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Learning Outcomes

- Determine whether a decimal is a solution of an equation
- Solve equations containing decimals

Determine Whether a Decimal is a Solution of an Equation

Solving equations with decimals is important in our everyday lives because money is usually written with decimals. When applications involve money, such as shopping for yourself, making your family's budget, or planning for the future of your business, you'll be solving equations with decimals.

Now that we've worked with decimals, we are ready to find solutions to equations involving decimals. The steps we take to determine whether a number is a solution to an equation are the same whether the solution is a whole number, an integer, a fraction, or a decimal. We'll list these steps here again for easy reference.

Determine whether a number is a solution to an equation

1. Substitute the number for the variable in the equation.
2. Simplify the expressions on both sides of the equation.
3. Determine whether the resulting equation is true.
 - If so, the number is a solution.
 - If not, the number is not a solution.

example

Determine whether each of the following is a solution of $x - 0.7 = 1.5$

1. $x = 1$

2. $x = -0.8$

3. $x = 2.2$

Solution

1.	
	$x - 0.7 = 1.5$
Substitute $\textcolor{red}{1}$ for x.	$\textcolor{red}{1} - 0.7 \stackrel{?}{=} 1.5$
Subtract.	$0.3 \neq 1.5$

Since $x = 1$ does not result in a true equation, 1 is not a solution to the equation.

2.	
	$x - 0.7 = 1.5$
Substitute $\textcolor{red}{-0.8}$ for x.	$\textcolor{red}{-0.8} - 0.7 \stackrel{?}{=} 1.5$
Subtract.	$-1.5 \neq 1.5$

Since $x = -0.8$ does not result in a true equation, -0.8 is not a solution to the equation.

3.	
	$x - 0.7 = 1.5$
Substitute $\textcolor{red}{2.2}$ for x.	$\textcolor{red}{2.2} - 0.7 \stackrel{?}{=} 1.5$
Subtract.	$1.5 = 1.5$

Since $x = 2.2$ results in a true equation, 2.2 is a solution to the equation.

try it

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Solve Equations with Decimals

In previous chapters, we solved equations using the Properties of Equality. We will use these same properties to solve equations with decimals.

Properties of Equality

Subtraction Property of Equality	Addition Property of Equality
For any numbers $a, b, \text{ and } c$	For any numbers $a, b, \text{ and } c$
If $a = b$, then $a - c = b - c$.	If $a = b$, then $a + c = b + c$.
The Division Property of Equality	The Multiplication Property of Equality
For any numbers $a, b, \text{ and } c, \text{ and } c \neq 0$	For any numbers $a, b, \text{ and } c$
If $a = b$, then $\frac{a}{c} = \frac{b}{c}$	If $a = b$, then $ac = bc$

The Properties of Equality state that when you add, subtract, multiply or divide the same quantity from both sides of an equation, you still have equality.

example

Solve: $y + 2.3 = -4.7$

Show Solution

Solution

We will use the Subtraction Property of Equality to isolate the variable.

	$y + 2.3 = -4.7$
Subtract $\textcolor{red}{2.3}$ from each side, to undo the addition.	$y + 2.3 \textcolor{red}{-} 2.3 = -4.7 \textcolor{red}{-} 2.3$
Simplify.	$y = -7$
Check:	$y + 2.3 = -4.7$
Substitute $y = \textcolor{red}{-7}$.	$\textcolor{red}{-7} + 2.3 \stackrel{?}{=} -4.7$
Simplify.	$-4.7 = -4.7$

Since $y = -7$ makes $y + 2.3 = -4.7$ a true statement, we know we have found a solution to this equation.

try it

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example

Solve: $a - 4.75 = -1.39$

Show Solution

Solution

We will use the Addition Property of Equality.

	$a - 4.75 = -1.39$	
Add 4.75 to each side, to undo the subtraction.	$a - 4.75 + \textcolor{red}{4.75} = -1.39 + \textcolor{red}{4.75}$	
Simplify.	$a = 3.36$	
Check:	$a - 4.75 = -1.39$	
Substitute $a = \textcolor{red}{3.36}$	$\textcolor{red}{3.36} - 4.75 \stackrel{?}{=} -1.39$	
.	$-1.39 = -1.39$	

Since the result is a true statement, $a = 3.36$ is a solution to the equation.

try it

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In the following video we show more examples of using the addition and subtraction properties of equality to solve linear equations that contain decimals.

[Video Link](#)

example

Solve: $-4.8 = 0.8n$

Show Solution

Solution

We will use the Division Property of Equality.

Use the Properties of Equality to find a value for n .

	$-4.8 = 0.8n$
We must divide both sides by 0.8 to isolate n .	$\frac{-4.8}{0.8} = \frac{0.8n}{0.8}$
Simplify.	$-6 = n$
Check:	$-4.8 = 0.8n$
Substitute $n = -6$.	$-4.8 \stackrel{?}{=} 0.8(-6)$
	$-4.8 = -4.8$

Since $n = -6$ makes $-4.8 = 0.8n$ a true statement, we know we have a solution.

try it

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Watch the next video to see how to solve another equation with decimals that requires division.

[Video Link](#)

example

Solve: $\frac{p}{-1.8} = -6.5$

Show Solution

Solution

We will use the Multiplication Property of Equality.

		$\frac{p}{-1.8} = -6.5$
Here, p is divided by -1.8 . We must multiply by -1.8 to isolate p		$\textcolor{red}{-1.8}(\frac{p}{-1.8}) = \textcolor{red}{-1.8}(-6.5)$
Multiply.		$p = 11.7$
Check:	$\frac{p}{-1.8} = -6.5$	
	$\frac{\textcolor{red}{11.7}}{-1.8} \stackrel{?}{=} -6.5$	

Substitute [$p = \textcolor{red}{11.7}$]	[$-6.5 = -6.5$]	
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A solution to [$\frac{p}{-1.8} = -6.5$] is [$p = 11.7$]

try it

[See this interactive in the course material.](#)

The following video shows an example of how to solve an equation with decimals that requires multiplication.

[Video Link](#)

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