

Unit 3

Expressions

- Exponents
- Order of Operations
- Evaluating Algebraic Expressions
- Translating Words to Math
- Identifying Parts of Expressions
- Evaluating Formulas
- Algebraic Properties
- Simplifying Expressions
- Identifying Equivalent Expressions

Name: _____

Math Teacher: _____

Unit 3 Calendar

11/4	11/5	11/6	11/7	11/8
Unit 3 Pre-Test MSG set up Exponents HW: IXL D.2	No School Election Day	Wildcat Lab HW: IXL O.3	Exponents/ Order of Operations HW: IXL O.6	Order of Operations Quiz #1 (Order of Operations)
IXL Week of 11/4: D.2, O.3, O.6				
11/11	11/12	11/13	11/14	11/15
Evaluating Expressions HW: IXL Y.4 & Y.5	Evaluating Expressions Using Formulas HW: IXL Y.6	Translating Words to Math HW: IXL Y.1	Translating Words to Math HW: Y.3	Quiz #2 (Evaluating Expressions and Translating)
IXL Week of 11/11: Y.4, Y.5, Y.6, Y.1, Y.3				
11/18	11/19	11/20	11/21	11/22
Combining Like Terms HW: IXL Y.7	Wildcat Lab HW: IXL Y.15	Combining Like Terms HW: IXL Y.9	Putting it all together HW: IXL Y.10	Quiz #3 (Combining Like Terms)
IXL Week of 11/18: Y.7, Y.15, Y.9, Y.10				
11/25	11/26	11/27	11/28	11/29
Thanksgiving Break				
12/2	12/3	12/4	12/5	12/6
Distributive Property HW: IXL Y.11, Y.16	Distributive Property HW: IXL Y.12	Unit 3 Review Stations HW: Study Guide	Unit 3 Mini Post Test/ Review Stations HW: Study Guide	Unit 3 End of Unit Test
IXL Week of 12/2: Y.11, Y.16, Y.12				

Unit 3 IXL Tracking Log

Unit 3: Expressions

Standards, Checklist and Concept Map

Georgia Standards of Excellence (GSE):

MGSE6.EE.1: Write and evaluate numerical expressions involving whole-number exponents.

MGSE6.EE.2: Write, read, and evaluate expressions in which letters stand for numbers.

MGSE6.EE.2a: Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation "Subtract y from 5" as $5 - y$.

MGSE6.EE.2b: Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. For example, describe the expression $2(8 + 7)$ as a product of two factors; view $(8 + 7)$ as both a single entity and a sum of two terms.

MGSE6.EE.2c: Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = \frac{1}{2}$.

MGSE6.EE.3: Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression $3(2 + x)$ to produce the equivalent expression $6 + 3x$; apply the distributive property to the expression $24x + 18y$ to produce the equivalent expression $6(4x + 3y)$; apply the properties of operations to $y + y + y$ to produce the equivalent expression $3y$.

MGSE6.EE.4: Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions $y + y + y$ and $3y$ are equivalent because they name the same number regardless of which number y stands for.

What Will I Need to Learn??

- _____ I can evaluate expressions, including with variables and exponents
- _____ I can translate words to expressions
- _____ I can identify parts of expressions
- _____ I can substitute to evaluate formulas
- _____ I can apply the Order of Operations
- _____ I can use the distributive property
- _____ I can identify equivalent expressions

Unit 3 Circle Map: Make a Circle Map of important vocab and topics from the standards listed above.

		Required Skills	
		Skill	Your Score
Week of 11/4	D.2 (Evaluate Exponents)		
	O.3 (Evaluate Numerical Expressions Involving Whole Numbers)		
	O.6 (Evaluate Numerical Expression Involving Decimals)		
Week of 11/11	Y.4 (Evaluate Variable Expressions with Whole Numbers)		
	Y.5 (Evaluate Multi-Variable Expressions)		
	Y.6 (Evaluate Variable Expressions with Decimals and Fractions)		
	Y.1 (Write Variable Expressions – One Operation)		
Week of 11/18	Y.3 (Write Variable Expressions – Word Problems)		
	Y.7 (Identify Terms & Coefficients)		
	Y.15 (Add and Subtract Like Terms)		
	Y.9 (Properties of Addition)		
	Y.10 (Properties of Multiplication)		
Week of 12/2	Y.11 (Multiply Using the Distributive Property)		
	Y.16 (Identify Equivalent Expressions I)		
	Y.12 (Factor Using the Distributive Property)		

