I'm not a bot

If an exponent of a number is a fraction, it is called a fractional exponent. Exponents show the number of times a number is replicated in multiplication. For example, 42 = 44 = 16. Here, exponent 2 is a whole number. In the number, say x1/y, x is the base and 1/y is the fractional exponent.In this article, we will discuss the concept of fractional exponents, and their rules, and learn how to solve them. We shall also explore negative fractional exponents and solve various examples for a better understanding of the concept. What are Fractional Exponents? Fractional exponents are ways to represent powers and roots together. In any general exponential expression of the form ab, a is the base and b is the exponent. When b is given in the fractional form, it is known as a fractional exponent. A few examples of fractional exponents are 21/2, 32/3, etc. The general form of a fractional exponent is xm/n, where x is the base and m/n is the exponent.Look at the figure given below to understand how fractional exponents are represented.Some examples of fractional exponents that are widely used are given below:ExponentName of the exponentIndication1/2Square roota1/2 = a1/3Cube roota1/3 = 3a1/4Fourth roota1/4 = 4aFractional Exponents Rules There are certain rules to be followed that help us to multiply or divide numbers with fractional exponents easily. Many people are familiar with whole-number exponents, but when it comes to fractional exponents, they end up doing mistakes that can be avoided if we follow these rules of fractional exponents.Rule 1: a1/m a1/n = a(1/m + 1/n)Rule 2: a1/m a1/n = a(1/m - 1/n)Rule 3: a1/m b1/m = (ab)1/mRule 4: a1/m b1/m = (ab)1/mRule 5: a-m/n = (1/a)m/nThese rules are very helpful while simplifying fractional exponents. Let us now learn how to simplify fractional exponents.Simplifying Fractional Exponents Simplifying fractional exponents can be understood in two ways which are multiplication and division. It involves reducing the expression or the exponent to a reduced form that is easy to understand. For example, 91/2 can be reduced to 3. Let us understand the simplification of fractional exponents with the help of some examples.1) Solve 38 = 81/3We know that 8 can be expressed as a cube of 2 which is given as, 8 = 23. Substituting the value of 8 in the given example we get, (23)1/3 = 2 since the product of the exponents gives 31/3=1. 38=81/3=2.2) Simplify (64/125)2/3In this example, both the base and the exponent are in fractional form. 64 can be expressed as a cube of 4 and 125 can be expressed as a cube of 5. They are given as, 64=43 and 125=53. Substituting their values in the given example we get, (43/53)2/3. 3 is a common power for both the numbers, hence (43/53)2/3 can be written as ((4/5)3)2/3, which is equal to (4/5)2 as 32/3=2. Now, we have (4/5)2, which is equal to 16/25. Therefore, (64/125)2/3 = 16/25.Multiply Fractional Exponents With the Same BaseTo multiply fractional exponents with the same base, we have to add the exponents and write the sum on the common base. The general rule for multiplying exponents with the same base is a1/m a1/n = a(1/m + 1/n). For example, to multiply 22/3 and 23/4, we have to add the exponents first. So, 2/3 + 3/4 = 17/12. Therefore, 22/3 23/4 = 217/12.How to Divide Fractional Exponents?The division of fractional exponents can be classified into two types.Division of fractional exponents with different powers but the same basesDivision of fractional exponents with the same powers but different basesWhen we divide fractional exponents with different powers but the same bases, we express it as a1/m a1/n = a(1/m - 1/n). Here, we have to subtract the powers and write the difference on the common base. For example, 53/4 51/2 = 5(3/4-1/2), which is equal to 51/4.When we divide fractional exponents with the same powers but different bases, we express it as a1/m b1/m = (ab)1/m. Here, we are dividing the bases in the given sequence and writing the common power on it. For example, 95/6 35/6 = (9/3)5/6, which is equal to 35/6.Negative Fractional Exponents Negative fractional exponents are the same as rational exponents. In this case, along with a fractional exponent, there is a negative sign attached to the power. For example, 2-1/2. To solve negative exponents, we have to apply exponents rules that say a-m = 1/am. It means before simplifying an expression further, the first step is to take the reciprocal of the base to the given power without the negative sign. The general rule for negative fractional exponents is a-m/n = (1/a)m/n.For example, let us simplify 343-1/3. Here the base is 343 and the power is -1/3. The first step is to take the reciprocal of the base, which is 1/343, and remove the negative sign from the power. Now, we have (1/343)1/3. As we know that 343 is the third power of 7 as 73 = 343, we can re-write the expression as 1/(73)1/3. Since 3 and 1/3 cancel each other, the final answer is 1/7.Related Articles Example 1: Evaluate 181/2 21/2.Solution: In this question, fractional exponents are given. The powers are the same but the