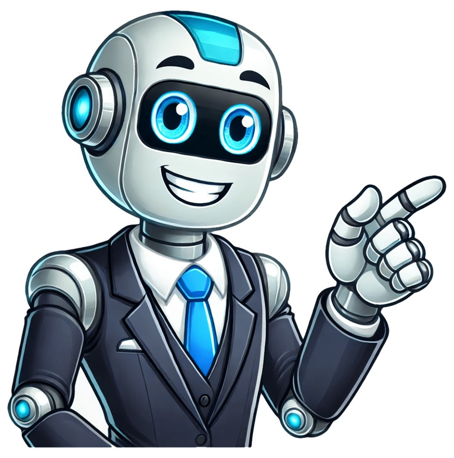

Rules of math equations

Algebra is the field of mathematics which deals with representation of a situation using mathematical symbols, variables and arithmetic operations like addition, subtraction, multiplication and division leading to the formation of relevant mathematical expressions. In this lesson we will go through all the rules of algebra, operations and formulas. Algebra Basics We need to know the basic terminology which relates to algebra in order to understand its basics. An expression consisting of 4 main parts, variables, operators, exponents, coefficients and constants along with an equal to symbol is known as an algebraic equation. Let us take an equation, ax2 + bx + c = d. In algebra, the term with highest exponent is written in the starting and further the terms are written with reducing powers. In the above image ax2 + bx + c = d, there are 4 terms. An algebraic equation may have different terms which are like or unlike. Like terms in an equation are the ones which constitute same variables and exponents. On the other hand, unlike terms in an equation constitute different variables and exponents. Algebra Rules There are five basic rules of algebra. They are: Commutative Rule of Addition Commutative Rule of Multiplication Associative Rule of Addition Associative Rule of Multiplication Distributive Rule of Multiplication Commutative Rule of Addition In algebra, the commutative rule of addition states that when two terms are added, the order of addition does not matter. The equation for the same is written as, (a + b) = (b + a). For example, (x3 + 2x) = (2x + x3) Commutative Rule of Multiplication The commutative rule of multiplication states that when two terms are multiplied, the order of multiplication does not matter. The equation for the same is written as, (a × b) = (b × a). For example, (x4 - 2x) × 3x = 3x × (x4 - 2x). LHS = (x4 - 2x) × 3x = (3x5 - 6x2) RHS = 3x × (x4 - 2x) = (3x5 - 6x2) Here, LHS = RHS, this proves that their values are equal. Associative Rule of Addition In algebra, the associative rule of addition states that when three or more terms are added, the order of addition does not matter. The equation for the same is written as, a + (b + c) = (a + b) + c. For example, x5 + (3x2 + 2) = (x5 + 3x2) + 2 Associative Rule of Multiplication Similarly, the associative rule of multiplication states that when three or more terms are multiplied, the order of multiplication does not matter. The equation for the same is written as, a × (b × c) = (a × b) × c. For example, x3 × (2x4 × x) = (x3 × 2x4) × x. Distributive Rule of Multiplication The distributive rule of multiplication states that when we multiply a number to addition of two numbers, it results in the output which is same as the sum of their products with the number individually. This is distribution of multiplication over addition. The equation for the same is written as, a × (b + c) = (a × b) + (a × c). For example, x2 × (2x + 1) = (x2 × 2x) + (x2× 1). Algebraic Operations The four basic algebraic operations are: Addition Subtraction Multiplication Division In each of the algebraic operations performed, we always categorize the terms in our algebraic equations as like and unlike terms. Addition When two or more terms in an algebraic equation are separated by a plus sign "+", the algebraic operation is addition. We always add the like terms and unlike terms separately as they are treated as two different quantities. Mathematically two different quantities cannot be added together. Example of like terms addition: 5b + 3b = 8b Example of unlike terms addition: 25x + 35y As we can see in the examples, the like terms when added give the same term while the unlike terms cannot be added any further. Subtraction When two or more terms in any algebraic equation are separated by a minus sign "-", the algebraic operation is subtraction. Just