Chapter One:
The Building Blocks Of Algebra

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Algebra I Order of Op. & Evaluating Ex. 1A

Algebra is the process of using the **properties of numbers** to manipulate **unknown** or **changing quantities**. These quantities are known as **variables** and are often represented using **letters** to distinguish them from numbers we do know (which we just use the numbers for). When we group (combine) numbers together, we get what is known as an **expression**.

An **expression** is any combination of numbers that we know and ones that we don't (variables).

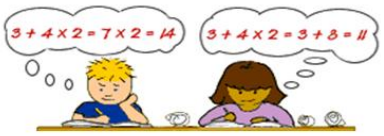
Examples: $2x - 7$ or $6x + 7y$

Order of Operations

Problem: Evaluate the following arithmetic expression $3 + 4 \times 2$

Solution:

Student 1	Student 2
3 + 4 x 2	3 + 4 x 2
= 7 x 2	= 3 + 8
= 14	= 11



It seems that each student interpreted the problem differently, resulting in two different answers. When performing arithmetic operations there can be only one correct answer. We need a set of rules in order to avoid this kind of confusion. Mathematicians have devised a standard order of operations for calculations involving more than one arithmetic operation.

In order to eliminate any confusion on which steps to follow, the Order of Operations was created. We use the acronym **PEMDAS** (MD and AS are interchangeable).

Parenthesis (Start with the innermost and most out)
Exponents
Multiplication/**D**ivision (From left to right)
Addition/**S**ubtraction (From left to right)

Exercise 1: Review order of operations by giving the value of each of the following purely numerical expressions. Do these without the use of a calculator in order to review basic middle school number concepts. You must show your work, step by step.

(a) $8 - \frac{1}{2} \cdot 6 + 24 \div 6$ (b) $4(8 - 6) - 7(5 - 3)$ (c) $(2 - 7)(5 - 3) + 3^2$

Knowing your order of operations is absolutely essential! Once we move past expressions that contain only numbers to ones that contain variables, you need to be able to "read" an expression and understand what is being done to the variable.

Exercise 2: If the letter x represents some unknown quantity, explain the calculation that each of the following expressions involving x represents.

(a) $3x - 8$ (b) $\frac{x-4}{2}$ (c) $4x^2 - 8$

Evaluating Expressions

If you can read an algebraic expression (one that has variables), then you should also be able to **evaluate the expression**.

Evaluating an Expression: Finding the result of the calculations of an expression when all variables are known.

Example: Evaluate $3x + 1$ when $x = 2$

$$3(2) + 1$$
$$6 + 1$$
$$7$$

Exercise 3: For each given expression, explain in steps what the calculation is doing and then find its value for the given variable values.

(a) Evaluate $4x - 7$ when $x = 5$. Explain what calculations are occurring in the expression and then find its value.

Explanation: Calculation:

(b) Evaluate the expression $8 - 2x^2$ when $x = -3$. Show all steps in your calculations.

(c) Evaluate the expression $\frac{2(x+8)}{3} + 1$ for when $x = -2$. Show all steps in your calculations.

The idea of **equivalent expressions**, or **equivalency**, is extremely important. It is the basis of how many if not most of our **algebraic manipulations**.

EQUIVALENT EXPRESSIONS

Two (or more) algebraic expressions are **equivalent** if they have the same value for every value of the substitution variable (or variables). In other words, no matter what value you stick in for x (or y or z) the two expressions come out equal.

Exercise 4: Consider the three expressions below. By substituting in the values of x given, determine which two expressions are **equivalent**. Show your calculations of the expressions' values and circle your final answers.

	$5(x-3)$	$5x-3$	$5x-15$
$x = 7$	$5\big((7)-3\big)$ $5(4)$ 20	$5(7)-3$ $35-3$ 32	$5(7)-15$ $35-15$ 20
$x = 4$			

Exercise 5: Which property, the commutative, associative, or distributive, justifies the **equivalency** of the two expressions you determined to be equivalent above?

Name:_____ Date:_____ Period:_____

Algebra I Order of Op. & Evaluating Ex. 1A HW

1) Using order of operations, evaluate the following numerical expressions. Do not use a calculator for this section, and remember to show all work, step by step.