bases are different. Hence, we can solve this problem as, 181/2 21/2 = (18/2)1/2 = 91/2 = 3. Therefore, 3 is the required answer.Example 2: Solve the given expression involving the multiplication of terms with fractional exponents.21/2 41/4 81/8Solution: 4 can be expressed as a square of 2, i.e. 4 = 22. So, 41/4 can be written as (22)1/4. It is equal to 21/2. Now, 8 can be expressed as a cube of 2, i.e. 8 = 23. So, 81/8 can be written as (23)1/8. It is equal to 23/8. Therefore, the given expression can be re-written as,21/2 21/2 23/8Multiplication of fractional exponents with the same base is done by adding the powers and writing the sum on the common base. 2(1/2 + 1/2 + 3/8)= 211/8Therefore, 21/2 41/4 81/8 = 211/8.Example 3: Evaluate 32/3 91/2Solution: To solve this, we will reduce 91/2 to the simplest form. So, we have91/2 = (32)1/2= 332/3 91/2 = 32/3 31= 32/3 - 1= 3-1/3View Answer >go to slidego to slidego to slideHave questions on basic mathematical concepts?Become a problem-solving champ using logic, not rules. Learn the why behind math with our certified expertsBook a Free Trial ClassFAQs on Fractional Exponents Fractional exponents mean the power of a number is in terms of fraction rather than an integer. For example, in am/n the base is 'a' and the power is m/n which is a fraction.What is the Rule for Fractional Exponents?In the case of fractional exponents, the numerator is the power and the denominator is the root. This is the general rule of fractional exponents. We can write xm/n as n(xm).What To Do With Negative Fractional Exponents?If the exponent is given in negative, it means we have to take the reciprocal of the base and remove the negative sign from the power. For example, 2-1/2 = (1/2)1/2.How To Solve Fractional Exponents?To solve fractional exponents, we use the laws of exponents or the exponent rules. The fractional exponents' rules are stated below:Rule 1: a1/m a1/n = a(1/m + 1/n)Rule 2: a1/m a1/n = a(1/m - 1/n)Rule 3: a1/m b1/m = (ab)1/mRule 4: a1/m b1/m = (ab)1/mRule 5: a-m/n = (1/a)m/nHow To Add Fractional Exponents?There is no rule for the addition of fractional exponents. We can add them only by simplifying the powers, if possible. For example, 91/2 + 1251/3 = 3 + 5 = 8.How To Divide Fractional Exponents?Division of fractional exponents with the same base and different powers is done by subtracting the powers, and the division with different bases and same powers is done by dividing the bases first and writing the common power on the answer.Square roots are often represented using radical signs, like this \[\sqrt{9}\]. But, there is another way of representing this. You can use a fractional exponent rather than a radical symbol, as they are more convenient to use. For example,\[\sqrt{9}\] can be written as 91/2.In Mathematics, fractional exponent also known as rational exponent are expressions that are rational numbers rather than integers. It is an alternate representation for expressing powers and roots together. The general form of fraction exponent is\[x^{\frac{a}{b}} = \sqrt[b]{x^{a}}\]In a fractional exponent, the numerator is the power and the denominator is the root. In the above example, a and b are positive real numbers, and x is a real number, a is the power and b is the root.Define Fractional ExponentA fractional exponent is represented as xp/q where x is a base and p/q is an exponent. This expression is equivalent to the qth root of x raised to the pth power, or \[\sqrt[q]{x^{n}}\]. For example, \[\sqrt[3]{8^{2}}\] can be written as 82/3. In fractional exponent, the exponent is written before the radical symbol, and also if the base is negative, calculating the root is not simple, instead, it requires complex numbers.Fractional Exponent Laws1. The n-th root of a number can be written using the power 1/n as follows:\[a \frac{1}{n} = \sqrt[n]{a}\]The n-th root of k when multiplied itself by n times, given us k.\[k\frac{1}{n} \times k\frac{1}{n} \times k\frac{1}{n} \times . . . . . \times k\frac{1}{n} = k\]Example:The cube root of 27 is 9 (as 9 = 27)The cube root of 9 can also be written as \[9^{1/3}\] or \[\sqrt[3]{9} = 3\]The following three numbers are equivalent.\[9^{1/3}\] or \[\sqrt[3]{9} = 3\]2. If we need to raise the nth root of a number to the power p(say), we can write this as:\[x^{p/q} = (\sqrt[q]{x})^{p}\]The above expression means we need to calculate the n-th root of a number x, then raise the result to the power p.In the fractional exponent form, we can write this as:(x1/q)pWe can also write the above expression in another way, raise x to the power p, then find the nth root of the result that is(xp)1/qHowever, the first method is much easier, but calculating the root gives us a smaller number, which can be easily raised to the power p.How Negative Fractional Exponent Works?In negative fractional exponents, we first deal with the negative exponent, then apply the fractional exponent rule. For example,\[x^{-a} = \frac{1}{x^{a}}\]\[\frac{1}{x^{-a}} = x^{a}\]Both of the above equations are true when the variable is a positive real number.How to Multiply