as in case of addition, the terms are differentiated as like or unlike terms and then subtracted further. Example of like terms subtraction: 3x2 - x2 = 2x2 Example of unlike terms subtraction: 6bc - 9ab Multiplication When two or more terms in an algebraic equation are separated by a multiplication sign "×", the algebraic operation performed is multiplication. While multiplying the like terms or unlike terms we use Laws of Exponents. Example of like terms multiplication: 16f × 4f = 64f2 Example of unlike terms multiplication: x × y3 = xy3 Division When two or more terms in any algebraic equation are separated by a division sign "/", the algebraic operation performed is division. While dividing the like terms, the similar terms can be simplified while for the case of unlike terms, the terms cannot be simplified any further easily. Example of like terms division: 8b/2b = 4 Examples of unlike terms division: x2/2y2 Algebraic Formulas The algebraic formulas that are used more often and must be kept in knowledge are: Topics Related to Basics of Algebra FAQs on Basics of Algebra The basic rules in algebra are: Commutative Rule of Addition Commutative Rule of Multiplication Associative Rule of Addition Associative Rule of Multiplication Distributive Rule of Multiplication What is the Golden Rule in Algebra? The golden rule in algebra is to keep both sides of the equation balanced, i.e; whatever operation is being used on one side of equation, the same will be used on the other side too. What are the Four Algebraic Operations? Addition Subtraction Multiplication Division How Do You Add and Subtract Like Terms? When like terms are added or subtracted, the coefficients are added or subtracted and written before the like terms. Can We Add or Subtract Two Unlike Terms? No, we cannot add or subtract two unlike terms. Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. Order of Operations: Introduction, Rules, and Examples. In mathematics, order of operations is very important and used widely in order to get the correct result. The order of operations is important because it guarantees that all people can read and calculate a problem in the same way. To avoid the wrong result, we use the order of operations. It is the rule that tells the correct sequence of steps for calculating a math expression. In order to remember this order, we use PEMDAS which stands for Parenthesis, Exponent, Multiplication, Division, Addition, and Subtraction. In other words, you must start calculating in any math problem by Parenthesis first, then the exponent, then multiplication and division from left to right, then addition and subtraction from left to right. If there is more than one same operation in a problem solve the leftmost one first, then work right. We can also a complex math problem in which math expression is used by an online PEMDAS Calculator.PEMDAS is used in the United States, teachers use PEMDAS to remember the order of operations. In Asia, teachers use BODMAS to remember the order of operations. BODMAS stands for Brackets, Order, Division/Multiplication, Addition, and Subtraction.Order of operations follows some rules. Let us discuss them briefly.In order of operations, always start with operations contained within parenthesis. Parenthesis is used to group part of an expression. If there is more than one set of parentheses, first solve the leftmost and then right one. Parenthesis are denoted by small brackets ().Example 1Solve the parentheses of 4/2 * 3 + (4 + 8) – 23 + (3×6).Solution Step 1: solve the leftmost parenthesis first. 