

ACHIEVE THE CORE

Equations

8.EE.C.7 Procedural Skill and Fluency Mini-Assessment by Student Achievement Partners

OVERVIEW

This mini-assessment is designed to illustrate aspects of the standard 8.EE.C.7, specifically the expectation that students solve linear equations. This mini-assessment is designed for teachers to use either in the classroom, for self-learning, or in professional development settings to:

- Evaluate students' progress toward some of the skills described by 8.EE.C.7 in order to prepare to teach this material or to check for student ability with grade-appropriate content;
- Gain knowledge about assessing skills at the depth expected at grade 8; and
- Illustrate CCSS-aligned assessment problems.

MAKING THE SHIFTS

This mini-assessment attends to **focus** as it addresses solving and analyzing linear equations, which are key components of the major work of the grade.¹ It illustrates **coherence** across grades as the questions require students to extend their understanding of solving equations. While this mini-assessment primarily targets *procedural skill and fluency*, one of the three aspects of **rigor**, there are also some questions that intentionally assess *conceptual understanding*.

A CLOSER LOOK

In the CCSS procedural skill builds alongside conceptual understanding. Students are adding to their set of strategies toolbox for transforming expressions and solving equations where possible. As students work with a variety of equations, they come to understand that equations may result in one solution, no solutions, or infinitely many solutions. In this mini-assessment, questions 1 and 2 address both procedural skill and conceptual understanding as they require students to reason about equations and their solutions. Questions 3-10 present a variety of equations for students to solve. They include rational numbers as coefficients and solutions to maintain coherence with students' broader work with the number system. It is not expected that all students use exactly the same set of steps to solve a given equation, as procedural skill in solving equations also grants students flexibility to manipulate equations differently.

8.EE.C.7: Solve linear equations in one variable.

8.EE.C.7a: Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the forms $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

8.EE.C.7b: Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

Work in grade 8 synthesizes the developed skills and fluencies in grade 6 and 7 as students display full understanding of the processes used to solve a variety of equations. They should be asking themselves when analyzing and solving equations, "What value of the variable makes this linear equation true?" Students who leave grade 8 without meeting the expectations of 8.EE.C.7 are likely to have difficulty with the work of the Reasoning with Equations and Inequalities domain of the High School standards.

¹ For more on the Major Work of the grade, see achievethecore.org/focus.

Equations Mini-Assessment

Name: _____ Date: _____

- 1) Complete the following equation so that it has no solutions.

$$7x - 3x + 2 - x = \underline{\hspace{2cm}}x + \underline{\hspace{2cm}}$$

- 2) Mark the column to show whether the solution will be positive, negative, zero, or whether there is no solution.

	solution is positive	solution is negative	solution is zero	there is no solution
$3x = 5$				
$5z + 7 = 3$				
$7 - 5w = 3$				
$4a = 9a$				
$y = y + 1$				

Solve each equation or write that there are no solutions or infinitely many solutions. Show your work.

<p>3.</p> $\frac{x + 3}{2} = 5$	<p>4.</p> $17 + 5(2x - 9) = (-6x + 10) + 4$
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Equations Mini-Assessment

5.

$$8(2x + 9) = 56$$

6.

$$37x + \frac{1}{2} - \left(x + \frac{1}{4}\right) = 9(4x - 7) + 5$$

7.

$$4 - \frac{x - 5}{2} = -\frac{1}{2}(x - 5) + 4$$

8.

$$\frac{2}{3}(2x + 12) = 16$$

9.

$$(-x + 7) + \frac{5}{3} = \frac{1}{2}x + 9$$

10.

$$-4x - 2(8x + 1) = -(-2x - 10)$$

Equations Procedural Skill and Fluency Mini-Assessment – Answer Key

Name: _____ Date: _____

- 1) Complete the following equation so that it has no solutions.

$$7x - 3x + 2 - x = \underline{3}x + \underline{5}$$

Any expression of the form $mx + b$ where m is 3 and b is not 2.

- 2) Mark the column to show whether the solution will be positive, negative, zero, or whether there is no solution.

	solution is positive	solution is negative	solution is zero	there is no solution
$3x = 5$	X			
$5z + 7 = 3$		X		
$7 - 5w = 3$	X			
$4a = 9a$			X	
$y = y + 1$				X

Solve each equation or write that there are no solutions or infinitely many solutions. Show your work.

