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The most common irrational number is Pi or 3.14159265358. Some examples of rational numbers are 5, 10, 3/4, and .80. For more examples of rational and irrational numbers see our math practice app. Rational numbers can be expressed in the form of a p/q fraction, where the denominator, q, does not equal 0.Irrational numbers cannot be simplified into a fraction with whole numbers as the numerator and denominator.Rational numbers as decimals are either finite or have a repeating pattern, whereas irrational numbers as decimals dont have a pattern and dont end.1Rational numbers are numbers that can be expressed as fractions. A rational number is a type of real number in the form of a fraction, p/q, where q does not equal 0. In short, theyre ratios made from 2 integers or whole numbers. Rational numbers can also be expressed as both positive and negative numbers, and 0 itself is also a rational number.[1]Identify a rational number by checking to see if it can be represented as p/q, where q0. Then, ensure you can further simplify the p/q ratio and translate it into decimal form.For example, is a rational number because it can be calculated as a fraction where q (4) does not equal 0, and its decimal form (.75) is finite. 2Irrational numbers can be written in decimals but not as fractions. As a contradiction of rational numbers, irrational numbers cannot be simplified into a fraction or expressed as a ratio of integers. Instead, theyre often expressed in square root () form or as a decimal. After the decimal point of an irrational number, there are endless non-repeating digits.[2]Identifying an irrational number is simple! Check to see if it can be expressed as a fraction, where p and q are integers and q 0. If it cant, then its an irrational number.For example, 2 (the square root of 2) is irrational. When expressed as a decimal, it becomes the number 1.41421356237, which cannot be made into a simple fraction. Advertisement 1Rational numbers become finite or recurring decimals when divided. You can identify rational numbers based on their appearance in decimal form. When a decimal is finite (meaning it ends rather than continuing in an infinite string of numbers) or has a repeating pattern of numbers, it is a rational number that can be converted into a fraction.[3]A decimal number does not need both properties to be rational; it can be either finite or recurring.An example of a finite decimal would be .875, which can be expressed as the rational number .An infinite but recurring decimal like 9.45454545 is rational. You can identify it by looking at the numbers after the decimal point; the 45 repeating pattern confirms this number as rational.2Whole numbers, natural numbers, and integers are all rational. This is a fairly wide umbrella: whole numbers are numbers that are not fractions (0, 1, 2, 3), while integers include all of those numbers and their negative counterparts (-2, -1, 0, 1, 2). Natural numbers are simply all positive integers (1, 2, 3, 4, 5).[4]These numbers are rational because they can all be expressed as a simple fraction, p/q, where q 0. For example, 2 becomes 2/1, -2 becomes -2/1, and so on.Since a rational number is defined as a ratio or fraction made from 2 integers, any integer, whole, or natural number qualifies as rational.3Perfect squares are rational because they're whole numbers. When you see a number expressed in square root form (like 2 or 49), some are rational, and some are irrational. Perfect squaresintegers that can be expressed as the square of another integerare rational, which you can find by solving for the square root of the number written.[5]For example, 49 is a rational number. When you solve to find the square root of 49, the answer is 7 (an integer expressed as the square of 49, another integer), which can also be written as the fraction 7/1.4The sum or product of rational numbers is always rational. No matter which 2 rational numbers you add or multiply together, youll always get a rational number as your answer. For example, look at the rational numbers and . If you add them together, the answer is , and if you multiply them, the answer is .[6] and are both rational numbers because they are simple fractions made from whole numbers. Advertisement 1Irrational numbers cant be simplified into a ratio with integers. When you encounter a number that is impossible to turn into a fraction made up of whole numbers, that automatically makes it an irrational number. Conversely, you can tell when a number isnt irrational if you can successfully express it as a ratio.[7]5 is irrational. When you solve for the square root of 5, the result is 2.2360679775, which cant be converted into a simple fraction.2Non-terminating and non-recurring decimals are irrational. When looking at a number with decimals, you dont need to do any math to identify it as either rational or irrational. Simply study the decimals! When the number is non-terminating (meaning it doesnt end) and non-recurring (meaning theres no repetitive pattern to the numbers), its definitively irrational.[8]A number like 3.605551275 is irrational. If you look at it, you can see that its both non-terminating (indicated by the ellipses) and non-repeating (the numbers do not make a pattern).3Surds are also considered irrational numbers. When calculating square roots, there are perfect squares and surds. Where perfect squares can be simplified into whole numbers, surds are those square roots that cannot and are, therefore, irrational. If the result of a square root equation is not a whole number, its an irrational surd.[9]For example, 2 is a surd. When solved, 2 is 1.41421356237, which isnt a whole number and cant be expressed as a fraction.4The sum or product of irrational numbers is not always irrational. Unlike rational numbers, adding and multiplying irrational numbers doesn't guarantee a particular type of result. It depends entirely on the numbers you're using. Sometimes the solution will be irrational, and sometimes it'll be rational.[10] For example:2 is irrational. When you multiply the square roots 2 and 3, the answer is 6, which is also irrational. When you multiply 2 and 2, the answer is 4which is a perfect square and a rational number. Advertisement 1Simple fractions like are rational numbers. Not only is a fraction made from whole numbers where the denominator is not equal to 0, but it can also be expressed as a finite decimal (.5). All fractions from and to 376/290 are rational numbers.[11]Note that the denominator of a rational number can be any real number at all, so long as it isnt 0.216 is a rational number, while 3 is irrational. Comparing square roots, 16 simplifies to 4, a whole number, meaning that its a perfect square and a rational number. Meanwhile, 3 simplifies to 1.73205080757, a non-terminating and non-repeating decimal, meaning that its a surd and an irrational number.[12]3 is an irrational number, but .777777 is a rational number. Weve all seen the symbol for pi () before, but what does the number actually look like? As a decimal, is expressed as 3.14159265259, a non-terminating and non-repeating number and therefore irrational. Conversely, a decimal like .777777 is rational because even though it is also non-terminating, the number 7 repeats continually.