Unit 3 - Vocabulary

Term	Definition
Algebraic expression	A group of variable(s), operation(s), and/or number(s) that represents a quantity. Expressions do not contain equal signs.
Coefficient	A number which multiplies a variable
Constant	A quantity that has a fixed value that doesn't change, such as a number.
Exponent	Shows how many times to multiply the base number by itself
Like terms	Terms whose variables (and exponents) are the same
Order of operations	A specific order in which operations must be performed in order to get the correct solution to a problem
Term	One part of an algebraic expression that may be a number, a variable, or a product of both
Variable	A symbol, usually a letter, that represents a number
Associative property of addition	This property states that no matter how numbers are grouped, their sum will always be the same
Associative property of multiplication	This property states that no matter how numbers are grouped, their product will always be the same
Commutative property of addition	This property states that numbers may be added together in any order, and the sum will always be the same
Commutative property of multiplication	This property states that numbers may be multiplied together in any order, and the product will always be the same
Distributive property	Multiplying a number is the same as multiplying its addends by the number, then adding the products

Unit 3 – Vocabulary – You Try

Term	Definition
Algebraic expression	
Coefficient	
Constant	
Exponent	
Like terms	
Order of operations	
Term	
Variable	
Associative property of addition	
Associative property of multiplication	
Commutative property of addition	
Commutative property of multiplication	
Distributive property	

Math 6 – Unit 3: Expressions Review

1) Identify each part of the expression. Write "n/a" if the part is not in the expression: $9(3x^2 + 4)$

- a) coefficient: 3 b) constant: 9, 4
c) variable: x d) exponent: 2
e) quotient: n/a f) product: $3x^2$, $9(3x^2 + 4)$
g) factors: 9, $(3x^2 + 4)$, 3, x h) sum: $3x^2 + 4$
i) difference: n/a

2) What does it mean when a number is squared or cubed? Give an example of each. If a number is squared, the exponent is 2. Example: "4 squared" is $4^2 = 4 \times 4 = 16$.

If a number is cubed, the exponent is 3. Example: "4 cubed" is $4^3 = 4 \times 4 \times 4 = 64$.

3) Evaluate the expression. Show EACH step. $10^2 - (14 - 2 + 7)$

81

4) Write using exponents AND solve? $5 \cdot 5 \cdot 5 \cdot 5 =$

$5^4 = 624$

5) If $m=5$, evaluate the expression: $4m^2 + 6m$

130

6) Apply the distributive property to write an equivalent expression to $9(y - 3)$.

$9y - 27$

7) Combine like terms to simplify this expression:

$$8x^3 + 4x^2 + 12x^3 - x^2 \\ 20x^3 + 3x^2$$

8) The cost of renting a moving truck is \$39.99 plus an additional \$0.50 for each mile driven. Write an expression to represent the cost of renting the truck for m miles.

$39.99 + .50m$ (not on test)

9) Give an example of each of the properties below:

a) commutative property: $4 + 5 = 5 + 4$

b) distributive property: $6(2x + 1) = 12x + 6$

c) associative property: $(9 \times 7) \times 3 = 9 \times (7 \times 3)$

10) Write an expression for the product of 6 and c . $6c$

11) Write an expression for 22 less than y . $y - 22$

12) Which expression is not equivalent to the others?

a) $3(4 + 2)$ b) $3(4) \times 3(2)$ c) $3(4) + 3(2)$ d) $12 + 6$

13) The formula $A=lw$ can be used to find the area of a rectangle. Ms. Julien is mowing a rectangular lawn that is 9.5 yards long and 6 yards wide. What is the area of the lawn?

57 square yards

14) The formula for surface area of a cube is $SA = 6s^2$. Find the surface area of a cube whose side length (s) is 12 cm.

864

15) The expression $12n + 75$ can be used to find the total price for n students to take a field trip to the science museum. Evaluate the expression $12n + 75$ if there are 25 students attending the field trip. ($n = 25$).

375

16) Write a phrase for the expression $\frac{n}{7}$. The quotient of n and 7

17) Which expression represents the phrase, "eight less than the product of six and b ?"

- a) $8 - 6b$ b) $6 - b + 8$ c) $6b - 8$ d) $6b \times 8$

18) Evaluate 10 squared. 100

19) When you combine like terms, you must look for terms with the same variable AND exponent. Choose the expression that is equivalent to $4m + 4m^2 - m + 6m^2 + 2m^2$

- a) $15m^2$ b) $17m^2$ c) $12m^2 + 3m$ d) $10m^2 - 3m$

20) Silly Sally has a friend named Cuckoo for Cocoapuffs. He also does not understand how to apply the order of operations, and has made a mistake in the problem below. Find the mistake and explain in THREE COMPLETE SENTENCES what the mistake is and what should have been done. Then write what the correct answer really is.

$$125 - 15 \cdot 2^3 + 5$$

$$125 - 15 \cdot 6 + 5$$

$$125 - 90 + 5$$

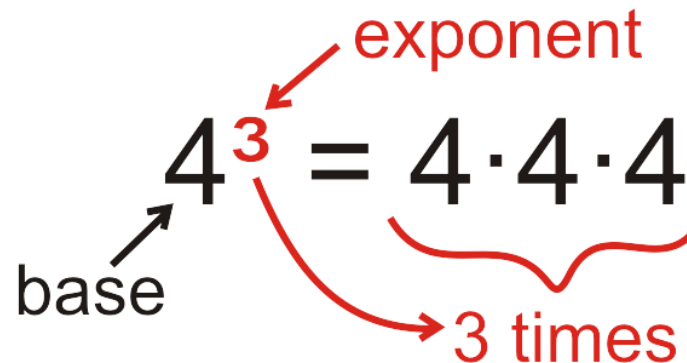
$$35 + 5$$

$$40$$

Cuckoo worked out everything according to the order of operations, BUT he did not solve 2^3 correctly. He said 2^3 is 6, but it should be 8. The correct answer should be 10.

