

# We will solve and model equations in one variable.

**Common Core Standard 7.EE.1**

Apply properties of operations as strategies to add, subtract, factor and expand linear expressions with rational coefficients.

**Common Core Standard 7.EE.2**

Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

Activating Prior Knowledge

Consider the following expression:

$$(3x + 6)$$

**This expression is a statement.**

**$3x$  and  $6$  are called terms.**

Checking for Understanding (CFU)

What are we going to do today?  
Today, we:  
\_\_\_\_\_  
\_\_\_\_\_.

Checking for Understanding 2 (CFU2)

What is an expression (Pair-Share)?  
An expression is:  
\_\_\_\_\_  
\_\_\_\_\_.

Recall from Previous Lessons (CFU3)

In the expression  $3x + 6$   
The term 3 is called a/an:  
\_\_\_\_\_  
The term  $x$  is called a/an:  
\_\_\_\_\_  
The term 6 is called a/an:  
\_\_\_\_\_.

## Concept Development

An expression such as  $x + 3$  describes two quantities.

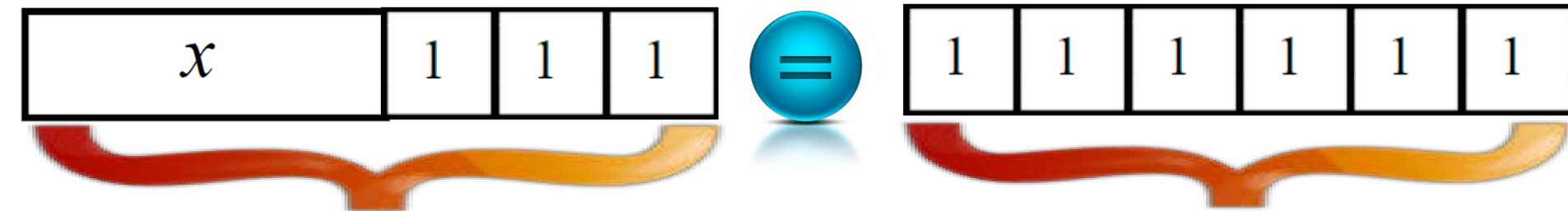
One quantity ( $x$ ) is unknown. It is added to a constant of 3.

In a tape diagram, we can show these terms separately as:



As we evaluate this expression, we are left wondering about the value of  $x$ . Without any further information given, we cannot solve for  $x$ . We have an incomplete statement.

If you were given further information, such as the expression  $x + 3$  has a sum of 6, you would now have a complete sentence or statement.



An **equation** states two **expressions** are **equal** in value.

Therefore, the expression  $x + 3$  is equal in value to 6. Since  $x + 3 = 6$ , the value of  $x$  must be 3.

### Checking for Understanding

Why is the expression  $x + 3$  considered incomplete? (Pair-Share)

The expression is considered to be an incomplete statement because: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_.

### Checking for Understanding 2

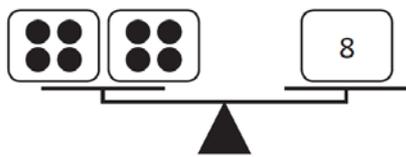
How are equations different than expressions? (Pair-Share)

An equation is different than an expression because: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_.

Look at these balanced scales.

In each box on the left there are 4 dots and on the other side is the number 8.

This makes sense because it shows the equation  $4 + 4 = 8$ . An equation is a sum with an equals symbol. One side must equal or balance the other just like these scales.



