SOLVING EQUATIONS A.1.5 – A.1.8

An Equation Mat can be used to represent the process of solving an equation. An Equation Mat is created by putting two Expression Mats side by side—one for each side of the equal sign.

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 there are *infinitely many solutions*, or *all real numbers* are solutions.

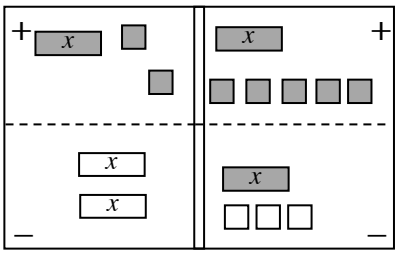
See the Math Notes box in Lesson A.1.7 for a list of all the legal moves and their corresponding algebraic language. Also see the Math Notes box in Lesson A.1.8 for solving a linear equation and checking the solution.

For additional examples and practice, see the Checkpoint 1 materials.

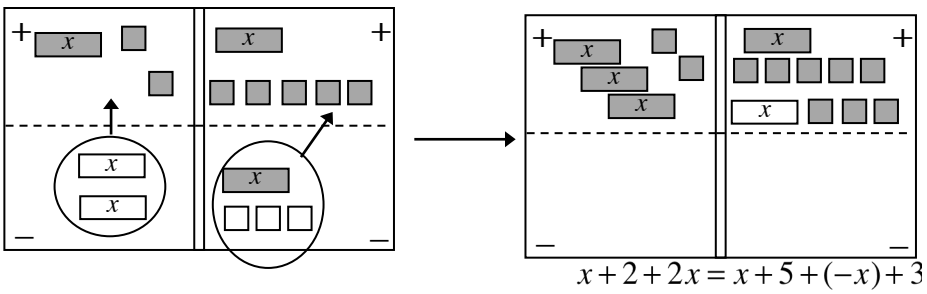
Example 1

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

First, build the equation on an Equation Mat.

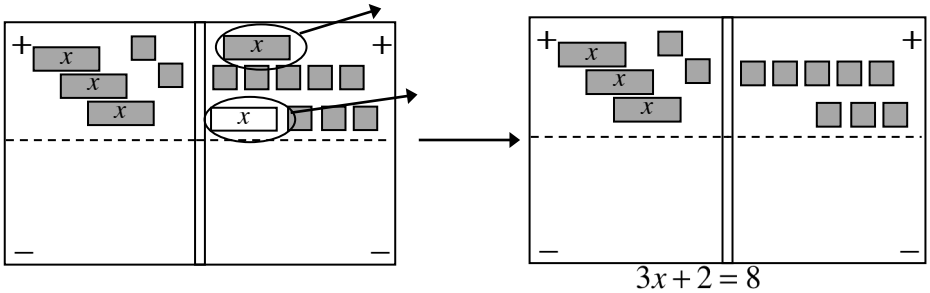


Second, flip the tiles in the subtraction region to the addition region (change subtraction to adding the opposite).



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

Continue to simplify using legal moves. For example, remove zero pairs.

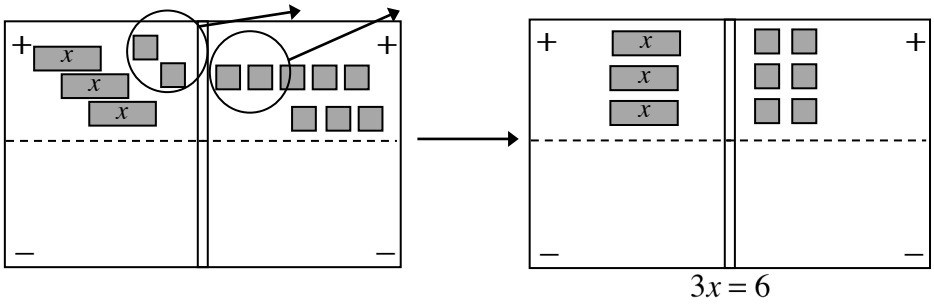


$3x + 2 = 8$

Example continues on next page →

Example continued from previous page.

Isolate x-terms on one side and non-x-terms on the other by placing or removing matching tiles from both sides of the Equation Mat. Remove zero pairs again if needed.



Finally, arrange tiles into equal-sized groups on both sides. Since both sides of the equation are equal, determine the value of x. In this case, the tiles can be arranged into three groups, resulting in $x = 2$.

Example 2

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

$3x + 3x + (-1) = 4x + 9$	Flip all tiles from subtraction region to addition region.
$6x + (-1) = 4x + 9$	Combine like terms.
$6x = 4x + 10$	Add 1 to each side, remove zero pairs.
$2x = 10$	Remove $4x$ from each side.
$x = 5$	Arrange into two groups.

Example 3

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

$-2x + 1 + 3x + (-3) = -4 + (-x) + (-2)$	Flip all tiles from subtraction region to addition region.
$x + (-2) = (-x) + (-6)$	Combine like terms.
$x = (-x) + (-4)$	Add 2 to each side, remove zero pairs.
$2x = -4$	Add x to both sides, remove zero pairs.
$x = -2$	Arrange into two groups.

CFS
1. Inverse operations are used and

2. Equation is kept balanced throughout entire process

3. Equation is solved vertically and all work shown to isolate the variable

4. Solution is checked through substitution

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Solving Equations

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. $0.5x - (-x + 3) = x - 5$

