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Combining like terms is a fundamental skill in algebra that simplifies expressions and makes solving equations more manageable. In this article, we will delve into the intricacies of identifying and combining like terms to create more concise algebraic expressions. We'll start by discussing how to identify like terms, which are essentially variables with the same exponent or constant factors. Next, we'll explore methods for simplifying expressions by grouping these similar components together. As we progress through the post, you'll learn how to combine coefficients effectively while maintaining the integrity of your algebraic expression. Finally, we will provide some practice problems designed to reinforce your understanding of combining like terms and prepare you for tackling complex mathematical challenges. In algebra, it is essential to recognize and understand the concept of like terms in order to simplify expressions and solve equations effectively. This section will give you a thorough comprehension of like terms, their identification and the significance they have in algebra. Like terms are algebraic expressions that have the same variables raised to the same powers. For example, 3x2y and -5x2y are considered like terms because both contain x2y as their variable part. On the other hand, 4xy2 and 7x3y would not be classified as like terms since their variable parts (xy2 and x3y) differ from each other. The coefficients (the numerical factors) can be different; only the variables need to match. If there is more than one variable present in a term, all variables must appear with identical exponents for those expressions to qualify as "like." Numerical constants without any attached variables can also be combined together when simplifying an expression or equation. Identifying like terms is an important step in simplifying expressions. Let's proceed to the next area of Simplifying Expressions and discover how we can benefit from this understanding. Algebraic simplification is a key ability which can help you to resolve issues with greater ease and accuracy. One of the primary methods for simplification is combining like terms. In this section, we will explore the process of combining like terms in order to simplify algebraic expressions. To begin with, let's understand what it means to combine like terms. Like terms are those which have the same variables raised to the same powers; they only differ by their coefficients (the numbers multiplied by these variables). For example, 3x2y and -5x2y are like terms because both have x2y as their variable part. The process of combining like terms involves adding or subtracting their coefficients while keeping the variable part unchanged. Here's a step-by-step guide on how to do this: Identify all pairs of like terms: Scan through your expression and find any groups of two or more similar-looking items that can be combined together. Add or subtract coefficients: Once you've identified all pairs/groups of like terms, add/subtract their respective numerical parts (coefficients) accordingly based on whether they're being added (+) or subtracted (-). Rewrite expression with simplified term(s): Replace each group/pair with its simplified version – i.e., one term whose coefficient equals the sum/difference calculated in Step #2 above – leaving everything else unchanged within your original equation/expression. Note: It's important not just to identify but also arrange these matched sets properly so as not to accidentally mix up unrelated elements during subsequent steps. Let's look at an example to better understand the process: Example: Simplify 5x + 3y – 2x + y Identify like terms: We have two sets of like terms here (5x – 2x) and (3y + y). Add/subtract coefficients: For the x-terms, we get (5 – 2)x = 3x. For the y terms, we get (3 + 1)y = 4y. Rewrite expression with simplified term(s): Our final simplified expression is thus: 3x + 4y. In some cases, you may need to use the distributive property before combining like terms. The distributive property states that a(b+c)=ab+ac for any numbers a,b,c. Applying this rule can help reveal hidden like terms within expressions containing parentheses or other grouping symbols. Example: Simplify x(2+x) – x(x+1) Distribute first: We get (2x+x2) – (x2 + x). Rewrite subtraction as addition of negative term(s): This gives us [(2x + x2) + (-x2 – x)]. Combine like terms: We get (2x – x) + (x2 – x2) = x. Rewrite expression with simplified term(s): Our final simplified expression is thus: x. Combining like terms is a fundamental concept in algebra that can help simplify complex expressions. By following the steps outlined above, you can easily identify and combine like terms to make solving algebraic expressions more manageable. Simplifying expressions is a fundamental skill for any math student, and mastering it can open up many opportunities in mathematics. Moving on to the next topic of combining coefficients will further build upon this foundation by introducing students to more complex operations with variables. Important Lesson: The process of combining like terms in algebra involves identifying pairs or groups of similar-looking items and adding/subtracting their coefficients while keeping the variable part unchanged. This helps simplify complex expressions, making it easier to solve problems more efficiently and effectively. The distributive property can also be used to reveal hidden like terms within expressions containing parentheses or other grouping symbols. In this section, we will explore how to combine coefficients when combining like terms in algebraic expressions. The process of combining coefficients is crucial for