MATHS

BOOKS - KC SINHA MATHS (HINGLISH)

PROGRESSIONS (AP GP) - FOR COMPETITION

Solved Examples

1. If x,y, and z are positive real numbers different from 1 and $x^{18}=y^{21}=z^{28}$ show that $3, 3\log_y x, 3\log_z y, 7\log_x z$ are in A.P.

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2. Four different integers form an increasing $A.P$ One of these numbers is equal to the sum of the squares of the other three numbers. Then The smallest number is

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3. If the sum of first p terms of an A.P. is equal to the sum of the first q terms, then find the sum of the first (p + q) terms.

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4. The ratio of the sums of n terms of two Aps is $(3n-13):(5n+21)$. Find the ratio of the 24th terms of the two progressions.

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5. If the sum of m terms of an $A.\ P$ is equal to these that n terms and also to the sum of the next p terms, prove $(m+n)\left(\frac{1}{m}-\frac{1}{p}\right)=(m+p)\left(\frac{1}{m}-\frac{1}{n}\right)$

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6. If $s_1, s_2, s_3, \ldots\ldots\ldots s_{2n}$ are the sums of infinite geometric series whose first terms are respectively 1,2,3,...2n and common ratioi are respectively $\frac{1}{2}, \frac{1}{3}, \ldots\ldots\ldots\ldots, \frac{1}{2n+1}$ find the value of $s_1^2 + s_2^2 + \ldots\ldots\ldots + s_{2n-1}^2$

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7. How many geometric progressions are possible containing 27, 8 and 12 as three of its/their terms

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8. The natural number a for which $\sum_{k=1,n} f(a+k) = 16(2^n - 1)$ where the function f satisfies the relation $f(x+y) = f(x).\, f(y)$ for all natural numbers x,y and further $f(1) = 2$ is:- A) 2 B) 3 C) 1 D) none of these

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9. IF S_1, S_2, S_3 denote the sum $n(>1)$ terms of three sequences in A.P., whose first terms are unity and common differences are in H.P.prove that $n=\dfrac{2S_3S_1-S_1S_2-S_2S_3}{S_1-2S_2+S_3}$

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10. If $x_1, x_2, x_3 \dots, x_n$ are in H.P. prove that $x_1x_2+x_2x_3+x_3x_4+\dots\dots\dots+x_{n-1}x_n=(n-1)x_1x_n$

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11. If pth, qth , rth and sth terms of an AP are in GP then show that (p-q), (q-r), (r-s) are also in GP

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12. if $(m+1)th, (n+1)th$ and $(r+1)th$ term of an AP are in GP.and m, n and r in HP. . find the ratio of first term of A.P to its common difference

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13. If $y-z, 2(y-a), y-x$ are in H.P. prove that $x-a, y-a, z-a$ are in G.P.

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14. A sequence $a_1, a_2, a_3, . a_n$ of real numbers is such that $a_1 = 0, |a_2| = |a_1+1|, |a_3| = |a_2+1|, >, |an| = |a_{n-1}+1|$. Prove that the arithmetic mean $\frac{a_1+a_2+\ldots\ldots\ldots+a_n}{n}$ of these numbers cannot be les then - 1/2.

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15. Find the coefficient of x^{99} and x^{98} in the polynomial $(x-1)(x-2)(x-3)\ldots\ldots\ldots.(x-100)$.

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16. Find the sum to n terms of the series: $\frac{1}{1+1^2+1^4}+\frac{1}{1+2^2+2^4}+\frac{1}{1+3^2+3^4}+$

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17. Find the sum to n terms of the series : $5+11+19+29+41\vdots$

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18. $1+3+7+15+31+\ldots+$ to n terms

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19. Find the $1+2.2+3.2^2+\ldots\ldots+t_n$

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20. If a, b, c, d, e, x are real and $(a^2+b^2+c^2+d^2)x^2-2(ab+bc+cd+de)x+(b^2+c^2+d^2+e^2)\leq 0$

then a,b,c,d,e are in (A) A.P. (B) G.P. (C) H.P. (D) none of these

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21. If S_n denote the sum of first n terms of an A.P. whose first term is $a and S_{nx}/S_x$ is independent of x, $then S_p = p^3$ b. p^2a c. pa^2 d. a^3

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22. If rational numbers a,b,c be th pth, qth, rth terms respectively of an A.P. then roots of the equation $a(q-r)x^2+b(r-p)x+c(p-q)=0$

are necessarily (A) imaginary (B) rational (C) irrational (D) real and equal

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23. If $(r)_n$, denotes the number $rrr\ldots(n digits)$, where $r = 1, 2, 3, \ldots, 9$

and $a = (6)_n, b = (8)_n, c = (4)_{2n}$, then

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24. If a_1, a_2, a_3 are in G.P. having common ratio r such that $\sum_{k=1}^{n} a_{2k-1} = \sum_{k=1}^{n} a_{2k+2} \neq 0$ then number of possible value of r is (A) 1 (B) 2 (C) 3 (D) none of these

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25. If a_1, a_2, a_3, a_4 are in H.P. then $\frac{1}{a_1 a_4} \sum_{r=1}^{3} a_r a_{r+1}$ is a root of (A) $x^2 - 2x - 15 = 0$ (B) $x^2 + 2x + 15 = 0$ (C) $x^2 + 2x - 15 = 0$ (D) $x^2 - 2x + 15 = 0$

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26. If a and b are digits between 0 and 9 the the rational number represented by 0 $. ababab$ is (A) $\frac{10a+b}{99}$ (B) $\frac{9+b}{90}$ (C) $\frac{a+b}{99}$ (D) $\frac{(99ab+10a+b)}{990}$

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27. If $\frac{l+mx}{l-mx}=\frac{m+nx}{m-nx}=\frac{n+px}{n-px}, x \neq 0$. Then the number l,m,n and p are in (A) A.P. (B) G.P. (C) H.P. (D) none of these

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28. If $a_1, a_2, a_3 \ldots \ldots .. a_n$ are in H.P. and $f(k)=\sum_{r=1}^{n} a_r - a_k$ then $\frac{f(1)}{a_1}, \frac{f(2)}{a_3} \ldots . \frac{f(n)}{a_n}$ are (A) A.P. (B) G.P. (C) H.P. (D) none of these

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29. If $x=\sum_{n=0}^{\infty} a^n, y=\sum_{n=0}^{\infty} b^n, z=\sum_{n=0}^{\infty} c^n$ where a, b, c are in A.P and $|a|<1, |b<1, |c| \; <1,$ then x, y, z are in

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30. If $a+b+c=3$ and $a>0, b>0, c>0$ then the greatest value of $a^2b^3c^2=$ (A) $(3^2)(2^3)(7^2)$ (B) $\frac{3^{10}2^4}{7^7}$ (C) $\frac{3^7 2^5}{7^2}$ (D) $\frac{3^7 2^4}{7^7}$

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31.

$$\frac{1^4}{1.3}+\frac{2^4}{3.5}+\frac{3^4}{5.7}+\ldots\ldots+\frac{n^4}{(2n-1)(2n+1)}=\frac{n(4n^2+6n+5)}{48}+\frac{}{16}$$

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32. The sum of the sereis $1+2^2x+3^2x^2+4^2x^3+\ldots..\infty where -1<x<1=$ (A)

$\frac{1+x}{((1-x))^3}$ (B) $\frac{x}{(1+x)^3}$ (C) $\frac{1-x^2}{(1+x)^3}$ (D) none of these

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33. For a positive integer n let $a(n)=1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{(2^n)-1}$.

