# DECIMAL NUMERALS

**Words to be Learned**

**Exercise 1**

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

diagram *n*, separate *a, v,* decimal, indefinitely, procedure *п,* situation, introduce *v,* algorithm, placement, vertical, standard *n, a,* identity.

**Exercise 2**

*Repeat after the teacher.*

|  |  |
| --- | --- |
| comma запятая  point точка  left левый  skip пропускать  repeat повторять  pattern схема, образец  observe 1. наблюдать; *2.* соблюдать  namely а именно  full полный  care забота  careful тщательный, внимательный  step шаг | lie (lay, lain) лежать  keep (kept) держать, хранить  align располагать на одной линии  far 1. далеко; 2. далекий  appropriate соответствующий, подходящий  correspond 1. соответствовать; 2. переписываться  hour час  affect воздействовать  agreement согласие |

**Notes**

1. over and over again – многократно
2. may prove helpful – может оказаться полезным
3. to the left (right) of – налево (направо) от
4. at the right of – справа
5. just as well – точно так же
6. take care of – (*зд.*)охватить, предусмотреть
7. in full agreement with –в полном соответствии с
8. this keeps each digit – это удерживает каждую цифру
9. as appropriate – как полагается

**Exercise 3**

*Listen and repeat after the speaker.*

[eı] – stable, waste, famous, danger, raise, con'tain, ob'tain, a'gain, mainly, stay, day, way, say, they, grey, 'stimulate, 'calculate, 'formulate, great;

[aı] – mild, bind, find, design, a'lign, sign, i'deal, item, shine, light, de'fine, ap'ply, sky, shy, 'typist, im'ply, high;

[au] – brown, town, down, out, about, found, stout, loud;

[ou] – note, so, only, though, low, slow, own, cold, hold, most, load, boat, road, coat, coast.

**Exercise 4**

*Read these words.*

may, veil, sigh, idle, outer, wild, design, old, designate, fight, mind, amount explain, town, cloud, fable, rain, gold coal, try, host, cycle, fly, wait, graduate, blow, round, noble, break, blind, flow, approach, although, stout, mild, load, low, mail, sign, align, plain, night, know, now, how, great.

**Exercise 5**

*Ask questions about the sentences below.*

1. I found this article very helpful. (why). 2. You should skip this chapter because it is not interesting. (why). 3. You are to place a point between these two digits. (what). 4. You ought to repeat these words again. (why). 5. The vertical line separates the two groups of digits. (how). 6. Our discussion dealt only with the general pattern. (why). 7. They are going to introduce the new system. (when). 8. He will have to be very careful if he is going to perform this operation. (why). 9. The student gave an example of an algorithm. (who). 10. Our teacher introduced a new system of equations, during the previous seminar. (when). 11. All those numerals were to be properly aligned. (in what way).

**Exercise 6**

*Read the text below and find in it answers for the following questions.*

1. How many numerals are used in our numeration system? 2. What does a comma separate? 3. What kind of numbers do all the digits to the left of the decimal number represent? 4. Can you give an example of a repeating decimal? 5. Can rational numbers be named by decimal numerals? 6. Why is it more difficult to learn division in decimal form? 7. Does each step of addition in fractional form have a corresponding step in decimal form? 8. Why is it unnecessary to write .26 as .260?

**Decimal Numerals**

In our numeration system we use ten numerals called digits. These digits are used over and over again1 in various combinations. Suppose, you have been given numerals 1, 2, 3 and have been asked to write all possible combinations of these digits. You may write 123, 132, 213 and so on. The position in which each digit is written affects its value. How many digits are in the numeral 7086? How many place value positions does it have? The diagram below may prove helpful2. A comma separates each group or period. To read 529, 248, 650, 396, you are to say: five hundred twenty-nine billion, two hundred forty-eight million, six hundred fifty thousand, three hundred and ninety-six.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Billions period | | | Millions period | | | Thousands period | | | Ones period | | |
| Hundred billions | Ten-billions | One-billion | Hundred millions | Ten-millions | One-million | Hundred-thousands | Ten-thousands | One-thousand | Hundreds | Hundreds | Hundreds |
| 5 | 2 | 9, | 2 | 4 | 8, | 6 | 5 | 0, | 3 | 9 | 6 |

But suppose you have been given a numeral 587.9 where 9 has been-separated from 587 by a point, but not by a comma. The numeral 587 names a whole number. The sign (.) is called a decimal point.

