tiles?**
Students	(Describe manipulatives.)
Teacher	**Yes, on the right side we show __ flats, __ rods, and __ units.** (Show with manipulatives.)
Teacher	**Now it's time to solve this equation. We'll solve this equation by isolating the variable. What is the variable in this equation?**
Students	*x*.
Teacher	***x* is the variable. We'll isolate the variable by removing the constant from the side of the equal sign with the variable. Where is the variable?**
Students	Left side/right side.
Teacher	**So, we'll remove the constant from the left side/right side of the equation. What's the constant that we should remove?**
Students	__.
Teacher	**We will use the inverse operation and add/subtract __ from the left/right side of the equation.** (Add or subtract with manipulatives.)
Teacher	**But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**
Students	Do the same thing to both sides.

Teacher	**Let's also add/subtract __ from the left/right side of the equation.** (Add or subtract with manipulatives.)
Teacher	**So, did we isolate the variable?**
Students	Yes.
Teacher	**What is equal to *x*?**
Students	__.
Teacher	**Great! *x* equals __. Let's say that together.**
Students	*x* equals __.
Teacher	**We used the algebra tiles to solve an equation. What equation did we solve?**
Students	__.
Teacher	**How can you use the algebra tiles to solve equations?**
Students	Use the algebra tiles to set up the problem. Then, isolate the variable by removing the constant from the variable side. When removing the constant, whatever we do to one side of the equation we also have to do to the other side of the equation.

ROUTINE WITHOUT MANIPULATIVES

Teacher	**Let's solve an equation. What's an equation?**
Students	A mathematical statement with the equal sign.
Teacher	**An equation has numbers and operator symbols. An equation also has an equal sign. What's the symbol that's always in an equation?**
Students	The equal sign.
Teacher	**Let's show different equations and solve them. Let's use our paper and pencil.** (Show pencil.)
Teacher	**Look at this equation.** (Show problem.)
Teacher	**Read the equation.**
Students	__.
Teacher	**Let's solve this equation. We'll need to focus on the equal sign in this problem. So, let's draw a vertical line down from the equal sign to help us remember to balance both sides of the equation.** (Draw vertical line.)
Teacher	**We'll solve this equation by isolating the variable. What is the variable in this equation?**
Students	*x*.
Teacher	***x* is the variable. We'll isolate the variable by removing the constant from the side of the equal sign with the variable. What's a constant?**
Students	A number that is on its own.
Teacher	**And in this problem, where is the variable?**
Students	Left side/right side.
Teacher	**I like to circle the variable to remember that I'm isolating the variable. Let's circle *x*.**
Students	(Circle *x*.)

Teacher	**So, we'll remove the constant from the left side/right side of the equation. What's the constant that we should remove?**
Students	__.
Teacher	**We will use the inverse operation and add/subtract __ from the left/right side of the equation. What's the inverse operation of the constant?**
Students	Add/subtract.
Teacher	**Let's write plus/minus __ under the constant.** (Write.)
Teacher	**But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**
Students	Do the same thing to both sides.
Teacher	**Let's also add/subtract __ from the left/right side of the equation. Let's write plus/minus __ under the constant on the other side of the equation.** (Write.)
Teacher	**Let's do the math on the left side of the equation. What's __ plus/minus __** (on left side)**?**
Students	__.
Teacher	**Let's write __.** (Write.)
Teacher	**Let's do the math on the right side of the equation. What's __ plus/minus __** (on right side)**?**
Students	__.
Teacher	**Let's write __.** (Write.)
Teacher	**So, did we isolate the variable?**
Students	Yes.
Teacher	**What is equal to *x*?**
Students	__.
Teacher	**Great! *x* equals __. Let's write that.** (Write.)
Teacher	**Let's read our answer.**
Students	*x* equals __.
Teacher	**What equation did we solve?**
Students	__.
Teacher	**How can solve equations?**
Students	Isolate the variable by removing the constant from the variable side. When removing the constant, whatever we do to one side of the equation we also have to do to the other side of the equation.

