

Let $S = \sum_{i=1}^n f(x_i)$, $A = \sum_{i=1}^a f(x_i)$ and $B = \sum_{i=a}^n f(x_i)$ then

Which of the following is/are ALWAYS true?

(Consider f as some arbitrary function)

A. $S = A + B$

B. $S = \sum_{i=1}^{a-1} f(x_i) + f(x_a) + B$

C. $S = \sum_{i=1}^{a-1} f(x_i) + B$

D. $S = A + B - f(x_a)$

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Answer: **Options C and D are Correct**

Given :

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$$B = \sum_{i=a}^n f(x_i)$$

Option A) It says $S = A + B$, which means $\sum_{i=1}^a f(x_i) + \sum_{i=a}^n f(x_i)$, when summation will be done then the term $f(x_a)$ had been added two times. The first time in A and the second time in B. So instead of $S = A+B$, it must be $S = A+B - f(x_a)$

Option B) $S = \sum_{i=1}^{a-1} f(x_i) + f(x_a) + B$

As we know $B = \sum_{i=a}^n f(x_i)$, And in summation we are adding $f(x_a)$ so overcounting of $f(x_a)$ has been done in this case. So this option is Incorrect.

Option C) $S = \sum_{i=1}^{a-1} f(x_i) + B$

In this option, $\sum_{i=1}^{a-1} f(x_i) + \sum_{i=a}^n f(x_i)$ had been done. So it can easily be observable that on the right-hand side of this option that each term is added once so we can write this as :

$$\sum_{i=1}^{a-1} f(x_i) + \sum_{i=a}^n f(x_i) = \sum_{i=1}^n f(x_i) = S$$

Actually here, The terms are broken down into two parts first from **1 to a-1** and second from **a to n**. So we are just adding both broken parts which give the result as from **1 to n**.


Option c is correct.

Option D). $S = A+B - f(x_a)$

Here while doing a summation of A and B the term $f(x_a)$ had been overcounted means counted two times but here, one time had been subtracted. So this option is also correct. As already explained in option A.

answered Mar 1, 2023 • selected Mar 6, 2024 by Deepak Poonia

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GauravRajpurohit 

Evaluate: $1 + (1 + b)r + (1 + b + b^2)r^2 + \dots$ to infinite terms for $|br| < 1$.

- A. $\frac{1}{(1-br)(1-r)}$
- B. $\frac{1}{(1-r)(1-b)}$
- C. $\frac{1}{(1-b)(b-r)}$
- D. None of these

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Solution :

Let $S = 1 + (1 + b)r + (1 + b + b^2)r^2 + \dots$

$$rS = r + (1 + b)r^2 + \dots$$


$$(i) - (ii)$$

$$\Rightarrow (1 - r)S = 1 + br + b^2r^2 + b^3r^3 + \dots$$

$$\Rightarrow S = \frac{1}{(1 - br)(1 - r)}$$

answered May 1, 2022 • selected Mar 6, 2024 by **Deepak Poonia**

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Evaluate $1 + 2x + 3x^2 + 4x^3 + \dots$ upto infinity, where $|x| < 1$.

- A. $\frac{1}{(1-x)^2}$
- B. $\frac{x}{(1-x)^2}$
- C. $\frac{x^2}{(1-x)^2}$
- D. $1 - \frac{1}{(1-x)^2}$

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Solution : Let $S = 1 + 2x + 3x^2 + 4x^3 + \dots$


$$xS = x + 2x^2 + 3x^3 + \dots$$

$$(i) - (ii) \Rightarrow (1 - x) S = 1 + x + x^2 + x^3 + \dots$$

$$\text{or } S = \frac{1}{(1-x)^2}$$

answered May 1, 2022

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Find the sum of first 24 terms of the A.P. a_1, a_2, a_3, \dots if it is known that

$$a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 225$$

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Therefore, $d = b - a$

$$\Rightarrow a_1 + a_{24} = a_5 + a_{20} = a_{10} + a_{15}$$

It is given that

$$(a_1 + a_{24}) + (a_5 + a_{20}) + (a_{10} + a_{15}) = 225$$

$$\Rightarrow (a_1 + a_{24}) + (a_1 + a_{24}) + (a_1 + a_{24}) = 225$$

$$\Rightarrow 3(a_1 + a_{24}) = 225$$

$$\Rightarrow a_1 + a_{24} = 75$$

We know that


$$S_n = \frac{n}{2}[a + l],$$

Where a is the first term, and l is the last term of an A.P.