4/2 * 3 + (4 + 8) – 23 + (3×6)4/2 * 3 + (12) – 23 + (3×6)4/2 * 3 + 12 – 23 + (3×6)Step 2: Now solve the next parenthesis.4/2 * 3 + 12 – 23 + (18)4/2 * 3 + 12 – 23 + 18Example 2Solve the parentheses of 7/3 * 3 + (14 – 8) – 3 + (14/2).Solution Step 1: solve the leftmost parenthesis first.7/3 * 3 + (14 – 8) – 3 + (14/2)7/3 * 3 + (6) – 3 + (14/2)Step 2: Now solve the next parenthesis.7/3 * 3 + 6 – 3 + (14/2)7/3 * 3 + 6 – 3 + (7)7/3 * 3 + 6 – 3 + 7After parentheses, calculate any exponents present in the expression. Exponents are a way of multiplying a number by itself in power times e.g., 34 is 3 multiplied by itself four times, so you would solve it by multiplying 3*3*3*3. If there is more than one exponent present in that expression solve the leftmost first then the right one. If there is no exponent in an expression ignore E in the PEMDAS and move to the next step.Example 1Solve the exponent of 4/23 * 3 + 4 + 8 – 32.Solution Step 1: solve the leftmost exponent first.4/23 * 3 + 4 + 8 – 32 4/(2x2x2) * 3 + 4 + 8 – 32 4/8 * 3 + 4 + 8 – 32 Step 2: Now solve the next exponent.4/8 * 3 + 4 + 8 – 3×3 4/8 * 3 + 4 + 8 – 9 Example 2Solve the exponent of 72/3 * 3 + 14 – 82 – 3 + 14/2.Solution Step 1: solve the leftmost exponent first.72/3 * 3 + 14 – 82 – 3 + 14/27×7/3 * 3 + 14 – 82 – 3 + 14/249/3 * 3 + 14 – 82 – 3 + 14/2Step 2: Now solve the next exponent.49/3 * 3 + 14 – 82 – 3 + 14/249/3 * 3 + 14 – 8×8 – 3 + 14/249/3 * 3 + 14 – 16 – 3 + 14/2After parenthesis and exponent in order of operations move on and look for any multiplication and division. Remember, the division does not necessarily come before multiplication, these operations are solved from left to right.Example 1Solve the multiplication and division of 4/2 * 3 + 4 + 8 – 9/3.Solution Step 1: Start from the left and divide the leftmost fraction.4/2 * 3 + 4 + 8 – 9/32 * 3 + 4 + 8 – 9/3Step 2: Now multiply.2 * 3 + 4 + 8 – 9/36 + 4 + 8 – 9/3Step 3: Now move to the right and check for any operation related to multiplication or division.6 + 4 + 8 – 9/36 + 4 + 8 – 3Example 2Solve the multiplication and division of 27/3 * 3 + 14 – 8 – 3 + 2 x 14/2.Solution Step 1: Start from the left and divide the leftmost fraction.27/3 * 3 + 14 – 8 – 3 + 2 x 14/29* 3 + 14 – 8 – 3 + 2 x 14/2Step 2: Now multiply.9 * 3 + 14 – 8 – 3 + 2 x 14/227 + 14 – 8 – 3 + 2 x 14/2Step 3: Now move to the right and check for any operation related to multiplication or division.27 + 14 – 8 – 3 + 2 x 14/227 + 14 – 8 – 3 + 28/2Step 4: Now divide.27 + 14 – 8 – 3 + 28/227 + 14 – 8 – 3 + 14After calculating parenthesis, exponent, multiplication, and division, our problem becomes very simple to solve as there is only addition and subtraction in the expression. Just like multiplication and division, we will add and subtract from left to right.Example 1Solve the addition and subtraction of 6 + 4 + 8 – 3.Solution Step 1: Start from the left and add the leftmost term.6 + 4 + 8 – 310 + 8 – 3Step 2: Now add again.10 + 8 – 318 – 3Step 3: Now only one term remaining, subtract it.18 – 315Example 2Solve the addition and subtraction of 27 + 14 – 8 – 3 + 14.Solution Step 1: Start from the left and add the leftmost term.27 + 14 – 8 – 3 + 1441 – 8 – 3 + 14Step 2: Now subtract.41 – 8 – 3 + 1433 – 3 + 14Step 3: Now subtract again33 – 3 + 1430 + 14Step 4: Now only one term remaining, add it.30 + 1444To calculate the order of operations, follow four steps.Solve parenthesis.Solve the exponent.Solve multiplication and division.Solve addition and subtraction.Let us take some examples in order to understand how to calculate any math expression according to the order of operation. Order of operations calculator is very essential for the accurate results of such problems.Example 1Evaluate 4/2 * 3 + (4 + 8) –32+ (3×6).Solution Step 1: Solve the parentheses.4/2 * 3 + (4 + 8) –32+ (3×6)4/2 * 3 + (12) –32+ (3×6)4/2 * 3 + 12–32+ (3×6)4/2 * 3 + 12 – 32+ (18)4/2 * 3 + 12 – 32+ 18Step 2: Solve the exponent.4/2 * 3 + 12 – 32+ 184/2 * 3 + 12 – 3×3+ 184/2 * 3 + 12 – 9 + 18Step 3: Solve the multiplication and division from left to right.4/2 * 3 + 12 – 9 + 182 * 3 + 12 – 9 + 186 + 12 – 9 + 18Step 4: Solve the addition and subtraction from left to right.6 + 12 – 9 + 1818 – 9 + 189 + 1827Example 2Evaluate 7/14 * 2 + (4 – 8) –62+ (13×2).Solution Step 1: Solve the parentheses.7/14 * 2 + (4 – 8) –62+ (13×2)7/14 * 2 + (-4) –62+ (13×2)7/14 * 2 – 4 – 62+ (13×2)7/14 * 2 – 4 –62+ (26)7/14 * 2 – 4 –62+ 26Step 2: Solve the exponent.7/14 * 2 – 4 –62+ 267/14 * 2 – 4 – 6×6 + 267/14 * 2 – 4 – 36 + 26Step 3: Solve the multiplication and division from left to right.7/14 * 2 – 4 – 36 + 260.5 * 2 – 4 – 36 + 261 – 4 – 36 + 26Step 4: Solve the addition and subtraction from left to right.1 – 4 – 36 + 26-3 – 36 + 26-39 + 26-13Order of OperationsOrder of fraction is used to avoid the wrong calculation. It uses PEMDAS (Parenthesis, Exponent, multiplication and Division, Addition and Subtraction) to order the expression. In other words, you must start calculating in any math problem by Parenthesis first, then the exponent, then multiplication and division from left to right, then addition and subtraction from left to right. This topic is not difficult. Once you grab the basic knowledge about this topic you will easily solve any problem related to the order of operations.Read More Articles "Operation Management Archives" The order of operations is a specific order or a set of rules, agreed upon by mathematicians, one must follow when performing arithmetic operations to simplify expressions. Quiz completed 0 times Here is the order for doing operations that you need to follow in the order given below to avoid having different answers when simplifying expressions. If grouping symbols are used such as parentheses, braces, or curly brackets, perform the operations inside the grouping symbols first. Then, proceed with exponents, and so forth... 1. Simplify any expression within parentheses, brackets or grouping symbols: ( ) [ ] { }2. Simplify powers or expressions involving exponents: 42, 25, or 533. Multiply and divide in order from left to right: × and ÷4. Add and subtract in order from left to right: + and - Order of operations problems Study the example in the figure below carefully so that you understand how to use the order of operations! More examples showing how to use the order of operations Example #1: 42 - 6 × 2 ÷ 4 × 3 + 5Do exponent:16 - 6 × 2 ÷ 4 × 3 + 5Multiply and divide from left to right16 - 12 ÷ 4 × 3 + 516 - 3 × 3 + 516 - 9 + 5Add and subtract from left to right16 - 9 + 57 + 512 Example #2: (2 + 52) + 4 × 3 - 10Do parenthesis:(2 + 25) + 4 × 3 - 1027 + 4 × 3 - 10Do multiplication27 + 12 - 10Add39 - 10Subtract29Example #3:10 - 14 ÷ 2 = 10 - 7 = 3 (Division comes before subtraction) Remember that if you see multiplication and division at the same time, perform the operation from left to right. Example #4:4 + 5 ÷ 5 × 6 = 4 + 1 × 6 = 4 + 6 =10 How to remember the order of operations The following acronyms can make it easier for you to remember the order of operations. PEMDAS (used mostly in the United States of America and also in France) BODMAS (used mostly in UK, Australia, and India) BEDMAS (used in Canada and New Zealand) The following mnemonic may help you remember the PEMDAS rule:PEMDAS (Please Excuse My Dear Aunt Sally)The P stands for parenthesesThe E stands for exponentsThe M stands for multiplyThe D stands for divisionThe S stands for subtraction Even though M comes before D in PEMDAS, the two operations have the same precedence. Same precedence means that multiplication is not more important than division. By the same token, even though A comes before S, the two operations have the same precedence. Addition is not more important than subtraction. A much better way, in my opinion, to write PEMDAS is P-E-MD-AS.In P-E-MD-AS, operations with the same precedence have no hyphens between them. For example, since addition and subtraction have the same precedence, there is no need to put a hyphen between them. However, P and E have a hyphen between them because P has a higher precedence than E. All the four letters in MDAS, DMAS, DMAS, and DMAS refer to multiplication, division, addition, and subtraction. In