Example

$x - 2 = 5$

EXAMPLE WITHOUT MANIPULATIVES

Teacher	**Let's solve an equation. What's an equation?**
Students	A mathematical statement with the equal sign.
Teacher	**An equation has numbers and operator symbols. An equation also has an equal sign. What's the symbol that's always in an equation?**
Students	The equal sign.
Teacher	**Let's show different equations and solve them. Let's use our paper and pencil.** (Show pencil.)
Teacher	**Look at this equation.** (Show problem.)
Teacher	**Read the equation.**
Students	$x - 2 = 5$.
Teacher	**Let's solve this equation. We'll need to focus on the equal sign in this problem. So, let's draw a vertical line down from the equal sign to help us remember to balance both sides of the equation.** (Draw vertical line.)
Teacher	**We'll solve this equation by isolating the variable. What is the variable in this equation?**
Students	*x*.
Teacher	***x* is the variable. We'll isolate the variable by removing the constant from the side of the equal sign with the variable. What's a constant?**
Students	A number that is on its own.
Teacher	**And in this problem, where is the variable?**
Students	Left side.
Teacher	**I like to circle the variable to remember that I'm isolating the variable. Let's circle *x*.**
Students	(Circle *x*.)
Teacher	**So, we'll remove the constant from the left side of the equation. What's the constant that we should remove?**
Students	-2.
Teacher	**We will use the inverse operation and add or subtract from the left side of the equation. What's the operation of the constant?**
Students	Subtract 2.
Teacher	**What's the inverse operation of subtract 2?**
Students	Add 2.
Teacher	**Let's write plus 2 under the constant.** (Write.)
Teacher	**But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**

Students	Do the same thing to both sides.
Teacher	**Let's also add 2 to the right side of the equation. Let's write plus 2 under the constant of 5 on the other side of the equation.**
	(Write.)
Teacher	**Let's do the math on the left side. What's -2 plus 2?**
Students	0.
Teacher	**Let's write 0.**
	(Write.)
Teacher	**Let's do the math on the right side. What's 5 plus 2?**
Students	7.
Teacher	**Let's write 7.**
	(Write.)
Teacher	**So, did we isolate the variable?**
Students	Yes.
Teacher	**What is equal to *x*?**
Students	7.
Teacher	**Great! *x* equals 7. Let's write that.**
	(Write.)
Teacher	**Let's read our answer.**
Students	*x* equals 7.
Teacher	**What equation did we solve?**
Students	$x - 2 = 5$.
Teacher	**How can solve equations?**
Students	Isolate the variable by removing the constant from the variable side. When removing the constant, whatever we do to one side of the equation we also have to do to the other side of the equation.

(2) Solving Multi-Step Equations with One Variable

Routine

Materials:

- Module 23 Problem Sets
- Module 23 Vocabulary Cards
    - If necessary, review Vocabulary Cards before teaching

ROUTINE WITHOUT MANIPULATIVES

Teacher	**Let's solve an equation. What's an equation?**
Students	A mathematical statement with the equal sign.
Teacher	**An equation has numbers and operator symbols. An equation also has an equal sign. What's the symbol that's always in an equation?**
Students	The equal sign.
Teacher	**Let's show different equations and solve them. Let's use our paper and pencil.** (Show pencil.)
Teacher	**Look at this equation.** (Show problem.)
Teacher	**Read the equation.**
Students	__.
Teacher	**Let's solve this equation. We'll need to focus on the equal sign in this problem. So, let's draw a vertical line down from the equal sign to help us remember to balance both sides of the equation.** (Draw vertical line.)
Teacher	**We'll solve this equation by isolating the variable. What is the variable in this equation?**
Students	*x*.
Teacher	***x* is the variable. We'll isolate the variable by removing the constant from the side of the equal sign with the variable. Where is the variable?**
Students	Left side/right side.
Teacher	**I like to circle the variable to remember that I'm isolating the variable. Let's circle *x*.**
Students	(Circle *x*.)
Teacher	**So, we'll remove the constant from the left side/right side of the equation. What's the constant that we should remove?**
Students	__.
Teacher	**We will use the inverse operation and add/subtract __ from the left/right side of the equation. Let's write plus/minus __ under the constant.** (Write.)
Teacher	**But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**

Students Do the same thing to both sides.

Teacher **Let's also add/subtract __ from the left/right side of the equation. Let's write plus/minus __ under the constant on the other side of the equation.**
(Write.)

Teacher **Let's do the math. What's __ plus/minus __** (on left side)**?**

Students __.

Teacher **Let's write __.**
(Write.)

Teacher **What's __ plus/minus __** (on right side)**?**

Students __.

Teacher **Let's write __.**
(Write.)

Teacher **So, did we isolate the variable?**

Students No.

Teacher **There's a coefficient with this variable. What's a coefficient?**

Students A number multiplied by a variable.

