A STEP-BY-STEP GUIDE AND INTRODUCTION TO:

HOW TO SOLVE ALGEBRAIC EQUATIONS

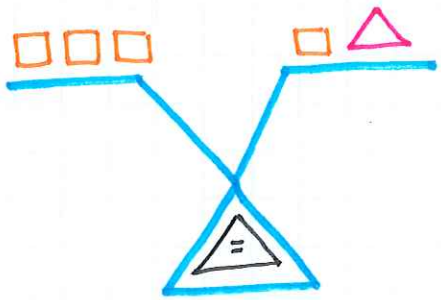
NAME:

DATE:

Equations are called equations because they have an "EQUALS SIGN". The EQUALS SIGN means that everything on the left side of the equation is EQUAL to everything on the right side. Essentially, the equals sign says that both sides of the equation are BALANCED.

1. EQUATIONS + BALANCE

Let's look at the following balance:



If this balanced scale is perfectly balanced then both sides are equal.

□ □ □ = □ △

If we know that □□□ = □△, what else do we know?

HINT: If we take away □ from both sides, is the scale balanced?

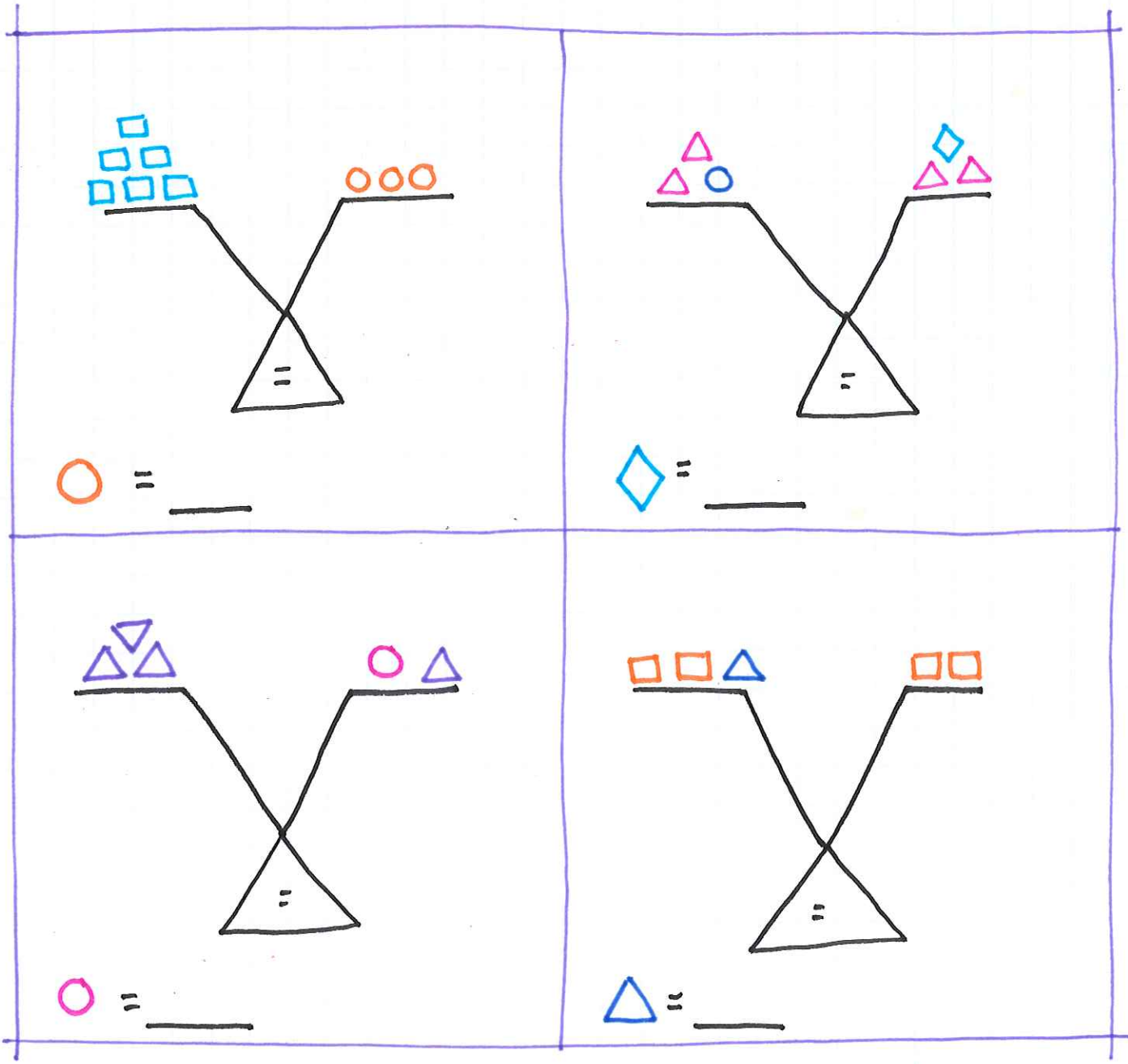
What is △ equal to?

1. EQUATIONS + BALANCE cont.

Algebra is all about maintaining BALANCE!

PRACTICE: If you are always careful to keep the scale balanced and to always do the same operations to both sides then you can learn to SOLVE EQUATIONS !