All digits to the left of3 the decimal point represent whole numbers. All digits to the right of the decimal point represent fractional parts of 1.

The place-value position at the right4 of the ones place is called tenths. You obtain a tenth by dividing 1 by 10. Such numerals like 687.9 are called decimals.

You read .2 as two tenths. To read .0054 you skip two zeroes and say fifty four ten thousandths.

Decimals like .666..., or .242424..., are called repeating decimals. In a repeating decimal the same numeral or the same set of numerals is repeated over and over again indefinitely.

We can express rational numbers as decimal numerals. See how at may be done.

 = 0.31**.**  =  =  = 0.16

The digits to the right of the decimal point name the numerator of the fraction, and the number of such digits indicates the power of 10 which is the denominator. For example, .217 denotes a numerator 217 and a denominator of 103 (ten cubed) or 1000.

In our development of rational numbers we have named them by fractional numerals. We know that rational numerals can just as well5 be named by decimal numerals. As you might expect, calculations with decimal numerals give the same results as calculations with the corresponding fractional numerals.

Before performing addition with fractional numerals, the fractions must have a common denominator. This is also true of decimal numerals.

When multiplying with fractions, we find the product of the numerators and the product of denominators. The same procedure is used in multiplication with decimals.

Division of numbers in decimal form is more difficult to learn because there is no such simple pattern as has been observed for multiplication.

Yet, we can introduce a procedure that reduces all decimal-division situations to one standard situation, namely the situation where the divisor is an integer. If we do so we shall see that there exists a simple algorithm that will take care of6 all possible division cases.

In operating with decimal numbers you will see that the arithmetic of numbers in decimal form is in full agreement with7 the arithmetic of numbers in fractional form.

You only have to use your knowledge of fractional numbers.

Take addition, for example. Each step of addition in fractional form has a corresponding step in decimal form.

Suppose you are to find the sum of, say, .26 and 2.18. You can change the decimal numerals, if necessary, so that they denote a common denominator. We may write .26=.260 or 2.18=2.180. Then we add the numbers just as we have added integers and denote the common denominator in the sum by proper placement of the decimal point.

We only have to write the decimals so that all the decimal points lie on the same vertical line. This keeps each digit8 in its proper place-value position.

Since zero is the identity element of addition it is unnecessary to write .26 as .260, or 2.18 as 2.180 if you are careful to align the decimal points, as appropriate9.

**Exercise 7**

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

to 'separate − *separation* − *'separable* − *in'separable;* indefinitely − *'definitely* − *'definite* − *in'definite;* **ֽ**situ'ation − *to 'situate;* to intro'duce −**ֽ***intro'duction;* to place − *to re'place* − *to dis'place* − *'placement* − *displacement;* i'dentity − *i'dentical* − *i'dentify;* to re'peat −**ֽ***repe'tition;* to ob'serve −**ֽ***obser'vation;* full − *fully;* care *n* − *to care* − *'careful* − *'carefully* − *'careless* − *'carelessness;* to a'lign − *a'lignment;* to**ֽ**corres'pond −**ֽ***corres' pondence* −**ֽ***corres' pondent n, a.*

**Exercise 8**

*Ask the speaker a question to find out the details.*

1. He had to dwell on the disadvantages of the old procedure. (why). 2. They were to prove that the generally accepted method was not good. (how). 3. We were able to visit this ancient town twice. (when). 4. They had to come to a certain agreement. (what kind of). 5. I was allowed to replace this complicated and old machine. (when). 6. They were able to choose some articles for publication. (which articles).