Exponents

An _____ tells how many times to multiply a base times itself.



You read 4^3 as 4 to the 3rd power or 4 cubed or 4 to the third power.

You read 5^2 as 5 squared or 5 to the second power.

If a base is being raised to the zero power, it will always be equal to one.

When evaluating an exponent REMEMBER, an exponent only works on what it touches!

Example:

$$2 + 3^3 = 2 + 9 = 11$$

$$(2 + 3)^3 = 5^3 = 125$$

You Try:

Evaluate:

1) 2^4

2) $5 + 7^2$

3) $(5 + 7)^2$

4) $10 - 3^2$

5) $(10 - 3)^2$

6) $2 - 2^0$

Exponents Practice

Example:

<u>Exponential Form</u>	<u>Expanded Form</u>	<u>Standard Form</u>
2^5	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	32
y^4	$y \cdot y \cdot y \cdot y$	Depends on value of y
9^2	$9 \cdot 9$	81
10^0		1
3^6	$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$	729

You Try: Fill in the blanks below to complete the chart.

<u>Exponential Form</u>	<u>Expanded Form</u>	<u>Standard Form</u>
6^3		
	$10 \cdot 10 \cdot 10$	
4^2		
	$x \cdot x \cdot x \cdot x \cdot x \cdot x$	
90^2		

FUN FACT: Any number raised to the ___ power always equals ___.

Let's explore why:

<u>Exponential Form</u>	<u>Expanded Form</u>	<u>Standard Form</u>
2^4		
2^3		
2^2		
2^1		
2^0		

Exponents Practice

Write using exponents.

1. $3 \times 3 \times 3 \times 3$ _____ 2. 364×364 _____

3. $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$ _____ 4. $13 \times 13 \times 13$ _____

5. $8 \times 8 \times 8 \times 7 \times 7$ _____ 6. 49 _____

Write in expanded form.

7. 10^4 _____ 8. 6^5 _____

9. 3^2 _____ 10. 7^3 _____

11. 12^4 _____ 12. 5 cubed _____

Write in standard form.

13. 5^4 _____ 14. 2^6 _____ 15. 11 squared _____

16. 10^7 _____ 17. 12^2 _____ 18. 6 cubed _____

Compare using $<$, $>$, or $=$.

19. $4^2 \bigcirc 2^4$ 20. $4^3 \bigcirc 3^4$ 21. $5^8 \bigcirc 5^9$

22. $3^8 \bigcirc 3 \times 8$ 23. $2^5 \bigcirc 5^2$ 24. $10^3 \bigcirc 10 + 10 + 10$

25. $5^3 \bigcirc 5 \times 5 \times 5$ 26. $7^3 \bigcirc 3^7$ 27. $10^4 \bigcirc 4 \times 10$

For each number in exponential notation, identify the base, exponent, and power. Use a calculator to write each number in standard form.

28. A typical American kid watches about 18^4 television advertisements between birth and high school graduation.

base _____ exponent _____

power _____ standard form _____

29. The highest point in Kentucky is Black Mountain. Its height is about 2^{12} feet.

base _____ exponent _____

power _____ standard form _____

Order of Operations

When computing a problem that has more than one operation, the "Order of Operations" lists the order in which to work the problem to ensure that no matter who solves the problem, the answer will always be the same. Having this set of rules prevents us from getting multiple answers to the same problem!



MULTIPLICATION and **DIVISION** are a group and they are worked from left to right.

ADDITION and **SUBTRACTION** are a group and they are worked from left to right.

When solving problems using the Order of Operations, your problems will look like a triangle (or a Dorito!) You must show all of your work as you complete each step!

Examples:

$8 + 14 \div 7 \times 3 - 5$	$6 - (5-3) + 10$	$42 - (8 - 6) \times 2^2$
$8 + 2 \times 3 - 5$	$6 - 2 + 10$	$42 - 2 \times 2^2$
$8 + 6 - 5$	$4 + 10$	$42 - 2 \times 4$
$14 - 5$	14	$42 - 8$
9		34

You Try:

1) $2 \cdot 2 + 3^2$ 2) $3 + (6 - 5)^3$ 3) $(2 + 4)^2 \div 2$

4) $42 \div (3^2 - 3)$ 5) $23 \cdot (3 + 4) \div 2$ 6) $2 + 4^2 - (3 + 2)$

7) $4^2 \div 8$ 8) $(3 - 1) + 6 \times 3$ 9) $90 \div 9 - 5 + 8$

Expressions

An _____ is a mathematical statement that contains numbers and operations.