simplifying expressions and solving equations effectively. To start, let us define a coefficient as the numerical factor that multiplies a variable or variables in an algebraic expression. In an algebraic expression, the coefficient is the numerical factor that multiplies a variable or variables. For example, in the term (5x + 5) is the coefficient of x. When you encounter similar terms with different coefficients (like terms), you can add or subtract their coefficients while keeping the variable part unchanged. The first step in combining like terms involves adding or subtracting their respective coefficients based on whether they have positive (+) or negative (-) signs: If both terms are positive (or both are negative), add their absolute values and keep the same sign as before. If one term has a positive sign and another has a negative sign, find the difference between their absolute values and use whichever sign corresponds to the larger value. Example: If we have the expression 3x + 7x – 2x, we can combine the like terms 3x, 7x, and -2x by adding their coefficients. This gives us 8x. In a polynomial with multiple terms and variables, it's essential to identify like terms first before combining their coefficients. Remember that like terms have the same variable(s) raised to the same power. Example: If we have the polynomial 3x2 + 2xy + 5x2 – 4xy, we can combine the like terms 3x2 and 5x2 by adding their coefficients to get 8x2. We can also combine the like terms 2xy and -4xy by subtracting their coefficients to get -2xy. Combining coefficients is an important skill to master in order to understand and solve more complex equations. Let's now proceed to tackling some sample exercises in order to hone our aptitude for this concept. Remember that the key to success is identifying like terms and then combining their coefficients. Simplify the expression: 5x + 7y – 3x + y To combine like terms, first identify them: (5x – 3x) + (7y + y). Now, combine the coefficients of each set of like terms: (5-3)x + (7+1)y = 2x + 8y. Simplify the expression: $-6a^2b^3 - a^2b^3 + ab^2 - ab^2$ The given expression has two sets of like terms: $-6a^2b^3$ and $-a^2b^3$ +ab^2 and -ab^2 Combine their respective coefficients: $(-6 - 1)a^2b^3 + (1 - 1)ab^2 = -7a^2b^3$ Remember that when dealing with exponents, only variables with matching exponents are considered as "like" for our purposes. When subtracting a term from another term or adding a negative term to another term, consider it as adding its opposite value. For example: 5x – 3x = 5x + (-3x). This makes it easier to combine the coefficients. Simplify the expression: $4x^2y - 2xy^2 + x^2y - xy^2$ The given expression has two sets of like terms: $4x^2y$ and x^2y -$2xy^2$ and -xy^2 Combine their respective coefficients: $(4 + 1)x^2y + (-2 - 1)xy^2 = 5x^2y - 3xy^2$ The rule for combining like terms states that you can only add or subtract terms with the same variable and exponent. To combine them, simply add or subtract their coefficients while keeping the variable and exponent unchanged. It's essential to understand that only similar variables with identical exponents can be combined. Also, remember to follow the proper order of operations (PEMDAS) when simplifying expressions involving multiple mathematical operations. Combining like terms means adding or subtracting algebraic expressions with the same variables and exponents. For example, in 2x + 5y – x + 4y, we have two sets of like terms: '2x' and '-x', '5y' and '4y'. Combining these gives us a simplified expression: x + 9y. To identify which terms to combine, look for those having the same variable raised to an identical power. Group these together by either adding or subtracting their coefficients as required by the given expression. Combining Like Terms In this article, we learned how to simplify algebraic expressions by combining like terms. When we talk about like terms, we refer to terms that have the same variables raised to the same power. For example, 3x and 5x are like terms because they both have x raised to the first power. However, 3x and 3y are unlike terms because they have different variables. When we combine like terms, we add or subtract their coefficients while keeping the variables the same. Let's look at an example: 2x + 3y – 5x – 2y First, we identify the like terms: 2x and -5x, and 3y and -2y. We can then combine them: 2x – 5x + 3y – 2y = -3x + y It's important to note that we cannot combine unlike terms. For example, we cannot simplify 3x + 2y because x and y are unlike terms. By practicing problems involving combining like terms, math students can improve their skills in simplifying algebraic expressions. Remember to always look for similar variables with matching exponents and add or subtract their coefficients accordingly. If you want to learn more about any other math-related topic, visit The Math Index! In this unit, students will explore how to solve linear equations by combining like terms, using the distributive property, and identifying the number of solutions for the equations. Term: A number, a variable(s), or a number and a variable(s) multiplied together. Terms are separated by a positive (+) or negative (-) sign. Constant: A number by itself with no variable. Coefficient: The number being multiplied by the variable. Like Terms: Terms that have identical variable(s). Unlike Terms: Terms that do not have identical variable(s). Click on each word to see an example: Term, Constant, Coefficient, Like Terms, Unlike Terms. Example: 5, 2x, $-3x^2$, 0.5xy Example: 5 Example: 2 in 2x Example: 3x and 2x are like terms because they both contain the variable x. Example: 2x and 2y are unlike terms because they contain different variables. In algebra, terms