



WALDEN GREEN
MONTESSORI



LESSON ANSWER KEY

6th Year - Unit 4

Expressions & Equations

(EE)

Solve each expression.

2^3 8

3^{4-2} 9

$(17-9)^2$ 64

Solve each expression.

4^3 64

5×4^2 80

$5^3 \div 5^2$ 5

Solve each expression.

8^2 64

$4^3 - 5$ 59

$(1 + 4)^3$ 125

Solve each expression.

1^8 1

$2^{10 \div 2} \div 8$ 4

$2^4 \div 2$ 8

Write the expressions but do not solve.

thirteen minus five, all to the third power $(13-5)^3$ seven cubed 7^3 five squared plus three 5^2+3

Whole-Number Exponents

Directions: Solve each expression.

1. 2^4 16

2. 3^3 27

3. 4^{4-2} 16

4. 5×2^3 40

5. $(18-9)^2$ 81

6. $4^3 \div 4^2$ 4

Directions: Write the expressions but do not solve.

7. eight to the fifth power minus two

$8^5 - 2$

8. four raised to the three-minus-two power

4^{3-2}

9. six cubed

6^3

10. the quantity of seven minus one, all raised to the fourth power

$(7-1)^4$

Whole-Number Exponents

Directions: Solve each expression.

1. 4^3 **64**

2. 1^6 **1**

3. $5^3 - 2$ **123**

4. $6^{6 \div 3} \div 3$ **72**

5. $(2 + 5)^3$ **343**

6. $3^3 \div 3$ **9**

Directions: Write the expressions but do not solve.

7. seven cubed plus two

$7^3 + 2$

8. nine raised to the five-minus-two power

9^{5-2}

9. one fourth of the quantity three squared

$\frac{1}{4}(3^2)$

10. twelve minus eight, all to the sixth power

$(12-8)^6$

Write the expressions using numbers and symbols.

the sum of d and 5

$$\underline{d+5}$$

the product of 7 and b

$$\underline{7b}$$

Write the expressions using numbers and symbols.

14 divided by j

$$\underline{14 \div j}$$

w subtracted from 2

$$\underline{2-w}$$

Write the expressions using numbers and symbols.

divide g by 4

$$\underline{g \div 4}$$

subtract m from 12

$$\underline{12-m}$$

Write the expressions using numbers and symbols.

multiply 9 and r

$$\underline{9r}$$

add c to 1

$$\underline{1+c}$$

Solve each problem.

The volume of a cube is given by the expression s^3 , and its surface area is given by the expression $6s^2$, where s is the length of the cube's side.

What is the volume of a cube with a side length of 4 inches? $\underline{64 \text{ in}^3}$

What is the surface area of a cube with a side length of 4 inches? $\underline{96 \text{ in}^2}$

Variables (Letters Stand for Numbers)

Directions: Write the expressions using numbers and symbols.

- the sum of c and 4 **$c+4$**
- the product of 5 and w **$5w$**
- 16 divided by b **$16 \div b$**
- r subtracted from 9 **$9-r$**

Directions: Which statement best describes the expression?

- $(b + 7)(3 - h)$
 - The product of two numerals
 - The quotient of two factors
 - The sum of two numbers
 - The product of two factors

Directions: Solve the problem correctly.

- The volume of a cube is given by the expression s^3 and its surface area is given by the expression $6s^2$, where s is the length of the cube's side. What is the volume of a cube with a side length of 5 inches?

 125 in^3

Variables (Letters Stand for Numbers)

Directions: Write the expressions using numbers and symbols.

1. divide f by 3 $f \div 3$

2. subtract k from 6 $6 - k$

3. multiply 8 and p $8p$

4. add d to 2 $2 + d$ or $d + 2$

Directions: Identify the coefficient in this expression.

5. $4(b + f)$ 4

Directions: In the expression below, what is the best description of $(b + 7)$?

6. $(b + 7)(3 - h)$
- a. The difference of two values
 - b. The factor multiplied by $(3 - h)$
 - c. The quotient of two factors
 - d. The product of two numerals

Directions: Solve the problem correctly.

7. The volume of a cube is given by the expression s^3 and its surface area is given by the expression $6s^2$, where s is the length of the cube's side. What is the surface area of a cube with a side length of 5 inches?