Then $a(100)\leq 100$ b. $a(100)>\dot{}\ 100$ c. $a(200)\leq 100$ d. $a(200)\leq 100$

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34. Let $\Delta(x)=\begin{vmatrix} x+a & x+b & x+a-c \\ x+b & x+c & x-1 \\ x+c & x+d & x-b+d \end{vmatrix}$ and $\int_0^2 \Delta(x)dx=-16$,

where a, b, c, d are in A.P. then the common difference (i) 1 (ii)2 (iii)3 (iv)4

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35. If a, b, c are in A.P and a^2, b^2, c^2 are in H.P then

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36. Sum of n terms of the series $\frac{1}{1.2.3.4.}+\frac{1}{2.3.4.5}+\frac{1}{3.4.5.6}+\ldots.$

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37. If $a_n=\int_0^{\pi}\frac{\sin(2n-1)x}{\sin x}dx, then a_1a_2a_3$ are in (A) A.P. (B) G.P. (C) H.P. (D) none of these

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38. Find the sum of series $\left(3^3=2^3\right)+\left(5^3=4^3\right)+\left(7^3=6^3\right)+$ to n terms

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39. The three digit number whose digits are in G.P. and the digits of the number obtained from it by subtracting 400 form an A.P. is equal to.

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40. The value of x for which the numbers $\log_3 2, \log_3(2^x - 5)$ and $\log_3\left(2^x - \frac{7}{2}\right)$ are in A.P.=

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Exercise

1. If $a_1, a_2, a_3, \ldots\ldots\ldots a_n$ are in A.P, where $a_i > 0$ for all i show that

$$\frac{1}{\sqrt{a_1} + \sqrt{a_2}} + \frac{1}{\sqrt{a_2} + \sqrt{a_3}} + \ldots\ldots + \frac{1}{\sqrt{a_{n-1}} + \sqrt{a_n}} = \frac{n-1}{\sqrt{a_1} + \sqrt{a_n}}$$

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2. If $a_1, a_2, a_3, \ldots\ldots\ldots\ldots a_n$ are in A.P. whose common difference is d, show tht $\sum_2^n \frac{\tan^{-1} d}{1 + a_{n-1}a_n} = \tan^{-1}\left(\frac{a_n - a_1}{1 + a_n a_n}\right)$

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3. If $a_1, a_2, a_3, \ldots\ldots\ldots a_n, a_{n+1}, \ldots\ldots\ldots$ be A.P. whose common difference is d and $S_1 = a_1 + a_2 + \ldots\ldots\ldots + a_n, S_2 = a_{n+1} + \ldots\ldots\ldots\ldots + a_{2n}, S_3 = a_{2n+1}$ etc show that $S_1, S_2, S_3, S_4\ldots\ldots\ldots\ldots$ are in A.P. whose common difference is $n^2 d$.

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4. If $\log 2, \log(2^x - 1) and \log 2 \log(2^x + 3)$ are in A.P., write the value of $x \cdot$

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5. If $I_n = \int_0^\pi \frac{1 - \cos 2nx}{1 - \cos 2x} dx$ or $\int_0^\pi \frac{\sin^2 nx}{\sin^2 x} dx$, show that $I_1, I_2, I_3\ldots\ldots\ldots\ldots$ are inA.P.

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6. A cashier has to count a bundle of Rs. 12,000 one rupee notes. He counts at the rate of Rs. 150 per minute for an hour, at the end of which he begins to count at the rate of Rs. 2 less every minute then he did the previous minute. Find how long he will take to finish his task and explain the double answer.

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7. If a, b, c, d and p are different real numbers such that $(a^2+b^2+c^2)p^2-2(ab+bc+cd)p+(b^2+c^2+d^2)\leq 0$, then show that a, b, c and d are in G.P.

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8. If $\log_x a, a^{\frac{x}{2}}$ and $\log_b x$ are in G.P. then find x.

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9. Find the sum of n terms of series $(x+y)+(x^2+xy+y^2)+(x^3+x^2y+xy^2+y^3)+\ldots\ldots\ldots\ldots\ldots\ldots$

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10. Prove that in a sequence of numbers 49,4489,444889,44448889 in which every number is made by inserting 48-48 in the middle of previous as indicated, each number is the square of an integer.

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11. Solve the following equations for x and y:

$$\log_{10} x + \log_{10} (x)^{\frac{1}{2}} + \log_{10} (x)^{\frac{1}{4}} + \ldots . = y$$

$$\frac{1+3+5+\ldots+(2y-1)}{4+7+10+\ldots+(3y+1)} = \frac{20}{7\log_{10} x}$$

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12. Find the values of $x \in (-\pi, \pi)$ which satisfy the equation $8^{1+|\cos x|+|\cos^2 x|+|\cos^{2x}|+} = 4^3$

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13. The sum oif the first ten terms of an A.P. is equal to 155, and the sum of the first two terms of a G.P. is 9. Find these progressionsif the first term of the A.P. equals the common ratio of the G.P. and the 1st term of G.P. equals the common difference of A.P.

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14. If an A.P. and a G.P. have the same 1st and 2nd terms then show that every other term of the A.P. will be less than the corresponding term of G.P. all the terms being positive.

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15. Find the sum of all the numbers of the form n^3 which lie between 100 and 10000.

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16. Prove that the numbers of the sequence $121, 12321, 1234321, \ldots\ldots\ldots.$ are each a perfect square of odd integer.

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17. The sum to n terms of the series $\frac{3}{1^2}+\frac{5}{1^2+2^2}+\frac{7}{1^2+2^2+3^2}\pm------$ is

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18. Show that $\frac{1}{x+1}+\frac{2}{x^2+1}+\frac{4}{x^4+1}+\ldots..+\frac{2^n}{x^{2n}+1}=\frac{1}{x-1}-\frac{2^{n+1}}{x^{2^{n+1}}-1}$

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19. The sum of n terms of the series 5/1.2.1/3+7/2.3.1/3^2+9/3.4.1/3^3+11/4.5.1/3^4+..$is(A)$1+1/2^(n-1).1/3^n(B) 1+1/(n+1).1/3^n(C)1-1/(n+1).1/3^n(D)1+1/2n-1.1/3^n`

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20. If $x+y+z=a$, show that $\left(\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)^{-1} \geq \frac{9}{a}$

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21. If x and y are positive real numbers and m, n are any positive integers, then $\frac{x^n y^m}{(1+x^{2n})(1+y^{2m})} < \frac{1}{4}$

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22. If the arthmetic mean of $(b-c)^2, (c-a)^2$ and $(a-b)^2$ is the same as that of $(b+c-2a)^2, (c+a-2b)^2$ and $(a+b-2c)^2$ show that $a=b=c$.