are the basic components of expressions. A term can be a single number (a constant), a variable (like x or y), or a combination of numbers and variables multiplied together. Terms are separated by addition (+) or subtraction (-) signs in an expression. Understanding the distinction between like and unlike terms is crucial as it helps in simplifying expressions and solving algebraic equations effectively. Like terms are terms that have exactly the same variable components raised to the same powers. The coefficients (the numbers multiplying the variables) do not need to be the same. For instance, in the expression 3x2 + 5x2, both terms are like terms because they contain the same variable x raised to the same power (2). Examples of like terms include: 7xy and -2xy (same variables x and y with no powers) 4a3b2 and -9a3b2 (same variables a and b, a raised to the 3rd power, and b to the 2nd power) Defining Unlike Terms Unlike terms, on the other hand, are terms that have different variable parts or exponents. The difference might be in the variable itself or in the exponent of the same variable. For example, 3x2 and 5x3 are unlike terms because, even though they both contain the variable x, the powers are different. More examples include: x2 and y2 (different variables) 2ab and 2ba2 (same variables but different powers) 5x and 5y (different variables) Simplifying Expressions Using Like and Unlike Terms Simplifying algebraic expressions often involves combining like terms. This process is called "collecting like terms." For example, in the expression 4x + 3x2 - 2x, you can combine the like terms 4x and -2x to simplify the expression to 2x + 3x2. When dealing with unlike terms, remember that they cannot be combined through addition or subtraction due to their different variable parts or exponents. Each term stands alone in the expression. Expression Like or Unlike? 3x and 5x Like $2x^2$ and 3x Unlike 7y and -7y Like 4ab and 4ba Like 5m and 5n Unlike Practice entering 'like' or 'unlike' for the following expressions: Combining like terms is a critical process in algebra that involves simplifying algebraic expressions by adding or subtracting terms that are alike. Terms are considered 'like' if they have identical variable parts, including the variables and their exponents. Click on the link below to join EdPuzzle's open class, which will allow you to view all of the EdPuzzle videos for this course. Once you have clicked on the link below, refresh this page. Why Combine Like Terms? The primary reason for combining like terms is to simplify an expression, making it easier to handle and solve equations. Simplification can help in solving equations, evaluating expressions, and understanding algebraic relationships more clearly. How to Identify Like Terms Like terms have the same variable factors. For example, 2x2y and 5x2y are like terms because both contain the same variables x and y, with x raised to the 2nd power. However, 2xy and 2x2y are not like terms because the exponent of x differs. Examples of Combining Like Terms Consider the expression 3x + 4x - 2x + 5. Here, all the terms involving x are like terms. They can be combined as follows: The simplified expression is 5x + 5. Steps to Combine Like Terms Identify all like terms in the expression. Add or subtract the coefficients of these like terms while keeping the variable part unchanged. Rewrite the expression with the combined like terms. Practical Example Let's simplify the expression 6a2b - 3ab2 + 2a2b + 4ab2: Combine like terms 6a2b and 2a2b: 6a2b + 2a2b = 8a2b Combine like terms -3ab2 and 4ab2: -3ab2 + 4ab2 = 1ab2 The simplified expression is 8a2b + ab2. Combining like terms is fundamental in algebra for simplifying expressions and solving equations more efficiently. It helps to create clearer and less complex expressions which are crucial for advanced algebraic operations and calculus. Expression Simplified 3x + 2x 5x 4a + 6a 10a 7y - 2y 5y 5b + 3b + 2b 10b 9m - 4m 5m Practice simplifying the following expressions: The Distributive Property, also known as the distributive law of multiplication over addition, is a crucial algebraic property used to simplify expressions and solve equations. It states that multiplying a sum by a number is the same as multiplying each addend of the sum by the number and then adding the results. The formula for the distributive property can be expressed as follows: a(b + c) = ab + ac Why Use the Distributive Property? This property is particularly useful for simplifying expressions that involve parentheses and are not immediately easy to add or subtract. It helps in breaking down complex problems into simpler parts that are easier to manage and solve. Examples of the Distributive Property Consider the expression 3(2 + 4). Applying the distributive property, we multiply 3 by each addend inside the parentheses: 3(2 + 4) = 3×2 + 3×4 = 6 + 12 = 18 This simplifies the expression to 18, demonstrating how the distributive property aids in multiplication across a sum. Application in Variable Expressions The distributive property is also invaluable when dealing with variable expressions. For example: 5(x + 3) = 5x + 15 2(a + 7) = 2a + 14 Complex Example Let's apply the distributive property to a more complex expression: 4(x + 2y - 3z). Multiplying 4 by each term within the parentheses gives: 4(x + 2y - 3z) = 4x + 8y - 12z This demonstrates how the property simplifies expressions involving multiple terms and different operations. The distributive property is essential for simplifying and solving algebraic equations, making it a foundational element in algebra and beyond. Understanding and applying this property allows for more efficient and accurate problem-solving in mathematics. Expression Simplified 2(3x + 4) 6x + 8 5(2y + 3) 10y + 15 3(4z - 2) 12z - 6 4(1a + 2b) 4a + 8b 6(1m - 3n) 6m - 18n Practice applying the distributive property to these expressions: There are two things that you must be able to do when simplifying algebraic expressions. The first is to be able to use the distributive property. The second math concept that you must understand is how to combine like terms. Before we dive into analyzing "like terms", let's first discuss what a term is and the vocabulary associated with terms. What is a Term? Take a look at these three terms. 