Teacher **To truly isolate the variable, we need to remove the coefficient. We'll remove the coefficient from the left side/right side of the equation. What's the coefficient that we should remove?**

Students __.

Teacher **If the coefficient is multiplied by *x*, then we will use the inverse operation and divide __ from the left/right side of the equation. Let's write divide __ under the coefficient.**
(Write.)

Teacher **But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**

Students Do the same thing to both sides.

Teacher **Let's also divide __ from the left/right side of the equation. Let's write divide __ under the constant on the other side of the equation.**
(Write.)

Teacher **Let's do the math. What's __ divided by __** (on left side)**?**

Students __.

Teacher **Let's write __.**
(Write.)

Teacher **What's __ divided by __** (on right side)**?**

Students __.

Teacher **Let's write __.**
(Write.)

Teacher **Now is the variable isolated?**

Students Yes.

Teacher **What is equal to *x*?**

Students __.

Teacher **Great! *x* equals __. Let's write that.**

(Write.)

Teacher **Let's read our answer.**

Students *x* equals __.

Teacher **What equation did we solve?**

Students __.

Teacher **How can you solve equations?**

Students Draw a line vertically down from the equal sign. Circle the variable. Then, isolate the variable by removing the constant. Divide the variable by a coefficient if necessary.

Example

$11 = 2y + 5$

EXAMPLE WITHOUT MANIPULATIVES

Teacher **Let's solve an equation. What's an equation?**

Students A mathematical statement with the equal sign.

Teacher **An equation has numbers and operator symbols. An equation also has an equal sign. What's the symbol that's always in an equation?**

Students The equal sign.

Teacher **Let's show different equations and solve them. Let's use our paper and pencil.**
(Show pencil.)

Teacher **Look at this equation.**
(Show problem.)

Teacher **Read the equation.**

Students 11 = 2*y* + 5.

Teacher **Let's solve this equation. We'll need to focus on the equal sign in this problem. So, let's draw a vertical line down from the equal sign to help us remember to balance both sides of the equation.**
(Draw vertical line.)

Teacher **We'll solve this equation by isolating the variable. What is the variable in this equation?**

Students *y*.

Teacher ***y* is the variable. We'll isolate the variable by removing the constant from the side of the equal sign with the variable. Where is the variable?**

Students Right side.

Teacher **I like to circle the variable to remember that I'm isolating the variable. Let's circle *y*.**

Students (Circle *y*.)

Teacher **So, we'll remove the constant from the right side of the equation. What's the constant that we should remove?**

Students 5.

Teacher	**We will use the inverse operation and add or subtract from the right side of the equation. What's the inverse operation with plus 5?**
Students	Minus 5.
Teacher	**Let's write minus 5 under the constant.**
	(Write.)
Teacher	**But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**
Students	Do the same thing to both sides.
Teacher	**Let's also subtract 5 from the left side of the equation. Let's write minus 5 under the constant on the other side of the equation.**
	(Write.)
Teacher	**Let's do the math on the left side of the equation. What's 11 minus 5?**
Students	6.
Teacher	**Let's write 6.**
	(Write.)
Teacher	**Let's do the math on the right side of the equation. What's 5 minus 5?**
Students	0.
Teacher	**Let's write 0.**
	(Write.)
Teacher	**So, did we isolate the variable?**
Students	No.
Teacher	**There's a coefficient with this variable. What's a coefficient?**
Students	A number multiplied by a variable.
Teacher	**To truly isolate the variable, we need to remove the coefficient. We'll remove the coefficient from the right side of the equation. What's the coefficient that we should remove?**
Students	2.
Teacher	**If the coefficient is multiplied by *y*, then we will use the inverse operation and divide 2 from the right side of the equation. Let's write divide 2 under the coefficient.**
	(Write.)
Teacher	**But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**
Students	Do the same thing to both sides.
Teacher	**Let's also divide 2 from the left side of the equation. Let's write divide 2 under the constant on the other side of the equation.**
	(Write.)
Teacher	**Let's do the math on the left side of the equation. What's 6 divided by 2?**
Students	3.
Teacher	**Let's write 3.**
	(Write.)
Teacher	**What's 2 divided by 2?**

Students	1.
Teacher	**Let's write 1. You could also not write the 1 because it's implied with the *y*.** (Write.)
Teacher	**Now is the variable isolated?**
Students	Yes.
Teacher	**What is equal to *y*?**
Students	3.
Teacher	**Great! *y* equals 3. Let's write that.** (Write.)
Teacher	**Let's read our answer.**
Students	*y* equals 3.
Teacher	**What equation did we solve?**
Students	$11 = 2y + 5$.
Teacher	**How can you solve equations?**
Students	Draw a line vertically down from the equal sign. Circle the variable. Then, isolate the variable by removing the constant. Divide the variable by a coefficient if necessary.