Fractional Exponents With the Same Base?Multiplying the fractional exponent with the same base means adding the exponents together. For example:\[y^{1/3} \times y^{1/3} \times y^{1/3} = y^{1} = y\]As \[y^{1/3}\] means the cube root of y. It means when \[y^{1/3}\] is multiplied thrice, the product is y.Let us consider any other case:\[y^{1/3} \times y^{1/3} = y^{(1/3 + 1/3)}\]= \[x^{2/3}\], this can also be written as \[\sqrt[3]{y^{2}}\]How to Divide Fractional Exponents With the Same Base?Dividing the fractional exponent with the same base means subtracting the exponents together. For example:\[y^{1/3} \div y^{1/3} = x^{0} = 1\]This implies that any number, when divided by itself, is equivalent to 1, and the zero exponent rule says that any number raised to an exponent of 0 is equal to 1.Here are some examples that show how radical expressions can be rewritten using fractional exponents.Rewriting Radicals Expressions Using Fractional ExponentsRadical FormFractional ExponentIntegers\[\sqrt{36}\]\[36^{1/2}\]6\[\sqrt{49}\]\[49^{1/2}\]7\[\sqrt{100}\]\[100^{1/2}\]10\[\sqrt[3]{16}\]\[16^{1/3}\]2\[\sqrt[3]{125}\]\[125^{1/3}\]5\[\sqrt[3]{1000}\]\[1000^{1/3}\]10\[\sqrt{y}\]\[y^{1/2}\]\[\sqrt[3]{y}\]\[y^{1/3}\]\[\sqrt[4]{y}\]\[y^{1/3}\]\[\sqrt[n]{y}\]\[y^{1/n}\]Rewriting Radicals in Fractional Exponent Form With Numerators Other Than One\[\sqrt[3]{16^{2}}\]\[16^{2/3}\]\[\sqrt[4]{16^{3}}\]\[16^{3/4}\]\[\sqrt[5]{16^{2}}\]\[16^{2/5}\]\[\sqrt[n]{16^{x}}\]\[16^{x/n}\]Solved Examples1. Calculate \[(8 x^{2} y^{4})^{1/3}\]Solution:\[(8)^{1/3} (x^{2}) (y^{4})^{1/3}\]\[= 2 x^{2/3} y^{4/3}\]Here, we used the rule:\[(a^{m})^{n} = a^{mn}\]We took each item from the bracket and raised to power . we have done because each item in the bracket is multiplied (if they were added or subtracted, multiplying the items won't be possible).2. Rewrite \[\sqrt[5]{x^{8}}\] using a fractional exponent.Solution:Using the definition of \[a^{m/n}\], we get,\[\sqrt[5]{x^{8}} = x^{8/5}\]3. Rewrite \[\sqrt{39}\] using a fractional exponentsSolution:Using the definition of \[a^{1/n}\], we get:\[\sqrt{39} = 39^{1/2}\].4. Rewrite \[y^{3/7}\] using radicalsSolution:Using the definition of \[a^{m/n}\], we get,\[y^{3/7} = \sqrt[7]{x^{3}}\] If an exponent of a number is a fraction, it is called a fractional exponent. Exponents show the number of times a number is replicated in multiplication. For example, 42 = 44 = 16. Here, exponent 2 is a whole number. In the number, say x1/y, x is the base and 1/y is the fractional exponent.In this article, we will discuss the concept of fractional exponents, and their rules, and learn how to solve them. We shall also explore negative fractional exponents and solve various examples for a better understanding of the concept. What are Fractional Exponents? Fractional exponents are ways to represent powers and roots together. In any general exponential expression of the form ab, a is the base and b is the exponent. When b is given in the fractional form, it is known as a fractional exponent. A few examples of fractional exponents are 21/2, 32/3, etc. The general form of a fractional exponent is xm/n, where x is the base and m/n is the exponent.Look at the figure given below to understand how fractional exponents are represented.Some examples of fractional exponents that are widely used are given below:ExponentName of the exponentIndication1/2Square roota1/2 = a1/3Cube roota1/3 = 3a1/4Fourth roota1/4 = 4aFractional Exponents Rules There are certain rules to be followed that help us to multiply or divide numbers with fractional exponents easily. Many people are familiar with whole-number exponents, but when it comes to fractional exponents, they end up doing mistakes that can be avoided if we follow these rules of fractional exponents.Rule 1: a1/m a1/n = a(1/m + 1/n)Rule 2: a1/m a1/n = a(1/m - 1/n)Rule 3: a1/m b1/m = (ab)1/mRule 4: a1/m b1/m = (ab)1/mRule 5: a-m/n = (1/a)m/nThese rules are very helpful while simplifying fractional exponents. Let us now learn how to simplify fractional exponents.Simplifying Fractional Exponents Simplifying fractional exponents can be understood in two ways which are multiplication and division. It involves reducing the expression or the exponent to a reduced form that is easy to understand. For example, 91/2 can be reduced to 3. Let us understand the simplification of fractional exponents with the help of some examples.1) Solve 38 = 81/3We know that 8 can be expressed as a cube of 2 which is given as, 8 = 23. Substituting the value of 8 in the given example we get, (23)1/3 = 2 since the product of the exponents gives 31/3=1. 38=81/3=2.2) Simplify (64/125)2/3In this example, both the base and the exponent are in fractional form. 64 can be expressed as a cube of 4 and 125 can be expressed as a cube of 5. They are given as, 64=43 and 125=53. Substituting their values in the given example we get, (43/53)2/3. 