(a) $22 - 2 \cdot 6$ (b) $6 - \frac{1}{4} \cdot 16 + 21 \div 3$ (c) $(8 - 5)(5 - 3)^2$

2) Evaluate the following expressions for the values of x given. Show the steps in your calculation.

(a) $\frac{4(x-2)}{x-1}$ when $x = 0$ (b) $\frac{-3x^2+4}{4} - 1$ when $x = -2$ (c) $\frac{(2x+4(x-1))}{4}$ when $x = 2$

3) Robert just got his first job and is saving 45 dollars a week. He also has 155 dollars saved from his birthday that just passed. To see how much money he will have in his bank account, Robert came up with the following expression: $45w + 155$, where w is the number of weeks that he has been saving.

(a) Exactly how much will he have saved in 6 weeks?

(b) After his first **month** he had more than he expected to have due to interest the bank provided. This let Robert come up with a better expression, $\frac{w^2}{25} + 45w + 155$, where w is the number of **weeks**. How much will he have in 1 **year**?

4) Using order of operations, solve the following. Use your calculator to verify your answer.

(a) $(-5)^2 + 2 \cdot (3 + 1)$

(b) $-(5)^2 + 2 \cdot 3 + 1$

(c) Explain what changed from the expression in (a) to (b) and why that changed your answer.

5) Andrew received a 95 on his last test and the only question he got wrong was the following:

(a) Read through the question and Andrew's work. Find and circle his mistake.

(b) Explain what he did wrong and what he should have done.

Evaluate: $x^2 - 2(x-3)$ when $x = 3$.

Andrews work:

$= x^2 - 2(x-3)$

$= 3^2 - 2(3-3)$

$= 3^2 - 2(0)$

$= 9 - 2(0)$

$= 7(0)$

$= 0$

(c) Using your knowledge and abilities, show Andrew how to evaluate the expression correctly. State the correct value.

Name: _**Homework Answers**_ Date: _____ Period:___
Algebra Order of Op. & Evaluating Ex. 1A HW

1) (a) 10 (b) 9 (c) 12

2) (a) 8 (b) -3 (c) 2

3) (a) $425 (b) $2,603.16

4) (a) 33 (b) -18 (c) Explanation

5) (a) Circle (b) Explanation (c) 9

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Algebra I Combining Like Terms 1B

Combining Like Terms

Like Terms are terms that contain the SAME variables raised to the SAME power. Only the numerical coefficients of these terms will be different. Remember that an expression is composed of different terms. In an expression, only the Like Terms can be combined. We combine like terms to simplify and condense algebraic expressions so that we can work with them more easily. To combine like terms, we add the coefficients and keep the variables.

How to Combine Like Terms

Think about going to a Fast Food Restaurant with your family. Here is the list of food that Amanda and Pete want for dinner.

Amanda: 2 Hamburgers, 1 French Fries and 1 drink
Pete: 3 Hamburgers, 2 French Fries and 2 drinks

We can write this algebraically:

2H + 1F + 1D + 3H + 2F + 2D

Now we can combine the like terms so that the list is simplified and ready for us to order our meal quickly.

2H + 1F + 1D + 3H + 2F + 2D

5H + 3F + 3D

Exercise 1: Review combining like terms by giving the simplified version of each of the following expressions. You must show your work, step by step.

(a) $7x + 5 - 3x + 11$

(b) $6w^2 + 11w + 8w^2 - 15w$

(c) $6x + 4 + 15 - 7x$

(d) $(12m - 5) - (7m - 11)$

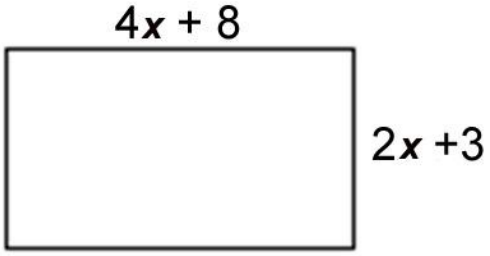
(e) $(2x^2 - 3x + 7) - (-3x^2 + 4x - 7)$

(f) $11a^2b - 12ab^2$

(g) $7z + 8 + 5z - 10$ (h) $(16c^2 - 8 + 13c) + (9 - 4c^2 + 7c)$ (i) $(2y - 5) + (6 + 3y)$

(j) $(7c^2 - 5c + 10) - (7c^2 - 9c)$ (k) $(7n - 13) - (19n^2 - 15 + 12n)$ (l) $(19a - 5) - (6a - 11)$

Exercise 2: Rachel is planning to put up a fence around her rectangular garden. She has drawn the following diagram to support her through her planning process. The length of her garden is represented by $4x + 8$ feet and the width of her garden is represented by $2x + 3$ feet. How much fencing would be necessary to completely enclose the rectangular garden?