**Checking for Understanding**

Why do we call these scales balanced?  
(Pair-Share)

The scales are called balanced because:

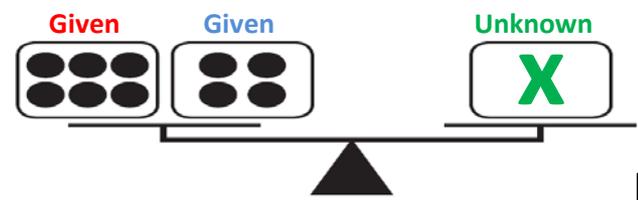
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**Balancing the Scales / Forming Equations**

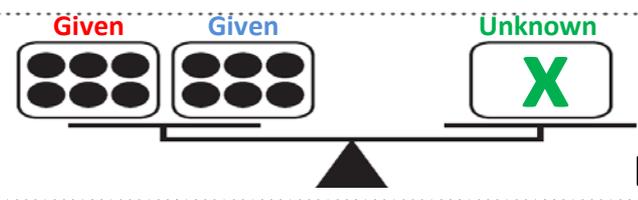
- 1 Determine what information is given (numbers or symbols).
- 2 Set a variable (use x) for the unknown / missing quantity.
- 3 Check and interpret the solution. Justify your solution.



Given      Given      Unknown

$$\square + \square = \square$$

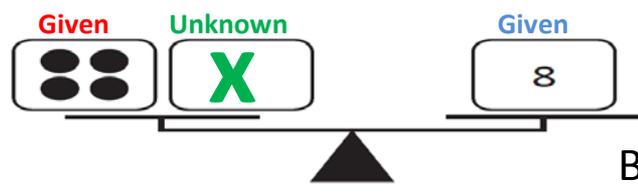
Balancing the equation, if  $6 + 4 = x$ ,  $x$  must equal \_\_\_\_.



Given      Given      Unknown

$$\square + \square = \square$$

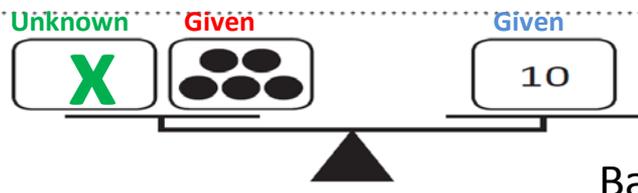
Balancing the equation, if  $6 + 6 = x$ ,  $x$  must equal \_\_\_\_.



Given      Unknown      Given

$$\square + \square = \square$$

Balancing the equation, if  $4 + x = 8$ ,  $x$  must equal \_\_\_\_.



Unknown      Given      Given

$$\square + \square = \square$$

Balancing the equation, if  $x + 5 = 10$ ,  $x$  must equal \_\_\_\_.

## Skill Development

A **one-step equation** requires one inverse operation to solve for the variable.

- To keep an equation balanced, inverse operations must be done on both sides of the equation.

$$x + 2 = 5$$



$$\begin{array}{r} x + 2 = 5 \\ - 2 \quad - 2 \\ \hline x = 3 \end{array}$$

Operation	Inverse
Addition (+)	Subtraction (-)
Subtraction (-)	Addition (+)
Multiplication (*)	Division (÷)
Division (÷)	Multiplication (*)

**QUESTION 1:** What is the original operation being performed?

**QUESTION 2:** What is the inverse operation to be performed?

### Checking for Understanding

Why are Inverse Operations performed on both sides of an equation? (Pair-Share)

Inverse operations are performed on both sides of an equation

3 + 2 is equal to 5



The **solution** is the value of the **variable** that makes the equation true. In this case,  $x = 3$ .

A **one-step equation** requires one inverse operation to solve for the variable. This isolates the variable.

An inverse operation is the *opposite* of the given operation.

EQUATION GIVEN	What is the operation of the equation?	What inverse operation would be used to solve the equation?
$a + 4 = 7$		
$m - 6 = 13$		
$5x = 25$		
$\frac{k}{2} = 8$		
$f + (-7) = 8$		
$-7y = -49$		

# Guided Practice

A **one-step equation** requires one inverse operation to solve for the variable.

- To keep an equation balanced, inverse operations must be done on both sides of the equation.