[13] Advertisement Add New Question Question Is x^2 - 33 a rational number? It depends on what x equals. If x is a rational number or the square root of a rational number, (x - 33) is rational. Question Is 49 an irrational number? No. 49 is a rational number, because it can be written as the fraction -- or ratio -- 49/1. (It doesn't have to be written that way. It's just that it can be written that way.) Question Is 6/23 divided by 15/127 irrational or rational? It's rational. (6/23) (15/127) = (6/23)(127/15) = 762/345. Since that's the ratio of two whole numbers, it's a rational number. See more answers Ask a Question Advertisement Co-authored by: Math Instructor, City College of San Francisco This article was co-authored by Grace Imson, MA and by wikiHow staff writer, Glenn Carreau. Grace Imson is a math teacher with over 40 years of teaching experience. Grace is currently a math instructor at the City College of San Francisco and was previously in the Math Department at Saint Louis University. She has taught math at the elementary, middle, high school, and college levels. She has an MA in Education, specializing in Administration and Supervision from Saint Louis University. This article has been viewed 41,407 times. Co-authors: 2 Updated: January 3, 2023 Views:41,407 Categories: Mathematics PrintSend fan mail to authors Thanks to all authors for creating a page that has been read 41,407 times. Rational numbers and Irrational NumbersWhat is a rational number?A rational number is a type of number that can be written as the quotient or fraction of two integers, where the numerator is an integer and the denominator is a non-zero integer. In other words, any number that can be expressed in the form a/b, where a and b are integers and b 0, is considered a rational number. For example, 1/2 is a rational number because it is the result of dividing the integer 1 by the non-zero integer 2. Rational numbers include not only fractions like 3/4 and -5/6, but also whole numbers and integers, since numbers like 4 or -3 can be written as 4/1 and -3/1, respectively.What are rational numbers?Rational numbers are numbers that can be expressed as a fraction or ratio of two integers, where the denominator is not zero. In other words, a rational number is any number that can be written in the form a/b, where a and b are integers and b 0. These numbers can be positive or negative, and they include whole numbers, integers, fractions, and certain decimals.Rational numbers also include decimals that either terminate (such as 0.75) or repeat in a pattern (such as 0.333...). Every rational number has a unique decimal representation, which can help us compare the size or value of different rational numbers. For example, the fraction 1/4 has the decimal form 0.25, which is a terminating decimal, while 1/3 is 0.333..., a repeating decimal.In summary, if a number can be written as a simple fraction or shows a predictable decimal pattern, it is a rational number.Terminating decimal examples:1. 0.5 = 1/22. 0.25 = 1/43. 0.75 = 3/44. 0.2 = 1/55. 1.6 = 8/56. 3.125 = 25/8A terminating decimal is a decimal number that ends or stops after a certain number of digits. For example, 0.5 and 2.75 are terminating decimals because they don't go on forever. These decimals come from fractions where the bottom number (the denominator) can be made using only the numbers 2 and/or 5 when it's simplified.Repeating decimal examples: 1. 0.333... = 1/3 (The 3 goes on forever.)2. 0.666... = 2/3 (The 6 keeps repeating.)3. 0.111... = 1/9 (The 1 repeats again and again.)4. 0.727272... = 8/11 (The "72" repeats over and over.)5. 0.181818... = 2/11 (The digits "18" keep repeating.)6. 1.555... = 14/9 (The 5 repeats after the decimal.)A repeating decimal is a decimal that goes on forever but has a pattern that repeats. Youll often see a line or bar over the repeating part, like this: 1/3 for 0.333...rational vs irrational numbers posterWhy are rational numbers important?Rational numbers are important for several reasons, and understanding them is key in everyday life and math. Here's why:Real-Life Use: We use rational numbers every day. For example, when you divide something into equal parts (like cutting a pizza), you're dealing with fractions or rational numbers. When you handle money, prices, or measurements, they are often written as rational numbers.Understanding Decimals and Fractions: Rational numbers help us understand fractions and decimals. They show us how to convert between fractions (like 1/2) and decimals (like 0.5), which helps us in many math problems.Comparison and Estimation: Rational numbers let us compare numbers easily. We can see which is bigger or smaller by converting them into fractions or decimals. This helps in estimating things, like comparing prices or measuring length.Problem-Solving: Many math problems, like adding, subtracting, multiplying, and dividing fractions, involve rational numbers. Knowing how to work with them makes solving problems easier.Building a Strong Math Foundation: Learning about rational numbers builds a strong foundation for future math topics, like algebra and geometry, where you'll need to deal with fractions, decimals, and ratios.Rational numbers are also essential in mathematics, physics, engineering, and economics because they allow us to express many different values as a single number. For example, the number 1 can be written as a rational number in many different ways: 1/1, 2/2, 3/3, 4/4, etc. All of these fractions are different, but they all represent the same value. This flexibility helps in solving a wide range of problems, from calculating the speed of a car in physics to determining the cost of an item in economics.In summary, rational numbers are important because they help us with practical tasks, math skills, problem-solving, and future learning. They are part of the world around us, and understanding them makes us better at solving everyday problems!Rational Number ExamplesRational Numbers in the Real WorldRational numbers are everywhere in our daily lives, from the prices of goods in stores to the interest rates on loans. Here are some examples:Price of a can of soda: If a can of soda costs \$1.50, it can be written as a rational number. This is in the form p/q, where p is the price in dollars, and q is the number of cans. In this case, p = 1.5 and q = 1, so the rational number is 1.5/1.Interest rate on a loan: If the interest rate on a loan is 5%, it can be written as a rational number. In the form p/q, where p is the interest rate (in percent) and q is 100 (since percentages are out of 100), the rational number is 5/100.Rational Numbers in MathRational numbers are also important in math, especially in algebra and calculus. Here are some examples:Slope of a line: In algebra, the slope of a line is often expressed as a rational number. For example, if a line has a slope of 3/4, this means that for every 1 unit increase in the x-coordinate, the y-coordinate increases by 3/4 units.Solving equations: Some equations can only be solved using rational numbers. For instance, in the equation x 2x 8 = 0, we can find the roots of the equation. The roots are -4/1 and -2/1, which are rational numbers.Rational Numbers in Everyday LifeRational numbers show up in everyday life too. Here are a few more examples:Temperature: The temperature outside is often given in degrees Fahrenheit, which is a rational number. For instance, if the temperature is 72F, we can write it as 72/1, where p = 72 and q = 1 (since its simply 72 degrees without any fractional part).Speed of a car: The speed of a car is often given in miles per hour, which is another example of a rational number. For example, if a car is traveling at 55 miles per hour, we can write it as 55/1, where p = 55 and q = 1.Rational numbers are important because they help us express many different valueswhether we're talking about money, temperature, speed, or solving math problems. They're everywhere and make it easier to understand and compare different situations.. Is 0 a rational number?0 is a rational number because it can be expressed as a fraction with an integer denominator. For example, 0 can be written as 0/1. Since:The numerator (0) is an integerThe denominator (e.g., 1, 2, -5) is a nonzero integerThis fits the definition of a rational number.Difference between rational and irrational numbers with examplesAs a