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USE OF SOFTWARE PACKAGES IN TEACHING THE SUBJECT OF NUMERICAL LINES

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In the educational process, teaching students in mathematical subjects by connecting the subjects with their specialty subjects ensures that students master the subject easily. The topic of lines is one of the main topics of Higher Mathematics. Since the concepts of this topic are new for students, they face some difficulties in mastering it. Several years of experience in the educational process show that teaching topics related to mathematical subjects in connection with programming increases students' interest in science and ensures easy mastering of subjects.

The students were given the task of finding the part of the subject of strings related to programming, calculating sums of strings and approaching them in two different ways. In this work, we present examples of the results obtained by them.

It is known that if $a_1 + a_2 + a_3 + ... + a_n + ...$ a sequence of eigensums of a series $S_1, S_2, S_3, ..., S_n, ...$ has a finite limit, then the series is an convergent series, which is a finite limit $S = \lim_{n\to\infty} S_n$ and is its sum. If is a sequence of eigensums of a series $S_1, S_2, S_3, ..., S_n, ...$ If the limit of is infinite or does not exist, then the sequence is diverging.

In order to check the convergence of series, we check the convergence of the initially given positive term series with the help of Dalamber's sign, the sufficiency condition of series convergence.

We check the convergence of the following positive case series using Dalamber's sign:

$$\sum_{n=1}^{\infty} \frac{2^n}{n^2}$$

$$a_{n+1} = \frac{2^{n+1}}{(n+1)^2}$$

$$\lim_{n\to\infty} \frac{n^2 * 2^{n+1}}{2^n * (n+1)^2} = \lim_{n\to\infty} \frac{2n^2}{n^2+2n+1} = 2 > 1.$$

According to Dalamber's sign, the series is diverging because the result is greater than 1. Now let's calculate the sum of the series in the program using sympy and numpy libraries of the Python programming language. To do this, the sum of the series and the limit are entered, and the following result is obtained, that is, the sum is infinite, and from this it follows that the series is decreasing:

```
from sympy import symbols, summation, oo

# Simvol
n = symbols( names: 'n', positive=True, integer=True)

#Yig'indisi formulasi
yigindisi_formula = (pow(2, n))/(pow(n,2))

# Cheksiz sonli yig'indisi
result = summation(yigindisi_formula, *symbols: (n, 1, oo))

# Natija
print(f"Cheksiz sonli qator yig'indisi: {result}")
```

```
D:\CalculusProject\venv\Scripts\python.exe D:\CalculusProject\summa.py
Cheksiz sonli qator yig'indisi: oo

Process finished with exit code 0
```

Let's look at the next example:

$$\sum_{n=1}^{\infty} \frac{n}{5^n}$$

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$$a_{n+1} = \frac{n+1}{5^{n+1}}$$

$$\lim_{n\to\infty} \frac{5^n * (n+1)}{n * 5^{n+1}} = \lim_{n\to\infty} \frac{n+1}{5 * n} = \frac{1}{5} < 1.$$

According to Dalamber's sign, the series converges because the result is less than 1. Now the sum of the array Python programming language libraries we calculate through It turns out that the sum of the series is : and since this is a finite number, we know that the series is convergent.

In the next example, when the same sequence of actions was performed, the following result was obtained

$$\sum_{n=1}^{\infty} \frac{7^n}{n+3}$$

$$a_{n+1} = \frac{7^{n+1}}{n+4}$$

$$\lim_{n\to\infty} \frac{a_{n+1}}{a_n} = \lim_{n\to\infty} \frac{7^{n+1} * (n+3)}{7^n * (n+4)} = \lim_{n\to\infty} \frac{7n+21}{n+4} = 7 > 1$$

According to Dalamber's sign, the line is moving away. We will see it in the program.

```
# Simvol
n = symbols( names: 'n', positive=True, integer=True)

# Yig'indisi formulasi
yigindisi_formula = (pow(7, n))/(n + 3)

# Cheksiz sonli yig'indisi
result = summation(yigindisi_formula, *symbols: (n, 1, oo))

# Natija
print(f"Cheksiz sonli qator yig'indisi: {result}")
```

```
Run  Asos_dastur  summa
D:\CalculusProject\venv\Scripts\python.exe D:\CalculusProject\summa.py
Cheksiz sonli qator yig'indisi: oo

Process finished with exit code 0
```

We believe that teaching mathematical subjects using the rich capabilities of Python programming language libraries will be of great importance in strengthening students' knowledge of specialized subjects. Because during such research, the student learns the subject of mathematics, and increases his knowledge of programming in the process of creating the result of the subject in programming.

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