$$S_{24} = \frac{24}{2}[a_1 + a_{24}] = 12 \times 75 = 900.$$

answered May 1, 2022 • edited May 1, 2022 by Lakshman Bhaiya

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Let k be some integer and it is given that $a \equiv b \pmod{n}$ then which of the following is ALWAYS true?

More than one option can be true.

- A. $a \equiv b - 3n \pmod{n}$
- B. $a \equiv b + k \pmod{n}$
- C. $a + k \equiv b + k \pmod{n}$
- D. $a + 5n \equiv b - 3n \pmod{n}$

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Given $a \equiv b \pmod{n}$ i.e. $(a - b) \% n = 0$

Option A: True

$$a \equiv b - 3n \pmod{n} = (a - b + 3n) \% n = ((a - b) \% n + (3n) \% n) \% n = (0 +$$

Option B: False

$$a \equiv b + k \pmod{n} = ((a - b) \% n - (k \% n)) \% n = (-k) \% n$$

Now since k can be any integer, k might not be a multiple of n .

Option C: True


$$a + k \equiv b + k \pmod{n} = (a + k - b - k) \% n = (a - b) \% n = 0$$

Option D: True

$$a + 5n \equiv b - 3n \pmod{n} = (a + 5n - b + 3n) \% n = ((a - b) \% n + (8n) \% n)$$

answered Mar 1, 2023

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Shoto 

Which of the following(s) ALWAYS hold given that $a \equiv b \pmod{n}$ is true for some int and n .

More than one option can be true.

- A. $a \bmod n = b \bmod n$
- B. $n \mid (a - b)$
- C. $n \mid a$
- D. $n \mid b$

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Answer : A, B

Given : $a \equiv b \pmod{n}$

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Now , let $a \bmod n = b \bmod n = r$ which is the remainder when a or b is divided by n

*So ' a ' can be written as : $a = n * q_1 + r$ where $q_1 \rightarrow$ Quotient when a is divided by n and $r \rightarrow$ Remainder*

*And ' b ' can be written as : $b = n * q_2 + r$ where $q_2 \rightarrow$ Quotient when b is divided by n and $r \rightarrow$ Remainder*

*Now , $a - b = (n * q_1 + r) - (n * q_2 + r)$*

$a - b = n(q_1 - q_2)$ which is clearly divisible by n

Hence , $n \mid (a - b)$ is True

Options C and D are asking us that if n always divides ' a ' and ' b ' given $a \equiv b \pmod{n}$


So one idea here could be to think of an counter example where this is not true

Lets Take $27 \equiv 47 \pmod{10}$, here $10 \nmid 27$ is false as you can see and also $10 \nmid 47$ is also false.


Hence , Options C and D are false

answered Mar 1, 2023 • edited Jul 6, 2024 by Harsh Saini_1

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Harsh Saini_1 

Which of the following options is/are TRUE?

A. $43 \equiv -2 \pmod{5}$


B. $5 \equiv -7 \pmod{3}$

C. $-10 \equiv -25 \pmod{7}$

D. $8 \equiv -8 \pmod{5}$

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“We can say that a is congruent to b modulo n , written $a \equiv b \pmod{n}$ if $n \mid (a - b)$ ”

Now we apply this to the options...