BODMAS rule, the B stands for bracket and the O stands for order. Order can be powers or roots.In BEDMAS rule, the B stands for bracket and the E stands for exponents.In BIDMAS rule, the B stands for bracket and the I stands for indices. Indices are powers such as 62 Keep in mind also that PEMDAS, BODMAS, BEDMAS, and BIDMAS are all correct ways to perform the order operations. None of them is better than the other. These are just names that are used, based on the country, to make it easier to remember the rules. Example #5:Simplify √4 + 1 + {2 - [(6 - 2) × 5] + 13}.Work first with the innermost set of parentheses or (6 - 2).√4 + 1 + {2 + [(6 - 2) × 5] + 13} = √4 + 1 + {2 - [4 × 5] + 13}Next, work again first with the inner set of parentheses or [4 × 5].√4 + 1 + {2 + [(6 - 2) × 5] + 13} = √4 + 1 + {2 - 20 + 13}Stay inside the parentheses until you are done. While working inside the parentheses, notice that you need to add and subtract in order from left to right.√4 + 1 + {2 + [(6 - 2) × 5] + 13} = √4 + 1 + {-18 + 13}√4 + 1 + {2 + [(6 - 2) × 5] + 13} = √4 + 1 + -5According to BODMAS rule, you need to do root first.√4 + 1 + {2 + [(6 - 2) × 5] + 13} = 2 + 1 + -5Add and subtract again in order from left to right√4 + 1 + {2 + [(6 - 2) × 5] + 13} = 3 + -5√4 + 1 + {2 + [(6 - 2) × 5] + 13} = -2The final answer is -2 A real-life example of PEMDAS The order of operations is a very important skill to have since you use it every day even if you are not aware of this. Say for instance,you go to the supermarket. Suppose peanuts cost $3.00 per pound and a bottle of water is 1 dollar. You get yourself 2 pounds of peanuts and 1 bottle of water. How much money do you pay? Since 1 pound of peanuts is 3 dollars and you bought 2 pounds, peanuts cost 6 dollars. Add that to the amount you pay for the water(1 dollar), you paid a total of 7 dollars. You may have figured this out without any major problems. However, if I present you with the following equation, which is a model of the problem above, you might have a tendency to add 3 to 1 and multiply the result by 2. That will be the incorrect way to do it! 2 × 3 + 1 Doing this will give 8 and it is not equal to 7. The correct way is to do multiplication first and then add the product to 1. S k i l l i n A L G E B R A Table of Contents | Home 6 OF The rule of symmetry The commutative rules The inverse of adding Two rules for equations ALGEBRA, we can say, is a body of formal rules. They are rules that show how something written one form may be rewritten in another form. For what is a calculation if not replacing one set of symbols into another? In arithmetic we replace '2 + 2' with '4.' In algebra, we may replace 'a + (−b)' with 'a − b.' a + (−b) = a − b. We call that a formal rule. The = sign means "may be rewritten as" or "may be replaced by." Here are some of the basic rules of algebra: 1· a   = a.   (1 times any number does not change it. Therefore 1 is called the identity of multiplication.)   (−1)a   = −a.   −(−a)   = a.   (Lesson 2)   a + (−b)   = a − b.   (Lesson 3)   a − (−b)   = a + b.   (Lesson 3)   Associated with these -- and with any rule -- is the rule of symmetry: For one thing, this means that a rule of algebra goes both ways. Since we may write p + (−q) = p − q   -- that is, in a calculation we may replace p + (−q) with p − q -- then, symmetrically: p − q = p + (−q). We may replace p − q with p + (−q). The rule of symmetry also means that in any equation, we may exchange the sides. If   15 = 2x + 7,   then we are allowed to write   2x + 7 = 15. And so the rules of algebra tell us what we are allowed to write. They tell us what is legal. Problem 1.   Use the rule of symmetry to rewrite each of the following. And note that the symmetric version is also a rule of algebra. To see the answer, pass your mouse over the colored area. To cover the answer again, click "Refresh" ("Reload").Do the problem yourself first!   