Exercise 3: What is the result when $11x^2 - 5x + 3$ is subtracted from $19x^2 + 7x - 9$?

Exercise 4: If $A = 6x^2 + 5x - 8$ and $B = 3x^2 - 7x + 11$, what is the value of $B - A$?

Name:_____ Date:_____ Period:_____

Algebra I Combing Like Terms 1B HW

1.) Review combining like terms by giving the simplified version of each of the following expressions. You must show your work, step by step.

(a) $(9-3x)+(14x^2-6x+7)$

(b) $(22x^2-13x+7)+(-9x^2+21x-7)$

(c) $(7x+9)-(8-2x)$

(d) $(4x^2-8x+3)+(6x^2-4x+11)$

(e) $(15+10x+7x^2)-(-6x-10x^2+9)$

(f) $(x^2-13x+7)-(3x^2-4-20x)$

(g) $(3y^2-5y+10)+(7y^2-13y+24)$

(h) $(-6a^2+4-9a)-(5-4a^2+7a)$

(i) $(6k^3-4k^2+7k+1)-(4k^3-3k^2+6k+1)$

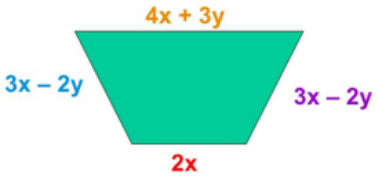
(j) $(15xy-6x^2y+9y^2x)-(9x^2y+11xy-4xy^2)$

____ 2.) When $8x^2+3x+2$ is subtracted from $9x^2-3x-4$, the result is:

[1] x^2-2 [2] $17x^2-2$

[3] $-x^2+6x+6$ [4] x^2-6x-6

3.) Use the provided diagram to complete the following.
(a) In algebraic terms of both x and y, find the perimeter of the following shape.



(b) What is the exact perimeter of the shape if $x = 5$ and $y = 8$?

4.) The pied piper and his friends are walking around a track that is shaped like a regular pentagon. Each side of the pentagon measures 85 feet. If they make 3 complete trips around the track, how far will they have walked?

Review Section:
5.) Would you be happy if the following expression represented your grade on the upcoming exam? Explain.

$$100 - 40 \div 5 \times 10$$

6.) Evaluate the following expression for when $x = 4$. Don't forget that you MUST show all steps!

$$(2x)^3 + 12x^2 - 18x + 11$$

Name: ***Homework Answers*** Date: _____ Period:____

Algebra Combining Like Terms 1B HW

1) (a) $14x^2 - 9x + 16$ (b) $13x^2 + 8x$

(c) $9x + 1$ (d) $10x^2 - 12x + 14$

(e) $17x^2 + 16x + 6$ (f) $-2x^2 + 7x + 11$

(g) $10y^2 - 18y + 34$ (h) $-2a^2 - 16a - 1$

(i) $2k^3 - k^2 + k$ (j) $-15x^2y + 4xy^2 + 9y^2x + 4xy$

2) (4)

3) (a) $12x - y$ (b) 52

4) 1,275 feet

5) 20; No

6) 643

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Algebra I Commutative and Associative Properties 1C

Commutative & Associative Properties

Numbers combine through the **operations** of addition, subtraction, multiplication, and division to produce other numbers. Sometimes, how they combine is dictated by **convention**, like with the **order of operations**. Other times, though, properties about numbers exist simply due to how these operations work.

Exercise 1: Add the following numbers **without** using a calculator.
Hint: Although **order of operations** tells us we should add from left to right, think about an easier way to sum these numbers. Show how you summed them.

$$3 + 9 + 4 + 2 + 7 + 1 + 6 + 8$$

Addition and multiplication have two very important properties with very technical names. The next exercise will review these properties.

Exercise 2: Fill in the missing blanks for each property.

(a) ***Commutative Property of Addition***:

$8 + 4$ gives the same sum as _____. Both sums equal _____.

(b) ***Commutative Property of Multiplication***:

6×3 gives the same product as _____. Both products equal _____.

