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:

______________________________
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:

```
   x + 1 1 1
```

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.

```
   x 1 1 1 = 1 1 1 1 1
```

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.
Why do we call these scales balanced?

(Pair-Share)

The scales are called balanced because:

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.

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

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

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

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

\[ x + 2 = 5 \]

\[ \begin{array}{c}
-2 \quad -2 \\
\hline
x \\
\end{array} \]

\[ x = 3 \]

\[ 3 + 2 \text{ is equal to } 5 \]

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.

<table>
<thead>
<tr>
<th>EQUATION GIVEN</th>
<th>What is the operation of the equation?</th>
<th>What inverse operation would be used to solve the equation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>( a + 4 = 7 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( m - 6 = 13 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( 5x = 25 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \frac{k}{2} = 8 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( f + (-7) = 8 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( -7y = -49 )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

\[
\begin{align*}
\text{Step 1: What operation is being performed?} & \quad \text{________________}_1 \\
\text{Step 2: What is the inverse operation needed?} & \quad \text{________________}_2 \\
\text{In the equation } r + 1 = -5, \text{ the value of the variable } r & \quad \text{is ________, because } _____ + 1 = -5 \\
\text{Step 1: What operation is being performed?} & \quad \text{________________}_3 \\
\text{Step 2: What is the inverse operation needed?} & \quad \text{________________}_4 \\
\text{In the equation } h + 3 = 10, \text{ the value of the variable } h & \quad \text{is ________, because } _____ + 3 = 10.
\end{align*}
\]

\[
\begin{align*}
\text{Step 1: What operation is being performed?} & \quad \text{________________}_5 \\
\text{Step 2: What is the inverse operation needed?} & \quad \text{________________}_6 \\
\text{In the equation } s - 8 = -1, \text{ the value of the variable } s & \quad \text{is ________, because } _____ - 8 = -1. \\
\text{Step 1: What operation is being performed?} & \quad \text{________________}_7 \\
\text{Step 2: What is the inverse operation needed?} & \quad \text{________________}_8 \\
\text{In the equation } r - 1 = -3, \text{ the value of the variable } r & \quad \text{is ________, because } _____ - 1 = -3.
\end{align*}
\]
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.
> 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. Check your solution.

\[
x + 2 = 3
\]

**Inverse Operation**

\[
\frac{x}{4} = 1
\]

**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

**WORD BANK (VOCABULARY)**

- Expression
- Opposite
- Balance
- Equation
- Isolate
- Expression
- Inverse
- Variable
- Coefficient

**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:

___________________

___________________

___________________

___________________

___________________

___________________
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.

Step 1: What operation is being performed? ________________
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.

Step 1: What operation is being performed? ________________
Step 2: What is the inverse operation needed? ________________

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

Step 1: What operation is being performed? ________________
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.

Step 1: What operation is being performed? ________________
Step 2: What is the inverse operation needed? ________________

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**

\[ y + 14 = 20 \]

\[
\begin{align*}
-14 & \quad -14 \\
\hline
y & = 6 \checkmark
\end{align*}
\]

The value which makes the equation true is 6.

### One Step Subtraction Example

**The Opposite of Subtraction is Addition**

\[ x - 120 = 80 \]

\[
\begin{align*}
+120 & \quad +120 \\
\hline
x & = 200 \checkmark
\end{align*}
\]

The value which makes the equation true is 200.

### Multiplication Example

**The Opposite of Multiplication is Division**

\[ 3n = 12 \]

\[
\begin{align*}
3n & = 12 \\
\hline
\frac{3n}{3} & = \frac{12}{3} \\
n & = 4 \checkmark
\end{align*}
\]

The value which makes the equation true is 4.

### One Step Division Example

**The Opposite of Division is Multiplication.**

\[ \frac{k}{2} = 16 \]

\[
\begin{align*}
\frac{k}{2} & = 16 \times 2 \\
\frac{k}{2} & = 32 \checkmark
\end{align*}
\]

The value which makes the equation true is 32.