3 is a common power for both the numbers, hence (43/53)2/3 can be written as ((4/5)3)2/3, which is equal to (4/5)2 as 32/3=2. Now, we have (4/5)2, which is equal to 16/25. Therefore, (64/125)2/3 = 16/25.Multiply Fractional Exponents With the Same BaseTo multiply fractional exponents with the same base, we have to add the exponents and write the sum on the common base. The general rule for multiplying exponents with the same base is a1/m a1/n = a(1/m + 1/n). For example, to multiply 22/3 and 23/4, we have to add the exponents first. So, 2/3 + 3/4 = 17/12. Therefore, 22/3 23/4 = 217/12.How to Divide Fractional Exponents?The division of fractional exponents can be classified into two types.Division of fractional exponents with different powers but the same basesDivision of fractional exponents with the same powers but different basesWhen we divide fractional exponents with different powers but the same bases, we express it as a1/m a1/n = a(1/m - 1/n). Here, we have to subtract the powers and write the difference on the common base. For example, 53/4 51/2 = 5(3/4-1/2), which is equal to 51/4.When we divide fractional exponents with the same powers but different bases, we express it as a1/m b1/m = (ab)1/m. Here, we are dividing the bases in the given sequence and writing the common power on it. For example, 95/6 35/6 = (9/3)5/6, which is equal to 35/6.Negative Fractional Exponents Negative fractional exponents are the same as rational exponents. In this case, along with a fractional exponent, there is a negative sign attached to the power. For example, 2-1/2. To solve negative exponents, we have to apply exponents rules that say a-m = 1/am. It means before simplifying an expression further, the first step is to take the reciprocal of the base to the given power without the negative sign. The general rule for negative fractional exponents is a-m/n = (1/a)m/n.For example, let us simplify 343-1/3. Here the base is 343 and the power is -1/3. The first step is to take the reciprocal of the base, which is 1/343, and remove the negative sign from the power. Now, we have (1/343)1/3. As we know that 343 is the third power of 7 as 73 = 343, we can re-write the expression as 1/(73)1/3. Since 3 and 1/3 cancel each other, the final answer is 1/7.Related Articles Example 1: Evaluate 181/2 21/2.Solution: In this question, fractional exponents are given. The powers are the same but the bases are different. Hence, we can solve this problem as, 181/2 21/2 = (18/2)1/2 = 91/2 = 3. Therefore, 3 is the required answer.Example 2: Solve the given expression involving the multiplication of terms with fractional exponents.21/2 41/4 81/8Solution: 4 can be expressed as a square of 2, i.e. 4 = 22. So, 41/4 can be written as (22)1/4. It is equal to 21/2. Now, 8 can be expressed as a cube of 2, i.e. 8 = 23. So, 81/8 can be written as (23)1/8. It is equal to 23/8. Therefore, the given expression can be re-written as,21/2 21/2 23/8Multiplication of fractional exponents with the same base is done by adding the powers and writing the sum on the common base. 2(1/2 + 1/2 + 3/8)= 211/8Therefore, 21/2 41/4 81/8 = 211/8.Example 3: Evaluate 32/3 91/2Solution: To solve this, we will reduce 91/2 to the simplest form. So, we have91/2 = (32)1/2= 332/3 91/2 = 32/3 31= 32/3 - 1= 3-1/3View Answer >go to slidego to slidego to slideHave questions on basic mathematical concepts?Become a problem-solving champ using logic, not rules. Learn the why behind math with our certified expertsBook a Free Trial ClassFAQs on Fractional Exponents Fractional exponents mean the power of a number is in terms of fraction rather than an integer. For example, in am/n the base is 'a' and the power is m/n which is a fraction.What is the Rule for Fractional Exponents?In the case of fractional exponents, the numerator is the power and the denominator is the root. This is the general rule of fractional exponents. We can write xm/n as n(xm).What To Do With Negative Fractional Exponents?If the exponent is given in negative, it means we have to take the reciprocal of the base and remove the negative sign from the power. For example, 2-1/2 = (1/2)1/2.How To Solve Fractional Exponents?To solve fractional exponents, we use the laws of exponents or the exponent rules. The fractional exponents' rules are stated below:Rule 1: a1/m a1/n = a(1/m + 1/n)Rule 2: a1/m a1/n = a(1/m - 1/n)Rule 3: a1/m b1/m = (ab)1/mRule 4: a1/m b1/m = (ab)1/mRule 5: a-m/n = (1/a)m/nHow To Add Fractional Exponents?There is no rule for the addition of fractional exponents. We can add them only by simplifying the powers, if possible. For example, 91/2 + 1251/3 = 3 + 5 = 8.How To Divide Fractional Exponents?Division of fractional exponents with the same base and different powers is done by subtracting the powers, and the division with different bases and same powers is done by dividing the bases first and writing the common power on the answer. If an exponent of a number is a fraction, it is called a fractional exponent. Exponents show the number of times a number is replicated in multiplication. For example, 42 = 44 = 16. Here, exponent 2 is a whole number. In the number, say x1/y, x is the base and 1/y is the fractional exponent.In this article, we will discuss the concept of fractional exponents, and their rules, and