150 in^2

Simplify.

$$e + e + e + e + e + e =$$

$$\underline{6e}$$

$$8j - 2j =$$

$$\underline{6j}$$

Simplify.

$$5 + 8h + 7 + 3h =$$

$$\underline{12+11h}$$

$$m + m + m + m + 5m =$$

$$\underline{9m}$$

Expand the expression using the distributive property.

$$2(6 + r) =$$

$$\underline{12+2r}$$

$$4(5z - 7) =$$

$$\underline{20z-28}$$

Expand the expression using the distributive property.

$$(9 + 3k)2 =$$

$$\underline{18+6k}$$

$$(8a + 6b)3 =$$

$$\underline{24a+18b}$$

Apply the distributive property to convert the expression to the greatest common factor multiplied by a term in parentheses.

$$42c + 12 = \underline{6(7c+2)}$$

$$36 - 3p = \underline{3(12-p)}$$

Generate Equivalent Expressions

Directions: Simplify.

1. $b + b + b + b =$ 4b

2. $7m - 3m =$ 4m

3. $4 + 9g + 6 + 3g =$ 10 + 12g

Directions: Expand the expression using the distributive property.

4. $4(3 + r) =$ 12 + 4r

5. $9(2p - 5) =$ 18p - 45

6. $(4 + 7g)6 =$ 24 + 42g

Directions: Apply the distributive property to convert the expression to the greatest common factor multiplied by a term in parentheses.

7. $36a + 9 =$ 9(4a+1)

8. $40 + 50d =$ 10(4+5d)

9. $28 - 7f =$ 7(4-f)

Generate Equivalent Expressions

Directions: Simplify.

1. $h + h + h + 4h =$ 7h

2. $22w + 12w =$ 34w

3. $81z + 5 - 46z - 5 =$ 35z

Directions: Expand the expression using the distributive property.

4. $13(e + 3) =$ 13e+39

5. $7(7p - 2) =$ 49p-14

6. $(4u + 8v)5 =$ 20u+40v

Directions: Apply the distributive property to convert the expression to the greatest common factor multiplied by a term in parentheses.

7. $15 + 21b =$ 3(5+7b)

8. $30 - 18f =$ 6(5-3f)

9. $60g + 48h =$ 12(5g+4h)

Is each equation always true, regardless of the value of the variable?

1. $b + b = 2b$

yes

2. $g \times g \times g = g^3$

yes

3. $2r - r = r$

yes

4. $a^3 \div a^4 = a$

yes

5. $(w + 1)^2 = 2w$

no

6. $d^4 \times d^2 = d^6$

yes

7. $5n^2 - 4n^2 = n^2$

yes

8. $j \div k = 1 \div k \div j$

no

9. $g \times h = h + g$

no

10. $4c^2 + p = c^2 + 4p$

no

Identify Equivalent Expressions

Directions: Is each equation always true, regardless of the value of the variable?

1. $m + m = 2m$

yes

2. $w \times w = w^2$

yes

3. $3y - y - y = y$

yes

4. $b^3 \div b^4 = b$

yes

5. $(e + 1)^2 = 2e$

no

6. $c^3 \times c^2 = c^5$

yes

7. $3v^2 - 2v^2 = v^2$

yes

8. $f \div h = 1 \div h \div f$

no

9. $5k - 3k^2 = k^2$

no

10. $a \times 1 \div d = a \div d$

yes

Identify Equivalent Expressions

Directions: Is each equation always true, regardless of the value of the variable?

1. $q^2 = 4q$

no

2. $c \times d = d + c$

no

3. $p = p^2 \div p$

yes

4. $f \div g = f + g$

no

5. $k \times k \times k \times k = k^4$

yes

6. $c \times b = b \times c \times 1$

yes

7. $h^2 = 2h^4 \div 2h$

no

8. $j^2 = (j + 2)^2$

no

9. $3m^2 + p = m^2 + 2p$

no

10. $r \times s \times r = r^2s$

yes

Solve each equation for y.

Hint: $y < 10$.

$$y + 2 = 7$$

$$\underline{y=5}$$

$$y - 8 = 1$$

$$\underline{y=9}$$

$$(y - 2) \div 5 = 1$$

$$\underline{y=7}$$

Solve each equation for y.