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23. If pth, qth, rth terms of an AP are in GP whose common ratio is k, then the root of equation $(q-r)x^+(r-p)x+(p-q)=0$ other than unity is

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24. If n be the number of sequence a, b, c, d, e satisfying the conditions (i) a,b,c,d,e are in A.P and G.P. both,(ii) c= 3,7 then $n=$

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25. If a,b,c are non zero real numbers such that $3(a^2+b^2+c^2+1)=2(a+b+c+ab+bc+ca)$ then a,b,c are in (A) A.P. only (B) G.P. only (C) A.P., G.P., and H.P. (D) A.P. and G.P.both

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26. If a, b, c, d are distinct integers in A. P. Such that $d=a^2+b^2+c^2$, then a + b + c + d is

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27. If $a_n=\int_0^{\pi}\frac{\sin(2n-1)x}{\sin x}dx$. Then the number a_1, a_2, a_3 .... Are in (A) A.P (B) G.P (C) H.P (D) none of these

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28. If a, b, c, d, e are in H.P., then $\frac{a}{b+c+d+e}, \frac{b}{a+c+d+e}, \frac{c}{a+b+d+e}, \frac{d}{a+b+c+e}, \frac{e}{a+b+c}$ are in (A) A.P. (B) G.P. (C) H.P. (D) none of these

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29. If a,b,c are proper fractiion are in H.P. and $x\sum_{n=1}^{\infty} a^n, y = \sum_{n=1}^{\infty} b^n, z = \sum_{n=1}^{\infty} c^n$ then x,y,z are in (A) A.P. (B) G.P. (C) H.P. (D) none of these

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30. If $S_1, S_2, S_3, \ldots\ldots\ldots\ldots S_n$ denote the sum of 1,2,3............n terms of an A.P. having first term a and $\frac{S_{kx}}{S_x}$ is independent of x then $S_1 + S_2 + S_3 + \ldots\ldots. + S_n =$ (A) $\frac{n(n+1)(2n+1)a}{6}$ (B) $\hat{}\ (n+2)C_3 a$ (C) $\hat{}\ (n+1)C_3 a$ (D) none of these

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31. If a,b,c,d are rational and are in G.P. then the rooots of equation $(a-c)^2x^2+(b-c)^2x+(b-x)^2-(a-d)^2=$ are necessarily (A) imaginary (B) irrational (C) rational (D) real and equal

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32. Sum of $\frac{1}{\sqrt{2}+\sqrt{5}}+\frac{1}{\sqrt{5}+\sqrt{8}}+\frac{1}{\sqrt{8}+\sqrt{11}}+\frac{1}{\sqrt{11}+\sqrt{14}}+\ldots\to n$ terms= (A) $\frac{n}{\sqrt{3n+2}-\sqrt{2}}$ (B) $\frac{1}{3}\left(\sqrt{2}-\sqrt{3n+2}\right.$ (C) n/(sqrt(3n+2)+sqrt(2))` (D) none of these

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33. If a,b,c are p^{th}, q^{th} and r^{th} term of an AP and GP both, then the product of the roots of equation $a^b b^c c^a x^2-abcx+a^c b^c c^a=0$ is equal to :

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34. If a,b,c, be the pth, qth and rth terms respectivley of a G.P., then the equation $a^q b^r c^p x^2 + pqrx + a^r b^{-p} c^q = 0$ has (A) both roots zero (B) at least one root zero (C) no root zero (D) both roots unilty

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35. Let $a = 1111(55 digits), b = 1 + 10 + 1 =^2 \ + \ + 10^4, c = 1 + 10^5 + 10^{10} + 10$ then $a = b + c$ b. $a = bc$ c. $b = ac$ d. $c = ab$

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36. If a,b,c,d, x are real and the roots of equation $(a^2 + b^2 + c^2)x^2 - 2(ab + bc + cd)x + (b^2 + c^2 + d^2) = 0$ are real and equal then a,b,c,d are in (A) A.P (B) G.P. (C) H.P. (D) none of these

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37. If an A.P., a G.P. and a H.P. have the same first term and same $(2n+1)$ th term and their $(n+1)^n$ terms are a,b,c respectively, then the radius of the circle. $x^2+y^2+2bx+2ky+ac=0$ is

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38. If $\sum_{r=1}^{n} t_r = \sum_{k=1}^{n} \sum_{j=1}^{k} \sum_{i=1}^{j} 2$, then $\sum_{r=1}^{n} \frac{1}{t_r} =$

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39. Consecutive odd integers whose sum is 25^2-11^2 are

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40. If a,b,c,d are distinct positive then $\frac{a^n}{b^n} > \frac{c^n}{d^n}$ for all $\varepsilon N \quad \text{if} \quad a, b, c, d$ are in (A) A.P. (B) G.P. (C) H.P. (D) none of these

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41. If $a = \sum_{r=1}^{\infty} \left(\frac{1}{r}\right)^2, b = \sum_{r=1}^{\infty} \frac{1}{(2r-1)^2}, then \frac{a}{b} =$ (A) $\frac{5}{4}$ (B) $\frac{4}{5}$ (C) $\frac{3}{4}$

(D) none of these

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42. If $\sum n^2 = 2870, then \sum n^3 =$ (A) 44100 (B) 48400 (C) 52900 (D) none of these

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43. If $9A.\ M.\ 's$ and $9H.\ M's$ be inserted between 2 and 3 and A be any $A.\ M.$ and H be the corresponding $H.\ M.$, then $H(5-A)$

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44. If $a-b, ax-by, ax^2-by^2a, b \neq 0)$ are in G.P., then $x, y\frac{ax-by}{a-b}$ are in (A) A.P. only (B) G.P.only (C) A.P., G.P. (D) A.P., and G.P and H.P

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45. If the square of differences of three numbers be in A.P., then their differences re in (A) A.P. (B) G.P. (C) H.P. (D) none of these

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46. 1,3,9 can be terms of (A) an A.P. out not of a G.P (B) G.P. but not of an A.P. (C) A.P. and G.P both (D) neither A.P nor G.P

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47. If $t_r = 2^{\frac{r}{3}} + 2^{-\frac{r}{3}}, then \sum_{r=1}^{100} t_r^3 - 3\sum_{r=1}^{100} t_r + 1 =$ (A) $\frac{2^{101}+1}{2^{100}}$ (B) $\frac{2^{101}-1}{2^{100}}$ (C) $\frac{2^{201}+1}{2^{100}}$ (D) none of these

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48. If a,b,c be the sum of n term of three $A.\ P's$ whose first terms are $unity$ and common differences are in H.P., then n=(A) $\dfrac{2ac+ab+bc}{a+c-ab}$ (B) $\dfrac{2ac-ab-bc}{a+c-ab}$ (C) $\dfrac{2ac-ab-bc}{a+c-ab}$ (D) $\dfrac{2ac-ab+bc}{a+c-ab}$