learn how to solve them. We shall also explore negative fractional exponents and solve various examples for a better understanding of the concept. What are Fractional Exponents? Fractional exponents are ways to represent powers and roots together. In any general exponential expression of the form ab, a is the base and b is the exponent. When b is given in the fractional form, it is known as a fractional exponent. A few examples of fractional exponents are 21/2, 32/3, etc. The general form of a fractional exponent is xm/n, where x is the base and m/n is the exponent.Look at the figure given below to understand how fractional exponents are represented.Some examples of fractional exponents that are widely used are given below:ExponentName of the exponentIndication1/2Square roota1/2 = a1/3Cube roota1/3 = 3a1/4Fourth roota1/4 = 4aFractional Exponents Rules There are certain rules to be followed that help us to multiply or divide numbers with fractional exponents easily. Many people are familiar with whole-number exponents, but when it comes to fractional exponents, they end up doing mistakes that can be avoided if we follow these rules of fractional exponents.Rule 1: a1/m a1/n = a(1/m + 1/n)Rule 2: a1/m a1/n = a(1/m - 1/n)Rule 3: a1/m b1/m = (ab)1/mRule 4: a1/m b1/m = (ab)1/mRule 5: a-m/n = (1/a)m/nThese rules are very helpful while simplifying fractional exponents. Let us now learn how to simplify fractional exponents.Simplifying Fractional Exponents Simplifying fractional exponents can be understood in two ways which are multiplication and division. It involves reducing the expression or the exponent to a reduced form that is easy to understand. For example, 91/2 can be reduced to 3. Let us understand the simplification of fractional exponents with the help of some examples.1) Solve 38 = 81/3We know that 8 can be expressed as a cube of 2 which is given as, 8 = 23. Substituting the value of 8 in the given example we get, (23)1/3 = 2 since the product of the exponents gives 31/3=1. 38=81/3=2.2) Simplify (64/125)2/3In this example, both the base and the exponent are in fractional form. 64 can be expressed as a cube of 4 and 125 can be expressed as a cube of 5. They are given as, 64=43 and 125=53. Substituting their values in the given example we get, (43/53)2/3. 3 is a common power for both the numbers, hence (43/53)2/3 can be written as ((4/5)3)2/3, which is equal to (4/5)2 as 32/3=2. Now, we have (4/5)2, which is equal to 16/25. Therefore, (64/125)2/3 = 16/25.Multiply Fractional Exponents With the Same BaseTo multiply fractional exponents with the same base, we have to add the exponents and write the sum on the common base. The general rule for multiplying exponents with the same base is a1/m a1/n = a(1/m + 1/n). For example, to multiply 22/3 and 23/4, we have to add the exponents first. So, 2/3 + 3/4 = 17/12. Therefore, 22/3 23/4 = 217/12.How to Divide Fractional Exponents?The division of fractional exponents can be classified into two types.Division of fractional exponents with different powers but the same basesDivision of fractional exponents with the same powers but different basesWhen we divide fractional exponents with different powers but the same bases, we express it as a1/m a1/n = a(1/m - 1/n). Here, we have to subtract the powers and write the difference on the common base. For example, 53/4 51/2 = 5(3/4-1/2), which is equal to 51/4.When we divide fractional exponents with the same powers but different bases, we express it as a1/m b1/m = (ab)1/m. Here, we are dividing the bases in the given sequence and writing the common power on it. For example, 95/6 35/6 = (9/3)5/6, which is equal to 35/6.Negative Fractional Exponents Negative fractional exponents are the same as rational exponents. In this case, along with a fractional exponent, there is a negative sign attached to the power. For example, 2-1/2. To solve negative exponents, we have to apply exponents rules that say a-m = 1/am. It means before simplifying an expression further, the first step is to take the reciprocal of the base to the given power without the negative sign. The general rule for negative fractional exponents is a-m/n = (1/a)m/n.For example, let us simplify 343-1/3. Here the base is 343 and the power is -1/3. The first step is to take the reciprocal of the base, which is 1/343, and remove the negative sign from the power. Now, we have (1/343)1/3. As we know that 343 is the third power of 7 as 73 = 343, we can re-write the expression as 1/(73)1/3. Since 3 and 1/3 cancel each other, the final answer is 1/7.Related Articles Example 1: Evaluate 181/2 21/2.Solution: In this question, fractional exponents are given. The powers are the same but the bases are different. Hence, we can solve this problem as, 181/2 21/2 = (18/2)1/2 = 91/2 = 3. Therefore, 3 is the required answer.Example 2: Solve the given expression involving the multiplication of terms with fractional exponents.21/2 41/4 81/8Solution: 4 can be expressed as a square of 2, i.e. 4 = 22. So, 41/4 can be written as (22)1/4. It is equal to 21/2. Now, 8 can be expressed as a cube