math student, you are probably well aware of the importance of rational numbers. After all, they make up the majority of the numbers we encounter in our daily lives. But what about irrational numbers?Though they may not get as much attention as rational numbers, irrational numbers actually play an important role in mathematics. Though they may seem like simple concepts, irrational numbers are essential to many branches of mathematics. For example, they are used in calculus to find the area under a curve. They are also used in physics to describe the behavior of waves.Without irrational numbers, many of the things we take for granted would be impossible to understand. So, the next time you're struggling with a math problem, remember that irrational numbers are there to help!Irrational numbers are numbers that cannot be expressed as a fraction, or as a ratio of two integers. In other words, they are numbers that cannot be written as a simple fraction.Rational numbers are any number that can be expressed as a fraction, where both the numerator and denominator are integers. In other words, rational numbers are numbers that can be written as a ratio where a and b are integers.Some examples of rational numbers include:1/2, 3/4, 10/5, 100/50.Some examples of irrational numbers include: (pi), 2 (the square root of 2), e, 3Take a Rational/Irrational QuizWhy are they called irrational numbers? The word "irrational" comes from the Latin word "irrationalis", which means "not rational". The term was first used by German mathematician Johann Heinrich Lambert in the 18th century.Did you know? Lambert was born in Mulhouse, Alsace, in 1728. His father was a silk merchant, and Lambert was educated at the local gymnasium. He then studied mathematics and physics at the Universities of Basel and Strasbourg. After graduation, he worked as a tutor in Mulhouse and Strasbourg. In 1755, Lambert went to Berlin, where he met the famous German mathematician Leonhard Euler. Euler was impressed with Lambert's work on the theory of light and color, and he recommended that Lambert submit his work to the Berlin Academy of Sciences. Lambert's work was published in the Academy's Transactions in 1760. Lambert's work on the optical properties of coal led to his appointment as professor of physics at the University of Frankfurt in 1764. He held this position until he died in 1777. Lambert's work on the theory of light and color was very influential in the development of the modern theory of light. His work on the optical properties of coal was also important in the development of the science of coal mining.Take a Rational/Irrational QuizThe sum or product of a rational and irrational numberThe sum of a rational and irrational number is always irrational. Why is this the case? What does this mean for adding numbers in general? The sum of a rational and irrational number is always irrational because an irrational number cannot be expressed as a rational number. For example, the sum of 1/2 and 2 is irrational because 2 cannot be expressed as a rational number. This means that when adding numbers if one of the numbers is irrational, the result will also be irrational. This has implications for adding numbers in general, as it means that the result of adding two numbers together can be irrational even if both numbers are rational.Are you preparing for the SAT? Need private math tutoring? Click the pic below.Prep Expert SAT & ACT courses are offered in every format and start at just $16 per hour!FTC Disclaimer: This post may contain affiliate links. We may earn a small commission from qualifying purchases when you click a link at no extra cost to you. As an Amazon Associate, I earn from qualifying purchases at no cost to you. Rational and Irrational Numbers are types of real numbers with different properties. Some of the key differences between them are:Rational numberscan be written as a fraction p/q, where bothpandqare integers.Irrational numbers, on the other hand, cannot be expressed as a ratio of two integers.The decimal form of arational numberwill either terminate or repeat, while the decimal of anirrational numberis non-terminating and non-repeating.Rational numbersinclude familiar values like fractions, whole numbers, and repeating decimals.Irrational numbersinclude numbers likeand2, which have infinite non-repeating decimal expansions.Let's discuss Rational and Irrational Numbers in detail.What are Rational Numbers?The word "rational" comes from "ratio" which means comparing two or more things. In simpler terms, rational numbers are like fractions they show the relationship between two whole numbers.A Rational Numbers is any number that can be expressed as the ratio of two integers. In mathematical terms, a rational number is a number that can be written in the form p/q, where p and q are integers, and q is not equal to zero. This means that fractions, whole numbers, and terminating or repeating decimals are all examples of rational numbers.Examples of Rational Numbers:Fractions: Numbers like 12/21 or 34/43 are rational because they are represented as a ratio of integers.Whole Numbers: Numbers like 5 and 7 are also rational because they can be written as 51/15 and 71/17.Repeating Decimals: The decimal 0.333... (repeating) is rational because it can be expressed as 13/31.Rational numbers are widely used in everyday life for things like measuring ingredients, dividing quantities, or financial calculations.Some examples of rational numbers are,m n m/n20220/2 = 10Rational 2202/20 = 0.1Rational 11001/100 = 0.01Rational 1001100/1 = 100Rational What are Irrational Numbers?Unlike rational numbers, irrational numbers cannot be written as a simple fraction. They are numbers whose decimal expansions are non-terminating and non-repeating. In other words, the decimal goes on forever without forming any recurring pattern. The most well-known irrational numbers are (pi) and 2.An Irrational Numbers is a type of real number that cannot be expressed as a simple fraction (ratio) of two integers. In other words, it's a number that cannot be written in the form a/b, where "a" and "b" are integers and "b" is not equal to zero.Examples of Irrational Numbers5, 11, 21, etc., are irrationalSquare Root of 2 (2)The square root of 2 is irrational. Its decimal representation goes on forever without repeating, and it cannot be expressed as a fraction. Approximate decimal representation: 1.4142...Pi ()Pi is the ratio of the circumference of a circle to its diameter. It is an irrational number.Approximate decimal representation: 3.141...Euler's Number (e) Euler's number is an irrational constant that is the base of natural logarithms. Approximate decimal representation: 2.718281828459045...These numbers are often found in geometry and trigonometry, where precise values are necessary for calculating measurements like the circumference of a circle or the diagonal of a square.Differences Between Rational and Irrational NumbersThe difference between rational and irrational number is added in the table below:PropertyRational NumbersIrrational NumbersDefinition Numbers that can be expressed as a ratio of two integersp/q whereq 0.Numbers that cannot be expressed as a ratio of two integers.FormFractions (a/b)Non-fractional Decimal RepresentationTerminating or repeating decimalsNon-terminating, non-repeating decimalsExample 3/4,5,0.75, 0.333 . . .2, , e, 1.414213 . . .Closure under Arithmetic OperationsAddition and subtractionMultiplication and division can be rational or irrationalAddition and subtraction can be rational or irrationalMultiplication and division can be rational or irrationalAdditive InverseExists (e.g., -3 for 3)Does not have additive inverse within irrationalsMultiplicative Inverse Exists (e.g., 1/3 for 3)Does not have multiplicative inverse within irrationals.Representation on the Number