(c) ***Associative Property of Addition***:

The sum $(3 + 5) + 9$ gives the same result as the sum _____

Both sums are equal to _____.

(d) ***Associative Property of Multiplication***:

The product $(2 \cdot 5) \cdot 7$ gives the same result as the product _____

Both products are equal to _____.

The **Commutative Property** and **Associative Property** essentially give us permission to rewrite addition and multiplication problems in different orders than what are normally given.

Exercise 3: Give an example that shows that subtraction is not commutative.

Even though subtraction is not commutative, we should remember a very important fact about subtraction: **it can always be made into the addition of opposites**. (5-3 is the same as 5+-3)

Exercise 4: Change the following expression involving addition and subtraction into one only involving addition and then use the commutative and associative properties to quickly determine the value of this expression. Through this, please review some properties of negative numbers.

$$7 - 3 + 8 - 2 - 6 + 1 - (-3)$$

We should be able to now extend the commutative and associative properties for numbers we know to numbers we don't know (variables). One of the very nice ways to illustrate the usefulness of these properties is in combining two or more expressions.

Exercise 5: Please recall the following quickly:

(a) $5x + 2x =$ (b) $7x + -3x =$ (c) $-8x + -2x =$

Does anyone know what this is called? _____

Exercise 6: In the following exercise we showed how two linear expressions are combined using various properties. List what the properties are:

$(3x + 7) + (2x + 8) = 3x + 7 + 2x + 8$ _____

$3x + 7 + 2x + 8 = 3x + 2x + 7 + 8$ _____

$3x + 2x + 7 + 8 = (3x + 2x) + (7 + 8)$ _____

$= 5x + 15$

Exercise 7: Combine the expressions below. Replace subtraction by addition of opposites, if needed.

(a) $4x + 6 + -2x - 9$ (b) $-6x + 9 + 10x + 3$ (c) $4y - 10 - 7y - 3$

(d) $3x - 4x + 2 + 8x$ (e) $-6a + 10 - 12a + 5$ (f) $2x - 4y - 8x + 10y$

Name:_____ Date:_____ Period:_____

Algebra I Commutative and Associative Props. 1C HW

1) Combing the expressions below. Replace subtraction by addition of opposites, if needed.

(a) $7x + 3 + 6x + 11$ (b) $12x + 10 + 3 + 8x$ (c) $10y + 12 - 7y - 8 - 3y$

(d) $8x - 6 - 7x + 10$ (e) $-6x + 9 + 4x - 9$ (f) $-4x + 5 - 12 - 7x + 4 + 2x$

(g) $12x - 15 - 3 + 2x - 15x$ (h) $-7x + 4 - 11 - 7x + 7 + 2x + 12x$ (i) $-2x + 18 + 4x - 12 - 6$

2) Use the associative property to rewrite the following. You do NOT need to simplify these.

(a) $2 + (3 + 4) =$ (b) $5 \cdot (3 \cdot 7) =$ (c) $3x - (2x + 9x)$

3) Use the commutative property to rewrite the following. You do NOT need to simplify these.

(a) $6 + 7 + 8$ (b) $12x + 8x - 3x$ (c) $-3y - 6y + 10y$

4) List which of the associative and commutative properties are being used in each step.

$(9x - 3) + (10 - 5x) = 9x - 3 + 10 - 5x$ _____

$9x - 3 + 10 - 5x = 9x - 5x - 3 + 10$ _____

$9x - 5x - 3 + 10 = (9x - 5x) + (-3 + 10)$ _____

$= 4x + 7$

5) Sophia and Emily are twin sisters and best friends. They're saving up for concert tickets and agreed to pay for the tickets together when they have enough money. They both created equations to see how fast they were making money and came up with the following expressions:

Sophia: $35w + 55 - 10w$

Emily: $28w + 75 - 5w + 12$ where w is the number of weeks they have been saving.

(a) Combine their expressions to see how much they are making together.

(b) Using the expressions, see if they will have about \$350 in four weeks. If not, how much will they be short?

(c) If their friend Becky also wants to join and is making money according to the expression $50w + 25$, create a new expression for the total and see if they will have about \$525 for the three of them after four weeks.