An _____ is an expression that contains at least one *variable*, along with operations and/or numbers.

Expressions	Algebraic Expressions	Non-Examples of Expressions
$48 \div 12$	$48 \div y$	y (this is a variable)
5^2	x^2	25 (this is a constant)
$13 + 9$	$13 + t \cdot 3$	$+$ (this is an operation)

Parts of Expressions

$$2x^3 + 4x - 7$$

coefficients: 2 and 4

variable: x

quotient: none

factors: 2, x, and 4

difference: $4x - 7$

constant: 7

exponent: 3

product: $2x^3$ and $4x$

sum: $2x^3 + 4x$

terms: $2x^3, 4x, 7$

Example:

$5x + 14$ This example has two terms, $5x$ and 14
 $5x$ is the product of 5 and x

$2(8 + 7)$ This example has three constants ($2, 8$ and 7)
 There is a product ($2 \cdot (8 + 7)$)
 There is a sum ($8 + 7$)
 There are two factors (2 and $8+7$)

You Try:

Use the expression below to identify the parts.

$$7y^2 + \frac{4x}{5} - 3$$

- a) coefficient: _____ b) constant: _____
 c) variable: _____ d) exponent: _____
 e) quotient: _____ f) product: _____
 g) factors: _____ h) sum: _____
 i) difference: _____ j) terms: _____

Evaluating Expressions

To evaluate, or solve an algebraic expression, you **substitute** a number in place of the variable(s) and then find the value.

Note: When a number and letter are written side by side with no operation indicated, then it can be assumed you will multiply them together.

$3x = 3$ times whatever x is.

$4p = 4$ times whatever p is

$6u + 4 =$ the sum of the product of 6 and whatever u is and 4

Examples:

Evaluate the following algebraic expressions when $a = 10, b = 3,$ and $c = 5.$

$$b + 18 \text{ (given expression)}$$

$$3 + 18 \text{ (substitute 3 in for b)}$$

$$21 \text{ (solution)}$$

$$4a \div c \text{ (given expression)}$$

$$4 \cdot 10 \div 5 \text{ (substitute)}$$

$$40 \div 5 = 8 \text{ (solution)}$$

$$b^2 \text{ (given expression)}$$

$$3^2 \text{ (substitute)}$$

$$9 \text{ (solution)}$$

You Try:

Substitute to evaluate the following algebraic expressions when $x = 2$, $y = 25$ and $z = 8$. Show all of your work!

1) $3z$	2) $y - z + x$	3) y^x
4) $z \div x$	5) $x + y + z$	6) $9 - x$
7) $100 - 10x - 10z$	8) $14 \div x + 2y$	9) w^0
10) xyz	11) $z(x + y)$	12) $x + x \cdot y$

STARTER:

Name: _____

Date: _____

Complete this table...

Expression	Terms	Variables	Constants	Coefficients
$3x + 2y + 5$	$3x, 2y, 5$	x and y	5	3 and 2
$7x + 4y + 2$				
$3x - 5$				
$6a + 4 - 6b$				
$a^2 + 2a - 9$				
$xy + 3x^2 + xz - 7$				

Simplifying Algebraic Expressions

"LIKE" TERMS

Use different colours to identify the "like" terms

You can find "like" terms if...

- they contain same variable
- the variable is raised to the same power

Using these terms, can you find different ways to express $3x + 6$?

PRACTICE:

Collect "like" terms to simplify these expressions

- $2x + 4 + 3x + 3 =$
- $5x + 1 + 2x + 2 =$
- $6y + 2 + y + 3 =$
- $2a + 2b + a - b =$
- $a^2 + 3a + 2 + 2a^2 - a =$
- $2x^2 - 3x + 1 + 2y^2 + x - 7 =$

Tip: If it helps, circle the different "like" terms in different colours

Ms. McRobie's Maths

Evaluating Expressions Extra Practice

Use substitution to evaluate each expression for the given value of the variable. Show your work!

1) $9y - 3$ (for $y = 11$)	2) $7m$ (for $m = 5$)	3) $d^2 - 2d$ (for $d = 9$)
4) $6q + 39$ (for $q=10$)	5) $6v$ (for $v = 3$)	6) $j^3 + 11$ (for $j = 8$)
7) $2k^2 + 5k + 2$ (for $k = 11$)	8) $\frac{n}{3} + n$ (for $n = 27$)	9) $a \div 3$ (for $a = 42$)
10) $4(11 + p) + 13$ (for $p = 89$)	11) $h^3 - 2$ (for $h = 7$)	12) $14z - 1$ (for $z = 9$)

Evaluating Expressions Extra Practice

Use substitution to evaluate each expression for the given value of the variable. Show your work!