of 2, i.e. 8 = 23. So, 81/8 can be written as (23)1/8. It is equal to 23/8. Therefore, the given expression can be re-written as,21/2 21/2 23/8Multiplication of fractional exponents with the same base is done by adding the powers and writing the sum on the common base. 2(1/2 + 1/2 + 3/8)= 211/8Therefore, 21/2 41/4 81/8 = 211/8.Example 3: Evaluate 32/3 91/2Solution: To solve this, we will reduce 91/2 to the simplest form. So, we have91/2 = (32)1/2= 332/3 91/2 = 32/3 31= 32/3 - 1= 3-1/3View Answer >go to slidego to slidego to slideHave questions on basic mathematical concepts?Become a problem-solving champ using logic, not rules. Learn the why behind math with our certified expertsBook a Free Trial ClassFAQs on Fractional Exponents Fractional exponents mean the power of a number is in terms of fraction rather than an integer. For example, in am/n the base is 'a' and the power is m/n which is a fraction.What is the Rule for Fractional Exponents?In the case of fractional exponents, the numerator is the power and the denominator is the root. This is the general rule of fractional exponents. We can write xm/n as n(xm).What To Do With Negative Fractional Exponents?If the exponent is given in negative, it means we have to take the reciprocal of the base and remove the negative sign from the power. For example, 2-1/2 = (1/2)1/2.How To Solve Fractional Exponents?To solve fractional exponents, we use the laws of exponents or the exponent rules. The fractional exponents' rules are stated below:Rule 1: a1/m a1/n = a(1/m + 1/n)Rule 2: a1/m a1/n = a(1/m - 1/n)Rule 3: a1/m b1/m = (ab)1/mRule 4: a1/m b1/m = (ab)1/mRule 5: a-m/n = (1/a)m/nHow To Add Fractional Exponents?There is no rule for the addition of fractional exponents. We can add them only by simplifying the powers, if possible. For example, 91/2 + 1251/3 = 3 + 5 = 8.How To Divide Fractional Exponents?Division of fractional exponents with the same base and different powers is done by subtracting the powers, and the division with different bases and same powers is done by dividing the bases first and writing the common power on the answer. Also called "Radicals" or "Rational Exponents" Whole Number Exponents First, let us look at whole number exponents: The exponent of a number says how many times to use the number in a multiplication. In this example: 82 = 8 8 = 64 In words: 82 could be called "8 to the second power", "8 to the power 2" or simply "8 squared" Another example: 53 = 5 5 5 = 125 But what if the exponent is a fraction? An exponent of 12 is a square root An exponent of 13 is a cube root An exponent of 14 is a 4th root And so on! Why? Let's see why in an example. First, the Laws of Exponents tell us how to handle exponents when we multiply: Which shows that x2x3 = x(2+3) = x5 So let us try that with fractional exponents: 9 9 = 9(+) = 9(1) = 9 So 9 times itself gives 9. Now, what do we call a number that, when multiplied by itself, gives another number? The square root of that other number! See: 9 9 = 9 And: 9 9 = 9 So 9 is the same as 9 Try Another Fraction Let us try that again, but with an exponent of one-quarter (1/4): 16 16 16 16 = 16(+++) = 16(1) = 16 So 16 used 4 times in a multiplication gives 16, and so 16 is a 4th root of 16 General Rule It worked for , it worked with , in fact it works generally: x1/n = The n-th Root of x In other words: A fractional exponent like 1/n means to take the n-th root: x1/n = nx What About More Complicated Fractions? What about a fractional exponent like 43/2 ? That is really saying to do a cube (3) and a square root (1/2), in any order. Let me explain. A fraction (like m/n) can be broken into two parts: a whole number part (m) , and a fraction (1/n) part So, because m/n = m (1/n) we can do this: xm/n = x(m 1/n) = (xm)1/n = nxm The order does not matter, so it also works for m/n = (1/n) m: xm/n = x(1/n m) = (x1/n)m = (nx)m And we get this: A fractional exponent like m/n means: Do the m-th power, then take the n-th root: xm/n = nxm or Take the n-th root, then do the m-th power: xm/n = (nx)m Some examples: 43/2 = 43(1/2) = (43) = (444) = (64) = 8 or 43/2 = 4(1/2)3 = (4)3 = (2)3 = 8 Either way gets the same result. 274/3 = 274(1/3) = 3274 = 3531441 = 81 or 274/3 = 27(1/3)4 = (327)4 = (3)4 = 81 It was certainly easier the 2nd way! Now ... Play With The Graph! See how smoothly the curve changes when you play with the fractions in this animation, this shows you that this idea of fractional exponents fits together nicely: images/graph-exponent.js Things to try: Start with m=1 and n=1, then slowly increase n so that you can see 1/2, 1/3 and 1/4 Then try m=2 and slide n up and down to see fractions like 2/3 etc Now try to make the exponent 1 Lastly try increasing m, then reducing n, then reducing m, then increasing n: the curve should go around and around 321,322, 1089, 1090, 1091, 1092, 2266, 3997, 17, 2267 Copyright 2023 Rod Pierce If an exponent of a number is a fraction, it is called a fractional exponent. Exponents show the number of times a number is replicated in multiplication. For example, 42 = 44 = 16. Here, exponent 