<u>Solving Multi-Step Equations with the Variable on One Side</u>

Remember that the **order of operations** is the rule that lets you know which operations to perform first in numerical expressions.

- Grouping symbols (Parentheses) ( ) or [ ]
- Powers (Exponents) x^n
- Multiply and Divide $\cdot \quad \div$

  from left to right
- Add and Subtract $+ \quad -$

  from left to right

When solving multi-step equations with the variable on one side, we use the order of operations in reverse to determine which things to handle first in the solving of an equation.

So, we will solve equations using this order of operations:

- Add and Subtract $+ \quad -$

  from left to right
- Multiply and Divide $\cdot \quad \div$

  from left to right
- Powers (Exponents) x^n
- Grouping symbols (Parentheses) ( ) or [ ]

Remember that our goal is always to create the additive identity of zero for addition or subtraction and the multiplicative identity of one for multiplication or division.

<u>Example 1:</u>

$7m - 17 = 60$

As we look at this equation, we can see that there are two numbers on the same side of the equation as the variable (7 and -17). In order to determine what number we should handle first, we should look at our reversed order of operations. The reversed order of operations says we should handle addition and subtraction first. That will be followed by taking care of any multiplication or division.

This means we should handle the -17 first since it is subtracted from the variable and then we will handle the 7 since it is multiplied into the variable.

Remember that in cases of addition and subtraction, we are trying to create the additive identity (zero). So, to make -17 equal zero, we should add 17 to both sides.

$7m - 17 = 60$

$\quad +17 \quad +17$

$7m = 77$ **The $7m$ doesn't change because we didn't do anything to that. The $-17 + 17$ becomes a zero that we don't need to write since it doesn't change anything. We add on the right-hand side; $60 + 17 = 77$.

Now, we have to handle the 7. In cases of multiplication and division, we are trying to create the multiplicative identity (one). To make the $7 \cdot$ equal one, we will need to divide by 7 on both sides.

$7m = 77$

$\frac{7m}{7} = \frac{77}{7}$

$m = 11$ **Remember that the $\frac{7}{7} = 1$ so we don't need to write that and we calculate the right-hand side; $\frac{77}{7} = 11$.

Once the variable is isolated, we have our solution. We should always double-check our solution, though.

$7m - 17 = 60$

$7(11) - 17 = 60$

$77 - 17 = 60$

$60 = 60$ ✓

Since our solution checks out, we know we have the correct solution: $\boldsymbol{m = 11}$.

<u>Example 2:</u>

$2a - 6 = 4$

As we look at this equation, we can see that there are two numbers on the same side of the equation as the variable (2 and -6). In order to determine what number we should handle first, we should look at our reversed order of operations. The reversed order of operations says we