a)   1· x = x x = 1· x   b)   (−1)x = −x −x = (−1)x   c)   x + 0 = x x = x + 0   d)   10 = 3x + 1 3x + 1 = 10   e)   xy = axay   axay = xy   f)   x + (−y) = x − y x − y = x + (−y)   g)   a2 +   b2   =   a + b   2   a + b   2 = a2 + b2 The commutative rules The order of terms does not matter. We express this in algebra by writing That is called the commutative rule of addition. It will apply to any number of terms. a + b − c + d = b + d + a − c = −c + a + d + b. The order does not matter. Example 1.   Apply the commutative rule to p − q. Solution.   The commutative rule for addition is stated for the operation + . Here, though, we have the operation − . But we can write p − q   =   p + (−q).   Therefore,   p − q   =   −q + p. * Here is the commutative rule of multiplication: The order of factors does not matter. abcd = dbac = cdba. The rule applies to any number of factors. What is more, we may associate factors in any way: (abc)d = b(dac) = (ca)(db). And so on. Example 2.   Multiply 2x· 3y· 5z. Solution.   The problem means: Multiply the numbers, and rewrite the letters. 2x· 3y· 5z = 2· 3· 5xyz = 30xyz. It is the style in algebra to write the numerical factor to the left of the literal factors. Problem 2.   Multiply.   a)   3x· 5y = 15xy   b)   7p· 6q = 42pq   c)   3a· 4b· 5c = 60abc Problem 3.   Rewrite each expression by applying a commutative rule.   a)   −p + q = q + (−p) = q − p   b)   (−1)6 = 6(−1)   c)   (x − 2) + (x + 1) = (x + 1) + (x − 2)   d)   (x − 2)(x + 1) = (x + 1)(x − 2) Zero We have seen the following rule for 0 (Lesson 3): For any number a: 0 added to any number does not change the number. 0 is therefore called the identity of addition. The inverse of adding The inverse of an operation undoes that operation. If we start with 5, for example, and then add 4, 5 + 4, then to undo that -- to get back to 5 -- we must add −4: 5 + 4 + (−4) = 5 + 0 = 5. Adding −4 is the inverse of adding 4, and vice-versa. We say that −4 is the additive inverse of 4. In general, corresponding to every number a there is a unique number −a, such that A number combined with its inverse gives the identity. We have seen that that rule is essentially the definition of −a. Thus, the additive inverse of a is −a. And the additive inverse of −a is a. −(−a) = a. Problem 4.   Transform each of the following according to a rule of algebra.   a)   xyz + 0 = xyz   b)   0 + (−q) = −q   c)   −¼ + 0 = −¼   d)   ½ + (−½) = 0   e)   −pqr + pqr = 0   f)   x + abc −abc = x g)   sin x + cos x + (−cos x) = sin x The student might think that this is trigonometry, but it is not. It is g)   algebra Problem 5   .   Complete the following.   a)   pq + (−pq) = 0   b)   z + (−z) = 0   c)   −&2$ + &2$ = 0   d)   ½x + 0 = ½x   e)   0 + (−qr) = −qr   f)   −π + 0 = −π g)   tan x + cot x + (−cot x) = tan x. Two rules for equations An equation is a statement that two things -- the two sides -- are equal. Inherent in the meaning of equal is the fact that, as long as we do the same thing to both, they will still be equal. That is expressed in the following two rules. Rule 1.   If   a = b,   then   a + c = b + c. The rule means: We may add the same number to both sides of an equation. This is the algebraic version of the axiom of arithmetic and geometry: If equals are added to equals, the sums are equal.   Example 3.   If   x − 2 = 6,   then   x = 6 + 2   = 8 -- upon adding 2 to both sides.   Example 4.   If   x + 2 = 6,   then   x = 6 − 2   = 4 -- upon subtracting 2 from both sides. But the rule is stated in terms of addition. Why may we subtract? Because subtraction is equivalent to addition of the negative. a − b = a + (−b). Therefore, any rule for addition is also a rule for subtraction. Note: In Example 3, adding 2 is the inverse of subtracting 2. And the effect is to transpose −2 to the other side of the equation as +2. In Example 4, the effect of subtracting 2 from both sides is to transpose +2 to the other side of the equation as −2. We will go into this more in Lesson 9. Problem 6.   