6) An example of an algebraic expression is:

(1) $x + 2$
(2) $y = x + 2$
(3) $y < x + 2$
(4) $y = x^2 + 2x$

7) An example of an algebraic equation is:

(1) $r^2 + 1$
(2) $2a + (n - 1)d$
(3) $5x = 7$
(4) $-25\pi + 100$

Review Section:

8) If $t = -3$, then $3t^2 + 5t + 6$ equals _____.

9) What is the first step in simplifying the expression $(2 - 3 \cdot 4 + 5)^2$?

(1) square 5
(2) add 4 and 5
(3) subtract 3 from 2
(4) multiply 3 by 4

10) What is the value of the expression $2x^3y$ when $x = -2$ and $y = 3$?

(1) -192
(2) -108
(3) -48
(4) 48

11) Brett was given the problem: "Evaluate $2x^2 + 5$ when $x = 3$." Brett wrote that the answer was 41. Was Brett correct? Explain your answer.

Name: ***Homework Answers*** Date: _____ Period:___

Algebra Commutative and Associative Props. 1C HW

1) (a) $13x + 14$ (b) $20x + 13$ (c) 4

(d) $x + 4$ (e) $-2x$ (f) $-9x - 3$

(g) $-x - 18$ (h) 0 (i) $2x$

2) (a) $(2 + 3) + 4$ (b) $(5 \cdot 3) \cdot 7$ (c) $(3x - 2x) + 9x$

3) (a) 8+6+7 (b) $12x - 3x + 8x$ (c) $10y - 3y - 6y$

4) Associative Property, Commutative Property, Associative Property

5) (a) $48w + 142$ (b) No, they will be short by $16. (c) Yes, they will have enough.

6) (1)

7) (3)

8) 18

9) (4)

10) (3)

11) 23; He is incorrect.

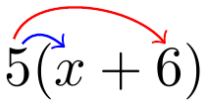
Name:_____ Date:_____ Period:_____

Algebra I The Distributive Property 1D

The Distributive Property

Example: $5(x+6)$

Since in the order of operations, multiplication comes **before** addition and subtraction, we must get rid of the multiplication before you can combine like terms. We do this by using the **distributive property**:



$5(x) + 5(6)$

$5x + 30$

THE DISTRIBUTIVE PROPERTY (OF MULTIPLICATION OVER ADDITION)

If a, b, and c all represent real numbers then: $a(b+c) = a \cdot b + a \cdot c$

Exercise 1: Simplify the following using the Distributive Property.

(a) $3(2x+5)+5(4x-6)$

(b) $8(x+2)-3(7x-9)$

(c) $4(7x-8)+6(5x+10)$

(d) $6(4x^2-5x+2)+3(-8x^2+11x+4)$

(e) $11(3x-5)-9(6x+7)$

(f) $12(3x^2-5x+8)-4(7x^2-6x-11)$

(g) $7(6x^2 - 14x + 15) + 8(10x^2 - 8x + 5)$

(h) $5(9x^2 + 7x - 5) - 14(2x^2 + 3x + 6)$

One common mistake that students make is not realizing that the distributive property works for division as well as multiplication. For division, the property would look in symbolic form like:

THE DISTRIBUTIVE PROPERTY (OF DIVISION OVER ADDITION)

If a, b, and c all represent real numbers then: $\frac{b+c}{a} = \frac{b}{a} + \frac{c}{a}$

Exercise 2: Express each of the following quotients as binomials in simplest form. Show your calculations. Some of your answers will contain fractional coefficients.

(a) $\frac{8x+4}{2}$

(b) $\frac{25x-50}{5}$

(c) $\frac{2x-16}{4}$

(d) $\frac{-9x+18}{12}$

(e) $\frac{77x+99}{-11}$

(f) $\frac{39x-52}{13}$

(g) $\frac{16x-40}{12}$

(h) $\frac{16x+22}{4}$

(i) $\frac{35x+75}{10}$

Name:_____ Date:_____ Period:_____

Algebra I The Distributive Property 1D HW

1) Simplify the following using the Distributive Property.

(a) $6(3x + 8) + 4(2x^2 + 9)$

(b) $5(3 + 7y) + 6(8y - 4y^2)$

(c) $7(2x + 8) - 4(3x^2 + 5x - 6)$

(d) $9(3xy + 7y - 5) + 5(3y^2 + 6)$

(e) $7(9x + 3y) + 4(2x + 6)$

(f) $8(4x^2 - 3x) + 5(6x - 7)$

2) Simplify the following expressions. Show your calculations.