13) $15e + 37$ (for $e = 5$)	14) $19r$ (for $r = 8$)	15) $x^2 + 2x + 4 + x$ (for $x = 10$)
16) $7(4 + h)$ (for $h=21$)	17) $13 + w$ (for $w = 26$)	18) $b - 15$ (for $b = 15$)
19) $\frac{y}{12} + y$ (for $y = 72$)	20) $3b^2 + 5b$ (for $b = 2$)	21) $8e + 22$ (for $e = 42$)
22) $2x^2 - 11x + 6$ (for $x = 12$)	23) $p^3 - 4p$ (for $p = 4$)	24) $16(3 + a) - a$ (for $a = 13$)

Using and Evaluating Formulas

A formula is a mathematical rule written using variables, usually an expression or equation describing a relationship between quantities.

To **evaluate** or **solve** a formula, you substitute the number for the variable.

Common Formulas

Area of a rectangle = $l \cdot w$

Surface Area of a Cube = $6s^2$

Area of a triangle = $\frac{1}{2}bh$

Volume of a Cube = s^3

Area of a Trapezoid = $h\left(\frac{b_1+b_2}{2}\right)$

Example 1: Mary Lou is setting up a lemonade stand. Her rectangular sign is 3 feet long and 2.5 feet wide. If the formula for area of a rectangle is $A = l \cdot w$, what is the area of her sign?

$A = l \cdot w$

→ Step 1: Write the formula.

$A = 3 \text{ ft} \cdot 2.5 \text{ ft}$

→ Step 2: Substitute for the variable(s).

$A = 7.5 \text{ ft}^2$

→ Step 3: Solve (in this case, multiply).

Example 2: Billy Bob needs to figure out the volume of a cube. It is 12 in tall. Help him find the volume, if the formula is $V = s^3$.

$V = s^3$

→ Step 1: Write the formula.

$V = 12 \text{ in} \cdot 12 \text{ in} \cdot 12 \text{ in}$

→ Step 2: Substitute for the variable(s).

$V = 144 \cdot 12$

→ Step 3: Solve (in this case, multiply).

$V = 1728 \text{ in}^3$

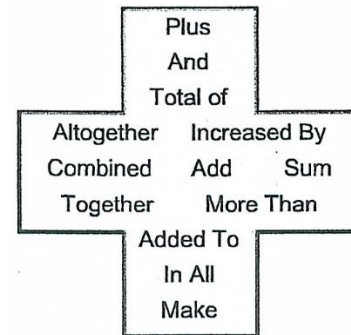
You Try:

- 1) What is the surface area of a cube that is 4 in. tall?
- 2) What is the area of a rectangle with a height of 8.5 cm and a width of 3 cm?
- 3) What is the area of a triangle with a height of 5m and a base length of 9m?
- 4) What is the area of a trapezoid that is 4cm high, with bases that are 10cm and 12cm long?
- 5) Why are formulas useful/helpful?

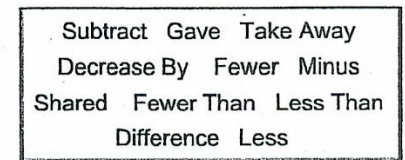
Words and Phrases to Math Symbols

Words can be translated into math symbols to form expressions and equations. Here is a list of key words to look for.

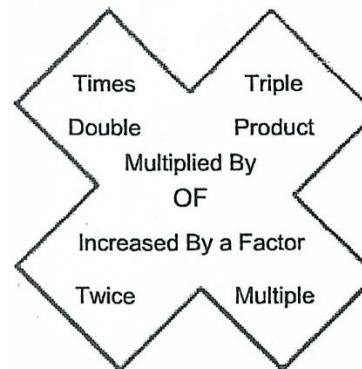
Addition



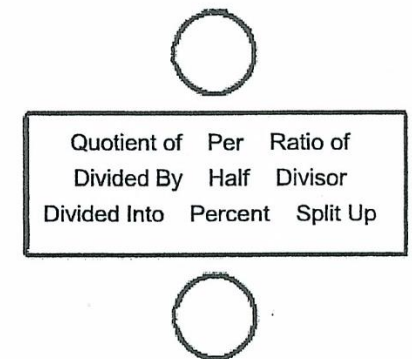
Subtraction



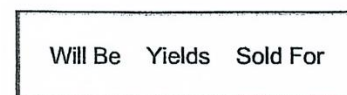
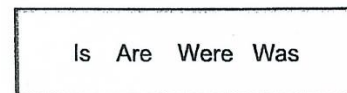
Multiplication



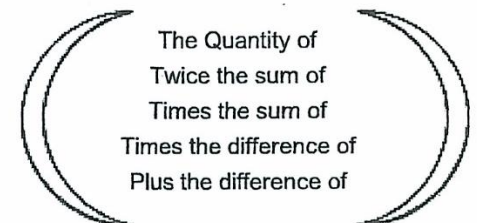
Division



Equals



Parenthesis Words



Writing Algebraic Expressions

Translating words into math symbols or math symbols into words can be done in many ways. Here are just a few examples.