**Solve one-step equations.**

- 1 Look at the equation. Determine what operation is being performed.
- 2 In order to solve for the variable, identify the inverse operation to be performed.
- 3 Perform the inverse operation (on both sides of the equation).
- 4 Determine the value of the variable. Complete the sentence below.

$$r + 1 = -5$$

$$h + 3 = 10$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $r + 1 = -5$ , the value of the variable  $r$  is \_\_\_\_\_, because \_\_\_\_\_ + 1 = -5

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $h + 3 = 10$ , the value of the variable  $h$  is \_\_\_\_\_, because \_\_\_\_\_ + 3 = 10.

$$s - 8 = -1$$

$$r - 1 = -3$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $s - 8 = -1$ , the value of the variable  $s$  is \_\_\_\_\_, because \_\_\_\_\_ - 8 = -1.

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $r - 1 = -3$ , the value of the variable  $r$  is \_\_\_\_\_, because \_\_\_\_\_ - 1 = -3.

# Guided Practice

A **one-step equation** requires one inverse operation to solve for the variable.

- To keep an equation balanced, inverse operations must be done on both sides of the equation.

**Solve one-step equations.**

- 1 Look at the equation. Determine what operation is being performed.
- 2 In order to solve for the variable, identify the inverse operation to be performed.
- 3 Perform the inverse operation (on both sides of the equation).
- 4 Determine the value of the variable. Complete the sentence below.

$$9d = -9$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $9d = -9$ , the value of the variable  $d$  is \_\_\_\_\_, because the product  $9$  and \_\_\_\_\_ is equal to  $-9$ .

$$-4g = -20$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $-4g = -20$ , the value of the variable  $g$  is \_\_\_\_\_, because the product of  $-4$  and \_\_\_\_\_ is equal to  $-20$ .

$$\frac{r}{-5} = 15$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $\frac{r}{-5} = 15$ , the value of the variable  $r$  is \_\_\_\_\_, because the quotient of \_\_\_\_\_ and  $-5$  is equal to  $15$ .

$$\frac{p}{4} = -3$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $\frac{p}{4} = -3$ , the value of the variable  $p$  is \_\_\_\_\_, because the quotient of \_\_\_\_\_ and  $4$  is equal to  $-3$ .

A **one-step equation** requires **one inverse operation** to solve for the variable.

- To keep an equation **balanced**, **inverse operations** must be done on **both sides** of the equation.

**Solve one-step equations.**

- Look at the equation. Determine what operation is being performed.
- In order to solve for the variable, identify the inverse operation to be performed.
- Perform the inverse operation (on both sides of the equation).
- Determine the value of the variable. Check your solution.

**Checking for Understanding 1**

Which inverse operation would be used to solve the one-step equation  $x - 4 = 6$  ?

How do you know?

**A Addition**  
**B Subtraction**

**Checking for Understanding 2**

Which inverse operation would be used to solve the one-step equation  $4x = 8$ ?

How do you know?

**A Multiplication**  
**B Division**

Inverse Operation

$$x + 2 = 3$$

Inverse Operation

$$\frac{x}{4} = 1$$

**Summarize What You Learned Today**

**QUESTION: (Pair – Share)**  
 What did you learn today about solving and modeling equations?  
 Use the words to the right.

Today, I learned:

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**WORD BANK (VOCABULARY)**

Expression	Opposite	Balance
Equation	Isolate	Expression
Inverse	Variable	Coefficient

# Independent Practice

A **one-step equation** requires one inverse operation to solve for the variable.  
• To keep an equation balanced, *inverse operations* must be done on both sides of the equation.

**Solve one-step equations.**

- 1 Look at the equation. Determine what operation is being performed.
- 2 In order to solve for the variable, identify the inverse operation to be performed.
- 3 Perform the inverse operation (on both sides of the equation).
- 4 Determine the value of the variable. Complete the sentence below.

$$w + 12 = -4$$

$$-4r = -12$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $w + 12 = -4$ , the value of the variable  $w$  is \_\_\_\_\_, because \_\_\_\_\_ + 12 is equal to -4.

In the equation  $-4r = -12$ , the value of the variable  $r$  is \_\_\_\_\_, because the product of -4 and \_\_\_\_\_ is equal to -12.

$$v - 3 = -7$$

$$\frac{w}{4} = 12$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $v - 3 = -7$ , the value of the variable  $v$  is \_\_\_\_\_, because \_\_\_\_\_ - 3 is equal to -7.

