Study the following.

algebra (**al**-juh-bruh) – the type of mathematics that uses letters as well as numbers in formulas, equations, etc. to solve problems. (Algebra comes from an Arabic word, al-jabr, that means "the putting together of broken parts". An algebra problem deals with a number of things that are "put together" in the solution.) (Barbara studied algebra in school.)

operation (op-uh-**ray**-shuhn) – an action performed on some set of quantities(numbers). Addition, multiplication, subtraction, division, raising to a power, etc. are operations. (He used the operations addition and multiplication to solve the problem.)

variable (**vair**-ee-uh-buhl) – a letter or other symbol that stands for different values. (x, y, a, α , and θ were all used as variables on the algebra worksheet.) (He used an x for the variable.) (α and θ are the Greek letters alpha and theta and can be used as variables.)

constant (**kon**-stuhnt) – a constant is a quantity that stays the same. (5 is a constant.) (-8 is a constant.)

equation (i-**kway**-zhuhn) – a mathematical statement that two things are equal. It is shown using an equal sign. (James solved the equation $2x + 4 = 10$.) (The equation $y = 3 + 2$ was easy to solve.)

solve (**solv**) – solve usually means to find the answer to an equation. (The problem said to solve for b, and the student found that $b = 7$.) (Kristen solved the equation $3x = 18$.)

Say each word out loud and write it in the blank.

algebra _____
operation _____
variable _____
constant _____
equation _____
solve _____

Write each definition in your own words.

algebra

operation

variable

constant

equation

solve

Write two sentences using each word.

algebra
1.

2.

operation
1.

2.

variable
1.

2.

constant
1.

2.

equation
1.

2.

solve
1.

2.

Write 5 examples of each.

operation

variable

constant

equation

Matching.

algebra	an action performed on some set of quantities
operation	a letter that stands for different values
variable	a mathematical statement that two things are equal
constant	a quantity that stays the same
equation	to find the answer to an equation
solve	the type of mathematics that uses letters and numbers to solve problems

Fill in the blanks.

b is a _____ . 3 is a _____ .

–6 is a _____ . θ is a _____.

"divided by" is an _____. g = 2 – 1 is an_____.

× is an _____. A = 4 × 5 is an _____.

Study the following.

A variable is something that can vary or change. Some real life examples are:

1. The temperature outside during the day.
2. The amount of rainfall each day.
3. The number of calories eaten each day.
4. Amount of time spent watching television.

A constant is something that does not change. It stays the same. Some real life examples are:

1. The number of ounces in a pound.
2. The number of days in a year.
3. The number of quarters in a dollar.
4. The number of minutes in an hour.

Write 4 real life examples of each.

variables
1.

2.

3.

4.

constants
1.

2.

3.

4.

Circle the operations.

× g – 8 + c -6 23 ÷ α M

Circle the variables.

× g – 8 + c -6 23 ÷ α M

Circle the constants.

× g – 8 + c -6 23 ÷ α M

Circle the equations.

x = 5 + 1 5 – 2 107 y = 3(5) 8 + 1 + 3

b 4 + 1 = y × 3 ÷ 18 θ = 8 – 2

Study the following.

In math, variables and constants help you find answers by solving equations.

Very simple equations look like this: $x = 3 + 2$

The variable is on one side and constants and operations on the other side.

To solve the equation, do the operations. In the example above, 3 + 2 equals 5 so the answer is written $x = 5$.

More examples: $y = 7 \times (-2)$
$y = -14$

$A = 18 \div 6$
$A = 3$

$\theta = -9 + 3$ (θ is the Greek letter theta)
$\theta = -6$

The variable can be on the right side also.

Examples: $6 + 1 = a$
$7 = a$
$a = 7$ You can switch the sides so the variable is on the left for the answer.

$7 \times (-3) = \alpha$ (α is the Greek letter alpha)
$-21 = \alpha$
$\alpha = -21$

$-20 \div 5 = r$
$-4 = r$
$r = -4$

Solve.