2x is a term, 5y is a term, and 7 is a term. The 7 does not have a variable. It is called a constant. Since it doesn't have a variable, its' value will always remain the same, 7. That's why it is called a constant.The 2 in the term 2x is called a coefficient. A coefficient is a number by which a variable is multiplied. The 5 in the term 5y is also a coefficient. So, now you know what these important vocabulary words mean: A constant is a term that is just a number, it does not contain a variable. A coefficient is the number that you multiply by a variable.Ok.. now moving onto like terms. What Are Like Terms? Let's take these six terms above as our examples.Like terms are two or more terms that have EXACTLY the same variables. (The coefficients do not have to be the same, just the variables!) For example, for the 6 terms above, 2x and 3x are like terms because they both just contain an x.Can you find the other set of like terms? Yes, 7 and 9 are like terms. 7 and 9 are like terms because they are both constants. Neither of them have a variable and that is what makes them like terms. What Does Not Have a Like Term? 5y does not have a like term because no other term has the variable y. 2xy does not have a like term because no other term has the variables x and y. Ok, enough vocabulary... let's look at a few examples. We are going to simplify each expression by combining like terms. Each term is separated by a plus sign or a minus sign. When you combine like terms, you MUST take the sign in front of the term with it or your answer may be incorrect! Example 1- Combining Like Terms I like to rewrite my like terms together. I feel that it makes it easier to compute and will help you to not lose your sign when you a lot of terms to combine. Example 2 - Subtraction Signs Make It Tricky! Ok, are you confident enough to use the distributive property when simplifying algebraic expressions? Sure you are, let's go! If you see an addition or subtraction problem inside a set of parenthesis, you must use the distributive property BEFORE simplifying the expression.As you review the next example, notice how the distributive property was used first, then the algebraic expression was simplified. Example 3 - Using the Distributive Property Ok... with three great examples, you should be ready to try some on your own! You can try a few practice problems here on the Simplifying Algebraic Expressions Practice Page. Simplifying Expressions Math Basics > Unit 4 Expressions > Lesson 4.12 Combining Like Terms with Distributive Property Click play to watch the video and answer the questions for points! Simplify each expression and click on the correct answer. Next we'll look at how we use the distributive property with combining like terms to simplify expressions. This expression has a few things going on. We have seven being multiplied by a minus four in parentheses. And then as a separate term, we have plus three A. So where do we begin when we're simplifying expressions? To know where to start, we think of the order of operations which tell us to first simplify what's inside parentheses. Well, here we have A minus four that can't be simplified any more than it already is, A and four are not like terms, so we can't combine them. So let's move on to the next step exponents. Well, there are no exponents in this expression, so we can keep going. Next, we move on to multiplication and division. We do have some multiplication. Here we have seven next to a set of parentheses. So that means the seven is being multiplied by what's inside the parentheses. We also have the multiplication with the three A that shows that three is being multiplied by A. But since three A is already as simplified as it can be, there's nothing we can do to simplify that term. But our first term, the seven times A minus four, that part can be simplified, but we have to use the distributive property. So remember, with distributive property, we're really just using multiplication. So that's why we can do it during our multiplication step of the order of operations. Wwe take the number that's on the outside of the parentheses and multiply it by each thing on the inside. So first we'll start by multiplying seven times A, which we can just write as seven A. Now we multiply seven times or minus four, which gives us -28, so that first part just becomes 7A -28. Now we can't forget our plus three A. So we'll just bring that on down. Now we're left with just addition and subtraction. So let's see how we can simplify this. Now, remember, when we're adding and subtracting, we can only add and subtract like terms together. Okay, so this is what we call combining like terms. This is done during the addition and subtraction step of the order of operations. Let's see what like terms we have. Here we have seven A and plus three A. They're like terms because they have the same variable, the A. So all we have to do is add seven A and three A together. Well, that gives us ten A and then we bring down the -28. There's nothing else to combine that with. So it just stays as it is. So our final answer is 10A -28. So look at what we just did. We took that whole big long