Name: _____ Date: _____

EQUATIONS AND THEIR SOLUTIONS
COMMON CORE ALGEBRA I

A LOT of time is spent in Algebra learning how to solve equations and then solving them for various purposes. So, it goes without saying that we really need to understand what it means for something to "solve" an equation. First, let's make sure we understand what an equation is:

EQUATION DEFINITION

An equation is simply a statement about the **equality** of two expressions. In other words, anything that takes this form:

Expression #1 = Expression #2

***Exercise* #1:** Which of the following is **not** an equation?

(1) $3+1=4+0$ (3) $2(4x+1)$

(2) $x^2-2x=8$ (4) $1+3=6$

Equations can be either true, like (1) above, or false, like (4) above, depending on whether the two expression are equal (true) or not equal (false).

***Exercise* #2:** Consider the equation $2x-8=10-x$.

(a) Why can't you determine whether this equation is true or false?

(b) If $x=5$, will the equation be true? How can you tell?

(c) Show that $x=6$ makes the equation true. Remember to think very carefully always about your order of operations.

SOLUTIONS TO EQUATIONS

A value for a variable is called a **solution to the equation** if, when substituted into both expressions, results in the equation being **true**.

This concept of the solution to an equation is **amazingly important**. It implies that you can always know when you have solved an equation correctly. As long as you can check the truth of the equation with arithmetic, then you will know if your value (of *x* often) is correct.

***Exercise* #3:** Determine whether each of the following values for the given variable is a solution to the given equation. Show the calculations that lead to your final conclusions.

(a) $2x+3=17$ and $x=7$

(b) $\frac{x-20}{5}=-4$ and $x=10$

(c) $2(x+5)=6(x-1)$ and $x=4$

(d) $x^2-1=2x+2$ and $x=-1$

(e) $\frac{3(x+2)}{4}-1=5$ and $x=2$

(f) $\frac{3}{4}x-1=-\frac{1}{2}x+9$ and $x=8$

So, this is no excuse land. If you solve an equation, you should always be able to check to see if your solution is correct. Sometimes, mistakes happen, and it is good to be able to spot them.

***Exercise* #4:** Kirk was checking to see if $x=7$ was a solution to the equation $4x-3=2x+11$. He concluded that it was not a solution based on the following work. Was he correct?

$4x-3=2x+11$

$4\cdot7-3=2\cdot7+11$

$4\cdot4=2\cdot18$

$16=36$ No!

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EQUATIONS AND THEIR SOLUTIONS
COMMON CORE ALGEBRA I HOMEWORK

FLUENCY

1. Decide if each of the following are **equations** or **expressions**. You do not need to solve the equations or evaluate the expressions.

(a) $5x+13$ (b) $4x+3=12$ (c) $\frac{6(x-1)}{4}+1=5$

(d) $3(x+2)^2-(45)^3$ (e) $3^2-5|2x-15|$ (f) $3[(x+2)^2+2(x-4)]=3\sqrt{4(2x+1)}$

2. Determine whether each of the following values for the given variable is a solution to the given equation. Show the calculations that lead to your final conclusions.

(a) $x-4=12$ and $x=8$ (b) $\frac{(3+x)}{4}=3$ and $x=9$

(c) $(x+2)-3(x-4)=6$ and $x=4$ (d) $\frac{1}{3}(x+2)=-\frac{2}{5}(x-9)$ and $x=4$

APPLICATIONS

3. A disease has three treatments, depending on the percent of the body affected by the disease. Doctors have the treatment down to three stages as follows;

   Stage 1: less than 15% Stage 2: 15-25% Stage 3: 25-50%

   For anything more then 50% there is no cure. If the disease is spreading according to the formula $P = 6d + 5$ where P is the percent of the body affected and d is the number of days, fill out the following chart and explain to a patient what you observed.

Days	% of body Affected
1	
2	
3	
4	
5	
6	
7	
8	

Explanation of What You Observe:

REASONING

4. Bobby wants to go on a school trip that will cost him \$250. He comes up with an equation that represents how much he needs to save each week as follows:

$$25w + 30 = 250, \text{ where } w \text{ is the number of weeks spent saving.}$$

(a) If he has 9 weeks to save will he have enough money to go on the trip? Explain.

(b) He also wants to have \$100 spending cash on the trip. He decides to save an extra \$10 a week. To do this he changes his original equation as follows;

$$25w + 30 + 10w = 250 + 100, \text{ where } w \text{ is the number of weeks spent saving.}$$

Will nine weeks be enough time now? Show your calculations and Explain.