2 is a whole number. In the number, say x1/y, x is the base and 1/y is the fractional exponent.In this article, we will discuss the concept of fractional exponents, and their rules, and learn how to solve them. We shall also explore negative fractional exponents and solve various examples for a better understanding of the concept. What are Fractional Exponents? Fractional exponents are ways to represent powers and roots together. In any general exponential expression of the form ab, a is the base and b is the exponent. When b is given in the fractional form, it is known as a fractional exponent. A few examples of fractional exponents are 21/2, 32/3, etc. The general form of a fractional exponent is xm/n, where x is the base and m/n is the exponent.Look at the figure given below to understand how fractional exponents are represented.Some examples of fractional exponents that are widely used are given below:ExponentName of the exponentIndication1/2Square roota1/2 = a1/3Cube roota1/3 = 3a1/4Fourth roota1/4 = 4aFractional Exponents Rules There are certain rules to be followed that help us to multiply or divide numbers with fractional exponents easily. Many people are familiar with whole-number exponents, but when it comes to fractional exponents, they end up doing mistakes that can be avoided if we follow these rules of fractional exponents.Rule 1: a1/m a1/n = a(1/m + 1/n)Rule 2: a1/m a1/n = a(1/m - 1/n)Rule 3: a1/m b1/m = (ab)1/mRule 4: a1/m b1/m = (ab)1/mRule 5: a-m/n = (1/a)m/nThese rules are very helpful while simplifying fractional exponents. Let us now learn how to simplify fractional exponents.Simplifying Fractional Exponents Simplifying fractional exponents can be understood in two ways which are multiplication and division. It involves reducing the expression or the exponent to a reduced form that is easy to understand. For example, 91/2 can be reduced to 3. Let us understand the simplification of fractional exponents with the help of some examples.1) Solve 38 = 81/3We know that 8 can be expressed as a cube of 2 which is given as, 8 = 23. Substituting the value of 8 in the given example we get, (23)1/3 = 2 since the product of the exponents gives 31/3=1. 38=81/3=2.2) Simplify (64/125)2/3In this example, both the base and the exponent are in fractional form. 64 can be expressed as a cube of 4 and 125 can be expressed as a cube of 5. They are given as, 64=43 and 125=53. Substituting their values in the given example we get, (43/53)2/3. 3 is a common power for both the numbers, hence (43/53)2/3 can be written as ((4/5)3)2/3, which is equal to (4/5)2 as 32/3=2. Now, we have (4/5)2, which is equal to 16/25. Therefore, (64/125)2/3 = 16/25.Multiply Fractional Exponents With the Same BaseTo multiply fractional exponents with the same base, we have to add the exponents and write the sum on the common base. The general rule for multiplying exponents with the same base is a1/m a1/n = a(1/m + 1/n). For example, to multiply 22/3 and 23/4, we have to add the exponents first. So, 2/3 + 3/4 = 17/12. Therefore, 22/3 23/4 = 217/12.How to Divide Fractional Exponents?The division of fractional exponents can be classified into two types.Division of fractional exponents with different powers but the same basesDivision of fractional exponents with the same powers but different basesWhen we divide fractional exponents with different powers but the same bases, we express it as a1/m a1/n = a(1/m - 1/n). Here, we have to subtract the powers and write the difference on the common base. For example, 53/4 51/2 = 5(3/4-1/2), which is equal to 51/4.When we divide fractional exponents with the same powers but different bases, we express it as a1/m b1/m = (ab)1/m. Here, we are dividing the bases in the given sequence and writing the common power on it. For example, 95/6 35/6 = (9/3)5/6, which is equal to 35/6.Negative Fractional Exponents Negative fractional exponents are the same as rational exponents. In this case, along with a fractional exponent, there is a negative sign attached to the power. For example, 2-1/2. To solve negative exponents, we have to apply exponents rules that say a-m = 1/am. It means before simplifying an expression further, the first step is to take the reciprocal of the base to the given power without the negative sign. The general rule for negative fractional exponents is a-m/n = (1/a)m/n.For example, let us simplify 343-1/3. Here the base is 343 and the power is -1/3. The first step is to take the reciprocal of the base, which is 1/343, and remove the negative sign from the power. Now, we have (1/343)1/3. As we know that 343 is the third power of 7 as 73 = 343, we can re-write the expression as 1/(73)1/3. Since 3 and 1/3 cancel each other, the final answer is 1/7.Related Articles Example 1: Evaluate 181/2 21/2.Solution: In this question, fractional exponents are given. The powers are the same but the bases are different. Hence, we can solve this problem as, 181/2 21/2 = (18/2)1/2 = 91/2 = 3. Therefore, 3 is the required answer.Example 2: Solve the given expression involving the multiplication of terms with