A. $43 \equiv -2 \pmod{5}$ so $5 \mid (43+2) = (43+2) / 5 = 45/5 = 9$ so it is correct.

B. $5 \equiv -7 \pmod{3}$ so $3 \mid (5+7) = 12 / 3 = 4$ so it is correct.


C. $-10 \equiv -25 \pmod{7}$ so $7 \mid (-10+25) = 15 / 7$. But 15 is not divisible by 7.

D. $8 \equiv -8 \pmod{5}$ so $5 \mid (8+8) = 16 / 5$. But 16 is not divisible by 5.

Hence, A and B are TRUE.

answered Mar 1, 2023

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Akash 15 

If S is the sum to infinity of a G.P. whose first term is ' a ', then the sum of the first n terms is

- A. $S \left(1 - \frac{a}{S} \right)^n$
B. $S \left[1 - \left(1 - \frac{a}{S} \right)^n \right]$
C. $a \left[1 - \left(1 - \frac{S}{a} \right)^n \right]$
D. $S \left[1 - \left(1 - \frac{S}{a} \right)^n \right]$

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Given that first term = a .

$$S = \text{sum to infinity of a G.P} = \frac{a}{(1 - r)}$$


$$\Rightarrow r = 1 - \frac{a}{S}$$


$$\Rightarrow S_n = \frac{a(1 - r^n)}{(1 - r)}$$

$$\Rightarrow S_n = S(1 - r^n)$$

$$\Rightarrow S_n = S \left[1 - \left(1 - \frac{a}{S} \right)^n \right]$$

answered May 1, 2022 • edited May 1, 2022 by **Lakshman Bhaiya**

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If the sum of p terms of an A.P. is q and the sum of q terms is p , then the sum of $p + q$ terms is _____.

- A. 0
- B. $p - q$
- C. $p + q$
- D. $-(p + q)$

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Let a be the first term and d be the common difference the AP's. Then sum to their n terms is given by.

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$$S_p = q$$

$$\frac{p}{2}\{2a + (p-1)d\} = 2ap + p(p-1)d = 2q \quad \longrightarrow (i)$$

Similarly,

$$S_q = p$$

$$\frac{q}{2}\{2a + (q-1)d\} = p$$

$$2aq + q(q-1)d = 2p \quad \longrightarrow (ii)$$

Subtract equation (ii) from equation (i), we get

$$2a(p-q) + \{p(p-1) - q(q-1)\}d = 2q - 2p$$

$$2a + (p+q-1)d = -2 \quad \longrightarrow (iii)$$

$$S_{p+q} = \frac{p+q}{2}\{2a + (p+q-1)d\}$$

$$S_{p+q} = \frac{p+q}{2}(-2) \quad [\because \text{From equation (iii)}]$$

$$\boxed{S_{p+q} = -(p+q)}$$

Reference:

- https://lh6.googleusercontent.com/Qerpe-hTn1BPh_0QyQfHDxcqXEotQF-nMVKJ0I3_CtJ8PPK-WFc82FQfTIKDtJPfK2lcMxlLuyQC_NP4T8Quqg9CED-mwzfl6Ka_cMnlYDiDXhBQNoDnpOdAUzofioxN4GW5-U1b

answered May 1, 2022 • selected Oct 6, 2023 by Arjun

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If the sum of an infinitely decreasing GP is 3, and the sum of the squares of its terms is _____
sum of the cubes of the terms is _____

- A. $\frac{105}{13}$
- B. $\frac{108}{13}$
- C. $\frac{729}{8}$
- D. None of these

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Let the GP be a, ar, ar^2, \dots , where $0 < r < 1$. Then, $a + ar + ar^2 + \dots = 3$ and $a^2 + a^2r^2 + a^2r^4 + \dots = 9/2$.

$$\Rightarrow \frac{a}{1-r} = 3 \quad \text{and} \quad \frac{a^2}{1-r^2} = \frac{9}{2}$$


$$\Rightarrow \frac{9(1-r)^2}{1-r^2} = \frac{9}{2} \Rightarrow \frac{1-r}{1+r} = \frac{1}{2} \Rightarrow r = \frac{1}{3}.$$

Putting $r = \frac{1}{3}$ in $\frac{a}{1-r} = 3$, we get $a = 2$.

Now the required sum of the cubes is $a^3 + a^3r^3 + a^3r^6 + \dots = \frac{a^3}{1-r^3} = \frac{8}{1-\frac{1}{27}}$

answered May 1, 2022 • edited Aug 31, 2022 by Arjun

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