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49. If a,b,c in G.P. x,y be the A.M.\'s between a,b and b,c respectively then $\left(\dfrac{a}{x}+\dfrac{c}{y}\right)\left(\dfrac{b}{x}+\dfrac{b}{y}\right)=$ (A) 2 (B) -4 (C) 4 (D) none of these

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50. If positive numbers a, b, c are in H.P., then equation $x^2-kx+2b^{101}-a^{101}-c^{101}=0(k\in R)$ has both roots positive both roots negative one positive and one negative root both roots imaginary

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51. $\sum_{n=1}^{\infty}\left(\tan^{-1}\left(\frac{4n}{n^4-2n^2+2}\right)\right)$ is equal to (A) $\tan^{-1}(2)+\tan^{-1}(3)$ (B) $4\tan^{-1}(1)$ (C) $\frac{\pi}{2}$ (D) $\sec^{-1}\left(-\sqrt{2}\right)$

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52. If

$b_i = 1 - a_i, na = \sum_{i=1}^{n} a_i, nb = \sum_{i=1}^{n} b_i, then \sum_{i=1}^{n} a_i, b_i + \sum_{i=1}^{n} (a_i - a)^2 =$

ab b. nab c. $(n+1)ab$ d. nab

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53. If the sum of the series $\sum_{n=0}^{\infty} r^n, |r| < 1 iss,$ then find the sum of the series $\sum_{n=0}^{\infty} r^{2n}$.

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54. Four numbers are such that the first three are in.A.P while the last three are in G.P. If the first number is 6 and common ratio of G.P. is $\frac{1}{2}$ the the number are (A) 6,8,4,2 (B) 6,10,14,7 (C) 6,9,12,6 (D) 6,4,2,1

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55. The sum of all two digit odd natural numbers in (A) 5049 (B) 2475 (C) 4905 (D) 2530

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56. The series $2\frac{x}{x+30+\left(2\frac{x}{(x+3)^2}\right)+\left(2\frac{x}{(x+3)^3}\right)+\ldots\ldots\ldots \to \infty}$ will have a definite sum when (A) $-1 < x < 3$ (B) $0 < x < 1$ (C) $x = 0$ (D) none of these

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57. if $\dfrac{a^{n+1}+b^{n+1}}{a^n+b^n}$ harmonic mean of $a\&b$ then n is

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58. The nth term of the series $2\frac{1}{2}+1\frac{7}{3}+1\frac{1}{9}+\frac{20}{23}+\ldots\ldots\ldots Is(A)$ 20/(5n+3)(B)20/(5n-3)(C)20(5n+3)(D)20/(5n^2+3)`

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59. Let $a_1, a_2, \ldots\ldots a_{10}$ be in A.P. and $h_1, h_2, \ldots. h_{10}$ be in H.P. If $a_1 = h_1 = 2$ and $a_{10} = h_{10} = 3, thena_4h_7$ is (A) 2 (B) 3 (C) 5 (D) 6

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60. If a,b,c,d are positive real number with $a+b+c+d=2$,then $M=(a+b)(c+d)$ satisfies the inequality

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61. If $a = 1 + b + b^2 + b^3 + \ldots\ldots \to \infty where|b| < 1$ then roots of equation $ax^2 + x - ab = 0$ are (A) $-1, ab$ (B) $1, b$ (C) $-1, b$ (D) $-1, a$

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62. If the sum of the first $2n$ terms of the A.P. 2, 5, 8, ..., is equal to the sum of the first n terms of A.P. 57, 59, 61, ..., then n equals 10 b. 12 c. 11 d. 13

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63. If the prth term of an A.P. is q and qth term is p, then rth term is (A) $q - p + r$ (B) $p - q + r$ (C) $p + q + r$ (D) $p + q - r$

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64. If the numbers p,q,r are in A.P. then $m^{7p}, m^{7q}, m^{7r}(m > 0)$ are in (A) A.P. (B) G.P. (C) H.P. (D) none of these

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65. $1^2 + (1^2 + 2^2) + (1^2 + 2^2 + 3^2)$, +..........upto 22nd term is (A) 22368 (B) 23276 (C) 22376 (D) none of these

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66. If $1^2 + 2^2 + 3^2 + n^2 = 1015$ then the value of n is equal to

(A) 13

(B) 14

(C) 15

(D) none of these

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67. Sum of the first n terms of the series $\frac{1}{2} + \frac{3}{4} + \frac{7}{8} + \frac{15}{16} +$ is equal to (1988, 2M) $2^n - n - 1$ (b) $1 - 2^{-n}$ $n + 2^{-n} - 1$ (d) $2^n + 1$

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68. If the sum of the roots of the equation $ax^2 + bx + c = 0$ is equal to sum of the squares of their reciprocals, then bc^2, ca^2, ab^2 are in

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69. The third term of a geometric progression is 4. The production of the first five terms is 4^3 b. 4^5 c. 4^4 d. none of these

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70. If A_1, A_2 be two A.M. and G_1, G_2 be two G.K.s between $aandb$ then $\frac{A_1 + A_2}{G_1 G_2}$ is equal to $\frac{a+b}{2ab}$ b. $\frac{2ab}{a+b}$ c. $\frac{a+b}{ab}$ d. $\frac{a+b}{\sqrt{ab}}$

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71. If a, b, c are distinct positive real numbers in G.P and $\log_c a, \log_b c, \log_a b$ are in A.P, then find the common difference of this A.P

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72. $1+\frac{3}{2}+\frac{5}{2^2}+\frac{7}{2^3}+\ldots\ldots\ldots \to \infty$ is equal to (A) 3 (B) 6 (C) 9 (D) 12

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73. If $x^a = y^b = c^c$, where a, b, c are unequal positive numbers and x, y, z are in GP, then $a^3 + c^3$ is :

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74. If G_1 and G_2 are two geometric means and A the asrithmetic mean inserted between two numbers, then the value of $\frac{G_1^2}{G_2}+\frac{G_2^2}{G_1}$ is (A) $\frac{A}{2}$ (B)

A (C) $2A$ (D) none of these

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75. If the sum of n terms of an A.P. is $3n^2 + 5n$ and its mth term is 164, find the value of m.