a)   If   b)   If   x − 1 = 5,   x + 1 = 5, then then   x = 6. x = 4.   On adding 1 to both sides. On subtracting 1 from both sides.   c)   If   d) If   x − 4 = −6,   x + 4 = −6,   then then   x = −2. x = −10.   On adding 4 to both sides. On subtracting 4 from both sides. Rule 2.   If   a = b,   then   ca = cb. This rule means: We may multiply both sides of an equation by the same number. Example 5.   If Now, what happened to 2x to make it 10x ? We multiplied it by 5. Therefore, to preserve the equality, we must multiply 3 by 5, also. 10x = 15. Example 6.   If Here, we multiplied both sides by 2, and the 2's simply cancel. See Lesson 26 of Arithmetic, Example 5. Example 7.   If Here, we divided both sides by 2. But the rule states that we may multiply both sides. Why may we divide? Because division is equal to multiplication by the reciprocal. In this example, we could say that we multiplied both sides by ½. Any rule for multiplication, then, is also a rule for division. Problem 7.   a) If   b) If   x = 5,   x = −7,   then then   2x = 10. −4x   = 28.   c) If   d) If   x3 = 2,   x4 = −2   then then x = 6. x = −8.   On multiplying both sides by 3. On multiplying both sides by 4.   Problem 8.   Divide both sides.   a)   If   b) If   3x = 12,   −2x = 14,   then then   x = 4. x = −7.   On dividing both sides by 3. On dividing both sides by −2.   c)   If   d) If   6x = 5,   −3x = −6,   then then   x = 56 x = 2. Problem 9. Changing signs on both sides. Write the line that results from multiplying both sides by −1.   a)   −x = 5.   b)   −x = −5.   c)   −x = 0.   x = −5.   x = 5.   x = −0 = 0.   This problem illustrates the following theorem: In any equation we may change the signs on both sides. This follows directly from the uniqueness of the additive inverse. If   −a = b,   then   a + b = 0. We list the basic rules and properties of algebra and give examples on how they may be used. Let \(a\), \(b \) and \(c \) be real numbers, variables or algebraic expressions. 1. Commutative Property of Addition. \[a + b = b + a \] Examples: 1. real numbers \[2 + 3 = 3 + 2 \] 2. algebraic expressions \[x^2 + x = x + x^2 \] 2. Commutative Property of Multiplication. \[a \times b = b \times a \] Examples: 1. Real numbers: \[5 \times 7 = 7 \times 5 \] 2. Algebraic expressions: \[(x^3 - 2) \times x = x \times (x^3 - 2) \] 3. Associative Property of Addition. \[(a + b) + c = a + (b + c) \] Examples: 1. real numbers \[(2 + 3) + 6 = 2 + (3 + 6) \] 2. algebraic expressions \[(x^3 + 2x) + x = x^3 + (2x + x) \] 4. Associative Property of Multiplication. \[(a \times b) \times c = a \times (b \times c) \] Examples: 1. Real numbers \[(7 \times 3) \times 10 = 7 \times (3 \times 10) \] 2. Algebraic expressions \[(x^2 \times 5x) \times x = x^2 \times (5x \times x) \] 5. Distributive Properties of Addition and Multiplication. \[a \times (b + c) = a \times b + a \times c \] and \[(a + b) \times c = a \times c + b \times c \] Examples: 1. Real numbers \[2 \times (2 + 8) = 2 \times 2 + 2 \times 8 \] \[(2 + 8) \times 10 = 2 \times 10 + 8 \times 10 \] 2. Algebraic expressions \[x \times (x^4 + x) = x \times x^4 + x \times x \] \[(x^4 + x) \times x^2 = x^4 \times x^2 + x \times x^2 \] 6. The reciprocal of a non zero The reciprocal of a real number \(a\) is \[\frac{1}{a}\]. and \[a \times \left(\frac{1}{a}\right) = 1\] Examples: The reciprocal of \(5 \) is \[\frac{1}{5}\] and \[5 \times \left(\frac{1}{5}\right) = 1\]. 7. The additive inverse of a number The additive inverse of \(a \) is \[- a \] and \[a + (- a) = 0 \] Examples: additive inverse of \(-6 \) is \[-(-6) = 6 \] and \[- 6 + (6) = 0 \] 8. The additive identity The additive identity is \[0 \]. and \[a + 0 = 0 + a = a \] 9. The multiplicative identity The multiplicative identity is \[1 \]. and \[a \times 1 = 1\times a = a \] More pages related to