LineRepresentable as exact points on the number line.Also representable as points on the number line, but not expressible as a simple fraction.How to Classify Rational and Irrational Numbers?According to the definition of rational and irrational numbers can be classified as the numbers which can be written in p/q form are rational whereas the number which cannot be written in p/q form are irrational. Below Venn diagram shows us the diagram for rational and irrational numbers.Rational number and Irrational number ClassificationRead More, Irrational numbers, in contrast to rational numbers, are pretty complicated. As Wolfram MathWorld explains, they cannot be expressed by fractions, and when you try to write them as a number with a decimal point, the digits just keep going on and on, without ever stopping or repeating a pattern. So what sort of numbers behave in such a crazy fashion? Basically, ones that describe complicated things. Pi Perhaps the most famous irrational number is pi sometimes written as , the Greek letter for "p" which expresses the ratio of the circumference of a circle to the diameter of that circle. As mathematician Steven Bogart explained in this 1999 Scientific American article, that ratio will always equal pi, regardless of the size of the circle. Since Babylonian mathematicians attempted to calculate pi nearly 4,000 years ago, successive generations of mathematicians have kept plugging away, coming up with longer and longer strings of the decimal expansion with non-repeating patterns. In 2019, Google researcher Emma Hakura Iwao managed to extend pi to 31,415,926,535,897 digits. Some (But Not All) Square Roots Sometimes, a square root that is, a factor of a number that, when multiplied by itself, produces the number that you started with is an irrational number, unless it's a perfect square that's a whole number, such as 4, the square root of 16. One of the most conspicuous examples is the square root of 2, which works out to 1.414 plus an endless string of non-repeating digits. That value corresponds to the length of the diagonal within a square, as first described by the ancient Greeks in the Pythagorean theorem. Page 2 Mathematician and cosmologist Ruth Gregory once said, "It is hard to overstate the importance of Noether's work in modern physics." Indeed, while it's tough for us laypeople to wrap our heads around it, "Noether's theorem" is one of the great scientific insights of the past century and laid the groundwork for abstract algebra and theoretical physics. Born in Germany in the late 19th century to a mathematician father, Emmy Noether wasn't allowed to officially enroll in university, which was male-only. So she audited classes, passed all her exams and earned her undergraduate degree. She later earned a Ph.D. at another university that finally accepted women but wasn't allowed to hold a teaching position. In 1915, a year after Albert Einstein published his general theory of relativity, the young Noether, then an unpaid lecturer at the University of Gttingen was summoned by a group of the world's leading mathematicians to help solve a problem with Einstein's revolutionary take on gravity. Unfazed, she proved why general relativity doesn't go against the established law of conservation of energy. Three years later, she published her own groundbreaking theorem establishing the mathematical relationship between laws of conservation and something called symmetry. Noether's theorem which isn't a theory, but a mathematical proof proved that every law of conservation (energy, momentum, angular momentum, etc.) was bound to an associated symmetry in nature. Before this, scientists had not realized these were related. With Noether's mathematical tool, physicists developed the Standard Model, which describes the interactions of weak, strong and electromagnetic forces. And Noether's theorem is now helping to explain the behavior of black holes and the existence of dark matter. How we are comparing and ordering rational and irrational numbers ?The given numbers may in the form of fraction, percentage, decimals, square roots etc. We convert the given numbers into decimal and compare them.Let us understand what are rational and irrational numbers.What is rational number ?All numbers that can be written in the form of p/q is rational number.What are irrational numbers ?The numbers that cannot be written in the form of fraction, those are irrational numbers.Is percentage a rational number ?YesFor example, 35% = 35/100Which can be represented as fraction. So, it is rational number.Is decimal a rational number ?YesFor example,0.27= 27/100Which can be represented as fraction. So, it is rational number.Is repeating decimal a rational number ?YesFor example,0.27777..... Let x = 0.2777..... ----(1)Multiplying by 10 on both sides, we get10x = 2.7777.....----(2)(2) - (1)10x - x = 2.777..... - 0.2777.....9x = 2.5x = 2.5/9x = 25/90x = 5/14Which can be represented as fraction. So, it is rational number.Is non repeating decimal a rational number ?NoFor example,0.2785387.....It cannot be written as fraction. So, it is not a rational number.Example Problems on Comparing and Ordering Rational and Irrational NumbersOrder the following numbersfrom least to greatest :Problem 1 :135%, 13.5, 8 3/5Solution :135%, 13.5, 8 3/5135/100, 13.5, 43/51.35, 13.5, 8.6Numbers from least to greatest are1.35, 8.6 and 13.5So, the numbers fromleast to greatest is 135% < 8 3/5 < 13.5Problem 2 :1/6, 16.7%, 0.16Solution :1/6, 16.7%, 0.160.166, 16.7/100, 0.160.166, 0.167, 0.16So, the numbers fromleast to greatest is 0.16 < 1/6 < 16.7%.Order the following numbersfrom greatest to least :Problem 3 :0.42, 4.2%, 2/5Solution :0.42, 4.2%, 2/50.42, 4.2/100, 0.40.42, 0.042, 0.4So, the numbers fromgreatest to least is 0.42 > 2/5 > 4.2%.Problem 4 :3 1/3, 3.34, 300%Solution :3 1/3, 3.34, 300%10/3, 3.34, 300/1003.33, 3.34, 3So, the numbers fromgreatest to least is 3.34 > 3 1/3 > 300%.Put the following inascending order :Problem 5 :45%, 1/2, 0.6, 1Solution :45%, 1/2, 0.6, 145/100, 1/2, 0.6, 10.45, 0.5, 0.6, 1Hence, ascending orderis 45% < 1/2 < 0.6 < 1.Problem 6 :4, 0.8, 50%, 0Solution :4, 0.8, 50%, 04, 0.8, 50/100, 04, 0.8, 0.5, 0Hence, ascending orderis 0 < 50% < 0.8 < 4.Put the following numbersin descending order :Problem 7 :45%, 1/2, 0.045Solution :45%, 1/2, 0.04545/100, 1/2, 0.0450.45, 0.5, 0.045Hence descending orderis 1/2 > 45% > 0.045.Problem 8 :125%, 1 1/2, 1.26Solution :125%, 1 1/2, 1.26125/100, 3/2, 1.261.25, 1.5, 1.26Hence descending orderis 1 1/2 > 1.26 > 125%.Problem 9 :Which is least number of the following.0.4,0.09 and 1/2Solution :0.40.09 =9/100= 3/10= 0.31/2 = 0.50.3 is the least, then 0.09 is least.Problem 10 :Which of the following is greater ? or they are same.a) (100 - 64) b) 100 - 64Solution :They are not same.a) (100 - 64)(100 - 64) =36 ==>(6 x 6) ==> 6b) 100 - 64100 - 64 ==> 10 - 8 ==> 2So, a is greater.Problem 11 :Graph the numbers on the number line.2.55, 9/5,24,,9Solution :2.55 = we cannot do further simplification9/5 = 1.824 = 4.8 = 3.149 =(3 x 3) =3Problem 12 :Write it in order from greatest to least.10/4,10, 4.75,16Solution :10/4 = 2.510 = 3.3.....4.75 = 4.75 (already it is a decimal)16 =(4 x 4) ==> 4Greatest to least :4.75, 4, 3.333..., 2.54.75, 16, 10, 10/4Problem 13 :Use or = compare.-104 ____ -10Solution :-104 = -10...