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76. The rational number, which equals the number $2.\overline{357}$ with recurring decimal is:

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77. If $x \in \{1, 2, 3, ..., 9\}$ and $f_n(x) = xxx.... x$ (n digits), then $f_n^2(3) + f_n(2)$

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78. Let $S_n = \sum_{r=0}^{\infty} \frac{1}{n^r}$ and $\sum_{n=1}^{k} (n-1)S_n = 5050 then k =$ (A) 50 (B) 505 (C) 100 (D) 55

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79. If $\sum_{n=1}^{k} \left[\frac{1}{3} + \frac{n}{90}\right] = 21$ where [x] dentes the integeral part of x, then k= (A) 84 (B) 80 (C) 85 (D) none of these

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80. Let $f: R \rightarrow R$ such that $f(x)$ is continuous and attains only rational value at all real x and f(3)=4. If a_1, a_2, a_3, a_4, a_5 are in H.P. then $\sum_{r=1}^{4} a_r a_{r+1} = (A) f(3).\ a_1 a_5$ (B) $f(3).\ a_4 a_5$ (C) $f(3).\ a_1 a_2$ (D) $f(2).\ a_1 a_3$

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81. The roots of equation $x^2 + 2(a-3)x + 9 = 0$ lie between -6 and 1 and $2, h_1, h_2, \ldots, h_{20}[a]$ are in H.P., where [a] denotes the integeral part of a and $2, a_1, a_2, \ldots a_{20}$ [a] are in A.P. then $a_3 h_{18} =$ (A) 6 (B) 12 (C) 3 (D) none of these

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82. If three successive terms of as G.P. with commonratio $r > 1$ form the sides of a triangle and [r] denotes the integral part of x the $[r] + [-r] =$ (A) 0 (B) 1 (C) -1 (D) none of these

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83. I $a_n = \int_0^{\frac{\pi}{2}} \frac{1 - \cos 2nx}{1 - \cos 2x} dx then a_1, a_2, a_3, \ldots\ldots\ldots, a_n$ are in (A) A.P. only (B) G.P.only (C) H.P. only (D) A.P., G.P. and H.P.

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84. If $a_1, a_2, a_3 \ldots\ldots\ldots$ are in H.P. and $f(k)=\sum_{r=1}^{n} a_r - a_k, the \frac{a_1}{f(1)}, \frac{a_2}{f(2)}, \frac{a_3}{f(3)}, \ldots\ldots\ldots, \frac{a_n}{f(n)}$ are in (A) A.P. (B) G.P (C) H.P. (D) none of these

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85. If the sides of a triangle are in G.P., and its largest angle is twice the smallest, then the common ratio r satisfies the inequality `0

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86. The sum of n terms of the series $\frac{5}{1.2}\frac{.1}{3}+\frac{7}{2.3}\frac{.1}{3^2}+\frac{9}{3.4}\frac{.1}{3^3}+\frac{11}{4.5}\frac{.1}{3^4}+..$ is (A) $1+\frac{1}{2^{n-1}}\frac{.1}{3^n}$ (B) $1+\frac{1}{n+1}\frac{.1}{3^n}$ (C) $1-\frac{1}{n+1}\frac{.1}{3^n}$ (D) $1+\frac{1}{2}n-\frac{1.1}{3^n}$

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87. If $\frac{b+c}{a+d} = \frac{bc}{ad} = 3\left(\frac{b-c}{a-d}\right)$ then a,b,c,d are in (A) H.P. (B) G.P. (C) A.P. (D) none of these

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88. If $\log\left(\frac{2b}{3c}\right), \log\left(\frac{4c}{9a}\right)$ and $\log\left(\frac{8a}{27b}\right)$ are in A.P. where a, b, c and are in G.P. then a,b,c are the length of sides of (A) a scelene triangle (B) anisocsceles tirangel (C) an equilateral triangle (D) none of these

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89. If S_r denotes the sum of r terms of an A.P. and $\frac{S_a}{a^2} = \frac{S_b}{b^2} = c$. Then $S_c =$ (A) c^3 (B) $\frac{c}{a}b$ (C) abc (D) $a+b+c$

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90. If S_p denotes the sum of the series $1 + r^p + r^{2p} + \to \infty and s_p$ the sum of the series $1 - r^{2p} r^{3p} + \to \infty, |r| < 1, then S_p + s_p$ in term of S_{2p} is $2S_{2p}$ b. 0 c. $\frac{1}{2} S_{2p}$ d. $-\frac{1}{2} S_{2p}$

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91. If $a, b and c$ are in $AP,$ then the straight line $ax + by + c = 0$ will always pass through a fixed point whose coordinates are_____

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92. The value of $10^3 + 11^3 + 12^3 + \dots\dots\dots\dots + 100^3$ is equal to (A) 25500475 (B) 25500000 (C) 25000000 (D) none of these

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93. If $a_n =$ the digit at units palce in the number o $1! + 2! + 3! + \dots\dots\dots n!$ for $n \geq 4$ the $a_4, a_5, a_6, \dots\dots\dots$ are in (A) A.P. only (B) G.P. only (C) A.P. and G.P. only (D) A.P., G.P. and H.P.

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94. Let a,b,c be positive real numers such that $bx^2 + \left(\sqrt{\left((a+c)^2 + 4b^2\right)}x + (a+c), = 0, \forall x \varepsilon R, then\right.$ a,b,c are in (A) G.P. (B) A.P. (C) H.P. (D) none of these

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95. The coefficient of x^{49} in the product $(x-1)(x-3)(x+99) is -99^2$ b. 1 c. -2500 d. none of these

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96. if $a, a_1, a_2, a_3, ..., a_{2n}, b$ are in $A. P.$ and $a, g_1, g_2, ...g_{2n}, b$ are in $G. P.$ and h is $H. M.$ of a, b then $\frac{a_1 + a_{2n}}{g_1 \cdot g_{2n}} + \frac{a_2 + a_{2n-1}}{g_2 \cdot g_{2n-1}} + ... + \frac{a_n + a_{n+1}}{g_n \cdot g_{n+1}}$ is equal

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97. Let α be the A.M. and β, γ be two G.M.\'s between two positive numbes then the value of $\frac{\beta^3 + \gamma^3}{\alpha\beta\gamma}$ is (A) 1 (B) 2 (C) 0 (D) 3

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98. If the sum of n positive number is 2n, then the product of these numbers is (A) $\leq 2^n$ (B) $\geq 2^n$ (C) divisible by 2^n (D) none of these

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99. Let $p, q, r \varepsilon R^+$ and $27pqr \geq (p+q+r)^3$ and $3p+4q+5r=12$ then $p^3+q^4+r^5$ is equal to

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100. Sum of the first n terms of an A.P. having positive terms is given by $S_n = (1+2T_n)(1-T_n)(where T_n$ is the nth term of the series). The value of T_2^2 is (A) $\frac{\sqrt{2}+1}{2\sqrt{2}}$ (B) $\frac{\sqrt{2}-1}{2\sqrt{2}}$ (C) $\frac{1}{2\sqrt{2}}$ (D) none of these

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101. Let a be the A.M. and b,c bet wo G.M\'s between two positive numbers. Then b^3+c^3 is equal to (A) abc (B) $2abc$ (C) $3abc$ (D) $4abc$

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102. If $a > 0, b > 0, c > 0$ and the minimum value of $a^2(b+c) + b^2(c+a) + c^2(a+b)$ is kabc, then k is (A) 1 (B) 3 (C) 6 (D) 4

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103. If $(2+x)(2+x^2)(2+x^3)..........(2+x^{100}) = \sum_{r=0}^{n} k_r x^r, then$ n= (A) 2550 (B) 5050 (C) 2^8 (D) none of these