**Exercise 9**

*Listen to the questions about the text and write down your answers* (+, −).

1. Are there five digits in the decimal system of notation? 2. Does the position of the digit affect its value? 3. Does a point separate each period? 4. Do the digits to the right of the decimal point represent whole numbers? 5. Do you obtain a tenth by dividing 1 by 10? 6. Can rational numbers be named by decimal numerals? 7. Must we have a common denominator before we add decimal numerals? 8. Is division in decimal form difficult? 9. Can we express rational numbers as decimal numerals? 10. Is zero the identity element of addition?

**Exercise 10**

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

1. We consider your data very helpful. 2. All these combinations have been repeated over and over again. 3. There is a diagram below. 4. The change of the order may affect the result. 5. It has to be pointed out that the procedure developed is very complicated. 6. On the right and on the left of the comma you see three digits. 7. He obtained the difference after he had subtracted the numeral. 8. The identity property is being considered by the students. 9. The value of the digit is defined by its position. 10. Yes, the necessary procedure has always been followed. 11. The given definition corresponds to the idea of uniqueness. 12. You may change 3.29 to 3.290 if it helps] you to obtain the correct answer. 13. When you deal with decimalnumbers you are to align the decimal points. 14. In the operation of multiplication it is the product of the numerator and the denominator that we actually find.

b) *Name the predicate in each one of the sentences above. Pay special attention to the functions of the verb 'to have'.*

**Exercise 11**

*Go back to the text 'Decimal Numerals',*

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

b) *Write a few questions to ask your group-mates;*

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

**Exercise 12**

a) *Ask questions about the text to follow.*

Developing the definition of addition of rational number, the students discover that the basic rule of addition applies to every addition involving rational numbers.

In a rigorous treatment (*строгий подход*) to rational numbers a mathematician will define addition as follows:

 +  = **.**

Then he will check to determine whether or not this definition preserves (*сохранять*) the usual closure, commutative, and associative properties and whether or not the number zero remains the identity element.

b) *Now that you have written your questions, be prepared to answer them in class.*

**Exercise 13**

*Read these words and give Russian equivalents of the words in italics.*

digit − *digital;* use − *useful* − *usefulness* − *uselessness;* possible − *possibly* − *possibility;* value − *valuable* − *valueless;* separate *a* − *to separate* − *separable* − *inseparable;* to suppose − *supposition;* to repeat − *repetition;* power − *powerless* − *powerful;* to expect − *unexpected;* difficult − *difficulty;* integer − *integration;* to exist − *existence;* agreement − *disagreement;* to use − *usable;* to change − *changeless* − *unchanged;* placement − *displacement;* identity − *identify* [aı'dentıfaı]; element − *elementary;* appropriate − *appropriately.*

**Exercise 14**

*Render the text (you may work in pairs).*

**Exercise 15**

*Say the following in English.*

1. Эти числа использованы в различных комбинациях. 2. Диаграмма оказалась полезной. 3. Запятая отделяет периоды. 4. Этот знак называют десятичной точкой. 5. В числе 5.2 цифра 5 находится слева от точки и обозначает целое число. 6. Если мы разделим 1 на 10, то мы получим одну десятую. 7. Периодические дроби были введены сегодня на уроке. 8. Рациональные числа могут быть выражены в десятичных дробях. 9. Покажите мне диаграмму. 10. Где схема? 11. Эту дробь нельзя сократить. 12. Отдели запятой эти три цифры. 13. Нам пришлось изменить процедуру. 14. Они получили нужную информацию? 15. Он сказал, что они уже обсудили ситуацию. 16. Она согласилась прийти?

**Exercise 16**

*Discuss the text of Exercise 12. Work in pairs.*