Hint: $y < 10$.

$$4y = 16$$

$$\underline{y=4}$$

$$y^2 + 3 = 12$$

$$\underline{y=3}$$

$$y^3 = 64$$

$$\underline{y=4}$$

Solve the problem.

When substituted for 'y', does each number make the inequality, $2y > 11$, true or false?

$$y = 6 \quad \underline{\text{true}}$$

$$y = 5 \quad \underline{\text{false}}$$

$$y = 3 \quad \underline{\text{false}}$$

$$y = 7 \quad \underline{\text{true}}$$

Solve the problem.

When substituted for 'y', does each number make the inequality, $9 + y < 15$, true or false?

$$y = 4 \quad \underline{\text{true}}$$

$$y = 5 \quad \underline{\text{true}}$$

$$y = 6 \quad \underline{\text{false}}$$

$$y = 7 \quad \underline{\text{false}}$$

Solving Equations and Inequalities by Substitution

Directions: Solve each equation for y . *Hint: $y < 10$.*

- | | | | |
|-------------------|---------------------------|-------------------------|---------------------------|
| 1. $y + 3 = 4$ | <u> y=1 </u> | 2. $y + 5 = 10$ | <u> y=5 </u> |
| 3. $y - 5 = 2$ | <u> y=7 </u> | 4. $y - 7 = 1$ | <u> y=8 </u> |
| 5. $6y = 24$ | <u> y=4 </u> | 6. $y^3 = 125$ | <u> y=5 </u> |
| 7. $y^2 + 4 = 20$ | <u> y=4 </u> | 8. $(y - 2) \div 6 = 1$ | <u> y=8 </u> |

Directions: Solve each problem.

9. If $y = 6$, is the inequality true or false?
 $y + 3 < 12$ **true**
10. If $y = 7$, is the inequality true or false?
 $y + 3 < 12$ **true**
11. If $y = 8$, is the inequality true or false?
 $y + 3 < 12$ **true**
12. If $y = 9$, is the inequality true or false?
 $y + 3 < 12$ **false**

Solving Equations and Inequalities by Substitution

Directions: Solve each equation for y . *Hint: $y < 10$.*

- | | | | | | |
|----|-----------------|--------------------------------|----|----------------------|--------------------------------|
| 1. | $4 + y = 6$ | <u>$y=2$</u> | 2. | $3 + y = 8$ | <u>$y=5$</u> |
| 3. | $9 - y = 5$ | <u>$y=4$</u> | 4. | $10 - y = 1$ | <u>$y=9$</u> |
| 5. | $28 \div y = 7$ | <u>$y=4$</u> | 6. | $(y + 1)^2 = 9$ | <u>$y=2$</u> |
| 7. | $6y + 1 = 19$ | <u>$y=3$</u> | 8. | $10 - 81 \div y = 1$ | <u>$y=9$</u> |

Directions: Solve each problem.

12. If $y = 3$, is the inequality true or false?
 $y^y > 25$ **true**
9. If $y = 4$, is the inequality true or false?
 $3y > 12$ **false**
10. If $y = 5$, is the inequality true or false?
 $7y + 6 < 42$ **true**
11. If $y = 6$, is the inequality true or false?
 $|y| > 9 - 3$ **false**

Isaiah divided all the money in his pocket evenly among his nine grandchildren. Nobody counted the amount that each child got. Write an equation to describe this. Use 'M' for the total amount Isaiah gave away. Use 'e' for the amount that each child got.

$$\underline{M \div 9 = e}$$

Maggie gets in line at the grocery store to buy 7 apples. While in line, she calculates that the apples will cost \$5 altogether. Write an equation to show how the cost of a single apple (call it 'a') relates to the total cost.

$$\underline{7a = 5 \text{ or } a = 5 \div 7}$$

Fred buys an apple, a banana, and a pineapple. His total bill is \$2. Write an equation that relates the cost of each of these three items to the total cost.

$$\underline{a + b + c = 2}$$

Seven eggs sat in a basket overnight. A fox came and took an unknown amount, and a raccoon came and took an unknown amount. In the morning, there were only three eggs left. Write an equation showing how seven eggs were reduced to three eggs. Use 'f' for the number the fox took and 'r' for the number the raccoon took.

$$\underline{7 - f - r = 3}$$

Taylor makes pancakes at her restaurant. She knows that one cup of powdered pancake mix will make 5 pancakes. Help Taylor write an equation to know how many pancakes can be made from any number of cups of pancake mix she chooses to use. Use 'P' for the number of pancakes and 'm' for the number of cups of pancake mix.

$$\underline{P = 5m}$$

Real-World Variables

Directions: Solve each problem.