-104 < -10Problem 14 :Several shops are having sales price are reduced by 62.5%, 2/3, 75%, 1/2 and 7/10. Which list shows the price reductions from greatest to least ?a) 75%, 62.5%, 1/2, 2/3, 7/10b) 75%, 7/10, 2/3, 62.5%, 1/2c) 75%, 7/10, 62.5%, 1/2, 2/3d) 75%, 7/10, 62.5%, 2/3, 1/2Solution :Given prices are,62.5%, 2/3, 75%, 1/2 and 7/1062.5% = 62.5/100 = 0.6252/3 = 0.6666.....75% = 75/100 = 0.751/2 = 0.57/10 = 0.7The order from greatest to least :0.75, 0.7, 0.6666...., 0.625, 0.575%, 7/10, 2/3, 62.5%, 1/2Problem 15 :Which is greater ?a)0.25 b)1/4 c) 0.233.....Solution :Option a :0.25 =25/100=(5x5) / (10x10)= 5/10= 0.5Option b :1/4=(1x1) / (2x2)= 1/2= 0.5Option c :Let x = 0.2333.... -----(1)Multiplying by 10 on both sides.10x = 2.3333..... -----(2)(2) - (1)10x - x = 2.333.... - 0.2333.....9x = 2.1x = 2.1/9x = 21/9x = 7/3x = 2.332.33 is greater. option c is correct. The key difference between rational and irrational numbers is, the rational number is expressed in the form of p/q whereas it is not possible for irrational number (though both are real numbers). Learn the definitions, more differences and examples based on them.Definition of Rational and Irrational NumbersRational Numbers: The real numbers which can be represented in the form of the ratio of two integers, say P/Q, where Q is not equal to zero are called rational numbers.Irrational Numbers: The real numbers which cannot be expressed in the form of the ratio of two integers are called irrational numbers.What is the Difference Between Rational Numbers and Irrational Numbers?S.NoRational NumbersIrrational Numbers1Numbers that can be expressed as a ratio of two numbers (p/q form) are rational numbers.Numbers that cannot be expressed as a ratio of two numbers are irrational numbers.2The decimal expansion of rational numbers is either terminating or recurring.The decimal expansion of irrational numbers is non-terminating and non-recurring.3Rational numbers include perfect squares such as 4, 9, 16, 25, and so on.Irrational numbers include surds such as 2, 3, 5, 7 and so on.4Both the numerator and denominator are integers, in which the denominator is not equal to zero.Irrational numbers cannot be written in fractional form.5Example: 3/2 = 1.5, 3.6767Example: 5, 11Video Lesson on Rational NumbersStay tuned with BYJUS The Learning App and download the app for Maths-related articles to learn easily.We can represent rational numbers in the form of the ratio of two integers(positive or negative), where the denominator is not equal to 0. But we cannot express irrational numbers in the same form.Examples of rational numbers are 1/2, 3/4, 11/2, 0.45, 10, etc.The examples of irrational numbers are Pi () = 3.14159., Eulers Number (e) = (2.71828),and 3, 2.If a number has a terminating or repeating decimal, it is rational; for example, 1/2 = 0.5.If a number has a non-terminating and non-repeating decimal, it is irrational, for example, o.315456732/3 = 0.66666We can see, after simplification, 2/3 is a repeating decimal. Hence, it is a rational number. Put your understanding of this concept to test by answering a few MCQs. Click Start Quiz to begin! Select the correct answer and click on the Finish buttonCheck your score and answers at the end of the quiz Visit BYJUS for all Maths related queries and study materials 0 out of 0 arewrong 0 out of 0 are correct 0 out of 0 are Unattempted View Quiz Answers and Analysis Imagine trying to fit every number in the universe into neat little boxes. Some numbers slide in perfectly, like fractions or whole numbers, while others refuse to conform, spilling over with endless, unpredictable decimals. This is the fascinating divide between rational and irrational numbersa concept that shapes the very foundation of mathematics.You encounter these numbers more often than you think. Every time you measure a circles circumference or calculate the square root of a non-perfect square, youre meeting an irrational number. On the other hand, rational numbers are the dependable onesfractions, integers, and decimals that end or repeat. Understanding the difference isnt just about math; its about seeing the worlds patterns and chaos in a whole new light. Rational numbers play a fundamental role in mathematics as they represent precise values that can be expressed as fractions or integers. A rational number is any number that can be written as the quotient of two integers, where the denominator isnt zero. In decimal form, rational numbers either terminate, like 0.5, or repeat, like 0.333. These numbers form a dense set, meaning between any two rational numbers, theres another rational number. This property highlights their importance in creating continuity in the number line. Common examples include integers, fractions, and decimals with finite or repeating patterns. For instance:Integers: 2, -7, 0Proper fractions: 4/5, -2/3Terminating decimals: 0.25, -1.75Repeating decimals: 0.666, -3.333 Consider the fraction 7/8. Converting it to decimal form gives 0.875, proving its rational. In contrast, (pi) and 2 cant represent rational numbers. Rational numbers exhibit characteristics that distinguish them mathematically:Closure under addition, subtraction, and multiplication: Adding or multiplying two rational numbers, like 1/3 and 2/5, always produces a rational result.Non-closure for division: Dividing a rational number by zero isnt valid, although division by non-zero rationals keeps the result rational.Orderable nature: Rational numbers can be arranged sequentially, such as -2, 0.5, and 3/4.Convertible forms: Rational numbers switch between fractional form and decimal representation effectively. Understanding these traits helps identify rational numbers across different contexts. Irrational numbers are fascinating as they introduce complexity to mathematical concepts. They cant be exactly expressed as fractions, and their decimal representations neither terminate nor repeat. These numbers reveal the infinite nature of mathematics. Irrational numbers are numbers that cannot be written as a ratio of two integers. They dont fit neatly into fractional forms, unlike their rational counterparts. Their decimal expansions go on infinitely without repeating patterns, making them non-terminating and non-repeating. For example, numbers like and 2 are categorized as irrational because they defy simple representation. Common examples of irrational numbers include well-known constants and certain roots: (pi): Represents the ratio of a circles circumference to its diameter, approximately 3.14159, but its exact value has no end or pattern.2: Arises from the diagonal length of a square with side length 1. Its approximately 1.41421 yet remains non-terminating.e (Eulers number): Approximately 2.71828, e appears in natural logarithmic functions and continuous growth modeling.Golden Ratio (): Found in nature, art, and architecture, approximately 1.61803, this ratio also exhibits non-repeating decimal patterns. While examining these, notice how none can be written as precise fractions, reinforcing their irrational nature. Non-repeating decimals: These numbers decimals keep going endlessly without forming recognizable sequences.Non-closure under arithmetic: Adding or multiplying two irrational numbers doesnt always produce another irrational number. For instance, 2 + (-2) equals 0, a rational number.Infinite on the number line: Irrational numbers exist throughout the number line, filling gaps between rational numbers.Incompatibility with fractions: They cant convert into an exact quotient of integers, unlike rational numbers. Recognizing these properties highlights how irrational numbers challenge the order and predictability of rational number sets. Understanding the distinctions between irrational and rational numbers helps you grasp their unique roles in mathematics. These differences are evident in their decimal forms, patterns, and examples. Decimal representations of rational numbers are either finite or infinite but repeating. For instance, 0.75 is finite, while 0.333 repeats endlessly. In contrast, irrational numbers have decimals that never terminate or repeat, such as 3.14159 () or 1.41421 (2). Rational numbers, derived as fractions like 3/4 or 7/6, allow for predictable decimal behavior. You encounter terminating decimals like 0.25 or repeating ones like 0.666 This pattern makes rational numbers well-organized. Irrational