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104. Let $S_1, S_2,$ be squares such that for each $n \geq 1,$ the length of a side of S_n equals the length of a diagonal of S_{n+1}. If the length of a side of $S_1 is 10 cm,$ then for which of the following value of n is the area of S_n less than 1 sq. cm? a. 5 b. 7 c. 9 d. 10

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105. The next term of the G.P. $x, x^2 + 2, and x^3 + 10$ is $\frac{729}{16}$ b. 6 c. 0 d. 54

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106. If $\hat{} nC_4, ^n C_5$ and $^nC_6$ are in A.P. then the value of n will be (A) 14

(B) 11 (C) 7 (D) 8

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107. If

$a, b, c are \in G. P.$ and $x, y be the AM's between a, b$ and $b, c respectively th$

$\frac{1}{a} + \frac{1}{b} = \frac{x+y}{6} (B) ax + cy = b$ (C) $\frac{a}{x} + \frac{c}{y} = 2$ (D) $\frac{1}{x} + \frac{1}{y} = \frac{2}{b}$

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108. If $a_n = \int_0^{\pi} \frac{\sin(2n-1)x}{\sin x} dx$. Then the number a_1, a_2, a_3 .... Are in

(A) A.P (B) G.P (C) H.P (D) none of these

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109. If the first two terms of a progression are $\log_2 256$ and $\log_3 81$ respectively, then which of the following stastement (s) is (are) true: (A) if the third term is $2\log_{61}$ the the terms are in A.P. (B) if the third term is $\log_2 8,$ the the terms are in A.P. (C) if the third term is $\log_4 16$ the the terms are in G.P. (D) if the third term is $\frac{2}{3}\log_2 16$ the the terms are in H.P.

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110. If first and $(2n-1)^t h$ terms of an AP, GP. and HP. are equal and their nth terms are a, b, c respectively, then (a) a=b=c (b)a+c=b (c) a>b>c and $ac-b^2=0$ (d) none of these

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111. The complex numbrs x and y such that $x, x+2y, 2x+y$ are n A.P. and $(y+1)^2, xy+5, (x+1)^2$ are in G.P. are (A) $x=3, y=1$ (B)

$x = -1 + 2\sqrt{2}i, y = \frac{1}{3}(-1 + 2\sqrt{2}i)$ (C)

$x = \sqrt{2} + i, y = 3\sqrt{5} - \sqrt{2}i$ (D) `x=-1(1+2sqrt(2)i), y= - 1/3 (1+2sqrt(2)i)

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112. The values of x for which $\frac{1}{1+\sqrt{x}}, \frac{1}{1-x}, \frac{1}{1-\sqrt{x}}$ are in A.P. lie in the interval (A) $(0, \infty)$ (B) $(1, \infty)$ (C) $(0, 1)$ (D) none of these

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113. If pth, qth, rth terms of an A.P. are in G.P. then common ratio of ths G.P. is (A) $\frac{q-r}{p-q}$ (B) $\frac{q-s}{p-r}$ (C) $\frac{r-s}{q-r}$ (D) $\frac{q}{p}$

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114. If A_1, A_2 be two A.M.\'s G_1, G_2 be the two G.M.\'s and H_1, H_2 be the two H.M.\'s between a and b then (A) $\frac{A_1 + A_2}{G_1 G_2} = \frac{a+b}{ab}$ (B) $\frac{H_1 + H_2}{H_1 H_2} = \frac{a+b}{a} b$ (C) $\frac{G_1 G_2}{H_1 H_2} = \frac{A_1 + A_2}{H_1 + H_2} (D) \frac{A_1 + A_2}{H_1 H_2} = \frac{a+b}{a-b}$

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115. If $f(n) = 1^2 + 2.2^2 + 3^2 + 2.4^2 + 5.6^2 + 2.6^2 + \ldots + n$ terms ,then

(A) $f(n) = \frac{n(n+1)^2}{2}$, if n is even (B) $f(n) = \frac{n^2(n+2)^2}{2}$, if $niseven(C)$f(n)= (n^2(n+1))/2, if $nisodd(D) f(n) = \frac{n(n+3)^2}{2}$ if n is odd

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116. Let T_r be the r^{th} term of an A.P whose first term is a and common difference is d IF for some integer m,n, $T_m = \frac{1}{n}$ and $T_n = \frac{1}{m}$ then $a - d =$

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117. The G.M. of two positive numbers is 6. Their arithmetic mean A and harmonic mean H satisfy the equation $90A + 5H = 918$, then A may be equal to (A) $\frac{5}{2}$ (B) 10 (C) 5 (D) $\frac{1}{5}$

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118. Let $a_1, a_2, a_3\ldots\ldots\ldots\ldots, a_n$ be positive numbers in G.P. For each n let A_n, G_n, H_n be respectively the arithmetic mean geometric mean and harmonic mean of $a_1, a_2, \ldots\ldots, a_n$ On the basis of above information answer the following question: A_k, G_k, H_k are in (A) A.P. (B) G.P. (C) H.P. (D) none of these

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119. .Let $a_1, a_2, \ldots\ldots\ldots$ be positive real numbers in geometric progression. For each n, let $A_nG_n, H_n,$ be respectively the arithmetic mean, geometric mean & harmonic mean of $a_1, a_2\ldots\ldots\ldots a_n$. Find an expression ,for the geometric mean of $G_1, G_2, \ldots\ldots. G_n$ in terms of $A_1, A_2, \ldots\ldots., A_n, H_1, H_2, \ldots\ldots., H_n$.

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120. Let S_n denote the sum of first n terms of a G.P. whose first term and common ratio are a and r respectively. On the basis of above information answer the following question: $S_1 + S_2 + S_2 + .. + S_n =$ (A) $\frac{na}{1-r} - \frac{ar(1-^n)}{(1-r)^{20}}$ (B) $\frac{na}{1-r} - \frac{ar(1+^n)}{(1+r)^{20}}$ (C) $\frac{na}{1-r} - \frac{a(1-^n)}{(1-r)^{20}}$ (D) none of these

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121. Let S_n denote the sum of first n terms of a G.P. whose first term and common ratio are a and r respectively. On the basis of above information answer the following question: The sum of product of first n terms of the G.P. taken two at a time in (A) $\frac{r+1}{r} S_n S_{n-1}$ (B) $\frac{r}{r+1} S_n^2$ (C) $\frac{r}{r+1} S_n S_{n-1}$ (D) none of these

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122. If sum of n termsof a sequende is S_n then its nth term $t_n = S_n - S_{n-1}$. This relation is vale for all $n > -1$ provided $S_0 = 0$. But if $S_{\neq}0$, then the relation is valid ony for $n \geq 2$ and in hat cast t_1 can be obtained by the relation$t_1 = S_1$. Also if nth term of a sequence $t_1 = S_n - S_{n-1}$ then sum of n term of the sequence can be obtained by putting $n = 1, 2, 3, . n$ and adding them. Thus $\sum_{n=1}^{n} t_n = S_n - S_0$. if $S_0 = 0, then \sum_{n=1}^{n} t_n = S_n$. On the basis of above information answer thefollowing questions: If the sum of n terms of a sequence is $10n^2 + 7n$ then the sequence is (A) an A.P. having common difference 20 (B) an A.P. having common difference 7 (C) an A.P. having common difference 27 (D) not an A.P.