1. Cassie gets in line at the grocery store to buy 5 apples. While in line, she calculates that the apples will cost \$3 altogether. Write an equation to show how the cost of a single apple (call it 'a') relates to the total cost.

$$\underline{5a=3 \text{ or } 3\div 5=a}$$

2. Conner steps on a scale holding three bricks of equal weight. The scale reads 250 pounds. Write an equation relating Conner's weight and the weight of the bricks to the total weight shown on the scale. Use 'C' for Conner's weight and 'b' for the weight of a single brick.

$$\underline{C+3b = 250}$$

3. Vince divided all the money in his pocket evenly among his five grandchildren. Nobody counted the amount that each child got. Write an equation to describe this. Use 'M' for the total amount Vince gave away. Use 'e' for the amount that each child got.

$$\underline{M\div 5=e \text{ or } 5e=M}$$

4. Greg gets in line at the hardware store to buy 20,000 nails. While in line, he calculates that the nails will cost \$300 altogether. Write an equation to show how the cost of a single nail (call it 'n') relates to the total cost.

$$\underline{20,000n=300 \text{ or } 300\div 20,000=n}$$

Real-World Variables

Directions: Solve each problem.

1. Mikey buys a kiwi, a lemon, a mango, and a nectarine . His total bill is \$2. Write an equation that relates the cost of each of these items to the total cost.

$$\underline{k+l+m+n=2}$$

2. Eight eggs sat in a basket overnight. A fox came and took an unknown amount, and a raccoon came and took an unknown amount. In the morning, there were only three eggs left. Write an equation showing how eight eggs were reduced to three eggs. Use 'f' for the number the fox took and 'r' for the number the raccoon took.

$$\underline{8-f-r=3}$$

3. A shirt-making machine can make 11 shirts per hour, but the first shirt made each day is never good enough to sell because the machine isn't fully warmed up. Write an equation that shows how many sellable shirts can be made in 'h' hours, assuming the machine is turned on once and never turned off.

$$\underline{S=11h-1}$$

4. Tracy makes pancakes at her restaurant. She knows that one cup of powdered pancake mix will make 8 pancakes. Help Tracy write an equation to know how many pancakes can be made from any number of cups of pancake mix she chooses to use. Use 'P' for the number of pancakes and 'm' for the number of cups of pancake mix.

$$\underline{P=8m}$$

Solve each equation.

$x + 6 = 13$ **$x=7$**

$5 + z = 9$ **$z=4$**

$2b = 2$ **$b=1$**

$c \times 8 = 32$ **$c=4$**

$e + 43 = 83$ **$e=40$**

$123 + g = 300$ **$g=177$**

$9j = 153$ **$j=17$**

Solve each equation.

$y + 9 = 16$ **$y=7$**

$7 + a = 14$ **$a=7$**

$8c = 72$ **$c=9$**

$d \times 12 = 108$ **$d=9$**

$f + 94 = 161$ **$f=67$**

$581 + h = 581$ **$h=0$**

$1,735 = 5n$ **$n=347$**

Solve each word problem.

Alice buys 18 shirts for a total of \$99. Express this as an equation, using 'x' as the cost of each shirt. Then, solve the equation for the value of 'x'.

$18x=99, x=\$5.5$

Troy has a stamp collection with an unknown number of stamps. He adds 16 stamps to it and then counts 31 in the total collection. Write this as an equation, using 'x' for the number of stamps he started with. Then, solve the equation for the value of 'x'.

$x+16=31, x=15$

Equations of the Form $x + p = q$ and $px = q$

Directions: Solve each equation.

