Irrational numbers and evaluation approximations.

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All integers and fractions are called rational numbers. For example, 5 ;14 /4; -12; -3/5; 137 etc. are each rational numbers. Any rational number can be written as a finite or infinite periodic decimal.

Rate: An infinite decimal that is not periodic is called an irrational number. For example, 2=1.4142136..., P=3.141592..., 3=1.732... etc. are irrational numbers. 3.14 is called an approximate value of P with an accuracy of 0.01. Similarly, 1.73 and 1.4 are approximate values of 3 and 2 with an accuracy of 0.01 and 0.1, respectively. Rotional numbers have a common axis with unity is the measure of measureless quantities.

If the method of finding any number of decimals of an irrational number is specified, such an irrational number is considered known (or given) .

If we divide infinite (or) decimal fractions representing a given (irrational or irrational) number by a decimal number, 0.1 of this number; 0.01;0.001;…. We generate the approximate value of Gacha with min. If we add 1 to the last stored number, we will create the approximate value of the given number with that precision, but with an extra I.

Equality and inequality between irrational numbers. Real numbers.

If two irrational numbers are correspondingly expressed as decimals consisting of different digits, they are considered equal. If the number in one's room is larger than , then it is larger. For example, the number 2745037... is larger than 2.745029... because all the numbers up to 6 are the same. the 6th digit of the first indicates a number greater than the 6th digit of the second.

This definition also works when comparing an irrational number with a rational number if the rational number is converted to a decimal. This definition applies if decimals with a period of 9 are changed to vowels ending in zeros , for example, 2, 39999 ...... instead of 2, 400000 ..... It is also suitable for comparing two spread rational numbers .

This follows from the above definition of inequalities.

If J is an irrational number, a is an approximate value obtained by subtracting the number J, and b is an approximate value obtained by adding the number J, then

$$\mathbf{a < J < b}$$

Irrational numbers can be positive or negative depending on the meaning of the measured quantity. As with rational numbers, the absolute value of the smaller of two negative real numbers is the larger, any negative number is less than zero, and zero is less than a positive number. Both rational and irrational numbers are called real numbers. Description of operations on irrational numbers. Let J and B be any given positive irrational numbers (j=3, B=2 in the following example) and let the descriptive values of numbers J and B be as follows.

Table 1.1. Approximate value of numbers.x

	Accuracy			
	0.1 up until	0.01 up until	0.001 up until	0.0001 up until
J is for the number	1.7	1.73	1.732	1.7320

B – for the number	1.4	1.41	1.414	1.4142

Their corresponding approximate values are obtained by adding one to the last digit of the decimal places in these numbers.

Then a) adding J and B is like this - finding a number is u

Here are the totals Here are the totals

be bigger than each be smaller than each

1.7+1.4 = 3.1 1.8+1.5 = 3.3

1.73 + 1.41 = 3.14 1.74 + 1.42 = 3.16

1.732+1.414 = 3.146 1.733 + 1.415 = 3.148

1.7320 + 1.4142 = 3.1462 1.7321 + 1.4143 = 3. 1464

etc. i.e. :

Addition of numbers in general J and B - any two real numbers a and b of a third a - number greater than the sum of any approximate values obtained by their minus, but less than the sum of any approximate values \u200b \u2000received by addition we assume without proof that there is and at the same time only one for .

b) taking the approximate values of the numbers a and b, we can say that: JB product is such a number that here are these multiplications here are these multiplications greater than each: less than each:

1.7 x 1.4=2.38 1.8 x 1.5=2.70

1.73 x 1.41=2.4393 1.74 x 1.42=2.4708

1.732 x 1.414=2.449048 1.733 x 1.415=2.452195

1.7320 x 1.4142=2.44939440 1.7321x1.4143=2.44970903

etc. i.e. :

To multiply a and b is to find a third number that is greater than the product of any approximate value of their minus, but less than the product of any approximate value of their plus. We accept without proof that such a number exists, and at the same time only one.

c) Irrational number J is a word that means finding the product made up of two, three, four, etc. multipliers equal to J in the second, third, fourth, etc. degree.

g) Inverse operations for irrational numbers are defined in the same way as for rational numbers, for example, subtracting a and b means finding the number a such that the sum of -b + X is equal to a

If one of the numbers a and b is rational and is an expression with finite decimals, then in the specified definitions, instead of approximate values of such a number, its exact value should be taken. Multiplication of an irrational number by zero is considered to be equal to zero, as in the case of rational numbers.