Operation	Verbal Expressions	Algebraic Expressions
+	<ul style="list-style-type: none"> - add 3 to a number - a number plus three - the sum of a number and 3 - 3 more than a number - a number increased by 3 	$n + 3$
-	<ul style="list-style-type: none"> - subtract 12 from a number - a number minus 12 - the difference of a number and 12 - 12 less than a number - a number decreased by 12 - take away 12 from a number - a number less 12 	$x - 12$
X	<ul style="list-style-type: none"> - 2 times a number - 2 multiplied by a number - the product of 2 and a number 	$2m$ or $2 \cdot m$
÷	<ul style="list-style-type: none"> - 6 divided into a number - a number divided by 6 - the quotient of a number and 6 	$a \div 6$

Example:

Translate the words into math symbols.

- 1) add 43 to a number, n

$$43 + n$$

- 2) a number, w decreased by 12.

$$w - 12$$

- 3) 8 less than a number y

$$y - 8$$

You Try:

1. add 43 to a number n
2. a number x divided into 25
3. 7 times a number e
4. take away a number c from 16
5. difference of a number q and 24
6. product of a number r and 41
7. 13 more than a number j
8. a number a less 49
9. a number v decreased by 28
10. a number b multiplied by 46
11. 30 minus a number h
12. a number u divided by 36
13. quotient of 23 and a number e
14. 8 less than a number y
15. subtract a number m from 19

16. 9 more than the twice a number a
17. sum of a number z and 34
18. 3 increased by a number p
19. 33 increased by a number u
20. add 6 to a number k
21. take away a number f from 20
22. The difference of 9 and x
23. sum of a number b and 35
24. a number x times 44
25. a number w decreased by 12
26. a number j minus 10
27. 32 less a number t
28. 48 multiplied by a number q
29. 4 divided by a number s
30. difference of a number c and 2

Commutative & Associative Properties

The **Commutative Property** says that the order in which you **add** or **multiply** two numbers does not change the sum or product. For any numbers a and b: $a + b = b + a$ **and** $a \times b = b \times a$

*Think commute, (like how you **move** to work) the numbers can move position without changing the outcome.*

The **Associative Property** says that the way you group numbers when you **add** or **multiply** them does not change the sum or product. For any numbers a, b or c: $(a + b) + c = a + (b + c)$ **and** $(ab)c = a(bc)$

Think associate, (like how you associate with your friends) the numbers can "hang out" in different groups and not change the outcome.

Example:

Which property is illustrated by each statement?

1) $13 + 14 = 14 + 13$

2) $2 + (3 + 4) = (2 + 3) + 4$

You Try:

1) $3 + 4 = 4 + 3$

2) $2(9) = 9(2)$

3) $xy = yx$

4) $g + h + 2 = g + 2 + h$

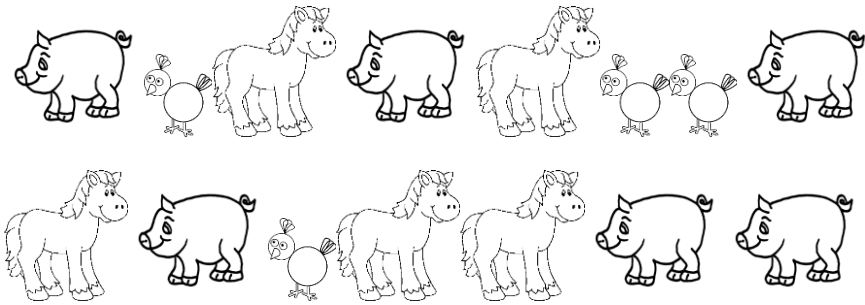
5) $(2 + 5) + 7 = 2 + (5 + 7)$

6) $(6 \cdot 5) \times 3 = 6(5 \cdot 3)$

7) $7 + m = m + 7$

8) $3(4 \cdot 5) = (3 \cdot 4) \cdot 5$

Combining Like Terms



Part 1: Look at the pictures of the farm animals below. Determine how many pigs, chickens, and horses there are.

Pigs: _____ Horses: _____

Chicken: _____

Part 2: Write an algebraic expression to show how many of each animal are on your paper. Instead of pictures, use variables to represent each animal. **Use p for pig, c for chicken, h for horse.**

Part 3: Simplify your algebraic expression by combining like animals.

Part 4: What if a horse got lost? How would you represent that in your expression?

More Combining Like Terms

Combining Like Terms is like matching your socks. In the same way that we put our socks in matching pairs, we can combine like terms to put terms with the **same variables and exponents** together.

Examples:

- 1) $2x$ and $3x$ have the same variable (x) to the same exponent (1), so they can be combined to make $5x$.
- 2) $5y^2$ and $4y^2$ have the same variable (y) and the same exponent (2), so they can be combined to make $9y^2$.
- 3) $8m$ and $3m^2$ are **NOT** like terms because they do have the same variable, but not the same exponent.

