# RATIONAL NUMBERS

**Words to be Learned**

**Exercise 1**

*Read these international words and try to guess their meaning.*

fraction ['fræk∫(ə)n], 'fractional, equivalent [ı'kwıv(ə)lənt] *a*, relatively ['relətıvlı], rational ['ræ∫ənl], process ['prəuses] *n*, to reduce [rı'dju:s], divisible [dı'vızəbl], concept ['kɔnsept] *n*, principle ['prınsəpl] *n*, valid ['vælıd] *a*.

**Exercise 2**

*Repeat after the teacher.*

|  |  |
| --- | --- |
| chapter ['t∫æptə] глава  numerator ['nju:m(ə)reıtə] числитель  denominator [dı'nɔmıneıtə] знаменатель  into ['ıntə, 'ıntu(:)] в (внутрь)  quantity ['kwɔntıtı] количество  proper ['prɔpə] 1. правильный; 2. присущий, собственный  improper [ım'prɔpə] неправильный  mixed [mıkst] смешанный  integer ['ıntıʤə] целое число  never ['nevə] никогда  ever ['evə] когда-либо  yet [jet] 1. тем не менее; 2. еще (нет)  high [haı] высокий | prime [praım] 1. простой; 2. первичный  attempt [ə'tem(p)t] *n* попытка; *v* пытаться  dwell (on) [dwel] (dwelt) останавливаться (на)  term [tɜ:m] член, термин  twice [twaıs] дважды; twice as вдвое  low [ləu] низкий  accordingly [ə'kɔ:dıŋlı] соответственно  conclude [kən'klu:d] делать заключение, вывод  conclusion [kən'klu:ʒ(ə)n] заключение  bring [brıŋ] (brought [brɔ:t], brought) приносить |

**Notes**

1. does not meet all of our needs – не удовлетворяет все наши потребности
2. dwell on – остановимся на
3. the same is true of – то же самое справедливо
4. the process of bringing – процесс приведения
5. reducing a fraction – сокращение дроби
6. draw the conclusion – сделать вывод
7. just as valid – столь же справедливо

**Exercise 3**

*Listen and repeat after the speaker.*

[л] – 'subject, 'publish, us, 'utter, cons'truct, a'bove, dis'cover, 'other, 'nothing, young, e'nough, double;

[ɔ] – hop, lot, want, what, water, was;

[ı] – system, duty, ready, gym, inch;

[e] – help, tend, head, bread, steady, ready;

[u] – book, took, look, put, pull;

[u:] – true, blue, rule, soon, group, smooth;

[ju:] – due, 'unity, use, news, knew, few, 'Newton, 'Europe, 'stupid.

**Exercise 4**

*Ask questions to which the following sentences could be answers.*

1. The numerator and the denominator of this fraction are divisible by two. 2. The given quantity should be properly divided. 3. It was impossible to reduce this fraction further. 4. The given principle is valid for all such cases. 5. The scientists were determined to develop further that idea. 6. You have to read the following chapter. 7. He was able to find a proper answer. 8. I wanted to know what had happened to that machine. 9. You are to choose the best program. 10. We have just come to this conclusion.

**Exercise 5**

*Read the text below and give a short outline of the text in English.*

**Rational Numbers**

In this lesson you will deal with rational numbers. Let us begin like this.

John has read twice as many books as Bill. John has read 7 books. How many books has Bill read?

This problem is easily translated into the equation 2*n*=7, where *n* represents the number of books that Bill has read. If we are allowed to use only integers, the equation 2*n*=7has no solution. This is an indication that the set of integers does not meet all of our needs1.

If we attempt to solve the equation 2*n*=7, our work might appear as follows.

2*n*=7, =, × *n* =, 1× *n* =, *n* =.

The symbol, or fraction,  means 7 divided by 2. This is not the name of an integer but involves a pair of integers. It is the name for a rational number. *A rational number* is the quotient of two integers (divisor and zero). The rational numbers can be named by fractions. The following fractions name rational numbers:

, , , , .

We might define a rational number as any number named by  where *a* and *n* name integers and *n*≠0.

Let us dwell on2 fractions in some greater detail.

Every fraction has a numerator and a denominator. The denominator tells you the number of parts of equal size into which some quantity is to be divided. The numerator tells you how many of these parts are to be taken.

Fractions representing values less than l, like  (two thirds) for example, are called proper fractions. Fractions which name a number equal to or greater than 1, like  *or* , are called improper fractions.

There are numerals like 1(one and one second), which name a whole number and a fractional number. Such numerals are called mixed fractions.

Fractions which represent the same fractional number like, , ,, and so on, are called equivalent fractions.

We have already seen that if we multiply a whole number by 1 we shall leave the number unchanged. The same is true of3 fractions since when we multiply both integers named in a fraction by the same number we simply produce another name for the fractional number. For example, l×=. We can also use the idea that 1 can be expressed as a fraction in various ways:,, and so on.

Now see what happens when you multiply *by* .You will have =1×=×==.

As a matter of fact in the above operation you have changed the fraction to its higher terms.

Now look at this:: 1=:==. In both of the above operations the number you have chosen for 1 is  In the second example you have used division to change  to lower terms, that is to . The numerator and the denominator in this fraction are relatively prime and accordingly we call such a fraction the simplest fraction for the given rational number.

You may conclude that dividing both of the numbers named by the numerator and the denominator by the same number, not 0 or 1 leaves the fractional number unchanged. The process of bringing4 a fractional number to lower terms is called reducing a fraction5.

To reduce a fraction to lowest terms, you are to determine the greatest common factor. The greatest common factor is the largest possible integer by which both numbers named in the fraction are divisible.

From the above you can draw the following conclusion6: mathematical concepts and principles are just as valid7 in the case of rational numbers (fractions) as in the case of integers (whole numbers).