(3) Solving Equations with Variables on Both Sides

Routine

Materials:

- Module 23 Problem Sets
- Module 23 Vocabulary Cards
    - If necessary, review Vocabulary Cards before teaching

ROUTINE WITHOUT MANIPULATIVES

Teacher	**Let's solve an equation. What's an equation?**
Students	A mathematical statement with the equal sign.
Teacher	**An equation has numbers and operator symbols. An equation also has an equal sign. What's the symbol that's always in an equation?**
Students	The equal sign.
Teacher	**Let's show different equations and solve them. Let's use our paper and pencil.** (Show pencil.)
Teacher	**Look at this equation.** (Show problem.)
Teacher	**Read the equation.**
Students	__.
Teacher	**Let's solve this equation. We'll need to focus on the equal sign in this problem. So, let's draw a vertical line down from the equal sign to help us remember to balance the sides of an equation.** (Draw vertical line.)
Teacher	**We'll solve this equation by isolating the variable. What is the variable in this equation?**
Students	*x*.
Teacher	***x* is the variable. We'll isolate the variable by removing the constant from the side of the equal sign with the variable. Where is the variable?**
Students	Left side and right side.
Teacher	**I like to circle the variable to remember that I'm isolating the variable. Let's circle *x*.**
Students	(Circle *x*.)
Teacher	**In this equation, *x* is on both sides. So, let's work with the *x* with the greater coefficient by removing the *x* with the coefficient that is less. Which *x* has a greater coefficient?**
Students	Left side/right side.
Teacher	**So, we'll remove the variable with the coefficient that is less from the left side/right side of the equation. Which coefficient and variable should we remove?**
Students	__.
Teacher	**We will use the inverse operation and add/subtract __ from the left/right side of the equation. Let's write plus/minus __ under the coefficient and variable.**

(Write.)

Teacher **But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**

Students Do the same thing to both sides.

Teacher **Let's also add/subtract __ from the left/right side of the equation. Let's write plus/minus __ under the coefficient and variable on the other side of the equation.**

(Write.)

Teacher **Let's do the math. What's __ plus/minus __** (on left side)**?**

Students __.

Teacher **Let's write __.**

(Write.)

Teacher **What's __ plus/minus __** (on right side)**?**

Students __.

Teacher **Let's write __.**

(Write.)

Teacher **We've removed one variable from one side of the equation. So, we'll remove the constant from the left side/right side of the equation. What's the constant that we should remove?**

Students __.

Teacher **We will use the inverse operation and add/subtract __ from the left/right side of the equation. Let's write plus/minus __ under the constant.**

(Write.)

Teacher **But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**

Students Do the same thing to both sides.

Teacher **Let's also add/subtract __ from the left/right side of the equation. Let's write plus/minus __ under the constant on the other side of the equation.**

(Write.)

Teacher **Let's do the math. What's __ plus/minus __** (on left side)**?**

Students __.

Teacher **Let's write __.**

(Write.)

Teacher **What's __ plus/minus __** (on right side)**?**

Students __.

Teacher **Let's write __.**

(Write.)

Teacher **So, did we isolate the variable?**

Students No.

Teacher **There's a coefficient with this variable. To truly isolate the variable, we need to remove the coefficient.**

Teacher	**We'll remove the coefficient from the left side/right side of the equation. What's the coefficient that we should remove?**
Students	__.
Teacher	**If the coefficient is multiplied by *x*, then we will use the inverse operation and divide __ from the left/right side of the equation. Let's write divide __ under the coefficient.** (Write.)
Teacher	**But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**
Students	Do the same thing to both sides.
Teacher	**Let's also divide __ from the left/right side of the equation. Let's write divide __ under the constant on the other side of the equation.** (Write.)
Teacher	**Let's do the math. What's __ divided by __** (on left side)**?**
Students	__.
Teacher	**Let's write __.** (Write.)
Teacher	**What's __ divided by __** (on right side)**?**
Students	__.
Teacher	**Let's write __.** (Write.)
Teacher	**Now is the variable isolated?**
Students	Yes.
Teacher	**What is equal to *x*?**
Students	__.
Teacher	**Great! *x* equals __. Let's write that.** (Write.)
Teacher	**Let's read our answer.**
Students	*x* equals __.
Teacher	**What equation did we solve?**
Students	__.
Teacher	**How can you solve this equation?**
Students	Draw a vertical line down from the equal sign. Remove the coefficient and variable of lesser value to the other side of the equal sign. Remove the constant to isolate the variable. Divide by the coefficient.