expression that we started with. And just by using distributive property and combining like terms, we simplified it to just 10A -28. Here's another example. This time we have eight B and then minus six times B plus five in parentheses. Just like before, we can't start with simplifying what's inside the parentheses because B plus five can't be simplified any more than it is. We can't add those together. So we're going to have to rely on our distributive property and combining like terms to help us simplify it. Now, remember, when we use distributive property we're not breaking the rules of the order of operations, we're still following the proper order. It's just that now, since we have some variables in here, we have to use these specific methods. Okay, so the distributive property gets done first before combining like terms because we always have to do multiplication before we add and subtract. So we're still following the proper order. So let's apply the distributed property. So we have a six in front of or to the left of the b plus five in parentheses. But we also have a subtraction sign to the left of the six. Remember, you always keep the sign that's to the left of the number or variable with it. That's the only way you'll remember if you need to treat it as a positive or negative. So since we have a subtraction sign with the six, we treat it as a negative six. So we're going to multiply that negative six times B, which becomes negative six B. We just smush them together, and then we have negative six times positive five. Negative six times positive five gives us negative 30. So remember those rules with integers? Multiplying a negative times a positive gives us a negative. So that's negative 30. So far, that part of our expression simplifies to -6B -30. And don't forget we have that eight B that's in the front there. Let's bring that on down. So now we just have subtraction left to simplify. And that we can do by combining like terms. We have two terms that have the variable B, eight B and minus six B. We have eight of B and take away six of those, we're left with two of B, so 2B. And then we just bring down our -30 because there was nothing else left to combine it with. So all of that simplifies to just 2B -30. So very, very important to remember when you see subtraction or negative signs, slow down and take your time. For example, you have to remember that that subtraction sign stays with that six that we started with. So we treat it as a negative six. Okay, if you do that you'll make sure that your answer is correct with those positives and negatives. So to simplify expressions that have variables we still follow the order of operations, but we have to use the new methods that we've learned. So first we'll apply the distributive property which is the multiplication step of the order of operations. And then we can combine like terms, which is the addition and subtraction step. So just remember, distributive property first, and then you can combine like terms and you'll be able to simplify those expressions that have variables. Learning Outcomes Recognize and combine like terms in an expression Use the order of operations to simplify expressions Some important terminology before we begin: operations/operators: In mathematics we call things like multiplication, division, addition, and subtraction operations. They are the verbs of the math world, doing work on numbers and variables. The symbols used to denote operations are called operators, such as [latex]+{, }-{, }\times{, }\div[/latex]. As you learn more math, you will learn more operators. term: Examples of terms would be [latex]2x[/latex] and [latex]-\Large\frac{3}{2}[/latex] or [latex]a^3[/latex]. Even lone integers can be a term, like [latex]0[/latex]. expression: A mathematical expression is one that connects terms with mathematical operators. For example [latex]\Large\frac{1}{2}ormalsize +\left(2^2\right)- 9\div\Large\frac{6}{7}[/latex] is an expression. Combining Like Terms One way we can simplify expressions is to combine like terms. Like terms are terms where the variables match exactly (exponents included). Examples of like terms would be [latex]5xy[/latex] and [latex]-3xy[/latex], or [latex]8a^2b[/latex] and [latex]a^2b[/latex], or [latex]-3[/latex] and [latex]8[/latex]. If we have like terms we are allowed to add (or subtract) the numbers in front of the variables, then keep the variables the same. As we combine like terms we need to interpret subtraction signs as part of the following term. This means if we see a subtraction sign, we treat the following term like a negative term. The sign always stays with the term. This is shown in the following examples: Combine like terms: [latex]5x-2y-8x+7y[/latex] In the following video you will be shown how to combine like terms using the idea of the distributive property. Note that this is a different method than is shown in the written examples on this page, but it obtains the same result. Combine like terms: [latex]x^2-3x+9-5x^2+3x-1[/latex] In the video that follows, you will be shown another example of combining like terms. Pay attention to why you are not able to combine all three terms in the example. Order of Operations You may or may not recall the order of operations for applying several mathematical operations to one expression. Just as it is a social convention for us to drive on the right-hand side of the road, the order of operations is a set of conventions used to provide order when you are required to use several mathematical operations for one expression. Perform all operations within grouping symbols first. Grouping symbols include parentheses ( ), brackets [ ], braces { }, and fraction bars. Evaluate exponents or square roots. Multiply