(a) $\frac{36x+21}{3}$

(b) $\frac{12x-24}{6}$

(c) $\frac{35x+15}{5}$

(d) $\frac{18x-15}{6}$

(e) $\frac{18-36x}{4}$

(f) $\frac{3(4x+8)}{6}$

____ 3) Which property is illustrated by the equation $ax + ay = a(x + y)$?
(1) associative (2) commutative (3) distributive (4) identity

Review Section:

____ 4) If M and A represent integers, $M + A = A + M$ is an example of which property?
(1) commutative (2) associative (3) distributive (4) closure

____ 5) What is the value of $\frac{x^2-4y}{2}$, if $x = 4$ and $y = -3$?

(1) -2 (2) 2
(3) 10 (4) 14

____ 6) Mr. Stanton asked his students to write an algebraic expression on a piece of paper. He chose four students to go to the board and write their expression.

Robert wrote: $4(2x + 5) \geq 17$
Meredith wrote: $3y - 7 + 11z$
Steven wrote: $9w + 2 = 20$
Cynthia wrote: $8 + 10 - 4 = 14$

Which student wrote an algebraic expression?
(1) Robert (2) Meredith (3) Steven (4) Cynthia

7) What is the expression $3(x^2 - 1) - (x^2 - 7x + 10)$ equivalent to?

Name: ***Homework Answers*** Date: _____ Period:___

Algebra The Distributive Property 1D HW

1) (a) $8x^2 + 18x + 84$ (b) $-24y^2 + 83y + 15$

(c) $-12x^2 - 6x + 80$ (d) $15y^2 + 63y + 27xy - 15$

(e) $71x + 21y + 24$ (f) $32x^2 + 6x - 35$

2) (a) $12x + 7$ (b) $2x - 4$ (c) $7x + 3$

(d) $3x - \frac{5}{2}$ (e) $-9x + \frac{9}{2}$ (f) $2x + 4$

3) (3)

4) (1)

5) (4)

5) (2)

7) $2x^2 + 7x - 13$

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Algebra I Exponents & Multiplication 1 E

Exponents & Multiplication

We've used exponents a little so far, but they will become much more important to us as our studies in Algebra progress. So, in the next few lessons we are going to work with some basic exponents. Recall that an **exponent** is a way to indicate **repeated multiplication by the same number**.

EXPONENTS AS REPEATED MULTIPLICATION

By definition, if n is a **positive integer**, i.e. $\{1, 2, 3, ...\}$, then $x^n = \underbrace{x \cdot x \cdot x \cdots x}_{\text{multiplied } n\text{-times}}$

Exercise 1: Write out each of the following products and then express them in the form x^n.

(a) $x^2\ x^3$ (b) $x^5\ x^2$ (c) $x^4\ x^4$

$(x)(x)\ \ (x)(x)(x)$

x^5

One of the nice aspects of exponents is that they follow very predictable patterns, often known as exponent rules. Let's figure out the simplest one in the next exercise.

Exercise 2: So what's the pattern? What did you notice? Can you give a general rule for what happens when you multiply two terms that have the same **base**?

EXPONENT RULE #1: $x^a \cdot x^b =$

The exponent rule allows us to multiply larger powers of variables without actually having to write out the products. Make sure you memorize these rules!

When multiplying Monomials:

Coefficients: _____ the coefficients.

Variables: When multiplying the variables of monomials you keep the base and _____ the exponents (Remember if there is no exponent written, the exponent is 1.)

Exercise 3: Quickly write each of the following products as a variable raised to a single power.

(a) x^4x^9 (b) $x^2x^3x^4$ (c) y^2y^6

(d) $x^{11}x^5$ (e) y^7y^9 (f) $x^{12}x^8$

Often you will need to be able to multiply more complicated terms and write them in as convenient (**simplest**) form as possible. The next exercise walks us how to do this and the laws and properties needed.

Exercise 4: Rewrite each of the following as equivalent expressions in simplest exponential form.