1. $x = 1 + 1$

2. $y = 5 \times 3$

3. $7 - 1 = a$

4. $\alpha = (-6)(-1)$

5. $(-20) \div 4 = p$

6. $t = 4 - -2$

7. $h = 16 \div 4$

8. $(7)(-6) = \theta$

9. $10 + 10 = y$

10. $A = 9 \times (-3)$

11. $r = -3 - 3$

12. $G = -12 \div (-2)$

Study the following.

expression (ek-**spresh**-uhn) – a mathematical statement that does **not** contain an equal sign. (The expression 4a + 4b + 8 was the first problem on the test.) (He wrote the expression 2 × 10.)

evaluate (i-**val**-yoo-ate) – to find the value of an expression by replacing variables with numbers. The values of the variables are given, and you replace them to find the answer. (Mark evaluated 4 × q when q = 3 and got 12.) (He replaced a 7 for the y in the expression y – 2 to evaluate and get an answer of 5.)

substitute (**suhb**-stuh-toot) – to put something else in instead. In math, substitute means to put in a number instead of the variable in an expression. (I substituted an 8 for the d in the expression d + 2 .)

replace (ri-**playss**) – another word meaning substitute

plug in (**pluhg in**) – another word meaning substitute

Say each word out loud and write it in the blank.

expression _____
evaluate _____
substitute_____
replace_____
plug in _____

Write each definition in your own words.

expression

evaluate

substitute

replace

plug in

Write two sentences using each word.

expression
1.

2.

evaluate
1.

2.

substitute
1.

2.

replace
1.

2.

plug in
1.

2.

Write 4 examples of expressions.

Matching. (Words can connect to more than one definition.)

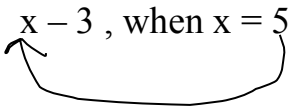
expression	to find the value of an expression by replacing variables with numbers
evaluate	
substitute	a mathematical statement that does **not** contain an equal sign.
replace	to put in a number instead of the variable in an
plug in	expression

Study the following.

How to evaluate expressions. (addition and subtraction)

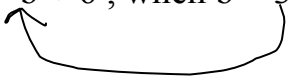
To evaluate an expression, replace the variable with the number that it equals. Then do the operation.

Examples:



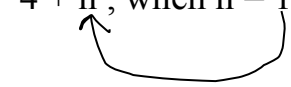
substitute

5 – 3 do the operation (subtraction)
2 answer



substitute

3 + 6 do the operation (addition)
9 answer



substitute

4 + 1 do the operation (addition)
5 answer

Evaluate the expressions.

1. $x - 3$, when $x = 8$

2. $y + 4$, when $y = 3$

3. $7 - j$, when $j = 2$

4. $9 + r$, when $r = 4$

5. $t + 8$, when $t = 1$

6. $10 - g$, when $g = 5$

7. $B - 1$, when $B = 4$

8. $\theta + 5$, when $\theta = 6$

9. $9 - m$, when $m = 4$

10. $x + 3$, when $x = 12$

Study the following.

When an integer and a variable are written right next to each other this shows multiplication.

Examples: 2x means 2 times x (or $2 \times x$)

3y means 3 times y (or $3 \times y$)

-4f means -4 times f

-10q means -10 times q

The reverse is also true. If you have an integer times a variable, you can write them next to each other without a multiplication sign.

Examples: $5 \times d$ is written as 5d

$7 \times j$ is written as 7j

$-2 \times h$ is written as -2h

The standard way to write an integer times a variable is without the multiplication sign, and with the integer first.

Examples: Write in the standard way.

$4 \times x$	standard way is 4x
$-5 \times y$	standard way is -5y
$w \times 3$	standard way is 3w
$k \times (-5)$	standard way is -5k

Write these expressions as multiplication problems.

1. 4b

2. -8k

3. 2y

4. -3g

Write these expressions in the standard way.

1. $2 \times z$
2. $-6 \times b$
3. $y \times 4$
4. $K \times 8$
5. $z \times (-6)$
6. $(-9) \times v$
7. $(-3) \times Q$
8. $r \times 2$
9. $m \times (-7)$
10. $2 \times p$

Study the following.

One times a variable is written without the one.

Examples: 1x is written x 1g is written 1g -1n is written –n

Write without the 1.

1. 1h 2. -1c 3. 1y

Write these expressions in the standard way.

1. $1 \times b$
2. $m \times 1$
3. $-1 \times d$
4. $p \times (-1)$

Study the following.

How to evaluate expressions. (multiplication and division)

To evaluate an expression, replace the variable with the number that it equals. Then do the operation.

