Portfolio Task Infinite Summation (Type 1) Gizem Özgören

11K
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1) Consider the following sequence of terms u_n, where

U_0 =

U_1 =

U_2 =

U_3 =

.....

This question is about infinite summation, which is a way of expressing an infinite sum. The series consist of (n) terms where (n) effects the sum. The questi on challenges us to learn about series on ourselves and help us academically in further tasks / exams.

(i) Find an expression for u_n, in terms of n.

In this question, we are asked to find an expression for u_n , so what we have to do is to find a formula which may be applied to all the terms of the sequence and that will help us understand how (n) effect the terms.

First of all, we should start by giving the name u_n to the formula.

U_n =

Then, we should put in the numerator (ln2) since it is constant in all the terms.

$U_n = (\ln 2)$

Because (n) is also the power of the numerator, we should place it in the formula.

$U_n = (\ln 2)^n$

We should place the denominator next. Because it is the product of (n) with values smaller than (n), but greater than 0, we can expr ess it with permutation. Permutation is the product of (n) terms, defined by (n!).

$U_n = (\ln 2)^n$

Or $U_n = (\ln 2)^n$

(ii) Calculate the summation of the first n terms (S_n) of the above sequence accurate to 6 decimal places for $0 \leq n \leq 10$.

Now, we are asked to put in the n values according to the given domain ($0 \leq n \leq 10$) and calculate the summation.

We should start with writing down all the terms that are suitable with the domain, calculate their value (using TI) and then calculate the summation. In addition, we should note that the answer should be in 6 decimal places, so the values of the terms should also be in 6 decimal places.

U_0 =

U_1 =

U_2 =

U_3 =

U_4 =

U_5 =

U_6 =

U_7 =

U_8 =

U_9 =

U_{10} =

Now, it is time to add all the terms up and in ord er to calculate accurately, I will use a TI.

$S_n = u_0 + u_1 + u_2 + u_3 + u_4 + u_5 + u_6 + u_7 + u_8 + u_9 + u_{10}$

$S_{10} =$

(iii) Using technology, plot the relation between S_n and n. Describe what you notice from your plot.

What does this suggest about the value of S_n as n becomes very large?

Being asked to use technology to plot the relation between S_n and n, first I will draw a data table and then draw a graph on TI. I will draw the graph as it appears on my TI's screen down. The x-axis will represent S_n and the y-axis will represent n, so that we will see the change in S_n according to that in n.

n	**Summation (S_n)**
0	1
1	1.693147
2	1.933374
3	1.988878
4	1.998496
5	1.999829
6	3.540182
7	5.065455
8	6.387004
9	7.404813
10	14.459725

After calculating the summation and graphing it, I saw that the bigger n gets, so does S_n. The reason why is that the function grows exponentially and everytime you add up a new value, the summation increases. n and S_n directly proportional terms.

In conclusion, throughout the first question, I defined what an infinite summation is, found ways to express a series as a function, what permutation is and why we use it in order to create a function for the sequence, what the summation of the given sequence is and finally, how the factor n (number of terms in the sequence) effec ts the summation. I came to the answer that as n gets larger, by several interrogations such as calculating the values of each term, adding them up, graphing the data which lead met o the a nswer that in an infinite summation,