(a) $2x^7 \cdot 8x^5$

(b) $(-4x^3)(2x^2)$

(c) $3x^5 \cdot 6x^2$

(d) $(3x^6y^7)(4xy^8)$

(e) $(6x^2y^5)(3x^{11}y^7)$

(f) $(7x^9y^{11})(8x^{13}y^{22})$

(g) $(-2x^3)(3x^4)(5x^5)$

(h) $(7x^4)(8x^{11})(2x^6)$

(i) $(-6x^3)^2$

(j) $(-4x^5)^3$

(k) $(5x^7)^4$

(l) $2x(3x-7)$

(m) $8x(3x^2-6x+11)$

(n) $-3x(6x^2-7x+11)$

(o) $5x(2x^2+3x-9)$

Name:_____ Date:_____ Period:_____

Algebra I Exponents & Multiplication 1 E HW

1) Rewrite each of the following as equivalent expressions in simplest exponential form.

(a) $4x^3 \cdot 7x^6$ (b) $x^5y^3x^2$ (c) $(-x^2)(3x^{10})$

(d) $(x^2y^3z^3)(2x^5y^7)$ (e) $(4x)^3$ (f) $(-3x^2)^2$

(g) $(9y^6)(8y^4)$ (h) $(-2x^2)(4x^7)(10x^9)$ (i) $(11a^2b)(2a^5b^6)(3a^8b^4)$

(j) $(2xy^2)^3$ (k) $(12z^5)(-z^6y)$ (l) $4x(9x^2 - 15x - 12)$

(m) $9x(7x^2 + 11x - 8)$ (n) $15x(2x^2 - 4x + 6)$ (o) $3x(6x^2 - 7x + 8)$

2) *To get you thinking about topics in the future:* For **multiplying** with exponents, we multiply the coefficients and add the exponents.

What do you think happens when we divide with exponents?

_____ the coefficient and _____ the exponents.

Try one: $\frac{12x^5}{3x^3} =$

Review Section:

3) Use the order of operations to explain why the equation $2^2 \cdot (6 + 5) = 29$ is false.

4) State which property (Associative, Commutative, or Distributive) was used to get from one equivalent expression to the next.

$-2(3x+5)+4(2x-1)$

$= -6x-10+4(2x-1)$ _____

$= -6x-10+8x-4$ _____

$= -6x+8x-10-4$ _____

$= (-6x+8x)+(-10-4)$ _____

$= (-6+8)x-1(10+4)$ _____

$= 2x-14$

5) If $x = 2$ and $y = -3$, what is the value of $2x^2 - 3xy - 2y^2$?

6) Simplify the following: $2(9x + 3) + 3(2x + 6)$

Name: ***Homework Answers*** Date: _____ Period:___

Algebra Exponents and Multiplication 1E HW

1) (a) $28x^9$ (b) x^7y^3 (c) $-3x^{12}$

(d) $2x^7y^{10}z^3$ (e) $64x^3$ (f) $9x^4$

(g) $72y^{10}$ (h) $-80x^{18}$ (i) $66a^{15}b^{11}$

(j) $8x^3y^6$ (k) $-12z^{11}y$ (l) $36x^3 - 60x^2 - 48x$

(m) $63x^3 + 99x^2 - 72x$ (n) $30x^3 - 60x^2 + 90x$ (o) $18x^3 - 21x^2 + 24x$

2) Divide, Subtract, $4x^2$

3) 44

4) List all the properties

5) 8

6) $24x + 24$

Name:_____ Date:_____ Period:_____

Algebra I Multiplication of Binomials 1 F

Multiplication of Binomials

At this point, we should now have a grasp on how to work with exponents. In this lesson, we will continue to explore expressions that are equivalent but look different. We will primarily be sticking with linear expressions (those where x is only raised to the first power) and quadratic expressions (where x is raised to the second power).

Recall that two expressions are equivalent if they return equal values when values are substituted into them.

Exercise 1: Consider the product $(x - 2)(x + 5)$. It is equivalent to one of the expressions below. Determine which by substituting in two values of x to check.

	$(x-2)(x+5)$	x^2-10	$x^2+3x-10$
$x = 3$	$(3-2)(3+5)$ $(1)(8)$ 8	$(3)^2-10$ $(9)-10$ -1	$(3)^2+3(3)-10$ $9+9-10$ $18-10$ 8
$x = 5$			

Multiplying Binomials:

-Binomials contain two different terms.

-These terms are grouped together by parenthesis and separated by either an addition or subtraction symbol.

-When we multiply binomials, we will use Double Distribution.