Some helpful hints to make combining like terms easier.

- 1) You can put different shapes around like terms before you combine them to make sure you don't miss any terms. Make sure you put the shape around the sign too!

$$\triangle 6m + \square 2p + \circ 3 + \square 4p - \triangle 2m + \circ 4$$

- 2) You can also highlight like terms before you combine them to make sure you don't miss any terms. Make sure you highlight the sign too!

$$6m + 2p + 3 + 4p - 2m + 4 =$$

$$6m - 2m + 2p + 4p + 3 + 4$$

$$4m + 6p + 7$$

Combining Like Terms Error Analysis

Sally is a silly little girl who makes mistakes! In Column #1, analyze her work and circle her mistake. In Column #2, explain what she did wrong. In Column #3, show how Silly Sally should work out the problem correctly. Show ALL work!

Silly Sally's Work (Circle her mistake):	What did Silly Sally do wrong?	Show Silly Sally how it's done! (Show ALL steps!)
$6x + 5x + 2y$ $11x + 2y$ $13xy$		
$3a^2 + 4a^2 - a^2$ $7a^2 - a^2$ $8a^2$		
$m + 3m - 4m + 2m$ $4m - 4m + 2m$ $16m + 2m$ $18m$		
$6y^3 + 2y^2 + 4y^3 + 2y^2$ $8y^2 + 4y^3 + 2y^2$ $10y^2 + 4y^3$		
$13x + 5 + 17x - 4.5 + x$ $18x + 17x - 4.5 + x$ $35x - 4.5 + x$ $30.5x + x$ $31.5x$		
$12r^2 + 3 + 8rs + 4r^2 - 16r^2$ $16r^2 + 3 + 8rs - 16r^2$ $24r^2s + 3 - 16r^2$ $8r^2s + 3$		

You Try:

$$1) 5x + x^2 + 8y - 2x + 3x^2 = 4x^2 + 3x + 8y$$

$$2) 9 + 6k + 3 + 2k^2 + 3 + 7k^2 = 9k^2 + 6k + 15$$

$$3) 12x + 3y - 2a + 6y - 5x = 7x + 9y - 2a$$

$$4) 5 + 6m + 12 - 6m - 17 = 0$$

$$5) 12h + 3p - 9h + 3 - 3p = 3h + 3$$

$$6) 3x + 2y + x = 4x + 2y$$

$$7) 8d + 2c - 2d + c = 6d + 3c$$

$$8) 10b^2 + 10b + 10b^2 = 20b^2 + 10b$$

$$9) 7a + 3n + 3a^2 = \text{already simplified}$$

$$10) 3m^4 + m^2 + 2m^4 = 5m^4 + m^2$$



$$11) \frac{1}{4}d + \frac{2}{3}g + \frac{1}{4}d =$$

The Distributive Property

Distributive Property

Words To multiply a sum by a number, multiply each addend by the number outside the parentheses.

Example

Numbers	Algebra
$2(7 + 4) = 2 \times 7 + 2 \times 4$	$a(b + c) = ab + ac$

Think of the factor that is being distributed as the mamma bird.
 What happens when the mamma doesn't feed her babies?
 They die! Don't kill off the baby birds, make sure mamma feeds them all!



Example

1. $10 \cdot 23 = 10(20 + 3)$

$$10 \cdot 20 + 10 \cdot 3$$

$$200 + 30$$

$$230$$

You Try:

1) $12 \cdot 41$

2) $11 \cdot 45$

3) $2 \cdot 123$

2. Use the Distributive Property to rewrite $2(x + 3)$.

$$2(x + 3) = 2(x) + 2(3) \quad \text{Distributive Property}$$

$$= 2x + 6 \quad \text{Multiply.}$$



You Try:

1) $8(x + 3)$

2) $5(9 + x)$

3) $2(x + 3)$

3. Fran is making a pair of earrings and a bracelet for four friends. Each pair of earrings uses 4.5 centimeters of wire and each bracelet uses 13 centimeters. Write two equivalent expressions and then find how much total wire is needed.

Using the Distributive Property, $4(4.5) + 4(13)$ and $4(4.5 + 13)$ are equivalent expressions.






$$4(4.5) + 4(13) = 18 + 52 \quad 4(4.5 + 13) = 4(17.5)$$

$$= 70 \quad = 70$$

So, Fran needs 70 centimeters of wire.

You Try:

Each day, Martin lifts weights for 10 minutes and runs on the treadmill for 25 minutes. Write two equivalent expressions and then find the total minutes that Martin exercises for 7 days.