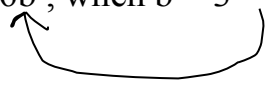
Examples:

$3x$, when $x = 5$

substitute

3×5 do the operation (multiplication)
15 answer

$6b$, when $b = 3$



substitute

6×3 do the operation (multiplication)
18 answer

$4 \div h$, when $h = 2$

substitute

$4 \div 2$ do the operation (division)
2 answer

$c \div 3$, when $c = 12$

substitute

$12 \div 3$ do the operation (division)
4 answer

Evaluate the expression.

1. $5n$, when $n = 4$

2. $8w$, when $w = 7$

3. $2q$, when $q = 4$

4. $-6m$, when $m = 3$

5. $15 \div y$, when $y = 3$

6. $j \div 4$, when $j = 24$

7. $-10 \div t$, when $t = 5$

8. $-4k$, when $k = 3$

9. $g \div (-2)$, when $g = 14$

10. $5n$, when $n = 1$

Study the following.

Evaluating expressions when you are substituting a negative integer.

When substituting it is a good habit to put the number in parentheses when you plug it in. This avoids confusions with negative signs.

Examples:

$3 - c$, when $c = -5$

Substitute the -5 using parentheses.

$3 - (-5)$	write the two minus signs as a plus sign
$3 + 5$	do the operation (addition)
8	answer

$-3b$, when $b = -4$

Substitute the -4 using parentheses.

$-3(-4)$	do the operation (multiplication)
12	answer

$-15 \div j$, when $j = -3$

Substitute the -3 using parentheses.

$-15 \div (-3)$	do the operation (division)
5	answer

Evaluate the expression.

1. $5 + n$, when $n = -3$

2. $-8 - w$, when $w = -7$

3. $2q$, when $q = -1$

4. $m - 6$, when $m = -2$

5. $-15 \div y$, when $y = -3$

6. $j \div (-4)$, when $j = -24$

7. $-10 + t$, when $t = -2$

8. $-4k$, when $k = -3$

9. $g \div (-2)$, when $g = -16$

10. $5 - n$, when $n = -1$

Study the following.

Evaluating expressions with exponents.

Remember that exponents mean the number of times another number is multiplied by itself. Example: $4^2 = (4)(4) = 16$

$$(-5)^3 = (-5)(-5)(-5) = -125$$

When substituting it is a good habit to put the number in parentheses when you plug it in. This avoids confusions with negative signs.

Examples: x^2 , when x = 3

Substitute the 3 using parentheses.

$(3)^2$	write as a multiplication problem
(3)(3)	multiply
9	answer

x^3 , when x = -5

Substitute the -5 using parentheses.

$(-5)^3$	write as a multiplication problem
(-5)(-5)(-5)	multiply
-125	answer

y^2 , when y = -7

Substitute the 3 using parentheses.

$(-7)^2$	write as a multiplication problem
(-7)(-7)	multiply
49	answer

Evaluate the expressions.

1. h^2 , when h = 8

2. n^4 , when n = (-3)

3. k^3 , when k = (-4)

4. m^6 , when m = (-1)

5. j^3 , when j = (-3)

Study the following.

If there is a negative sign in front of the variable with the exponent, the negative sign stays. Use parentheses when substituting.

Examples: $-x^2$, when x = 3

Substitute the 3 using parentheses.

$-(3)^2$ write as a multiplication problem
$-(3)(3)$ multiply
-9 answer

$-x^3$, when x = -3

Substitute the -3 using parentheses.

$-(-3)^3$ write as a multiplication problem
$-(-3)(-3)(-3)$ multiply the -3's
$-(-125)$ minus times a minus is a plus
125 answer

$-y^2$, when y = -6

Substitute the -6 using parentheses.

$-(-6)^2$ write as a multiplication problem
$-(-6)(-6)$ multiply the -6's
$-(36)$ minus times a plus (+36) is a minus
-36 answer

If you are having trouble with substituting, pretend you are cutting out the variable and replacing it with the integer put in parentheses.

Example: $-k^2$, when k = 5

$-\square^2$ cut out the k

$-(5)^2$ and replace it with a (5)

Study the following.

Evaluating more complex expressions.

Replace all the variables with the integer. Use parentheses around the integer. Then simplify using the order of operations rules.