numbers lack such patterns, presenting endless randomness. Their unpredictable nature, like the digits of or 3, reveals deeper mathematical complexity. Examples clarify distinctions effectively. Rational numbers include manageable forms like 1/2, 4, and -3. Decimal examples involve 1.2 or 0.4545 Irrational numbers add diversity with (non-repeating, related to circles), 5 (non-perfect square roots), and e (natural logarithms). These examples showcase how the two types complement each other but differ fundamentally. Rational and irrational numbers play essential roles in your daily life, even if youre not actively aware of them. Their unique properties influence various fields, from technology to architecture. Rational numbers support precise calculations in everyday activities. When shopping, you work with prices expressed as decimals or fractionsfor example, $12.99 or a 1/2-pound of produce. Measurements use rational numbers, as seen with rulers marked in inches and fractions like 1/4 or 3/8. Timekeeping relies on repeating decimals, such as 0.333 when dividing one hour by three.In technology, rational numbers enhance computational stability. For instance, programming languages use fractions and simple decimals in algorithms where approximations arent suitable, ensuring accuracy in outputs. Financial modeling also uses these numbers, ensuring payments and interests are calculated predictably without error margins. Irrational numbers appear prominently in advanced fields. The constant underlies geometry, particularly in circular measurements like calculating a wheels circumference. Architects and engineers apply irrational numbers to design precise structures. The Golden Ratio () enriches aesthetics and proportionality in architecture, appearing in iconic designs like the Parthenon.Scientific models frequently rely on irrational numbers too. For example, Eulers number (e) simplifies calculations in exponential growth, helping you analyze real-world phenomena like population growth or radioactive decay. In quantum mechanics, irrational values emerge in wave functions, manifesting the inherent complexity of the universe.Recognizing their presence reveals how integral they are across disciplines, from daily transactions to exploring the cosmos. Understanding the differences between rational and irrational numbers deepens your appreciation for the structure and complexity of mathematics. These two types of numbers, while distinct, work together to create a complete and fascinating number system.Whether youre exploring their properties, applying them in real-world scenarios, or marveling at their mathematical beauty, both rational and irrational numbers play vital roles in shaping how you interpret and interact with the world around you. Rational Numbers can be written as a ratio that compares two numbers or quantities, giving a simple fraction or mixed fraction p/q. These include integers or decimals terminating (finite) or recurring (repeating patterns). The denominator q is a natural number, i.e., non-zero.Irrational Numbers cannot be written as a ratio. In simple words, irrational numbers include numbers that cannot be simplified further (to fractions with natural numbers and integers.) The decimals of irrational numbers, if expanded, give neither finite nor recurring decimals. These include surds and unique numbers like (pi). Surds are non-perfect squares or cubes that cannot be simplified and remove the square or cube roots. pi is the most common irrational number. Below is a Venn diagram showing the rational and irrational numbers in the number system. Rational and Irrational Numbers We cannot list rational and irrational numbers since both have an infinite range. Some examples are given below. Common examples of rational numbers are: 6; it can be written as 1/8 or 1 and 1 are integers0.125; it can be written as 1/8 or 125/100081; it can be simplified further to 9 or 9/15.232323, or 0.111; these are recurring decimals as they are repeated in patterns Common examples of irrational numbers are: 1/0; denominator is zero; its value is 3.142, non-terminating and non-recurring99; its value is 9.94987.. and it cannot be simplified further While discussing rational and irrational numbers, we need to compare them to find how terms mathematically differ from each other. Below are the differences between rational and irrational numbers in a table. Rational NumbersIrrational NumbersCan be written in ratio form, i.e., p/qCannot be written in ratio (p/q) formInclude decimals that are terminating (finite) or recurring (repeated in patterns)Include decimals that are non-terminating (infinite) or non-recurring (not repeated in patterns)Include perfect squares such as 1, 4, 9, 16, 25, 36.Include surds (numbers that cannot be simplified to remove a square root or cube root etc.) such as 2, 3, 5The numerator and denominator are whole numbers; the denominator is not 0. E.g., 3/4, 1/9It is impossible to write the numbers in fractional form. E.g., , 7 Now, let us learn about identifying rational and irrational numbers through some examples. identify the rational and irrational numbers from the given set 1.36591237, 5/8, 0.36, 0.19755683, 0.7711, and 1/36Solution:As we know,Rational numbers are finite or recurring and irrational numbers are infinite or non-recurring,1.36591237 irrational 5/8 = 0.625 rational0.04 = 1/25 rational0.19755683 irrational 0.7711 rational1/36 = 0.0277777777777778; rational Q1. Can the product of two irrational numbers be rational? Ans. YES. The product of two irrational numbers may or may not be rational. For example, 3 3 = 3; 3 is a rational number. Last modified on December 23rd, 2023 Objectives:Identify the different types of numbers in the real number system.Classify a number as a rational or irrational number. What is the real number system?The real number system consists of numbers that fall on the number line. This means that the real number system consists of EVERY number in the universe! Numbers play an important part in the real world by assigning values and weighing variables. We use the real number system every day. The real number system is broken down into two kinds of numbers: rationals and irrationals. We can further break down rational numbers into integers, whole numbers, and natural num

2}}$$\{ = }}\dfrac{{\sqrt 7 + 2}}{{\left({\sqrt 7 - 2} \right)\left({\sqrt 7 + 2} \right)}}$$= \dfrac{{\sqrt 7 + 2}}{{{{\left({\sqrt 7 } \right)}^2}{ } } - {{\left(2 \right)}^2}}.....(a + b)(a - b) = ({a^2} - {b^2})$$= \dfrac{{\sqrt 7 + 2}}{{{{7}} - 4}}$$= \dfrac{{\sqrt 7 + 2}}{3}$Hence, the number obtained on rationalizing the denominator of $\dfrac{1}{{\sqrt 7 - 2}}{{ }}$ is $\dfrac{{\sqrt 7 + 2}}{3}$.13. $\dfrac{1}{{\sqrt 9 - \sqrt 8 }}$ is equal to(A) $\dfrac{1}{2}\left({3 - 2\sqrt 2 } \right)$(B) $\dfrac{1}{{3 + 2\sqrt 2 }}$(C) $3 - 2\sqrt 2$(D) $3 + 2\sqrt 2$Ans: DTo find the value of $\dfrac{1}{{\sqrt 9 - \sqrt 8 }}$, first we need to rationalize it. This can be done by multiplying both numerator and denominator by $\sqrt 9 + \sqrt 8$ $= \dfrac{1}{{\sqrt 9 - \sqrt 8 }}$$= \dfrac{1}{{\sqrt 9 - \sqrt 8 }} \times \dfrac{{\sqrt 9 + \sqrt 8 }}{{\sqrt 9 + \sqrt 8 }}$$= \dfrac{{3 + 2\sqrt 2 }}{{9 - 8}}$$= \dfrac{{3 + 2\sqrt 2 }}{1}$$= 3 + 2\sqrt 2$The value of $\dfrac{1}{{\sqrt 9 - \sqrt 8 }}$ is \[3 + 2\sqrt 2 \].14. After rationalizing the denominator of \[\dfrac{7}{{3\sqrt 3 - 2\sqrt 2 }}\], we get the denominator as(A) \[13\](B) \[19\](C) \[5\](D) \[35\]Ans: BTo find the number obtained on rationalizing the denominator of \[\dfrac{7}{{3\sqrt 3 - 2\sqrt 2 }}\] , multiply both numerator and denominator by $3\sqrt 3 + 2\sqrt 2$.