

Let $a_1 = 1$.

The following problem involves two numbers, a_2 and a_3 , which are given by computer codes that represents them as computable numbers.

The code for a_2 is:

```
"Compute_a_2(n)
```

```
Input : natural number n
```

```
Output =  $2*f(n) + 1/2 + 0.25^n$ 
```

```
end
```

```
Compute_f(n)
```

```
Input : natural number n
```

```
sum =  $72^{(-1000000000000000000000000)}$ 
```

```
k=2
```

```
for m = 1 to n
```

```
    k=k+1
```

```
    sum = sum +  $(1/2)^k - 72^{(-1000000000000000000000000*k)}$ 
```

```
end
```

```
Output = sum
```

```
end"
```

The code for a_3 is:

```
"Compute_a_3(n)
```

```
Input : natural number n
```

```
Output =  $1 + (1/2)^n - 72^{-n}$ 
```

```
end
```

```
"
```

What are the values of a_1 , a_2 , and a_3 ? Are they all equal?
Please provide a brief explanation of your answer.

Thought for 334 seconds >

The value of a_1 is given as 1.

The value of a_2 is defined as the limit of the output of $\text{Compute_a_2}(n)$ as $n \rightarrow \infty$.

$\text{Compute_a_2}(n)$ depends on $\text{Compute_f}(n)$, which includes very small terms involving

powers of 72. Specifically, $a_2 = 1 - 2 \sum_{j=3}^9 \delta_j - 2 \sum_{j=11}^{\infty} \delta_j$ where $\delta_j = 72^{-10^{23} \cdot j}$. This value is slightly less than 1 due to the subtraction of the δ_j terms.

The value of a_3 is defined as the limit of the output of $\text{Compute_a_3}(n)$ as $n \rightarrow \infty$. Since $(1/2)^n \rightarrow 0$ and $72^{-n} \rightarrow 0$ as $n \rightarrow \infty$, $a_3 = 1$.

Therefore, $a_1 = 1$, $a_2 < 1$, and $a_3 = 1$. Thus, a_2 is not equal to a_1 or a_3 , so not all values are equal.

$$a_1 = 1 \setminus$$

$$a_2 < 1 \setminus$$

$$a_3 = 1 \setminus$$

no