Operations on negative irrational numbers are performed according to the rules given for rational negative numbers. Looking more closely, it can be determined that the properties of operations on irrational numbers also have the properties of their operations on rational numbers, addition and multiplication operations, permutation and grouping have properties, multiplication and division, apart from them, has the property of distribution. The properties expressed by inequalities also hold for irrational numbers, for example: if a > b then a + y > p + y (if y > 0) and ay < by (if Y<O) if and the like.

Extract the root

Definition : A number that gives a when raised to the nth level is called the nth root of the number a.

level root of a number is defined as follows: $\sqrt[n]{a}$From the definition itself ($\sqrt[n]{a}$) ^{n} = a. This equality can be used to verify that the rooting operation was performed correctly. For example: $\sqrt[11]{2408}$let us find = 2 . To verify that this is correct , we raise 2 to the eleventh power. $2^{11} = 2048$ comes out. So the root is found correctly . Similar to this $\sqrt[4]{39.0625}$= 2 .5 because $2.5^4 = 39.0625$

Rational and Irrational algebraic expressions.

If a letter in an algebraic expression is not under a radical sign, this expression is said to be a rational expression with respect to this letter. Otherwise, the expression is called an irrational expression with respect to this letter. For example: the expression $3a + 2\sqrt{x}$is rational with respect to a and is irrational with respect to x. If an algebraic expression is called a rational algebraic expression without specifying which letter it is relative to, it is assumed to be rational relative to all the letters in this expression.

The main property of a radical

When we talk about roots (radicals), we understand only arithmetic roots. Let's take any radical, for example: $\sqrt[3]{a}$and raise the number under the root to a certain degree, for example: square, and at the same time the radional index, the number under the root, by the degree we raised it, therefore to the index, that is, in our example Let's multiply by J. Then the new radical is $\sqrt[6]{a^2}$. We prove that the amount of the radical does not change as a result of these two methods.

$\sqrt[3]{a}$Let's assume that we found a number X by calculating . Then we $\sqrt[3]{a}$can write the equations : x = and $X^{3 = a.}$ Let's square both values of the next equality.

$(X^3)^2 = a^{2,}$ that is, $x^6 = a^2$ from the next equality $X = \sqrt[6]{a^2}$ seems to be. So the number x alone is equal to both $\sqrt[3]{a}$ga and $\sqrt[6]{a^2}$, so : $\sqrt[3]{a} = \sqrt[6]{a^2}$ similarly the following can also be believed:

$\sqrt{a} = \sqrt[4]{a^2} = \sqrt[6]{a^3} = \sqrt[8]{a^4}$ .... ,

$\sqrt[3]{m^2} = \sqrt[6]{m^4} = \sqrt[9]{a^6} = \sqrt[12]{m^8}$ …..,

$\sqrt{1+x} = \sqrt[4]{(1+x)^2} = \sqrt[6]{(1+x)^3} =$ …..,

If the exponent of the root and the exponent of the expression under the root are multiplied (or divided) by the same number, the quantity of the radical does not change.

Results :

different level radicals one different to the pointer to bring can (this different the denominators one different to the denominator to bring looks like). Of this for everyone radical indicators common of the divisor (the best - eng to find the smallness of). and of them each one related filler to multipliers multiplied by that with together each one radical hint under expression belongs to to the degree raise enough

For example : $\sqrt{ax}$, $\sqrt[3]{a^2}$, $^6\sqrt{x}$

Radical indicators the most small divisor 6, complement multiplier the first radical 3 for the second radical 2 and for the third will be 1 . In that case :

$\sqrt{ax}= {}^6\sqrt{(ax)^3} = a^3 x^3$, $a^3 = {}^6(a^2)^3 = {}^6a^4$, ${}^6x$

if radical hint under expression degree being his pointer with radical indicator common to the multiplier have if , both indicator that's it to the multiplier to be can

Examples : 1) ${}^6X^2 = {}^3x$, 2) ${}^6(1+x)^3 = 1+x$

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