\[\dfrac{7}{{3\sqrt 3 - 2\sqrt 2 }}\]$= \dfrac{7}{{3\sqrt 3 - 2\sqrt 2 }} \times \dfrac{{3\sqrt 3 + 2\sqrt 2 }}{{3\sqrt 3 + 2\sqrt 2 }}$$= \dfrac{7\left({3\sqrt 3 + 2\sqrt 2 } \right)}{{{{\left({3\sqrt 3 } \right)}^2} - {{\left({2\sqrt 2 } \right)}^2}}$$ = $= \dfrac{7\left({3\sqrt 3 + 2\sqrt 2 } \right)}{{{27} - 8}}$$= \dfrac{7\left({3\sqrt 3 + 2\sqrt 2 } \right)}{{19}}$Therefore, the denominator after rationalization is 1915. The value of \[\dfrac{{\sqrt {32} + \sqrt {48} }}{{\sqrt 8 + \sqrt {12} }}\] is equal to(A) \[\sqrt 2 \](B) \[2\](C) \[4\](D) \[8\]Ans: B\[\dfrac{{\sqrt {32} + \sqrt {48} }}{{\sqrt 8 + \sqrt {12} }}\]= \dfrac{{4\sqrt 2 + 4\sqrt 3 }}{{2\sqrt 2 + 2\sqrt 3 }}$$= \dfrac{{4\left({\sqrt 2 { + }}\sqrt 3 } \right)}}{{2\left({\sqrt 2 { + }}\sqrt 3 } \right)}}$$= \dfrac{4}{2}$$= 2$Hence, the value of \[\dfrac{{\sqrt {32} + \sqrt {48} }}{{\sqrt 8 + \sqrt {12} }}\] is 2.16. If $\sqrt 2 = 1.4142$, then $\sqrt {\dfrac{{\sqrt 2 - 1}}{{\sqrt 2 + 1}}}$ is equal to(A) 2.4142 (B) 5.8282(C) 0.4142(D) 0.1718Ans: C$\sqrt {\dfrac{{\sqrt 2 - 1}}{{\sqrt 2 + 1}}}$$= \sqrt {\dfrac{{1.4142 - 1}}{{1.4142 + 1}}}$$= \sqrt {\dfrac{0.4142}}{{2.4142}}}$$= \sqrt {0.1715}$$= 0.4142$17. $\sqrt[4]{{\sqrt[3]{{2^2}}}}$ equals(A) ${2^{\dfrac{{ - 1}}{6}}}$(B) ${2^{ - 6}}$(C) ${2^{\dfrac{1}{6}}}$(D) ${2^6}$Ans: CSimplify it term by term.$\sqrt[4]{{\sqrt[3]{{2^2}}}}$$= {{\left({{\left({{2^2}} \right)}^{\dfrac{1}{3}}} \right)}^{\dfrac{1}{4}}}$$= \left({{\left({{2^2}} \right)}^{\dfrac{1}{3} \times }}^{\dfrac{1}{4}}} \right)$$= {\left({{2^2}} \right)^{\dfrac{1}{{12}}}}$$= {\left(2 \right)^{\dfrac{1}{6}}}$18. The product $\sqrt[3]{2}.\sqrt[4]{2}.\sqrt[{12}]{{32}}$ equals(A) $\sqrt 2$ (B) 2(C) $\sqrt[{12}]{2}$(D) $\sqrt[{12}]{{32}}$Ans: B$\sqrt[3]{2} \cdot \sqrt[4]{2} \cdot \sqrt[{12}]{{32}}$$= {\left(2 \right)^{\dfrac{1}{3}}} \cdot {\left(2 \right)^{\dfrac{1}{4}}} \cdot {\left(2 \right)^{\dfrac{1}{{12}}}}$$= {\left(2 \right)^{\dfrac{5}{{12}}}}$$= {\left(2 \right)^{\dfrac{1}{3}+\dfrac{1}{4}+ \dfrac{5}{2}}}$$= {\left(2 \right)^{\dfrac{{4 + 3 + 5}}{{12}}}}$$= {\left(2 \right)^{\dfrac{{12}}{{12}}}}$$= 2$Hence, the value of $\sqrt[3]{2} \cdot \sqrt[4]{2} \cdot \sqrt[{12}]{{32}}$ is 2.19. Value of $\sqrt[4]{{{{\left({81} \right)}^{ - 2}}}}$ is(A) $\dfrac{1}{9}$(B) $\dfrac{1}{3}$(C) 9(D) $\dfrac{1}{{81}}$Ans: ALet a be any integer $\{a\}^m)^n} = {a^{mn}}$\[\sqrt[4]{{{{\left({81} \right)}^{ - 2}}}}\]$= \sqrt[4]{{{{\left({\dfrac{1}{{81}}} \right)}^2}}}$$= {\left({{{\left({\dfrac{1}{{81}}} \right)}^2}} \right)}^{\dfrac{1}{4}}}$$= {\left({\dfrac{1}{{81}}} \right)^{2 \times \dfrac{1}{4}}}$$= {\left({\dfrac{1}{{81}}} \right)^{\dfrac{1}{2}}}$$= \dfrac{1}{9}$The value of $\sqrt[4]{{{{\left({81} \right)}^{ - 2}}}}$ is \[\dfrac{1}{9}\] .20. Value of \[{\left({256} \right)^{0.16}} \times {\left({256} \right)^{0.09}}\] is(A) \[4\](B) \[16\](C) \[64\](D) \[256.25\]Ans: ALet a and b are integers then ${a^m}.{a^n} = {a^{m + n}}$$\{\left({256} \right)^{0.16}} \times {\left({256} \right)^{0.09}}\] is 4.21. Which of the following is equal to\x]?(A) \[{x^{\dfrac{{12}}{7}}} - {x^{\dfrac{5}{7}}}\](B) \[\sqrt[{12}]{{{{\left({x^4} \right)}^{\dfrac{1}{3}}}}}\](C) \[{\left({x^3} \right)^{\dfrac{2}{3}}}\](D) \[{x^{\dfrac{{12}}{7}}} \times {x^{\dfrac{7}{{12}}}}\]Ans: C(A) \[{x^{\dfrac{{12}}{7}}} - {x^{\dfrac{5}{7}}}$ e x](B)$\sqrt[{12}]{{{{\left({x^4} \right)}^{\dfrac{1}{3}}}}}$$={ {\left(x \right)}^{4\times \dfrac{1}{3}\times \dfrac{1}{{12}}}}$$= {x^{\dfrac{1}{9}}}$$e x(C)\{\left({x^3} \right)^{\dfrac{2}{3}}}$$= {\left({x^3} \right)^{\dfrac{1}{2} \times }}^{\dfrac{2}{3}}$$= {x^{\dfrac{3}{3}}}$$= x$(D) \[{x^{\dfrac{{12}}{7}}} \times {x^{\dfrac{7}{{12}}}}$ e x\]So, option (C) is correctSample Questions1. Are there two irrational numbers whose sum and product both are rational? Justify.Ans: Yes, the sum and product of two irrational numbers are rational numbers.Assume, $4 + \sqrt 7 \& 4 - \sqrt 7 {\text{are two irrational numbers}}$$\{{(4)} + \sqrt 7) + (4 - \sqrt 7) = 8\text{ rational}$$(4 + \sqrt 7) \times (4 - \sqrt 7) = 16 - 7 = 9\text{ rational}$Hence we can conclude that two irrational numbers whose sum and product both are rational.2. State whether the following statement is true: There is a number \[{{x}}\] such that \[{{{x}}^{{2}}}\] is irrational but \[{{{x}}^{{4}}}\] is rational. Justify your answer by an example.Ans: True, the Statement given is true there is a number \[{{x}}\] such that \[{{{x}}^{{2}}}\] is irrational but \[{{{x}}^{{4}}}\] is rational.Assume,\[x = \sqrt[4]{2}\]\[{x^2} = {(\sqrt[4]{2})^2} = \sqrt 2 \text{ an irrational number}{\text{.}}\]\[{x^4} = {(\sqrt[4]{2})^4} = 2,\text{ a rational number}{\text{.}}\]Hence, the statement is There is a number \[{{x}}\] such that \[{{{x}}^{{2}}}\] is irrational but \[{{{x}}^{{4}}}\] is rational.EXERCISE 1.21. Let \[x\] and \[y\] be rational and irrational numbers, respectively. Is \[x + y\] necessarily an irrational number? Give an example in support of your answer.Ans: Yes, if \[{{x}}\] and \[{{y}}\] be rational and irrational numbers, respectively. Is \[{{x + y}}\] necessarily an irrational numberAssume,$x = 5\& y = \sqrt 7 $$x + y = 5 + \sqrt 7 (= p){\text{say}}$$\{{{p}}^{{2}}}\}{{ = }}\{{{5}}\{{ + }}\sqrt {7}} {{}}}^{{2}}}}$$\{{{p}}^{{2}}}\{{ = }}\{{{5}}^{{2}}}\{{ + }}\{{{{}}\sqrt {7}} {{}}}^{{2}}}\{{ + }}\{{{2}}\{{{5}}\{{{}}\sqrt {7}} {{}}}$$\{{{p}}^{{2}}}\{{ = }} {{25}}\{{ + }}\{{7}}\{{ + }}\{{10}}\sqrt {7}} \Rightarrow \dfrac{{{{p}}^{{2}}}\{{ - }}\{{32}}}}\{{{10}}}}\{{ = }}\sqrt {7}} $\[\{{x + y}\]$ is an irrational number.2. Let \[x\] be rational and \[y\] be irrational. Is \[xy\] necessarily irrational? Justify your answer by an example.Ans: No, if \[{{x}}\] be rational and \[{{y}}\] be irrational then, \[x{y}\]$ is not necessarily irrationalIf we suppose \[x = 2\] be a non-zero rational and $y = \sqrt 5$ be an irrational.Then, $x \times y = {{2}}\{ {\times }}\sqrt {5}\} {{ = }}\{{2}}\sqrt {5}\} {\text{ irrational}}$Hence, if \[{{x}}\] be rational and \[{{y}}\] be irrational then, \[x{y}\]$ is not necessarily irrational3. State whether the following statements are true or false? Justify your answer(i). $\dfrac{{\sqrt 2 }}{3}$ is a rational number.Ans: False, the division of an irrational number by a non-zero rational number gives an irrational number and here $\sqrt 2$ is an irrational number and 3 is a rational number.(ii). There are infinitely many integers between any two integers.Ans: False, As among two consecutive integers there is no existence of any integer.(iii). Number of rational numbers between \[15\] and \[18\] is finite.Ans: False, Among two rational numbers there exists an infinite number of rational numbers between them.(iv). There are numbers which cannot be written in the form $\dfrac{p}{q}$, \[q{ } e { }\]0 ,\[p, q\] both are integers.Ans: True, As there exists an infinite numbers which cannot be written in the form of $\dfrac{p}{q}$ where p and q are integers and$q e {0}}$.(v). The square of an irrational number is always rational.Ans: False, it cannot be always true as for an irrational number ${\left({\sqrt{{4}}}{{3}}}} \right)^{{2}}}$ = \sqrt 3$ which is not a rational number.(vi). \[\dfrac{{\sqrt {12} }}{{\sqrt 3 }}\] is not a rational number as $\sqrt {12}$ and $\sqrt 3$ are not integers.Ans: False, on solving \[\dfrac{{\sqrt {{{12}}} }}{{\sqrt {3}} }}\] we get,\[\dfrac{{\sqrt {12} }}{{\sqrt 3 } } = \dfrac{{\sqrt {4 \times 3} }}{{\sqrt 3 } } = \dfrac{{\sqrt 4 \times \sqrt 3 }}{{\sqrt 3 } } = \dfrac{{\sqrt 2 \times \sqrt 3 }}{{\sqrt 3 }} = 2 \times 1 = 2\] . Here, 2 is a rational number.(vii). $\dfrac{{\sqrt {15} }}{{\sqrt 3 }}$ is written in the form $\dfrac{p}{q}$, \[q{\text{ } } e {\text{ }}\]0\] and so it is a rational number.Ans: False, on solving $\dfrac{{\sqrt {{{15}}} }}{{\sqrt {3}} }}$ we get,\[\dfrac{{\sqrt {15} }}{{\sqrt {3}} }} = \dfrac{{\sqrt {5 \times 3} }}{{\sqrt 3 } } = \dfrac{{\sqrt 5 \times \sqrt 3 }}{{\sqrt 3 } } = \sqrt 5 \]. Here, $\sqrt 5$ is an irrational number.4. Classify the following numbers as rational or irrational with justification:(i). $\sqrt {196}$Ans: The given number is $\sqrt {{{196}}}$Here, $\sqrt {{{196}}} {{ = }}\sqrt {{{\left({{{14}}} \right)}^{{2}}}} {{ = }}{{14}}$, rational number.