or divide, from left to right. Add or subtract, from left to right. This order of operations is true for all real numbers. In the following example, you will be shown how to simplify an expression that contains both multiplication and subtraction using the order of operations. When you are applying the order of operations to expressions that contain fractions, decimals, and negative numbers, you will need to recall how to do these computations as well. In the following video you are shown how to use the order of operations to simplify an expression that contains multiplication, division, and subtraction with terms that contain fractions. Exponents and Square Roots In this section, we expand our skills with applying the order of operation rules to expressions with exponents and square roots. If the expression has exponents or square roots, they are to be performed after parentheses and other grouping symbols have been simplified and before any multiplication, division, subtraction, and addition that are outside the parentheses or other grouping symbols. Recall that an expression such as [latex]7^{2}[/latex] is exponential notation for [latex]7\cdot7[/latex]. (Exponential notation has two parts: the base and the exponent or the power. In [latex]7^{2}[/latex], [latex]7[/latex]is the base and [latex]2[/latex] is the exponent; the exponent determines how many times the base is multiplied by itself.) Exponents are a way to represent repeated multiplication; the order of operations places it before any other multiplication, division, subtraction, and addition is performed. In the video that follows, an expression with exponents on its terms is simplified using the order of operations. When there are grouping symbols within grouping symbols, calculate from the inside to the outside. That is, begin simplifying within the innermost grouping symbols first. Remember that parentheses can also be used to show multiplication. In the example that follows, both uses of parentheses—as a way to represent a group, as well as a way to express multiplication—are shown. In the following video, you are shown how to use the order of operations to simplify an expression with grouping symbols, exponents, multiplication, and addition. In the next example we will simplify an expression that has a square root. These problems are very similar to the examples given above. How are they different and what tools do you need to simplify them? a) Simplify [latex]\left(1.5+3.5\right)–2\left(0.5\cdot6\right)^{2}[/latex]. This problem has parentheses, exponents, multiplication, subtraction, and addition in it, as well as decimals instead of integers. Use the box below to write down a few thoughts about how you would simplify this expression with decimals and grouping symbols. Show Solution b) Simplify [latex]{{\left(\Large\frac{1}{2}ormalsize\right)}^{2}}+{{\left(\Large\frac{1}{4}ormalsize\right)}^{3}}\cdot \,32[/latex] Use the box below to write down a few thoughts about how you would simplify this expression with fractions and grouping symbols. Some people use a saying to help them remember the order of operations. This saying is called PEMDAS or Please Excuse My Dear Aunt Sally. The first letter of each word begins with the same letter of an arithmetic operation. Please [latex]\displaystyle \Rightarrow[/latex] Parentheses (and other grouping symbols) Excuse [latex]\displaystyle \Rightarrow[/latex] Exponents My Dear [latex]\displaystyle \Rightarrow[/latex] Multiplication and Division (from left to right) Aunt Sally [latex]\displaystyle \Rightarrow[/latex] Addition and Subtraction (from left to right) Note: Even though multiplication comes before division in the saying, division could be performed first. Which is performed first, between multiplication and division, is determined by which comes first when reading from left to right. The same is true of addition and subtraction. Don't let the saying confuse you about this! The order of operations gives us a consistent sequence to use in computation. Without the order of operations, you could come up with different answers to the same computation problem. (Some of the early calculators, and some inexpensive ones, do NOT use the order of operations. In order to use these calculators, the user has to input the numbers in the correct order.) Greetings math peeps! In today's post, we are going to review some of the basics: combining like terms and distributive property. It's so important to master the basics such as these, so you're prepared and ready to handle the harder stuff that's just around the corner, trust me they're coming! And for those who already feel comfortable with these topics, great! Skip ahead and try the practice questions at the bottom of this post and happy calculating! When do we combine "like terms?" Combining like terms allows us to simplify and calculate our answer with terms that have the same variable and same exponent values only. For example, we can combine the following expression: How do we combine like terms? We add or subtract the whole number coefficients and keep the variable they have in common. Why? We could not add these two terms together because their variables do not match! 2 is multiplied by x, while 3 is multiplied by the variable xy. Why? We could not add these two terms together because their variables and exponents do not match! 