Problem	 $($	 $+$ / $-$	 $)$	$=$	 $5 \bullet 30$	$+$ / $-$	 $5 \bullet 7$	$=$	Sum	Product
5(37)	5	(30 + 7))	=	5 • 30	+	5 • 7	=	150 + 35	185
12(13)	12	(10 + 3))	=				=		
100(52)				=				=		
8(17)				=				=		
				=	2 • 90	+	2 • 9	=		
	7	(30 + 5))	=				=		
4(14)				=				=		
				=				=	180 + 30	

The Distributive Property

Solve these problems two ways, use the distributive property and the order of operations.

1) $5(9 + 11)$

2) $12(3 + 2)$

Use the distributive property to rewrite the following expressions. Combine like terms if necessary.

3) $5(2 + 8)$

4) $10(x + 2)$

5) $14(a + b)$

6) $12(a + b + c)$

7) $7(a + b + c)$

8) $10(3 + 2 + 7x)$

9) $1(3w + 3x + 2z)$

10) $5(5y + 5y)$

11) $9(9x + 9y)$

12) $2(x + 1)$

13) $6(6 + 8)$

14) $4(5v + 6v)$

15) $3(2 + 6 + 7)$

16) $2(3x + 4y + 10x)$

17) $5(5x + 4y)$

Factoring

Factor an Expression

When numeric or algebraic expressions are written as a product of their factors, the process is called **factoring the expression**.

Example



1. Factor $12 + 8$.

$$12 = 2 \cdot 2 \cdot 3 \quad \text{Write the prime factorization of 12 and 8.}$$

$$8 = 2 \cdot 2 \cdot 2 \quad \text{Circle the common factors.}$$

The GCF of 12 and 8 is $2 \cdot 2$ or 4.

Write each term as a product of the GCF and its remaining factor. Then use the Distributive Property to *factor out* the GCF.

$$\begin{aligned} 12 + 8 &= 4(3) + 4(2) && \text{Rewrite each term using the GCF} \\ &= 4(3 + 2) && \text{Distributive Property} \end{aligned}$$

$$\text{So, } 12 + 8 = 4(3 + 2).$$

Factoring is the inverse of the distributive property. When you are factoring, you are looking to pull out the common factors that are in the addends. (You have to find the mamma and take her out!)














You Try:









Find the common factor (mamma bird) and factor it out of the expressions below.

1) $9 + 21$

2) $14 + 28$

3) $80 + 56$

													Final Expression
5	(x	+	3)	+	5	•	3	+	5	•	3	+	5x + 15
7	(y	+	5)	+	5	•	x	+	2	•	9	+	
10	(2b	+	20)	+	2	•	x	+	2	•	9	+	
					6	•	b	-	6	•	7	-	
													4x - 12
													2j + 2
8	(2c	-	32)	-									

								Final Expression
$($	$+/-$	$)$	$+/-$	$+/-$	$+/-$	$+/-$	$+/-$	$=$
12	$(3w$	$- 7)$	$100 \cdot x$	$+$	$100 \cdot 9$	$=$	$15x + 30$	$8n - 40$
77	$(9v$	$- 15)$	$9 \cdot z$	$-$	$9 \cdot 5$	$=$	$3x + 33$	
$.25$	$(n$	$+ 10)$	$\frac{1}{2} \cdot x$	$+$	$\frac{1}{2} \cdot 4$	$=$		

Factoring Practice

Factor the expressions.

1) $20g + 45$	2) $40 + 64u$
3) $35d + 21$	4) $48n + 4$
5) $90s + 80$	6) $55r + 44$
7) $99n + 45$	8) $12m + 22$
9) $10c + 8$	10) $45g + 81$
11) $14m + 16$	12) $21y + 9$
13) $35d + 40$	14) $12 + 8p$

Distributive Property Extra Practice

Multiply or Factor the expressions using the Distributive Property.

1) Factor: $25g + 50$	2) Multiply: $7(3x + 2) =$
3) Multiply: $3(21x + 19) =$	4) Factor: $36n + 48$
5) Factor: $49s + 14$	6) Multiply: $6(3x + 7) =$
7) Factor: $5x + 15$	8) Multiply: $7(18m + 25) =$
9) Multiply: $10(c + 40) =$	10) Factor: $64g + 68$
11) Factor: $21m + 300$	12) Multiply: $13(14y + 23) =$
13) Multiply: $7(13d + 2) =$	14) Factor: $120 + 80p$

Distributive Property & Combining Like Terms

Use the Distributive Property and Combine Like Terms.

1) $7(2c + 5) + 3c =$	2) $8(3 + 2y) - 10 =$
3) $14g + 3(6 - 2g) =$	4) $4x + 9(x + 7) =$
5) $5 + 4(x + 3) - 10 =$	6) $23x + 5x + 6(x + 3) =$
7) $(5 + x)4 + 5x =$	8) $15x + 7(5x + c) =$
9) $43(x + 1) + 53x =$	10) $3.4(1.2x + 4.5) + 12 =$
11) $2(x + 14) + x + 31 =$	12) $1.2(x + 7) - 2 =$
13) $8(a + 2) + 2(2 + 3a) =$	14) $12(2e + 14) + e(4 + 5) =$