- | | | | | | |
|----|---------------|---------------------------------|----|-------------------|----------------------------------|
| 1. | $x + 3 = 5$ | <u>$x=2$</u> | 2. | $8 + z = 11$ | <u>$z=3$</u> |
| 3. | $6b = 6$ | <u>$b=1$</u> | 4. | $c \times 9 = 36$ | <u>$c=4$</u> |
| 5. | $e + 57 = 91$ | <u>$e=34$</u> | 6. | $172 + g = 400$ | <u>$g=228$</u> |
| 7. | $8j = 128$ | <u>$j=16$</u> | 8. | $390 = 30m$ | <u>$m=13$</u> |

Directions: Solve each problem.

9. Frieda has an unknown number of ping-pong balls. She buys 310 more and then counts that she has a total of 500. Write an equation to describe this scenario. Use 'x' for the original number of ping-pong balls. Then, solve the equation for the value of 'x'.

$x+310=500, x=390$

10. Five siblings pool their money to buy a volleyball costing \$13.95. They each contribute the same amount, 'x'. Write an equation to describe the situation. Then, solve the equation for the value of 'x'.

$5x=13.95, x=2.79$

Equations of the Form $x + p = q$ and $px = q$

Directions: Solve each equation.

- | | | | | | |
|----|----------------|--------------------------|----|--------------------|---------------------------|
| 1. | $y + 6 = 13$ | <u>$y=7$</u> | 2. | $4 + a = 10$ | <u>$a=6$</u> |
| 3. | $7c = 28$ | <u>$c=4$</u> | 4. | $d \times 12 = 60$ | <u>$d=5$</u> |
| 5. | $f + 83 = 150$ | <u>$f=67$</u> | 6. | $213 + h = 213$ | <u>$h=0$</u> |
| 7. | $14k = 238$ | <u>$k=17$</u> | 8. | $1968 = 4n$ | <u>$n=492$</u> |

Directions: Solve each problem.

9. Doug has a stamp collection with an unknown number of stamps. He adds 28 stamps to it and then counts 43 in the total collection. Write this as an equation, using 'x' for the number of stamps he started with. Then, solve the equation for the value of 'x'.

$x+28=43, x=15$

10. Sophia buys 13 shirts for a total of \$52. Express this as an equation, using 'x' as the cost of each shirt. Then, solve the equation for the value of 'x'.

$13x=52, x=4$

Write a mathematical statement to express the inequality. Use 'x' for the unknown number.

an unknown number is less than 9

$$\underline{x < 9}$$

5 is greater than an unknown number

$$\underline{5 > x}$$

Provide three values of 'x' that satisfy the inequality.

$$x > 67$$

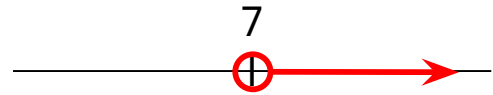
$$\underline{68}$$

$$\underline{69}$$

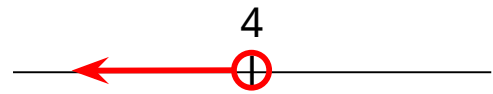
$$\underline{70 \text{ (& many others)}} \quad \underline{3.9 \text{ (& many others)}}$$

Graph each inequality.

an unknown number is greater than 7



an unknown number is less than 4



Provide three values of 'x' that satisfy both inequalities at the same time.

$$x < 4 \text{ and } x > 2.3$$

$$\underline{2.4}$$

$$\underline{3}$$

Answer the word problem correctly.

The lowest point in Missouri is 230 feet above sea level. Using 'x' as a variable to represent all land in Missouri, write an inequality that describes Missouri's elevation. $\underline{x > 230 \text{ or } 230 < x}$

The highest point in Missouri is 1,772 feet above sea level. Using 'x' as a variable to represent all land in Missouri, write an inequality that describes Missouri's elevation. $\underline{x < 1772 \text{ or } 1772 > x}$

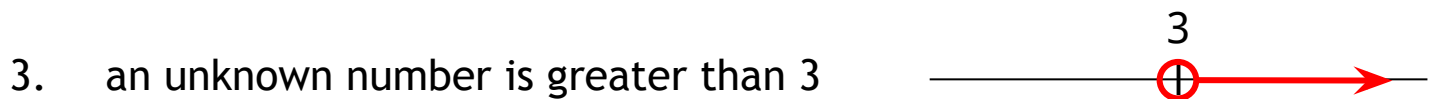
Real-World Inequalities

Directions: Write a mathematical statement to express the inequality. Use 'x' for the unknown number.