2 is multiplied by x, while 3 is multiplied by the variable x^2 . Exponents for each variable must match to be considered like terms. Distributive Property: Combining like terms and the distributive property go hand in hand. The distributive property rule states the following: There are no like terms to combine in the example above, but let's see what it would like to use the distributive property and combine like terms at the same time with the following examples: Example #1: Example #2: In some cases, we also have to distribute the -1 that can sometimes "hide" behind a parenthesis. Try the following questions on your own on combining like terms and the distributive property and check out the video above for more! Practice Questions: Solutions: Still got questions? No problem! Don't hesitate to comment with any questions or check out the video above. Happy calculating! Looking to review more of the basics? Check out this post on graphing equations of a line y=mx+b here. Facebook ~ Twitter ~ TikTok ~ Youtube We begin our discussion with the definition of a term. Definition: Term A term is a single number or variable, or it can be the product of a number (called its coefficient) and one or more variables (called its variable part). The terms in an algebraic expression are separated by addition symbols. Example 1 Identify the terms in the algebraic expression \[3x^2 + 5xy + 9y^2 + 12onumber \] For each term, identify its coefficient and variable part. Solution In tabular form, we list each term of the expression 3x^2 + 5xy + 9y^2 + 12, its coefficient, and its variable part. Term Coefficient Variable Part 3x2 3 x2 5xy 5 xy 9y2 9 y2 12 12 None Exercise How many terms are in the algebraic expression 3x2 + 2xy − 3y2? Answer 3 Example 2 Identify the terms in the algebraic expression \[a^3 − 3a^2b + 3ab^2 − b^3onumber \] For each term, identify its coefficient and variable part. Solution The first step is to write each difference as a sum, because the terms of an expression are defined above to be those items separated by addition symbols. \[a^3 + (−3a^2b)+3ab^2 + (−b^3)onumber \] In tabular form, we list each term of the expression \(a^3+(−3a^2b)+3ab^2+(−b^3)\), its coefficient, and its variable part. Term Coefficient Variable Part a3 1 a3 -3a2b −3 a2b 3ab2 3 ab2 −b3 −1 b3 Exercise How many terms are in the algebraic expression \(11 − a^2 − 2ab + 3b^2a\)? Answer 4 We define what is meant by "like terms" and "unlike terms." Definition Like and Unlike Terms. The variable parts of two terms determine whether the terms are like terms or unlike terms. Like Terms. Two terms are called like terms if they have identical variable parts, which means that the terms must contain the same variables raised to the same exponential powers. Unlike Terms. Two terms are called unlike terms if their variable parts are different. Example 3 Classify each of the following pairs as either like terms or unlike terms: (a) 3x and −7x, (b) 2y and 3y2, (c) −3t and 5u, and (d) −4a3 and 3a3. Solution Like terms must have identical variable parts. 3x and −7x have identical variable parts. They are "like terms." 2y and 3y2 do not have identical variable parts (the exponents differ). They are "unlike terms." −3t and 5u do not have identical variable parts (different variables). They are "unlike terms." −4a3 and 3a3 have identical variable parts. They are "like terms." Exercise Are −3xy and 11xy like or unlike terms? Answer Like terms When using the distributive property, it makes no difference whether the multiplication is on the left or the right, one still distributes the multiplication times each term in the parentheses. Distributive Property If a, b, and c are integers, then a(b + c) = ab + ac and (b + c)a = ba + ca. In either case, you distribute a times each term of the sum. "Like terms" can be combined and simplified. The tool used for combining like terms is the distributive property. For example, consider the expression 3y + 7y, composed of two "like terms" with a common variable part. We can use the distributive property and write \[3y+7y=(3+7)onumber \] Note that we are using the distributive property in reverse, "factoring out" the common variable part of each term. Checking our work, note that if we redistribute the variable part y times each term in the parentheses, we are returned to the original expression 3y + 7y. Example 4 Use the distributive property to combine like terms (if possible) in each of the following expressions: (a) −5x2 − 9x2, (b) −5ab + 7ab, (c) 4y3 − 7y2, and (d) 3xy2 − 7xy2. Solution If the terms are "like terms," you can use the distributive property to "factor out" the common variable part. a) Factor out the common variable part x2. \[\begin{aligned} -5x^2 -9x^2 =(-5-9)x^2 ~ & \textcolor{red}{ \text{ Use the distributive property.}} \\ =-14x^2 ~ & \textcolor{red}{ \text{ Simplify: } -5-9=-5+(-9) = -14.} \end{aligned}onumber \] b) Factor out the common variable part ab. \[\begin{aligned} -5ab +7ab = (-5+7)ab ~ & \textcolor{red}{ \text{ Use the distributive property.}} \\ =2ab ~ & \textcolor{red}{ \text{ Simplify: } -5+7 = 2.} \end{aligned}onumber \] c) The terms in the expression 4y3 − 7y2 have different variable parts (the exponents are different). These are "unlike terms" and cannot be combined. d) Factor out the common variable part xy2. \[\begin{aligned} 3xy^2 - 7xy^2 =(3-7)xy^2 ~ & \textcolor{red}{ \text{ Use the distributive property.}} \\ =-4xy^2 ~ & \textcolor{red}{ \text{ Simplify: } 3-7=3+(-7)=-4.