3.

$$\frac{x + 3}{2} = 5$$

Possible solution:

$$2\left(\frac{x + 3}{2}\right) = 2(5)$$

$$x + 3 = 10$$

$$x + 3 - 3 = 10 - 3$$

$$x = 7$$

4.

$$17 + 5(2x - 9) = (-6x + 10) + 4$$

Possible solution:

$$17 + 10x - 45 = -6x + 14$$

$$-28 + 10x = -6x + 14$$

$$-28 + 28 + 10x = -6x + 14 + 28$$

$$10x = -6x + 42$$

$$10x + 6x = -6x + 6x + 42$$

$$16x = 42$$

$$\frac{16x}{16} = \frac{42}{16}$$

$$x = \frac{42}{16} \text{ or equivalent}$$

Equations Procedural Skill and Fluency Mini-Assessment – Answer Key

<p>5.</p> $8(2x + 9) = 56$ <p><i>Possible solution:</i></p> $\frac{8(2x + 9)}{8} = \frac{56}{8}$ $(2x + 9) = 7$ $2x + 9 - 9 = 7 - 9$ $2x = -2$ $\frac{2x}{2} = \frac{-2}{2}$ $x = -1$	<p>6.</p> $37x + \frac{1}{2} - \left(x + \frac{1}{4}\right) = 9(4x - 7) + 5$ <p><i>Possible solution:</i></p> $37x + \frac{1}{2} - x - \frac{1}{4} = 36x - 63 + 5$ $36x + \frac{1}{2} = 36x - 58$ $36x - 36x + \frac{1}{2} = 36x - 36x - 58$ $\frac{1}{2} \neq -58$ <p style="text-align: center;"><i>No solutions</i></p>
<p>7.</p> $4 - \frac{x - 5}{2} = -\frac{1}{2}(x - 5) + 4$ <p><i>Possible solution:</i></p> $4 - 4 - \frac{x - 5}{2} = -\frac{1}{2}(x - 5) + 4 - 4$ $-\frac{x - 5}{2} = -\frac{1}{2}(x - 5)$ $2\left(-\frac{x - 5}{2}\right) = 2\left(-\frac{1}{2}(x - 5)\right)$ $-x - 5 = -x - 5$ <p style="text-align: center;"><i>Infinitely many solutions</i></p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Students who analyze the equation may recognize early in the solution pathway that the expressions on both sides of the equal sign are equivalent. Therefore, they may not show much work in order to identify that this equation has infinitely many solutions.</p> </div>	<p>8.</p> $\frac{2}{3}(2x + 12) = 16$ <p><i>Possible solution:</i></p> $\frac{3}{2} \left(\frac{2}{3}(2x + 12)\right) = \frac{3}{2}(16)$ $2x + 12 = 24$ $2x + 12 - 12 = 24 - 12$ $2x = 12$ $\frac{2x}{2} = \frac{12}{2}$ $x = 6$ <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Students may use structure to recognize that they can divide each side of the equation by $\frac{2}{3}$ rather than distributing the coefficient which will allow them to only work with whole numbers as they solve the equation.</p> </div>

Equations Procedural Skill and Fluency Mini-Assessment – Answer Key

9.

$$(-x + 7) + \frac{5}{3} = \frac{1}{2}x + 9$$

Possible solution:

$$-x + \frac{26}{3} = \frac{1}{2}x + 9$$

$$-x + x + \frac{26}{3} = \frac{1}{2}x + x + 9$$

$$\frac{26}{3} = \frac{3}{2}x + 9$$

$$\frac{26}{3} - 9 = \frac{3}{2}x + 9 - 9$$

$$-\frac{1}{3} = \frac{3}{2}x$$

$$\frac{2}{3} \left(-\frac{1}{3}\right) = \frac{2}{3} \left(\frac{3}{2}x\right)$$

$$-\frac{2}{9} = x$$

10.

$$-4x - 2(8x + 1) = -(-2x - 10)$$

Possible solution:

$$-4x - 16x - 2 = 2x + 10$$

$$-20x - 2 + 2 = 2x + 10 + 2$$

$$-20x = 2x + 12$$

$$-20x - 2x = 2x - 2x + 12$$

$$-22x = 12$$

$$\frac{-22x}{-22} = \frac{12}{-22}$$

$$x = -\frac{12}{22}$$