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123. If sum of n terms of a sequence is S_n then its nth term $t_n = S_n - S_{n-1}$. This relation is valid for all $n > -1$ provided $S_0 = 0$. But if $S_1 = 0$, then the relation is valid only for $n \geq 2$ and in hat cast t_1 can be obtained by the relation$t_1 = S_1$. Also if nth term of a sequence

$t_1 = S_n - S_{n-1}$ then sum of n term of the sequence can be obtained by putting $n = 1, 2, 3, . n$ and adding them. Thus $\sum_{n=1}^{n} t_n = S_n - S_0$. if $S_0 = 0, then \sum_{n=1}^{n} t_n = S_n$. On the basis of above information answer the following questions: If the sum of n terms of a sequence is $10n^2 + 7n$ then the sequence is (A) an A.P. having common difference 20 (B) an A.P. having common difference 7 (C) an A.P. having common difference 27 (D) not an A.P.

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125. If a,b,c are positive real numbers then $(1+a)^7(1+b)^7(1+c)^7$ (A) $< 7^7a^4b^4c^4$ (B) $\leq 7^7a^4b^4c^4$ (C) $> 7^7a^4b^4c^4$ (D) none of these

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126. If $x \in R$, the numbers $5^{1+x}+5^{1-x}, \frac{a}{2}, 25^x+25^{-x}$ form an A.P. then a must lie in the interval

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127. Find the sum of integers from 1 to 100 that are divisible by 2 or 5.

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128. Sum of infinite terms of series $3+5.\frac{1}{4}+7.\frac{1}{4^2}+....$ is

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129. The largest term common to the sequences $1, 11, 21, 31, \rightarrow 100$ terms and $31, 36, 41, 46, \rightarrow 100$ terms is 381 b. 471 c. 281 d. none of these

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130. Assertion: $\left[\left(1+\frac{1}{10000}\right)^{10000}\right]=2$ where [.] is the greatest integer function. Reason: $2<\left(1+\frac{1}{n}\right)^{n}<2.5$ for all n εN (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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131. Assertion: If n is odd then the sum of n terms of the series $1^2 + 2 \times 2^2 + 3^2 + 2 \times 4^2 + 5^2 + 2 \times 6^2 + 7^2 + \ldots is \dfrac{n^2(n+1)}{2}$. If n is even then the sum of n terms of the series. $1^2 + 2 \times 2^2 + 3^2 + 2 \times 4^2 + 5^2 + 2 \times 6^2 + \ldots\ldots is \dfrac{n(n+1)^2}{2}$(A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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132. Assertion: one root of equation $(a-d)^2 x^2 - \left[(b-c)^2\right\}(c-a)^2 x - (d-b)^2 = 0$ is necessarily 1. Reason: $(a-d)^2 = (b-c)^2 + (c-a)^2 + (d-b)^2$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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133. Assertion: x,y,z are in A.P., Reason: sum of an infinite G.P. having first term a and common ratio r is $\frac{a}{1-r} where -1 < r < 1$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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134. Assertion: $x-a, y-a, z-a$ are in G.P., Reason: If a,b,c are in H.P. then $a-\frac{b}{2}, b-\frac{b}{2}, c-\frac{b}{2}$ are in G.P. (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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135. Assertion: I_1, I_2, I_3,......... are in A.P. Reason: $I_{n+2}+I_n-2I_{n+1}=0$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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136. Assetion: $a_1, a_2, a_3, \ldots\ldots\ldots\ldots$ an are not in G.P. Reason: $a_{n+1} = a_n$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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137. Assertion: a^2, b^2, c^2 are in A.P., Reason: $\frac{1}{b+c}, \frac{1}{c+a}, \frac{1}{a+b}$ are in A.P. (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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138. Assertion: $\frac{S_1}{S_2} = \frac{n}{n+1}$, Reason: Numbers of odd termsof A.P. is $(n+1)$ and numbers of even terms is n. (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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139. Let n_{th} term of the sequence be given by t_n=$\frac{(n+2)(n+3)}{4}$ Assertion: $\frac{1}{t_1} + \frac{1}{t_2} + \ldots\ldots\ldots\ldots + \frac{1}{t_{2009}} = \frac{2009}{1509}$, Reason: $\frac{1}{(n+2)(n+3)} = \frac{1}{n+2} - \frac{1}{n+3}$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not the correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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140. The real numbers x_1, x_2, x_3 satisfying the equation $x^3 - x^2 + bx + \gamma = 0$ ar ein A.P. Find the intervals in which $\beta and \gamma$ lie.

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141. Let x be the arithmetic mean and y, z be the two geometric means between any two positive numbers, then $\frac{y^3+z^3}{xyz}= \cdot$ (1997C, 2M)

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142. If $\cos(x-y), , \cos x$ and $\cos(x+y)$ are in H.P., are in H.P., then $\cos x \cdot \sec\left(\frac{y}{2}\right)$=

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143. Let $pandq$ be the roots of the equation $x^2-2x+A=0$ and let $rands$ be the roots of the equation $x^2-18x+B=0.$ If `p

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144. Let T_r be the rth term of an A.P., for $r = 1, 2, 3,$ If for some positive integers $m, n,$ we have $T_m = \frac{1}{n} and T_n = \frac{1}{m}, then T_{mn}$ equals $\frac{1}{mn}$ b. $\frac{1}{m} + \frac{1}{n}$ c. 1 d. 0

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145. If $x > 1, y > 1, z > 1$ are in G.P. then $\frac{1}{1 + Inx}, \frac{1}{1 + Iny}, \frac{1}{1 + Inz}$ are in (A) A.P. (B) H.P. (C) G.P. (D) none of these

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146. If x_1, x_2, x_3 as well as y_1, y_2, y_3 are in G.P. with the same common ratio, then the points $(x_1, y_1), (x_2, y_2)$ and (x_3, y_3) (A) lie on a straight line (B) lie on a parabola (C) lie on a circle (D) are vertices of a triangle

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147. The harmonic mean of the roots of the equation $(5+\sqrt{2})x^2 - (4+\sqrt{5})x + 8 + 2\sqrt{5} = 0$ is 2 b. 4 c. 6 d. 8

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148. Let $a_1, a_2, \ldots\ldots a_{10}$ be in A.P. and $h_1, h_2, \ldots\ldots h_{10}$ be in H.P. If $a_1 = h_1 = 2 \text{ and } a_{10} = h_{10} = 3, then a_4 h_7$ is (A) 2 (B) 3 (C) 5 (D) 6

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149. Let $S_1, S_2,$ be squares such that for each $n \geq 1,$ the length of a side of S_n equals the length of a diagonal of $S_{n+1}.$ If the length of a side of $S_1 is 10 cm,$ then for which of the following value of n is the area of S_n less than 1 sq. cm? a. 5 b. 7 c. 9 d. 10

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150. If a, b, c, d are positive real umbers such that $a = b + c + d = 2, thenM = (a + b)(c + d)$ satisfies the relation $0 \leq M \leq 1 1 \leq M \leq 2 2 \leq M \leq 3 3 \leq M \leq 4$

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151. Consider an infinite geometric series with first term a and common ratio r. If its sum is 4 and the second term is 3/4, then $a = \frac{4}{7}, r = \frac{3}{7}$ b. $a = 2, r = \frac{3}{8}$ c. $a = \frac{3}{2}, r = \frac{1}{2}$ d. $a = 3, r = \frac{1}{4}$

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152. The fourth power of common difference of an arithmetic progression with integer entries is added to the product of any four consecutive terms of it. Prove that the resulting sum is the square of an integer.