Example 1: $3c - 5$, when $c = 4$

$3(4) - 5$
$12 - 5$
7

Example 2: $2x^2 + x - 8$, when $x = -3$

$2(-3)^2 + (-3) - 8$
$2(-3)(-3) + (-3) - 8$
$2(9) + (-3) - 8$
$18 + (-3) - 8$
$15 - 8$
7

Evaluate the expressions.

1. $4x + 1$, when $x = 2$

2. $2y^2 - 4$, when $y = 3$

3. $6q^2 - 9$, when $q = -3$

4. $2b^2 - 3b - 1$, when $b = 2$

5. $\dfrac{-4x^3}{2x - 1}$, when $x = (-2)$

6. $a^2 - 3a + 4$, when $a = -2$

Study the following.

formula (**for**-myuh-luh) – a special equation that always works for a certain type of problem. (I used the formula $A = l \times w$ to find the area of the table.)

Say the word out loud and write it in the blank.

formula _____

Write the definition in your own words.

formula

Write two sentences using the word.

formula
1.

2.

Study the following.

Formulas are solved by plugging in the values of each of the variables in the right hand side of the equation.

Example: $A = l \times w$, where $l = 5$ and $w = 2$
$A = 5 \times 2$
$A = 10$

Solve.

1. $A = l \times w$, where $l = 3$ and $w = 8$

2. $A = \frac{1}{2} \times b \times h$, where $b = 10$ and $h = 8$

3. $V = l \times w \times h$, where $l = 2$, $w = 3$ and $h = 4$

4. $d = r \times t$, where $r = 60$ and $t = 2$

5. $S = 16t^2 + vt$, where $v = 10$ and $t = 2$

6. $a = \frac{x + y + z}{3}$, where $x = -8$, $y = -9$ and $z = -10$

7. $d = \frac{m}{V}$, where $m = 6$ and $V = 3$

8. $I = Prt$, where $P = 200$, $r = 2$ and $t = 3$

Study the following.

Properties of Equality.

equality (i-**kwol**-uh-tee) – keeping things equal. Equality is related to the words "equal" and "equation". The properties of equality apply to equations. (Mary studied the four properties of equality so she could solve equations.)

These properties say that in order to keep an equation equal on both sides, if you do something to one side you must do it to the other.

Addition Property of Equality – if you add a number to one side of an equation, you must add the same number to the other side.

Subtraction Property of Equality – if you subtract a number from one side of an equation, you must subtract the same number from the other side.

Multiplication Property of Equality – if you multiply one side of an equation by a number, you must multiply the other side by the same number.

Division Property of Equality – if you divide one side of an equation by a number, you must divide the other side by the same number.

Say the word out loud and write it in the blank.

equality _____

Write each definition in your own words.
equality

Addition Property of Equality

Subtraction Property of Equality

Multiplication Property of Equality

Division Property of Equality

Study the following.

Examples:

Addition Property of Equality

$5 = 5$

$5 + 1 = 5 + 1$ add 1 to both sides

$6 = 6$

Subtraction Property of Equality

$8 = 8$

$8 - 3 = 8 - 3$ subtract 3 from both sides

$5 = 5$

Multiplication Property of Equality

$4 = 4$

$4 \times 2 = 4 \times 2$ multiply both sides by 2

$8 = 8$

or $4 (2) = 4 (2)$ multiply both sides by 2 in parentheses

$8 = 8$

Division Property of Equality

$14 = 14$

$14 \div 7 = 14 \div 7$ divide both sides by 7

$2 = 2$

or $\frac{14}{7} = \frac{14}{7}$ divide both sides by 7 as a fraction

$2 = 2$

Notice how the equations are still equal after applying the properties.

Write two examples of each.

Addition Property of Equality

Subtraction Property of Equality

Multiplication Property of Equality using the × symbol.

Multiplication Property of Equality using parentheses.

Division Property of Equality using the ÷ symbol.

Division Property of Equality using the fraction symbol.

Apply the property to the equation and solve each side.