Example

$4a - 7 = 3a - 3$

EXAMPLE WITHOUT MANIPULATIVES

Teacher	**Let's solve an equation. What's an equation?**
Students	A mathematical statement with the equal sign.
Teacher	**An equation has numbers and operator symbols. An equation also has an equal sign. What's the symbol that's always in an equation?**
Students	The equal sign.
Teacher	**Let's show different equations and solve them. Let's use our paper and pencil.** (Show pencil.)
Teacher	**Look at this equation.** (Show problem.)
Teacher	**Read the equation.**
Students	$4a - 7 = 3a - 3$.
Teacher	**Let's solve this equation. We'll need to focus on the equal sign in this problem. So, let's draw a vertical line down from the equal sign to help us remember to balance the sides of an equation.** (Draw vertical line.)
Teacher	**We'll solve this equation by isolating the variable. What is the variable in this equation?**
Students	a.
Teacher	**a is the variable. We'll isolate the variable by removing the constant from the side of the equal sign with the variable. Where is the variable?**
Students	Left side and right side.
Teacher	**I like to circle the variable to remember that I'm isolating the variable. Let's circle a.**
Students	(Circle a.)
Teacher	**In this equation, a is on both sides. So, let's work with the a with the greater coefficient by removing the a with the coefficient that is less. Which a has a greater coefficient?**
Students	Right side.
Teacher	**So, we'll remove the variable with the coefficient that is less from the right side of the equation. Which coefficient and variable should we remove?**
Students	$3a$.
Teacher	**We will use the inverse operation and subtract $3a$ from the right side of the equation. Let's write minus $3a$ under the coefficient and variable.** (Write.)
Teacher	**But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**
Students	Do the same thing to both sides.

Teacher	**Let's also subtract 3*a* from the left side of the equation. Let's write minus 3*a* under the coefficient and variable on the other side of the equation.**
	(Write.)
Teacher	**Let's do the math. What's 4*a* minus 3*a*?**
Students	*a*.
Teacher	**Let's write *a*.**
	(Write.)
Teacher	**What's 3*a* minus 3*a*?**
Students	0.
Teacher	**Let's write 0. We also could not write anything because we have none of the variable on the right side.**
	(Write.)
Teacher	**We've removed one variable from one side of the equation. So, we'll remove the constant from the left side of the equation. What's the constant that we should remove?**
Students	-7.
Teacher	**We will use the inverse operation and add 7 on the left side of the equation. Let's write plus 7 under the constant.**
	(Write.)
Teacher	**But, when solving equations, if we do something to one side of the equal sign, we have to do the same thing to the other side of the equal sign. What do we have to do when solving equations?**
Students	Do the same thing to both sides.
Teacher	**Let's also add 7 on the right side of the equation. Let's write plus 7 under the constant on the other side of the equation.**
	(Write.)
Teacher	**Let's do the math on the left side. What's -7 plus 7?**
Students	0.
Teacher	**Let's write 0. We also don't have to write anything if it's 0.**
	(Write.)
Teacher	**Let's do the math on the right side. What's -3 plus 7?**
Students	4.
Teacher	**Let's write 4.**
	(Write.)
Teacher	**So, did we isolate the variable?**
Students	Yes.
Teacher	**What is equal to *a*?**
Students	4.
Teacher	**Great! *a* equals 4. Let's write that.**
	(Write.)
Teacher	**Let's read our answer.**
Students	*a* equals 4.
Teacher	**What equation did we solve?**
Students	$4a - 7 = 3a - 3$.

Teacher	**How can you solve this equation?**
Students	Draw a vertical line down from the equal sign. Remove the coefficient and variable of lesser value to the other side of the equal sign. Remove the constant to isolate the variable. Divide by the coefficient.

D. Problems for Use During Instruction

See Module 23 Problem Sets.