INSTRUCTIONS: Simplify and solve for the following:



2. SIMPLIFYING

Algebraic expressions and equations always have variables. Variables are letters and symbols that represent unknown numbers. Think of a variable as a "MYSTERY NUMBER". Starting out, most of your variables will be Xs.

So let's take a look at this expression:

"$X + 8$"

... This expression represents X (mystery number) plus 8.

Now what about this expression:

"$X + X + 8$"

... This expression represents $X + X + 8$ or $2X + 8$

and how about this expression:

"$X + X + X + 8$"

... This expression represents $X + X + X + 8$ or $3X + 8$

What we are doing by putting our X variables together is SIMPLIFYING our expression.

We do this by COMBINING our LIKE TERMS

2. SIMPLIFYING cont.

The first thing you need to do in order to combine your like terms is to identify which terms are alike!

In general, the rules are very simple: Variables are variables. Numbers are Numbers.

This means that Xs stick with other Xs and Numbers can combine.

EXAMPLE

$X + 3 + 2X - 1$

$X + 2X = 3X$

$3 - 1 = 2$

X and 2X are variables so they combine into 3X. 3 and 1 are numbers. Because we subtract 1 we need to do $3 - 1 = 2$

$3X + 2$ ANSWER

EXAMPLE

so Let's practice combining our like terms and simplifying our expressions

$X + 4x + 2x$	$3x - 2x + 4$	$8x - 2x + 4 + 4$
$3x + 2 + 5x + 1$	$8x - 3x - x + 2$	$2 + 10 - 3 + 2x$
$3b + a + 2b + 2a$	$4b - 2a + 2b + 4a$	$2m + 4n + 3m + 6$

3. SOLVING EQUATIONS

An algebraic expression becomes an equation when you set it equal to something. The big difference between an expression and an equation is the EQUALS SIGN. Typically, when an equation has only 1 variable, we are able to SOLVE the equation or figure out the value of the variable.

$$2X + 2 = 8$$

↑ JUST ONE VARIABLE

↑ EQUALS SIGN

If we were to try and use words to describe the equation above we might say...

"TWO TIMES OUR MYSTERY NUMBER PLUS TWO EQUALS EIGHT"

Solving this equation means figuring at what our mystery number is. Think about it like CRACKING THE CODE!

If we remember part 1 (EQUATIONS + BALANCE) we do this by keeping both sides equal at all times and by ALWAYS DOING THE SAME THING TO BOTH SIDES. REMEMBER: Always Always Always...

STAY BALANCED

3. SOLVING EQUATIONS cont.

... So using our example, let's solve for our variable, X

$$2X + 2 = 8$$

In order to solve for my variable I need to get X alone.

If I take 2 from both sides I'm on my way.

$$\begin{array}{rcl} 2X + 2 & = & 8 \\ -2 & & -2 \\ 2X & = & 6 \end{array}$$

$$2X = 6$$

In words, this equation is TWO TIMES OUR MYSTERY NUMBER EQUALS SIX

So what number multiplied by TWO equals SIX?

$$(2X = 6) \div 2$$

$$2X \div 2 = 6 \div 2$$

$$X = 3$$

On the next page we will practice solving our equations.

The first section will help us practice adding/subtracting

The second section will help us practice multiplying/dividing

The third section will help us Practice BOTH!

1

$x - 8 = 10$

$+8 \quad +8$

$x = 18$

$\boxed{x = 18}$

2

$x + 12 = 20$

3

$15 = x - 5$

4

$8 = x + 7$

5

$7 + x = 5$

6

$x + 2 = 2$

7

$3x = 18$

8

$4x = 8$

9

$2x = 100$

10

$\frac{x}{2} = 10$

11

$\frac{x}{3} = 5$

12

$\frac{x}{5} = 5$

13

$3x + 5 = 20$

14

$4x = 3x + 12$

15

$\frac{x}{2} = 2x - 10$

STRATEGIES

#1 COMBINE AND SIMPLIFY.

Start to solve a multi-step equation ask yourself, is this equation written as simply as possible?

EXAMPLE: $2x + 3 = 3 + x + 8$

combine!

$3 + 8 = 11$

$2x + 3 = x + 11$

#2 GET ALL THE NUMBERS ON ONE SIDE OF THE EQUATION

It is often easier to combine numbers first. Either by adding or subtracting from both sides, move numbers to one side of the equation.

$$2x + 3 = x + 11$$
$$-3 \qquad -3$$

$2x = x + 8$

#3 GET ALL THE VARIABLES ON ONE SIDE OF THE EQUATION

After the numbers are combined, combine variables on one side of the equation.

$$2x = x + 8$$
$$-x \quad -x$$

$x = 8$

When in doubt remember TWO THINGS:

1. BALANCE
   KEEP BOTH SIDES EQUAL ALWAYS
2. ISOLATE YOUR VARIABLE
   SOLVING FOR "X" MEANS GETTING "X" TO "=" SOMETHING

MORE PRACTICE...

1. $9x - 4 = 50$

2. $-x - 4x = 25$

3. $3 - x = 6 - 2x$

4. $4x + 2 = 5x + 1$

5. $\frac{x}{3} = 9$

6. $\frac{x}{2} + 10 = 20$

7. $9x - 7 = 10x - 14$

8. $100 - x = 90 + x$

9. $\frac{x}{4} + \frac{x}{2} = 9$

10. $10 = x + 3 + 4$

11. $x + 2x = x + 18$

12. $\frac{x}{5} + x = 30$