fractional exponents.21/2 41/4 81/8Solution: 4 can be expressed as a square of 2, i.e. 4 = 22. So, 41/4 can be written as (22)1/4. It is equal to 21/2. Now, 8 can be expressed as a cube of 2, i.e. 8 = 23. So, 81/8 can be written as (23)1/8. It is equal to 23/8. Therefore, the given expression can be re-written as,21/2 21/2 23/8Multiplication of fractional exponents with the same base is done by adding the powers and writing the sum on the common base. 2(1/2 + 1/2 + 3/8)= 211/8Therefore, 21/2 41/4 81/8 = 211/8.Example 3: Evaluate 32/3 91/2Solution: To solve this, we will reduce 91/2 to the simplest form. So, we have91/2 = (32)1/2= 332/3 91/2 = 32/3 31= 32/3 - 1= 3-1/3View Answer >go to slidego to slidego to slideHave questions on basic mathematical concepts?Become a problem-solving champ using logic, not rules. Learn the why behind math with our certified expertsBook a Free Trial ClassFAQs on Fractional Exponents Fractional exponents mean the power of a number is in terms of fraction rather than an integer. For example, in am/n the base is 'a' and the power is m/n which is a fraction.What is the Rule for Fractional Exponents?In the case of fractional exponents, the numerator is the power and the denominator is the root. This is the general rule of fractional exponents. We can write xm/n as n(xm).What To Do With Negative Fractional Exponents?If the exponent is given in negative, it means we have to take the reciprocal of the base and remove the negative sign from the power. For example, 2-1/2 = (1/2)1/2.How To Solve Fractional Exponents?To solve fractional exponents, we use the laws of exponents or the exponent rules. The fractional exponents' rules are stated below:Rule 1: a1/m a1/n = a(1/m + 1/n)Rule 2: a1/m a1/n = a(1/m - 1/n)Rule 3: a1/m b1/m = (ab)1/mRule 4: a1/m b1/m = (ab)1/mRule 5: a-m/n = (1/a)m/nHow To Add Fractional Exponents?There is no rule for the addition of fractional exponents. We can add them only by simplifying the powers, if possible. For example, 91/2 + 1251/3 = 3 + 5 = 8.How To Divide Fractional Exponents?Division of fractional exponents with the same base and different powers is done by subtracting the powers, and the division with different bases and same powers is done by dividing the bases first and writing the common power on the answer. If an exponent of a number is a fraction, it is called a fractional exponent. Exponents show the number of times a number is replicated in multiplication. For example, 42 = 44 = 16. Here, exponent 2 is a whole number. In the number, say x1/y, x is the base and 1/y is the fractional exponent.In this article, we will discuss the concept of fractional exponents, and their rules, and learn how to solve them. We shall also explore negative fractional exponents and solve various examples for a better understanding of the concept. What are Fractional Exponents? Fractional exponents are ways to represent powers and roots together. In any general exponential expression of the form ab, a is the base and b is the exponent. When b is given in the fractional form, it is known as a fractional exponent. A few examples of fractional exponents are 21/2, 32/3, etc. The general form of a fractional exponent is xm/n, where x is the base and m/n is the exponent.Look at the figure given below to understand how fractional exponents are represented.Some examples of fractional exponents that are widely used are given below:ExponentName of the exponentIndication1/2Square roota1/2 = a1/3Cube roota1/3 = 3a1/4Fourth roota1/4 = 4aFractional Exponents Rules There are certain rules to be followed that help us to multiply or divide numbers with fractional exponents easily. Many people are familiar with whole-number exponents, but when it comes to fractional exponents, they end up doing mistakes that can be avoided if we follow these rules of fractional exponents.Rule 1: a1/m a1/n = a(1/m + 1/n)Rule 2: a1/m a1/n = a(1/m - 1/n)Rule 3: a1/m b1/m = (ab)1/mRule 4: a1/m b1/m = (ab)1/mRule 5: a-m/n = (1/a)m/nThese rules are very helpful while simplifying fractional exponents. Let us now learn how to simplify fractional exponents.Simplifying Fractional Exponents Simplifying fractional exponents can be understood in two ways which are multiplication and division. It involves reducing the expression or the exponent to a reduced form that is easy to understand. For example, 91/2 can be reduced to 3. Let us understand the simplification of fractional exponents with the help of some examples.1) Solve 38 = 81/3We know that 8 can be expressed as a cube of 2 which is given as, 8 = 23. Substituting the value of 8 in the given example we get, (23)1/3 = 2 since the product of the exponents gives 31/3=1. 38=81/3=2.2) Simplify (64/125)2/3In this example, both the base and the exponent are in fractional form. 64 can be expressed as a cube of 4 and 125 can be expressed as a cube of 5. They are given as, 64=43 and 125=53. Substituting their values in the given example we get, (43/53)2/3. 3 is a common power for both the numbers, hence (43/53)2/3 can be written as ((4/5)3)2/3, which is equal to (4/5)2 as 32/3