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 arbitary 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 :

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) had 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: $1+(1+b)r+(1+b+b^2)r^2+\ldots$ 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 $S = 1 + (1 + b)r + (1 + b + b^2)\, r^2 + ...$ ....(i)

$rS = r + (1 + b)\, r^2 + ...$ ....(ii)

(i) - (ii)

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

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

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

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GO Classes OP

Evaluate $1 + 2x + 3x^2 + 4x^3 + \ldots$ 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 $S = 1 + 2x + 3x^2 + 4x^3 + \ldots..$ ....(i)

$xS = x + 2x^2 + 3x^3 + \ldots\ldots\ldots$ ....(ii)

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

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

answered May 1, 2022

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GO Classes OP

Find the sum of first 24 terms of the $\mathrm{A.P.}$ $a_1,\ a_2,\ a_3,\ \ldots$ if it is known that

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

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Therefore, $d = b - a$

$\Rightarrow a_1 + a_{24} = a_5 + a20 = a_{10} + a_{15}$

It is given that

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

$\Rightarrow (a_1 + a_24) + (a_1 + a_{24}) + (a + a_{24}) = 225$

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

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

We know that

$$\mathrm{S}_n = \frac{n}{2}[a + l],$$

Where a is the first term, and l is the last term of an $\mathrm{A.P.}$

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

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

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GO Classes OP

Let k be some integer and it is given that $a \equiv b(\mod n)$ then which of the following(s) is/are ALWAYS true?
More than one option can be true.

A. $a \equiv b - 3n(\mod n)$
B. $a \equiv b + k(\mod n)$
C. $a + k \equiv b + k(\mod n)$
D. $a + 5n \equiv b - 3n(\mod n)$

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

Option A: True

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

Option B: False

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

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

Option C: True

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

Option D: True

$a + 5n \equiv b - 3n \pmod{\mathrm{n}} = (a + 5n - b + 3n)\%n = ((a-b)\%n + (8n)\%n)\%n = (0+0$

answered Mar 1, 2023

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Shoto

Which of the following(s) ALWAYS hold given that $a \equiv b(\bmod n)$ is true for some integers a, b 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

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

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

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

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

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

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

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

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

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

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

$Hence\ , Options\ C\ and\ D\ are\ false$

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. $43 \equiv -2(\bmod 5)$
B. $5 \equiv -7(\bmod 3)$
C. $-10 \equiv -25(\bmod 7)$
D. $8 \equiv -8(\bmod 5)$

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"We can say that a is congruent to b modulo n, written a ≡ b (mod n) if n | (a – b)."

Now we apply this to the options…

A. ***43 ≡ -2(mod 5)*** so **5 | (43+2) = (43+2) / 5 = 45/5 = 9** so it is correct.
B. ***5 ≡ -7(mod 3)*** so **3 | (5+7) = 12 / 3 = 4** so it is correct.
C. ***-10 ≡ -25(mod 7)*** so **7 | (-10+25) = 15 / 7**. But 15 is not divisible by 7.
D. ***8 ≡ -8(mod 5)*** so **5 | (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. $a\left[1-\left(1-\frac{a}{S}\right)^{n}\right]$
D. $S\left[1-\left(1-\frac{S}{a}\right)^{n}\right]$

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Given that first term = a.

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

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

$$\Rightarrow \mathrm{S}_n = \frac{a(1-r^n)}{(1-r)}$$

$$\Rightarrow \mathrm{S}_n = \mathrm{S}(1-r^n)$$

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

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

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GO Classes OP

If the sum of p terms of an $\mathrm{A.P.}$ 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. $-(p + q)$

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

$S_p = q$

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

Similarly,

$$S_q = p$$
$$\frac{q}{2}\{2a+(q-1)d\} = p$$
$$2aq + q(q-1)d = 2p \qquad \longrightarrow (ii)$$

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

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

$$S_{p+q} = \frac{p+q}{2}\{2a+(p+q-1)d\}$$
$$S_{p+q} = \frac{p+q}{2}(-2) \qquad [\because \text{From equation } (iii)]$$
$$\boxed{S_{p+q} = -(p+q)}$$

Reference:

- https://lh6.googleusercontent.com/Qerpe-hTn1BPh_0QyQfHDxcqXEotQF-nMVKJ0l3_CtJ8PPK-WFc82FQfTlKDtJPFK2lcMxlLuyQC_NP4T8Quqg9CED-mwzfl6Ka_cMnlYDiDXhBQNoDnpOdAUzofioxN4GW5-U1b

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

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GO Classes OP

If the sum of an infinitely decreasing GP is $3,$ and the sum of the squares of its terms is $9/2,$ the 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 $a, ar, ar^2, \ldots,$ where $0 < r < 1$. Then, $a + ar + ar^2 + \ldots = 3$ and $a^2 + a^2r^2 + a^2r^4 + \ldots = 9/2$.

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

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

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

Now the required sum of the cubes is $a^3 + a^3r^3 + a^3r^6 + \ldots = \frac{a^3}{1-r^3} = \frac{8}{1-\frac{1}{27}} = \frac{108}{13}$

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

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