1. an unknown number is less than 4 $x < 4$

2. 8 is greater than an unknown number $8 > x$

Directions: Graph the inequality.



Directions: Provide three values of 'x' that satisfy the inequality.

4. $x > 52$ Any numbers greater than 52 but not including 52.

Directions: Provide three values of 'x' that satisfy both inequalities at the same time.

5. $x < 5$ and $x > 2.5$ Any numbers between 2.5 and 5 but not including either. At least one must be a decimal (or fraction).

Directions: Answer the word problem correctly.

6. The highest point in Montana is 12,799 feet above sea level. Using 'x' as a variable to represent all land in Montana, write an inequality that describes the elevation of the rest of the state of Montana.

$x < 12,799$

Real-World Inequalities

Directions: Write a mathematical statement to express the inequality. Use 'x' for the unknown number.

1. an unknown number is greater than 5 **$5 > x$**

2. 2 is less than an unknown number **$2 < x$**

Directions: Graph the inequality.



Directions: Provide three values of 'x' that satisfy the inequality.

4. $x < 1 \frac{1}{4}$ **Any numbers less than $1 \frac{1}{4}$ but not including $1 \frac{1}{4}$. At least two must be fractions (or decimals) or negative.**

Directions: Provide three values of 'x' that satisfy both inequalities at the same time.

5. $26 < x < 28$ **Any numbers between 26 and 28 but not including either. At least two must include a decimal (or fraction).**

Directions: Answer the word problem correctly.

6. The lowest point in Montana is 1,820 feet above sea level. Using 'x' as a variable to represent all land in Montana, write an inequality that describes the elevation of the rest of the state of Montana.

$x > 1,820$

1. Connie earns \$11 per hour as a cashier. Write an equation that shows her earnings (E) after 'h' hours.

$$\underline{E=11h}$$

2. Use your equation from #1 to determine how much Connie will earn after working 40 hours this week.

$$\underline{\$440}$$

3. Using your equation from #1, how many hours will Connie have to work to earn \$1,001?

$$\underline{91}$$

4. Connie owes taxes equaling 10 percent of all her earnings. Help her write an equation to determine how much she owes in taxes (T) out of total earnings (E).

$$\underline{T=0.1E}$$

5. Janice and Katie are sisters. Their parents give them an allowance each week. Katie spent all of hers last week and has none left. Janice has \$8. Write an equation that relates the value of Janice's money to Katie's assuming neither spends any money for the foreseeable future, and they each get the same amount for an allowance.

$$\underline{J=K+8}$$

Real-world Dependent and Independent Variables

Directions: Solve each word problem.

1. Nichole and Mindy are sisters. Their parents give them an allowance each week. Mindy spent all of hers last week and has none left. Nichole has \$6. Write an equation that relates the value of Nichole's money to Mindy's assuming neither spends any money for the foreseeable future, and they each get the same amount for an allowance.

$$\underline{N=M+6}$$

2. Charlotte's grandma drives at a constant speed of 25 miles per hour. Write an equation that shows how many miles she will travel after an unknown number of hours.

$$\underline{d=25t \text{ or } m=25h}$$

3. Zoey drives her car 60 miles per hour on the highway. Write an equation that relates her distance traveled (d) to the time elapsed (t).

$$\underline{d=60t}$$

4. Use your equation from #3 to determine how far Zoey travels in 4 hours.

$$\underline{240 \text{ miles}}$$

5. Use your equation from #3 to determine how many hours it will take Zoey to travel 300 miles.

$$\underline{5}$$

Real-world Dependent and Independent Variables

Directions: Solve each word problem.

1. Stuart is three years younger than his brother Robert. Write an equation that shows Stuart's age with respect to Robert's.

$$\underline{S=R-3}$$

2. Heather earns \$9 per hour as a cashier. Write an equation that shows her earnings (E) after 'h' hours.

$$\underline{E=9h}$$

3. Use your equation from #2 to determine how much Heather will earn after working 40 hours this week.

$$\underline{\$360}$$

4. Using your equation from #2, how many hours will Heather have to work to earn \$999?

$$\underline{111}$$

5. Heather owes taxes equaling 10 percent of all her earnings. Help her write an equation to determine how much she owes in taxes (T) out of total earnings (E).

$$\underline{T=0.1E}$$