} \end{aligned}onumber \] Exercise Simplify: −8z − 11z Answer −19z Once you've written out all the steps for combining like terms, like those shown in Example 4, you can speed things up a bit by following this rule: Combining Like Terms To combine like terms, simply add their coefficients and keep the common variable part. Thus for example, when presented with the sum of two like terms, such as is 5x+ 8x, simply add the coefficients and repeat the common variable part; that is, 5x + 8x = 13x. Example 5 Combine like terms: −9y − 8y, −3y5 + 4y5 and −3u2 + 2u2. Solution a) Add the coefficients and repeat the common variable part. Therefore, \[−9y − 8y = −17y.onumber \] b) Add the coefficients and repeat the common variable part. Therefore, \[−3y^5 + 4y^5 = 1y^5.onumber \] However, note that 1y5 = y5. Following the rule that the final answer should use as few symbols as possible, a better answer is −3y5 + 4y5 = y5. c) Add the coefficients and repeat the common variable part. Therefore, \[−3u^2 + 2u^2 = (−1)u^2.onumber \] However, note that (−1)u2 = −u2. Following the rule that the final answer should use as few symbols as possible, a better answer is −3u2+ 2u2 = −u2. A frequently occurring instruction asks the reader to simplify an expression. Simplify The instruction simplify is a generic term that means "try to write the expression in its most compact form, using the fewest symbols possible." One way you can accomplish this goal is by combining like terms when they are present. Example 6 Simplify: 2x + 3y − 5x + 8y. Solution Use the commutative property to reorder terms and the associative and distributive properties to regroup and combine like terms. \[\begin{aligned} 2x + 3y - 5x + 8y = (2x - 5x) + (3y + 8y) ~ & \textcolor{red}{ \text{ Reorder and regroup.}} \\ = -3x + 11y ~ & \textcolor{red}{ \text{ Combine like terms:}} \\ ~ & \textcolor{red}{ 2x - 5x = -3x \text{ and } 3y + 8y = 11y.} \end{aligned}onumber \] Alternate solution Of course, you do not need to show the regrouping step. If you are more comfortable combining like terms in your head, you are free to present your work as follows: \[2x + 3y − 5x + 8y = −3x + 11y.onumber \] Exercise Simplify: −3a + 4b − 7a − 9b Answer −10a − 5b Example 7 Simplify: −2x − 3 − (3x + 4). Solution First, distribute the negative sign. \[\begin{aligned} -2x-3-(3x+4)= -2x-3-3x-4 ~ & \textcolor{red}{-(3x+4)=-3x-4.} \end{aligned}onumber \] Next, use the commutative property to reorder, then the associative property to regroup. Then combine like terms. \[\begin{aligned} =(-2x-3x)+(-3-4) ~ & \textcolor{red}{ \text{ Reorder and regroup.}} \\ =-5x+(-7) ~ & \textcolor{red}{ \text{ Combine like terms:}} \\ ~ & \textcolor{red}{ -2x-3x=-5x.} \\ =-5x-7 ~ & \textcolor{red}{ \text{ Simplify:}} \\ ~ & \textcolor{red}{-5x+(-7)=-5x-7.} \end{aligned}onumber \] Alternate solution You may skip the second step if you wish, simply combining like terms mentally. That is, it is entirely possible to order your work as follows: \[\begin{aligned} -2x-3-(3x+4) = -2x-3-3x-4 ~ & \textcolor{red}{ \text{ Distribute negative sign.}} \\ =-5x-7 ~ & \textcolor{red}{ \text{ Combine like terms.}} \end{aligned}onumber \] Exercise Simplify: −9a − 4 − (4a − 8) Answer −13a + 4 Example 8 Simplify: 2(5 − 3x) − 4(x + 3). Solution Use the distributive property to expand, then use the commutative and associative properties to group the like terms and combine them. \[\begin{aligned} 2(5-3x)-4(x+3) = 10-6x-4x-12 ~ & \textcolor{red}{ \text{ Use the distributive property.}} \\ =(-6x-4x)+(10-12) ~ & \textcolor{red}{ \text{ Group like terms.}} \\ =-10x-2 ~ & \textcolor{red}{ \text{ Combine like terms: }} \\ ~ & \textcolor{red}{-6x-4x=-10x \text{ and} \\ ~ & \textcolor{red}{10-12=-2.} \end{aligned}onumber \] Alternate solution You may skip the second step if you wish, simply combining like terms mentally. That is, it is entirely possible to order your work as follows: \[\begin{aligned} 2(5-3x)-4(x+3) = 10-6x-4x-12 ~ & \textcolor{red}{ \text{ Distribute.}} \\ =-10x-2 ~& \textcolor{red}{ \text{ Combine like terms.}} \end{aligned}onumber \] Exercise Simplify: −2(3a − 4) − 2(5 − a) Answer −4a − 2 Example 9 Simplify: −8(3x2y − 9xy) − 8(−7x2 − 8xy) Solution We will proceed a bit quicker with this solution, using the distributive property to expand, then combining like terms mentally. \[\begin{aligned} -8(3x^2y-9xy) -8(-7x^2y-8xy)=-24x^2y+72xy+56x^2y+64xy \\ = 32x^2y+136xy \end{aligned}onumber \] Exercise Simplify: (a2 − 2ab) − 2(3ab + a2) Answer −a2 − 8ab Combine like terms and simplify. 1. 17xy2 + 18xy2 + 20xy2 2. 12r − 12r 3. 16s − 5s 4. −5q + 7q 5. r − 13r − 7r 6. 19m + m + 15m 7. 13x2y + 2x2y 8. −8 + 17n + 10 + 8n 9. −2x3 − 19x2y − 15x2y + 11x3 10. −13 + 16m + m + 16 11. 9n + 10 + 7 + 15n 12. 3y +1+6y + 3 13. 3(−4x2 + 10y2) + 10(4y2 − x2) 14. −10q − 10 − (−3q + 5) 15. 7(8y + 7) − 6(8 − 7y) 16. −2(6 + 4n) + 4(−n − 7) 17. 8 − (4 + 8y) 18. 7(1 + 7r) + 2(4 − 5r) 19. −2(−5 − 8x2) − 6(6) 1. 55xy2 2. 0 3. 11s 4. 2q 5. −19r 6. 35m 7. 15x2y 8. 2 + 25n 9. 9x3 − 34x2y 10. 3 + 17m 11. 24n + 17 12. 9y + 4 13. −22x2 + 70y2 14. −7q − 15 15. 98y + 1 16. −40 − 12n 17. 4 − 8y 18. 15 + 39r 19. −26 + 16x2 Now is your chance to learn how to use the distributive property and combining like terms in order to solve more complex equations. It seems pretty easy to learn all of these skills in isolation, but using them together to solve one problem is the key in Algebra 1. So, how does this work? Here are a few steps to take when you come across an algebra equation that looks a little more challenging.Steps for Solving Algebra Equations If you see parenthesis, with more than one term inside, then distribute first!Rewrite your equations with like terms together. Take the sign in front of each term.Combine like terms.Continue solving the one or two-step equation. Let's look at a couple of examples to clarify those steps for you.This first example is a pretty basic equation that involves the distributive property. Take note of how I distribute first before applying the rules for solving equations. Example 1: Using the Distributive Property That example was pretty easy, I know! Let's look at one that requires a few more steps.This next example looks more confusing because the distributive property comes right in the middle of the equation. You still must distribute first and then combine like terms before solving the equation.