E. Vocabulary Cards for Use During Instruction

See Module 23 Vocabulary Cards.

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Module 23:
Solving Equations

Problem Sets

A. Equations with 1 coefficient, 1 variable, and 1 constant (10)
B. Equations with 2 constants and 1 variable; add/subtract (10)
C. Equations with 2 constants and 1 variable; multiply/divide (10)
D. Equations with 1 coefficient, 2 constants, and 1 variable (10)
E. Equations with 2 like variables (10)
F. Equations with exponents (10)

B.

$$4a = 12$$

B. $9x = 36$

B. $15 = 15D$

B. $56 = 7k$

B. $3r = 21$

B. $32 = 4t$

B. $7b = 49$

B. $5s = 60$

B. $132 = 11f$

B. $25 = 5g$

B. $16 = w - 4$

B. $2 - K = 5$

B. $9 + r = 9$

B. $5 + f = 8$

B. $2 = G - 9$

B. $7 = 11 - M$

B.

$$c + 4 = 6$$

B. $8 + h = 3$

B.

$$y + 4 = 12$$

B.

$$8 - p = 15$$

c. $2 = M \div 6$

c. $10 = E \div 2$

c. $8 = z \div 4$

c. $15 = j \times 5$

c. $5 = R \times 1$

c. $c \times 6 = 24$

c.

$$n \div 5 = 7$$

c. $b \times 9 = 36$

c. $k \times 8 = 72$

c. $4 = h \div 4$

D. $6b - 1 = 11$

D. $30 = 2n \times 3$

D. $21 + 3x = 51$

D. $5a - 2 = 13$

D.

$$64 - 5x = 14$$

D. $6v \times 4 = 72$

D. $7b - 7 = 42$

D. $47 - 3x = 32$

D. $55 = 5c + 5$

D. $3c + 2 = 11$

E. $2y + 5 = 15 - 3y$

E. $2x + 20 = x + 56$

E. $3k + 2 = 50 - k$

E. $4 + p = 3p + 18$

E. $3x + 12 = 72 + 8x$

E. $5x + 10 = x - 14$

E. $6 - 2f = 7f + 1$

E. $b + 2 = 7b + 20$

E. $48 - 5e = 3e + 8$

E. $4e - 7 = 3a - 3$

F. $x^2 + 13x - 7 = 15$

F. $7x^2 + 17x + 10 = 0$

F. $18r^2 + 61r = 50$

F. $k^2 + 9k - 5 = 5$

F. $h^2 - 7h = 0$

F. $y^2 + 5 = 8$

F. $20z^2 - 48z = 6$

F. $6x^2 + 17x - 88 = 0$

F. $g^2 + 18g + 1 = 72$

F. $n^2 + 5 = 11$

Module 23:

Solving Equations

Vocabulary Cards

base
coefficient
constant
equation
exponent
expression
grouping
inequality
like terms
operator
term
variable

base

A number that is multiplied by an exponent.

$$5^3$$

5 is the base

---

coefficient

A number that is multiplied by a variable.

$$5x + 9 = 24$$

5 is a coefficient

constant

A term that does not change; a number on its own.

$$5x + 9 = 24$$

9 and 24 are constants

---

equation

A mathematical statement that two expressions are the same or equal; must have an equal sign.

$$5x + 9 = 24$$

5x + 9 = 24 is an equation

(DOES have an = sign)

exponent

The power to which a number is raised.

$$5^{3}$$

3 is the exponent

---

expression

A combination of variables, numbers, and/or operations that represents a mathematical relationship; does not have an equal sign.

$5x + 9$ $\qquad$ 24

5x + 9 and 24 are expressions

(DOES NOT have an = sign)

grouping

A combination of variables, numbers, and/or operations grouped together in parentheses or brackets.

$$(15 + 4) \qquad 2[(6 + 4) \div 2]$$

---

inequality

An algebraic relation showing that a quantity is greater or less than another quantity.

$$5x + 9 > 24$$

The > makes this equation an inequality

like terms

Terms that have the same variable or constant and can be combined.

$2y \quad 4y \quad 8y$

---

operator

A symbol (+, –, × ÷) that represents a mathematical operation.

$5x + 9 = 24$

+ is an operator

term

A single number or a variable, or numbers and variables multiplied together.

$$5x + 9 = 24$$

5x, 9, and 24 are terms

---

variable

A symbol for an unknown value, which is usually represented by a letter.

$$5x + 9 = 24$$

x is a variable