$\sqrt {{{196}}}$ is a rational number.(ii). $3\sqrt {18}$Ans: The given number is ${3}\sqrt {{{18}}}$\[{{3}}\sqrt {{{18}}} {{ = }}{{3}}\sqrt {{{{{3}}}}^{{2}}}} {{ = }}{{3}}\sqrt {{{{{3}}}}^{{2}}}} {{ = }}{{3}}\sqrt {{2}} {{ = }}{{9}}\sqrt {{2}} \]\[\sqrt {{2}} \] is a non-repeating and non-terminating number.\[\Rightarrow {{3}}\sqrt {{{18}}} \] is a non-repeating and non-terminating number.Hence, the number \[{{3}}\sqrt {{{18}}} \]cannot be represented as a ratio of two integers.Therefore, the number \[{{3}}\sqrt {{{18}}} \] is anirrational number.(iii). $\sqrt {\dfrac{9}{{27}}}$Ans: The given number is$\sqrt {\dfrac{{9}}{{{{27}}}}}$.\[\sqrt {\dfrac{{9}}{{{{27}}}}} {{ = }}\sqrt {\dfrac{{9}}{{{{9}}{{ \times }}{{3}}}}} {{ = }}\dfrac{{{1}}}{{\sqrt {3}} }}\]\[\sqrt {3}} \] is an irrational number.\[\Rightarrow \dfrac{{{1}}}{{\sqrt {3}} }}\]\[\sqrt {3}} \] is an irrational number.$\Rightarrow \sqrt {\dfrac{{{9}}}{{{{27}}}}}$is an irrational number.(iv). $\sqrt {\dfrac{{28}}{{343}}}$Ans: The given number is $\sqrt {\dfrac{{{{28}}}}{{{{343}}}}}$$\[\dfrac{{\sqrt {{{28}}} }}{{\sqrt {{{343}}} }}{{ = }}\dfrac{{\sqrt {{{2}}{{ \times }}{{2}}{{ \times }}{{7}}} }}{{\sqrt {{{7}}{{ \times }}{{7}}{{ \times }}{{7}}} }}{{ = }}\dfrac{{\sqrt {{7}}}}{{\sqrt {{7}}}}\], simple fractionAnd we know that rational numbers are the real numbers that can be written in simple fractions.The number $\sqrt {\dfrac{{{{28}}}}{{{{343}}}}}$ is a rational number.(v). $- \sqrt {0.4}$Ans: The given number is $- \sqrt {{{0}}{{.4}}}$\[- \sqrt {{{0}}{{.4}}} {{ = }} - \sqrt {\dfrac{{{4}}}{{{{10}}}}} {{ = }} - \dfrac{{{2}}}{{\sqrt {{{10}}} }}\]Here, \[\sqrt {{{10}}} \] is an irrational number.\[\Rightarrow - \dfrac{2}{{\sqrt {{{10}}} }}\] is an irrational number.$\Rightarrow - \sqrt {{{0}}{{.4}}}$is an irrational number.(vi). $\dfrac{{\sqrt {12} }}{{\sqrt {75} }}$Ans: The given number is $\dfrac{{\sqrt {{{12}}} }}{{\sqrt {{{75}}} }}$.\[\dfrac{{\sqrt {{{12}}} }}{{\sqrt {{{75}}} }}{{ = }}\dfrac{{\sqrt {{{4 \times 3}}} }}{{\sqrt {{{25 \times 3}}} }}{{ = }}\dfrac{{\sqrt {4}} \sqrt {{3}} }}{{\sqrt {{{25}}} \sqrt {{3}} }}{{ = }}\dfrac{{\sqrt {{2}}}}{{\sqrt {{5}}}}\], simple fractionAnd we know that rational numbers are the real numbers that can be written in simple fractions.The number $\dfrac{{\sqrt {{{12}}} }}{{\sqrt {{{75}}} }}$ is rational number.(vii). \[0.5918\]Ans: The given number is \[{{0}}{{.5918}}\].\[{{0}}{{.5918}}\] is a terminating decimal so it can be written in the form of $\dfrac{p}{q}$ where p and q are integers and$q e {0}}$Hence, the number 0.5918 is a rational number.(viii). \[\left({1 + \sqrt 5 } \right){{ - }}\left({4 + \sqrt 5 } \right)\]Ans: The given number is \[\left({{{1}}{{ + }}\sqrt {5}} } \right) - \left({{{4}}{{ + }}\sqrt {5}} } \right)\]\[(1 + \sqrt 5) - (4 + \sqrt 5) = 1 - 4 + \sqrt 5 - \sqrt 5 = -3\], rational number.Hence, \[\left({{{1}}{{ + }}\sqrt {5}} } \right) - \left({{{4}}{{ + }}\sqrt {5}} } \right)\] is rational number.(ix). \[10.124124...\]Ans: The given number is \[{{10}}{{.124124}}...\]When any rational number is expressed in the form of decimal expansion then it is either terminating or non-terminating recurring.\[{{10}}{{.124124}}...\] is a non-terminating recurring decimal expansion so is a rational number.(x). \[1.010010001...\]Ans: The given number is \[{{1}}{{.010010001}}...\]\[{{1}}{{.010010001}}...\] is a non-terminating non-recurring decimal expansion so is an irrational number.\[{{1}}{{.010010001}}...\] is an irrational number.Sample Questions1. Locate $\sqrt {13}$ on the number line.Ans:(i). Write 13 as a square of two natural numbers $\[{{13}}{{ = }}{{9}}{{ + }}{{4 = }}{{3}}^{{2}}}{{ + }}{{2}}^{{2}}}\]$(ii). Draw OA of measurement ${{3}}\{\text{units}}$ on the number line and then BA of ${{2}}\{\text{units}}$ in perpendicular to OA.(iii). Taking O as a centre and radius equal to OB, draw an arc which will intersect the number line at point P.(iv). A right triangle with known leg lengths determines a hypotenuse that is of equal length to the number you want to place on the number line.(v). Point P is refer to $\sqrt {{13}}$ $ 2. Express \[0.12\overline 3 \]in the form $\dfrac{p}{q}$ where \[p\] and \[q\] are integers and \[q\text{ } } e 0.\]Ans: Assume, \[{{x}}{{ = 0}}{{.12\bar 3}}\]$10x = 1.2\overline 3$$\{10x - x = 1}\{{.2}}\overline {{3}} {{ - 0}}\{{.12}}\overline {{3}} {{ = 1}}\{{.233}}\overline {{3}} {{ }}...\{ - 0}}\{{.1233}}\overline {{3}} {{ }}...$$\{{9x = 1}}\{{.11}}$$\{{x = }}\dfrac{{{{1}}\{{.11}}}}\{{9}}}$$\{{x}}\{{ = }}\dfrac{{{{111}}}}\{{900}}}}$$\{{x}}\{{ = }}\dfrac{{{37}}}}\{{{300}}}}$Hence, the number \[{{0}}{{.12}}\overline 3 \] in the form $\dfrac{p}{q}$is \[\dfrac{{{{37}}}}\{{{300}}}}\] .3. Simplify: $(3\sqrt 5 - 5\sqrt 2)(4\sqrt 5 + 3\sqrt 2)$Ans: The given expression is$\{{3}}\sqrt {5}\} {{ - }}\{{5}}\sqrt {2}\} {{)}}\{{4}}\sqrt {5}\} {{ + }}\{{3}}\sqrt {2}\} {{)}}$$\Rightarrow \{{12}}\{ {\times }}\{{5}}\{{ - }}\{{20}}\sqrt {2}\} {{ \times }}\sqrt {5}\} {{ + }}\{{9}}\sqrt {5}\} {{ \times }}\sqrt {2}\} {{ - }}\{{15 \times 2}}$$\{\text{Add the like terms, we get:}}$$\Rightarrow \{60}\{{ - }}\{20}\sqrt {{10}}\} {{ + }}\{{9}}\sqrt {{10}}\} {{ - }}\{30}\$\Rightarrow \{30}\{{ - }}\{{11}}\sqrt {{10}}\}$Hence, ${{3}}\sqrt {5}\} {{ - 5}}\sqrt {2}\} {{)}}\{{4}}\sqrt {5}\} {{ + 3}}\sqrt {2}\} {{) = 30}}\{{ - }}\{{11}}\sqrt {{10}}\}$4. Find the value of \[a\] in the following:$\dfrac{6}{{3\sqrt {2} - 2\sqrt 3 }} = 3\sqrt 2 - a\sqrt 3$Ans: Given expression is $\dfrac{{{6}}\{{{{3}}\sqrt {2}\}} - {{2}}\sqrt {3}\}}{{{2}}\{{ + }}\{{2}}\{ {\times }}\{{3}}\sqrt {2}\} - {{a}}\sqrt {3}\}$$\{\text{Comparing the like terms, we get:}}$$a = - 2$5. Simplify: ${\left[{5{{\left({8^{\dfrac{1}{3}}} + 2{7^{\dfrac{1}{3}}} \right)}^3}} \right]^{\dfrac{1}{4}}}$ Ans: ${\left({5{{\left({{{{{2}}^{\dfrac{1}{3}}}} + {{{{3}}}^{\dfrac{1}{3}}}} \right)}^{\dfrac{1}{4}}}} \right)^{\dfrac{1}{2}}}$ = 2 \times {3^1}$$= 4 \times 36 + {\left({{{{4}}^2}} \right)^{\dfrac{1}{3}}} + 2 \times {3^1}$$= 4 \times 36 + {4^3} + 6$$= 144 + 64 + 6$$= {{ }}214$Activities for Chapter 1There are 4 activities in the chapter with an aggregate of 96 model questions and a ton of solved models, which explains every one of the fundamental concepts in the section. These questions cover every one of the significant subjects of the section like kinds of numbers, their properties, number line, whole numbers, and so on. The NCERT Exemplar issues with answers for Class 9 Math chapter 1 are meant to give abundant information to get every one of the ideas explained in detail from the chapter.Some Important topics from NCERT Exemplar for Class 9 Math Solutions Chapter 1 - 'Number Systems'NCERT Exemplar issues for CBSE Class 9 Math Chapter 1 solutions principally manage numbers, their types, and their capacities. It is the first and the principal chapter of Class 9 Math, which makes the base for different sections. In the previous classes, you learned with regards to number lines and this chapter is the lengthy model of number lines. Every type of number i.e regular numbers, whole numbers, irrational numbers, rational numbers, and natural numbers are clarified profoundly in the section.The number line and its ideas and functions are clarified minutely. The properties of numbers are depicted and clarified with the assistance of questions. With an aggregate of 4 activities and many solved models, this section contains properties of rational and irrational numbers, surd, radicals, laws of revolutionaries, properties of surds, and objective examples.

Rational and irrational. Compare rational numbers. Rational numbers and irrational numbers. Comparing and ordering rational numbers. Rational vs irrational numbers.

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