Let's look at this example:

$(x + 7)(x - 5)$

$x^2 - 5x + 7x - 35$

$x^2 + 2x - 35$

Exercise 2: Write out each of the following as equivalent trinomials (an expression involving three terms).

(a) $(x + 6)(x + 3)$ (b) $(x - 4)(x + 6)$ (c) $(x - 3)(x - 3)$

(d) $(2x + 3)(3x + 1)$

(e) $(3x - 4)(3x + 2)$

(f) $(x - 2)^2$

(g) $(x + 5)^2$

(h) $(x + 3)(x^2 - 5x + 7)$

(i) $(x - 6)(x^2 + 11x - 9)$

(j) $(x - 4)(4x^2 - 3x + 7)$

Exercise 3: Jeremy has noticed a pattern that he thinks is always true. If he picks any number and finds the product of one number larger and one number smaller than it, the result will always be one less than the square of his number.

(a) Test two numbers and see if Jeremy's pattern holds true.

(b) Give an algebraic explanation that shows that Jeremy's pattern will work for any number. Use let statements to clearly define your variables.

Name:_____ Date:_____ Period:_____

Algebra I Multiplication of Binomials 1 F HW

1) Rewrite each expression as a simpler, equivalent expression by first using the Distributive Property and then combining like terms.

(a) $x(x-2)$

(b) $x(x+6)+3(x+6)$

(c) $(x+3)(x+6)$

(d) $4x(2x+3)$

(e) $(3x-4)(3x+2)$

(f) $(x+3)(x-3)$

(g) $(3x+4)(2x-1)$

(h) $(x-3)^2$

(i) $(x+2)^2$

(j) $(x+4)(3x^2-7x+11)$

(k) $(x-6)(3x^2+8x-1)$

2) Which of the following expressions is equivalent to $(x+7)^2$? Show your work to support your answer.

(1) x^2+49 (2) $(x-7)(x+7)$ (3) $(x+7)(x+7)$ (4) $(7x)(7x)$

3) Continuing with the expression $(x+7)^2$, do the following:

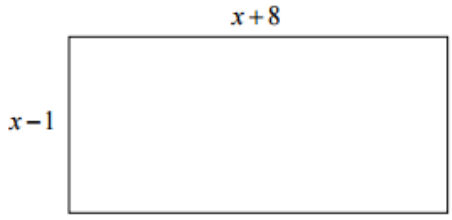
(a) By using the Distributive Property twice, show that this expression is equivalent to $x^2+14x+49$.

(b) Test the equivalency by finding the value of $(x+7)^2$ and $x^2+14x+49$ when $x=3$.

4) When reading some schematics of a rectangular garden you see the binomial $x+8$ feet represents the length and the binomial $x-1$ feet represents the width. Write an expression that represents the total area of the garden in the form ax^2+bx+c by using the distributive property.

(SUPER IMPORTANT!!*** This is on every NYS Common Core Regents!!!!)***

Recall that $Area = (Length)(Width)$



5) Challenge: Write an expression that is equivalent to: $(x + 2)(x - 6) - 3x - 6$
HINT: Double Distribute first

Review Section:

6) Find the product of $3x^3y^4$ and $-6x^4y^4$

7) Peter has 42 pieces of candy to divide evenly between his 2 children. If he puts the pieces into two boxes, how many pieces of candy are there per box?

8) Evaluate: $3x^2 + 2y$ when $x = -2$ and $y = -3$

Name: ***Homework Answers*** Date: _____ Period:___

Algebra Multiplication of Binomials 1F HW

1) (a) $x^2 - 2x$ (b) $x^2 + 9x + 18$ (c) $x^2 + 9x + 18$

(c) $8x^2 + 12x$ (d) $9x^2 - 6x - 8$ (e) $x^2 - 9$

(g) $6x^2 + 5x - 4$ (h) $x^2 - 6x + 9$ (i) $x^2 + 4x + 4$

(j) $3x^3 + 5x^2 - 17x + 44$ (k) $3x^3 - 10x^2 - 49x + 6$

2) (3)

3) (a) Show by double distribution (b) Test the value of $x = 3$ to show they are equivalent.

4) $Area = x^2 + 7x - 8\ feet$

5) $x^2 - 7x - 18$

6) $-18x^7y^8$

7) 21 pieces of candy per box

8) 6