Name: _____ Date: _____

LETTERS EVERYWHERE! – SOLVING LINEAR EQUATIONS WITH UNSPECIFIED CONSTANTS
COMMON CORE ALGEBRA I

At this point we should feel very competent solving linear equations. In many situations, we might even solve equations when there are **no actual numbers given**. Let's take a look at what we mean in Exercise #1.

***Exercise* #1:** Solve each of the following problems for the value of *x*. In (b), write your answer in terms of the unspecified constants *a*, *b*, and *c*.

(a) $5x+3=33$

(b) $ax+b=c$

The rules for solving linear equations (and all equations) don't depend on whether the constants in the problem are specified or not. The biggest difference in #1 between (a) and (b) is that in (b) you have to leave the results of the intermediate calculation undone.

***Exercise* #2:** Solve the following two equations. In letter (b), leave your answer in terms of the constants *a*, *b*, *c* and *d*.

(a) $\frac{x+5}{2}-7=3$

(b) $\frac{x+a}{b}-c=d$

Of course, we can have numbers we known (specified constants) thrown into the mix. The most important thing is to know when we can combine and produce a result and when we can't.

***Exercise* #3:** When $2(x-h)+k=8$ is solved for *x* in terms of *h* and *k*, its solution is which of the following? Show the algebraic manipulations you used to get your answer.

(1) $4+h-k$

(2) $h+4-\frac{k}{2}$

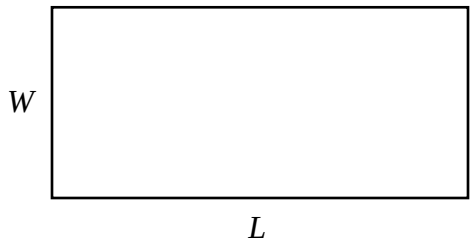
(3) $k-\frac{h}{2}+8$

(4) $4-h+k$

Many times this technique is used when we want to **rearrange** a **formula** to solve for a **quantity of interest**.

***Exercise* #4:** For a rectangle, the **perimeter**, *P*, can be found if the two dimensions of length, *L*, and width, *W*, are known.

(a) If a rectangle has a length of 12 inches and a width of 5 inches, what is the value of its perimeter? Include units.



(b) Write a formula for the perimeter, *P*, in terms of *L* and *W*.

(c) Rearrange this formula so that it "solves" for the length, *L*. Determine the value of *L* when $P = 20$ and $W = 4$.

There is one last complication that we need to look at that is often challenging for students at all levels. Let's take a look at this in the next problem.

***Exercise* #5:** Consider the equation $ax + b = cx + d$. We'd like to solve this equation for *x*. Let's start with the situation where we know the values of *a*, *b*, *c* and *d*.

(a) Solve: $8x + 1 = 5x + 22$

(b) Now solve: $ax + b = cx + d$

***Exercise* #6:** Which of the following solves the equation $ax - k = 3(x + h)$ for *x* in terms of *a*, *k*, and *h*. Show the manipulations to find your answer.

(1) $\frac{3h + k}{a - 3}$

(3) $\frac{k + 3h}{a + 3}$

(2) $\frac{3a + k}{h - 1}$

(4) $\frac{h + 3}{a + k}$

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SOLVING LINEAR EQUATIONS WITH UNSPECIFIED CONSTANTS
COMMON CORE ALGEBRA I HOMEWORK

FLUENCY

1. When $\frac{3(x-k)}{w}=4$ is solved for x in terms of w and k, its solution is which of the following? Show the algebraic manipulations you used to get your answer.

   (1) $\frac{4}{3}w+k$ (3) $k-\frac{4}{3}w$

   (2) $k-\frac{3w}{4}$ (4) $\frac{4}{3}+w-k$

2. Solve the following equations for x. It may help to make up an equation with numbers and solve it to the side to make sure you are not making any mistakes.

   (a) $a(x+b)-c=d$ (b) $\frac{e(x+c)}{b}=2$

   (c) $rx+qx-d=gc$ (d) $2ax-b=cx+d$

   (e) $zx=5g(2x-c)$ (f) $\frac{ax}{b}+\frac{cx}{d}=e$

APPLICATIONS

5. In physics the following formula relates your distance above the ground, *d*, relative to how long, *t*, an object has been in the air:

$$d = v_0 t + \frac{1}{2} a t^2$$

(a) Solve the formula for a, the acceleration due to gravity.

(b) Using your manipulated equation, find the value of a if $d = 80$, $v_0 = 50$ and $t = 8$.
*note: an acceleration towards the ground is negative.

REASONING

4. When traveling abroad many of the units used are different. One of the most common is the unit of temperature namely Fahrenheit versus Celsius. The conversion between the 2 temperatures is as follows.

$$C = \frac{5}{9}(F - 32)$$

(a) Using the formula above convert 50° Fahrenheit to Celsius.

(b) This conversion formula is very useful if you are given Fahrenheit, but less useful if you know a Celsius temperature. Solve the following equation for Fahrenheit, *F*, and then convert 50° Celsius into Fahrenheit. Is there a large difference in Fahrenheit and Celsius?