1. $4 = 4$ add 2 to both sides

2. $6 = 6$ subtract 1 from both sides

3. $2 = 2$ multiply both sides by (-6) using parentheses

4. $10 = 10$ divide both sides by 5 using the ÷ symbol

5. $8 = 8$ multiply both sides by 2 using the × symbol

6. $30 = 30$ divide both sides by 5 using a fraction symbol

7. $-4 = -4$ add three to both sides

8. $-1 = -1$ subtract 8 from both sides

9. $(-9) = (-9)$ multiply both sides by (-4) using parentheses

10. $-30 = -30$ divide both sides by 3 using the ÷ symbol

11. $5 = 5$ multiply both sides by 8 using the × symbol

12. $50 = 50$ divide both sides by -10 using a fraction symbol

Study the following.

Solving equations by guessing.

Simple algebra equations can be solved by guessing and checking.

Example 1:	x + 1 = 5	Guess what x could be so that when you add it to 1 you will get 5. Guess that x =4.
Check:	4 + 1 = 5	Substitute 4 in for x.
	5 = 5	Solve the left side.
		If both sides are equal you guessed correctly.
	x = 4	Answer.
Example 2:	x – 6 = 2	Guess what x could be so that when you subtract 6 you will get 2. Guess that x = 8.
Check:	8 – 6 = 2	Substitute 8 in for x.
	2 = 2	Solve the left side.
		If both sides are equal you guessed correctly.
	x = 8	Answer.
Example 3:	5x = 30	Guess what x could be so that when you multiply by 5 you will get 30. Guess that x = 6.
Check:	5(6) = 30	Substitute 6 in for x.
	30 = 30	Solve the left side.
		If both sides are equal you guessed correctly.
	x = 6	Answer.
Example 4:	x ÷ 2 = 12	Guess what x could be so that when you divide by 2 you will get 12. Guess that x = 24.
Check:	24 ÷ 2 = 12	Substitute 24 in for x.
	12 = 12	Solve the left side.
		If both sides are equal you guessed correctly.
	x = 24	Answer.

Example 5: $\frac{x}{2} = 3$ Guess what x could be so that when you divide by 2 you will get 3. Guess that x = 6.

Check: $\frac{6}{2} = 3$ Substitute 6 in for x.

$3 = 3$ Solve the left side.
If both sides are equal you guessed correctly.

$x = 6$ Answer.

Solve the equations by guessing and checking.

1. $x + 3 = 10$

2. $b - 3 = 9$

3. $3k = 15$

4. $j \div 2 = 3$

5. $\frac{w}{2} = 4$

6. $r + 1 = 9$

7. $w - 3 = 16$

8. $4y = 20$

9. $x \div 9 = 2$

10. $\frac{f}{10} = 4$

Review of variables, expressions, equations and formulas.

Write the definition of each word.

1. variable
2. constant
3. equation
4. expression

Evaluate the expressions.

1. $12 - y$, when $y = 8$
2. $x - 7$, when $x = 10$
3. $3c$, when $c = 2$
4. $-8g$, when $g = -1$
5. $-8 \div t$, when $t = 4$
6. $14 \div x$, when $x = 2$
7. $-7 - w$, when $w = -5$
8. $a \div (-2)$, when $a = -18$
9. n^3 , when $n = 2$
10. k^4 , when $k = -2$
11. $-y^2$, when $y = -1$
12. $-c^3$, when $c = -2$

13. $3g^2 - 2$, when $g = 3$

14. $2d^2 - d + 4$, when $d = -2$

15. $\dfrac{-5x^3}{5x + 3}$, when $x = -2$

16. $3 + 5x + x^2$, when $x = 3$

17. $\dfrac{-4x + 1}{x^2}$, when $x = 3$

18. $15 - x^3$, when $x = -2$

Solve.

1. $A = b \times h$, where $b = 10$ and $h = 20$

2. $S = 16t^2 + vt$, where $t = 2$ and $v = 10$

3. $d = \dfrac{m}{V}$, where $m = 20$ and $V = 5$

Apply the property of equality to the equation and solve both sides.

1. $3 = 3$ multiply both sides by 6

2. $-7 = -7$ add 4 to both sides

3. $9 = 9$ divide both sides by 3 using the fraction symbol

4. $10 = 10$ subtract 8 from both sides

5. $-18 = -18$ divide both sides by 6 using the fraction symbol

6. $(-2) = (-2)$ multiply both sides by -4 using parentheses

Solve by guessing and checking.

1. $x + 2 = 7$

2. $k - 1 = 9$

3. $3t = 12$

4. $\frac{z}{3} = 2$