SOLVING EQUATIONS 2.1.8 and 2.1.9

Using a Four-Region Equation Mat

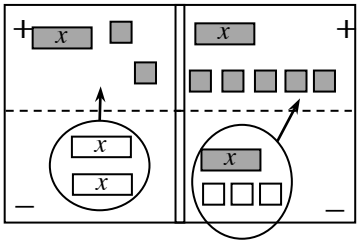
Combining two Expression Mats into an Equation Mat creates a concrete model for solving equations. Practice solving equations using the model will help students transition to solving equations abstractly with better accuracy and understanding.

In general, and as shown in the first example below, the negative in front of the parenthesis causes everything inside to "flip" from the top to the bottom or the bottom to the top of an Expression Mat, that is, all terms in the expression change signs. After simplifying the parentheses, simplify each Expression Mat. Next, isolate the variables on one side of the Equation Mat and the non-variables on the other side by removing matching tiles from both sides. Then determine the value of the variable. Students should be able to explain their steps. See the Math Notes boxes in Lessons 2.1.9 and 3.2.3 of the *Core Connections, Course 3* text. For additional examples and practice, see the *Core Connections, Course 3* Checkpoint 5 materials.

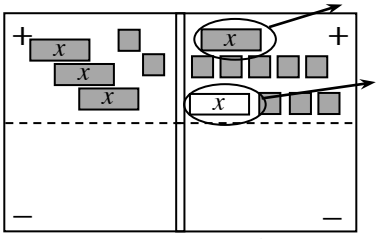
Procedure and Example

Solve $x + 2 - (-2x) = x + 5 - (x - 3)$.

First build the equation on the Equation Mat.

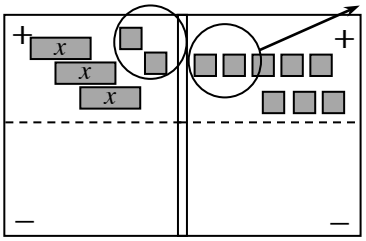


Second, simplify each side using legal moves on each Expression Mat, that is, on each side of the Equation Mat.



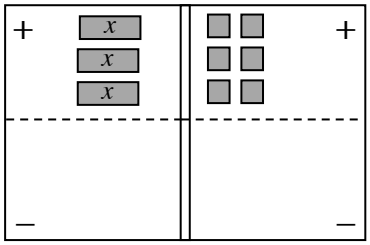
$x + 2 + 2x = x + 5 - x + 3$

Isolate x-terms on one side and non-x-terms on the other by removing matching tiles from both sides of the Equation Mat.



$3x + 2 = 8$

Finally, since both sides of the equation are equal, determine the value of x.



$3x = 6$

$x = 2$

Once students understand how to solve equations using an Equation Mat, they may use the visual experience of moving tiles to solve equations with variables and numbers. The procedures for moving variables and numbers in the solving process follow the same rules.

Note: When the process of solving an equation ends with different numbers on each side of the equal sign (for example, $2 = 4$), there is *no solution* to the problem. When the result is the same expression or number on each side of the equation (for example, $x + 2 = x + 2$) it means that *all numbers* are solutions. See the Math Notes box in Lesson 3.2.4 of the *Core Connections, Course 3* text.

Example 1 Solve: $3x + 3x - 1 = 4x + 9$

Solution:		
	$3x + 3x - 1 = 4x + 9$	problem
	$6x - 1 = 4x + 9$	simplify
	$2x = 10$	add 1, subtract $4x$ on each side
	$x = 5$	divide

Example 2 Solve: $-2x + 1 - (-3x + 3) = -4 + (-x - 2)$

Solution:		
	$-2x + 1 - (-3x + 3) = -4 + (-x - 2)$	problem
	$-2x + 1 + 3x - 3 = -4 - x - 2$	remove parentheses (flip)
	$x - 2 = -x - 6$	simplify
	$2x = -4$	add x, add 2 to each side
	$x = -2$	divide

Problems

Solve each equation.

1. $2x - 3 = -x + 3$
2. $1 + 3x - x = x - 4 + 2x$
3. $4 - 3x = 2x - 6$
4. $3 + 3x - (x - 2) = 3x + 4$
5. $-(x + 3) = 2x - 6$
6. $-4 + 3x - 1 = 2x + 1 + 2x$
7. $-x + 3 = 10$
8. $5x - 3 + 2x = x + 7 + 6x$
9. $4y - 8 - 2y = 4$
10. $9 - (1 - 3y) = 4 + y - (3 - y)$
11. $2x - 7 = -x - 1$
12. $-2 - 3x = x - 2 - 4x$
13. $-3x + 7 = x - 1$
14. $1 + 2x - 4 = -3 - (-x)$
15. $2x - 1 - 1 = x - 3 - (-5 + x)$
16. $-4x - 3 = x - 1 - 5x$
17. $10 = x + 6 + 2x$
18. $-(x - 2) = x - 5 - 3x$
19. $6 - x - 3 = 4x - 8$
20. $0.5x - (-x + 3) = x - 5$

Answers

1.	$x = 2$	2.	$x = 5$	3.	$x = 2$	4.	$x = 1$	5.	$x = 1$
6.	$x = -6$	7.	$x = -7$	8.	no solution	9.	$x = 6$	10.	$x = -7$
11.	$x = 2$	12.	all numbers	13.	$x = 2$	14.	$x = 0$	15.	$x = 2$
16.	no solution	17.	$x = 1\frac{1}{3}$	18.	$x = -7$	19.	$x = 2\frac{1}{5}$	20.	$x = -4$