In the equation  $\frac{w}{4} = 12$ , the value of the variable  $w$  is \_\_\_\_\_, because the quotient of \_\_\_\_\_ and 4 is equal to 12.

## One Step Addition Example

The Opposite of Addition is Subtraction

$$y + 14 = 20$$

$$-14 \quad -14$$

$$y = 6 \checkmark$$

The value which makes the equation true is 6.

## ONE STEP SUBTRACTION EXAMPLE

The Opposite of Subtraction is Addition

$$x - 120 = 80$$

$$+120 \quad +120$$

$$x = 200 \checkmark$$

The value which makes the equation true is 200.

## Multiplication Example

The Opposite of Multiplication is Division

$$3n = 12$$

$$\frac{\cancel{3}n}{\cancel{3}} = \frac{12}{3}$$

3/3 cancels down to become 1/1 = 1

$$n = 4 \checkmark$$

1n is simply "n"

The value which makes the equation true is 4.

## One Step Division Example

The Opposite of Division is Multiplication.

$$\frac{k}{2} = 16$$

k is divided by 2, so we need to multiply both sides by 2

$$\frac{k}{\cancel{2}} \times \cancel{2} = 16 \times 2$$

2/2 cancels down to become 1/1 = 1

$$k = 32 \checkmark$$

1k is simply "k"

The value which makes the equation true is 32.

A **one-step equation** requires one inverse operation to solve for the variable.

- To keep an equation balanced, inverse operations must be done on both sides of the equation.

### Solve one-step equations.

- 1 Look at the equation. Determine what operation is being performed.
- 2 In order to solve for the variable, identify the inverse operation to be performed.
- 3 Perform the inverse operation (on both sides of the equation). **SHOW ALL WORK.**
- 4 Determine the value of the variable. Complete the sentence below.

$$q + 10 = -30$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $q + 10 = -30$ , the value of the variable  $q$  is \_\_\_\_\_, because the sum of \_\_\_\_\_ and 10 is equal to -30.

$$-12h = -72$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $-12h = -72$ , the value of the variable  $h$  is \_\_\_\_\_, because the product of -12 and \_\_\_\_\_ is equal to -72.

$$r - 14 = -23$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $r - 14 = -23$ , the value of the variable  $r$  is \_\_\_\_\_, because the difference of \_\_\_\_\_ and 14 is equal to -23.

$$\frac{u}{12} = 1$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $\frac{u}{12} = 1$ , the value of the variable  $u$  is \_\_\_\_\_, because the quotient of \_\_\_\_\_ and 12 is equal to 1.

A **one-step equation** requires one inverse operation to solve for the variable.

- To keep an equation balanced, inverse operations must be done on both sides of the equation.

### Solve one-step equations.

- 1 Look at the equation. Determine what operation is being performed.
- 2 In order to solve for the variable, identify the inverse operation to be performed.
- 3 Perform the inverse operation (on both sides of the equation). **SHOW ALL WORK.**
- 4 Determine the value of the variable. Complete the sentence below.

$$z + 12 = -19$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $z + 12 = -19$ , the value of the variable  $z$  is \_\_\_\_\_, because the sum of \_\_\_\_\_ and 12 is equal to -19.

$$-6a = 6$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $-6a = 6$ , the value of the variable  $a$  is \_\_\_\_\_, because the product of -6 and \_\_\_\_\_ is equal to 6.

$$p + (-9) = 33$$

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $p + (-9) = 33$ , the value of the variable  $p$  is \_\_\_\_\_, because the difference of \_\_\_\_\_ and 9 is equal to 33.

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

Step 1: What operation is being performed? \_\_\_\_\_

Step 2: What is the inverse operation needed? \_\_\_\_\_

In the equation  $\frac{x}{3} = -1$ , the value of the variable  $x$  is \_\_\_\_\_, because the quotient of \_\_\_\_\_ and 3 is equal to -1.