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153. Let $\alpha and \beta$ be the roots of $x^2 - x + p = 0 and \gamma and \delta$ be the root of $x^2 - 4x + q = 0$. If $\alpha, \beta, and \gamma, \delta$ are in G.P., then the integral values of $p and q$, respectively, are $-2, \ -32$ b. $-2, 3$ c. $-6, 3$ d. $-6, \ -32$

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154. If the sum of the first $2n$ terms of the A.P. 2, 5, 8, ..., is equal to the sum of the first n terms of A.P. 57, 59, 61, ..., then n equals 10 b. 12 c. 11 d. 13

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155. Let the positive numebrs a,b,c,d be in A.P. Then abc, abd, acd, bcd re (A) not in A.P., G.P., H.P. (B) in A.P. (C) in G.P. (D) in H.P.

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156. .Let $a_1, a_2, \ldots\ldots\ldots\ldots$ be positive real numbers in geometric progression. For each n, let $A_n G_n, H_n$, be respectively the arithmetic mean, geometric mean & harmonic mean of $a_1, a_2 \ldots\ldots\ldots a_n$. Find an expression ,for the geometric mean of $G_1, G_2, \ldots\ldots.\,G_n$ in terms of $A_1, A_2, \ldots\ldots.\,, A_n, H_1, H_2, \ldots\ldots.\,, H_n$.

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157. If

$$\sin^{-1}\left(x - \frac{x^2}{2} + \frac{x^3}{4} - \ldots.\right) + \cos^{-1}\left(x^2 - \frac{x^4}{2} + \frac{x^6}{4} - \ldots.\right) = \frac{\pi}{2}$$

for $0 < |x| < \sqrt{2}$ then $x =$

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158. If $a - 1, a_2, , a_n$ are positive real numbers whose product is a fixed number c, then the minimum value of $a_1 + a_2 + \; + a_{n-1} + 2a_n$ is $a_{n-1} + 2a_n$ is b. $(n+1)c^{1/n}$ $2nc^{1/n}$ $(n+1)(2c)^{1/n}$

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159. Suppose a,b,c are in A.P and a^2, b^2, c^2 are in G.P If `a

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160. Let a, b be positive real numbers. If aA_1, A_2, b be are in arithmetic progression a, G_1, G_2, b are in geometric progression, and a, H_1, H_2, b are in harmonic progression, show that $\frac{G_1 G_2}{H_1 H_2} = \frac{A_1 + A_2}{H_1 + H_2} = \frac{(2a+b)(a+2b)}{9ab}$

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161. If $\alpha \in \left(0, \frac{\pi}{2}\right), then \sqrt{x^2 + x} + \frac{\tan^2 \alpha}{\sqrt{x^2 + x}}$ is always greater than or equal to $2 \tan \alpha \ 1 \ 2 \sec^2 \alpha$

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162. If a, b, c are in A.P. and a^2, b^2, c^2 are in H.P., then prove that either $a = b = c$ or $a, b, c = \frac{c}{2}$ form a G.P.

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163. An infinite G.P has first term x and sum 5 then x belongs

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164. If $a, b, c,$ are positive real numbers, then prove that (2004, 4M) $\{(1+a)(1+b)(1+c)\}^7 > 7^7 a^4 b^4 c^4$

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165. In the quadratic $ax^2 + bx + c = 0, D = b^2 - 4ac$ and $\alpha + \beta, \alpha^2 + \beta^2, \alpha^3 + \beta^3,$ are in

G.P , where α, β are the roots of $ax^2 + bx + c,$ then (a) $\Delta \neq 0$ (b) $b\Delta = 0$ (c) cDelta = 0(d)Delta = 0`

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166. Let $A_n = \left(\frac{3}{4}\right) - \left(\frac{3}{4}\right)^2 + \left(\frac{3}{4}\right)^3 + \dots . + (-1)^{n-1}\left(\frac{3}{4}\right)^n$ and $B_n = 1 -$. find the least odd natural numbers n_0, so that $B_n > A_n A$ for all $n \geq n_0$

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167. Let V_r denote the sum of the first' ' terms of an arithmetic progression (A.P.) whose first term is'r and the common difference is $(2r - 1)$. Let $T_r = V_{r+1} - V_r - 2$ and $Q_r = T_{r+1} - T_r$ for $r = 1, 2, \dots \dots .$ The sum $V_1 + V_2 + \dots \dots + V_n$ is

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168. Let V_r denote the sum of the first r terms of an arithmetic progression (AP) whose first term is r and the common difference is $(2r-1)$. Let $T_r = V_{r+1} - V_r - 2$ and $Q_r = T_{r+1} - T_r$ for $r = 1, 2$ T_r is always (A) an odd number (B) an even number (C) a prime number (D) a composite num,ber

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169. Let V_r denote the sum of the first r terms of an arithmetic progression (AP) whose first term is r and the common difference is $(2r-1)$. Let $T_r = V_{r+1} - V_r - 2$ and $Q_r = T_{r+1} - T_r$ for $r = 1, 2$ Which one of the following is a correct statement? (A) $Q_1, Q_2, Q_3 \ldots \ldots \ldots \ldots,$ are in A.P. with common difference 5 (B) $Q_1, Q_2, Q_3 \ldots \ldots \ldots \ldots,$ are in A.P. with common difference 6 (C) $Q_1, Q_2, Q_3 \ldots \ldots \ldots \ldots,$ are in A.P. with common difference 11 (D) $Q_1 = Q_2 = Q_3$

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170. Let A_1, G_1, H_1denote the arithmetic, geometric and harmonic means respectively, of two distinct positive numbers. For $n > 2$, let A_{n-1}, G_{n-1} and H_{n-1} has arithmetic, geometric and harmonic means as $A_n, G_N, H_N,$ respectively.

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173. Assertion: The numbers b_1, b_2, b_3, b_4 are neither in A.P. nor in G.P. Reason: The numbers b_1, b_2, b_3, b_3 are in H.P. (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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174. If the sum of first n terms of an AP is cn^2, then the sum of squares of these n terms is (2009) $\frac{n(4n^2-1)c^2}{6}$ (b) $\frac{n(4n^2+1)c^2}{3}$ $\frac{n(4n^2-1)c^2}{3}$ (d) $\frac{n(4n^2+1)c^2}{6}$

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