**Exercise 6**

**a)** *Shorten the text leaving out the unimportant details;*

**b)** *Write a few questions about the text to ask your class-mates;*

**c)** *Be prepared to render and discuss the text in class.*

**Exercise 7**

**a)** *Listen and repeat. Guess the meaning of the words in italics.*

**b)** *Arrange the words according to the parts of speech they belong to.*

rational–*ir'rational–'rationalize;* 'integer–*integral* ['ıntıgrəl] n, *a* – *integrity* [ın'tegrıtı]; indicate–*indication;* to appear–*to disappear;* fraction–*fractional;* to define–*definition–definite* ['defınıt] *a–* in'definite *a;* quantity–*quantitative* ['kwɔntıtətıv]; value *n, v,*– *valuable*–*valueless;* proper–*properly;* like *a*–*likeness;* same–*sameness;* to change–*unchanged*–*changeless;* simply–*simplify;* example–*examplify;* to conclude–*conclusion;* 'valid–*va'lidity;* to reduce– *reduction.*

**Exercise 8**

*Comment on the speaker's words.*

Sp.: They have not seen the program, (last week).

St.: *As far as I know* they *saw* the program last week.

**a)** 1. She has not given her test work to the teacher, (after the lesson). 2. They have never worked independently, (a few years ago). 3. She has never made an attempt to change the situation, (some time ago). 4. He has not made such a statement, (last night). 5. He has not proved this theorem, (two years ago). 6. He has not taken part in this investigation, (when he was in Moscow).

Sp.: He *did* the same exercise. (I was told).

St.: Yes, I was told he *had done* the same exercise.

**b)** 1. They *studied* various aspects of the problem. (I knew) 2. They *produced* important information. (he said) 3. They *discussed,* the advantages of the modern computer. (I was told) 4. He only *gave* a general definition. (I remembered)

**Exercise 9**

*Supply a general question to each one of these sentences.*

1. These are rational numbers. 2. I studied the first chapter. 3. This conclusion is rather unexpected. 4. You reduced the fraction correctly. 5. She is determined to finish her work in time. 6. I brought you the book. 7. He chose a wrong solution. 8. This integer is divisible by two. 9. It happened on Friday.

**Exercise 10**

*Read the questions about the text and write down your answers* (+,–)*.*

1. Is this chapter concerned with fractions? 2. Is the fraction  an improper fraction? 3. Are there mixed fractions? 4. Is it possible to reduce the fraction  to lower terms? 5. Could you change the fraction  to higher terms? 6. Is 20 divisible by 5? 7. Shall we change a fraction if we multiply it by 1? 8. Shall we change a fraction if we divide it by 1? 9. Is  a rational number? 10. Are principles of arithmetic valid in the case of mathematics? 11.Is a rational number another name for a fraction? 12. Does every fraction have a numerator and a denominator?

**Exercise 11**

*Ask questions to which the following sentences could be answers.*

1. Fractions like  are called proper fractions. 2. In the proper fraction the denominator is greater than the numerator. 3. In the improper fraction the denominator is less than the numerator. 4. A mixed fraction contains an integer and a proper fraction. 5. There also exist equivalent fractions. 6. You are to give an example of a mixed fraction. 7. The little boy was able to multiply and divide fractions. 8. If you write first  =  and then  =  that means that you have replaced 3 with *n.* 9. The words *choose* and *select* mean one and the same thing. 10. If you change a fraction from  *to*  you will reduce it to its lowest terms. 11.This chapter deals with various kinds of fractions. 12. Now we are concerned with mixed fractions.

**Exercise 12**

*Read the following text. Entitle it.*

Using mathematical concepts and principles, we can show the validity of the usual rule (*правило*) of arithmetic, that is, multiplying both integers named in a fraction by the same whole number simply produces another name for the fractional number.

From the solution of equations such as *4y =* 11,we find a general pattern that results from the division property of equations.

4*y* = 11,  =  why?, ×*y* =  why?, 1×*y =*  why?, *y =*  why?

Consider the equation *ny=c,* where *n* and с name integers *(п≠0).* Using the division property of equations we obtain the following solution.

*ny* = *c,*  =  why?, ×*y* =  why?, 1×*y* =  why?, *y* =  why?

From this we are able to make the following conclusion. *If ny* = *c,* then *y* =  *(п≠0).*

You have used this idea in arithmetic. It indicates that division and multiplication are inverse operations, that is, dividing by 5 is the inverse of multiplying by 5.

**Exercise 13**

*Read the words. Give the Russian equivalents of the words in italics.*

valid–*validity;* simple–simply–*simplification*–*simplify;* to solve–*solvable*–*insolvable;* result n–to result *v;* to obtain–*obtainable*–*unobtainable;* ideal–*idealist*–*idealistic;* proper–*properly;* mixed–*mixture–to mix;* relatively–*relative*–*relativity;* to determine– *determination*–*undetermined;* equal–*equalize.*

**Exercise 14**

*Say the following in English.*

1. Мы уже знаем, что каждая дробь имеет числитель и знаменатель. 2. На что указывает знаменатель? 3. На что указывает числитель? 4. Дроби, подобные  или , называют правильными дробями. 5. Дроби, называющие числа большие, чем единица, – неправильные дроби. 6. Дайте пример смешанной дроби. 7. Мы только что разделили отрезок на равные части. 8. Что вы знаете об эквивалентных дробях? 9. Вы, возможно, помните, что когда целое число умножают на 1, оно остается неизменным. 10. Что вы изменили в этом уравнении? 11. В этом уравнении вы заменили букву *а* цифрой. 12. Дробь  меньше единицы. 13. Дробь  больше единицы. 14. Возможно ли сократить эту дробь?