MATHS

BOOKS - KC SINHA MATHS (HINGLISH)

AP - FOR BOARDS

Solved Examples

1. Write the first three terms in each of the equences defined by the following: $t_n = n(n+1)$

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2. Write the first three terms in each of the equences defined by the following: $t_n = \frac{n^2}{n+2}$

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3. What is the 15th term of the sequence defined by $t_n = \frac{1}{2n-10}$

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4. Find the first five terms of the sequence for which

$t_1 = 1, t_2 = 2$ and $t_{n+2} = t_n + t + (n+1)$

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5. Show thast the sequence (t_n) defined by $t_n = x + (2n-1)b, wherex$ and b are constants, is an A.P. Fid its common difference.

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6. Show that the sequence defined by $a_n = 2n^2 + 1$ is not an A.P.

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7. Show that the sequence $(a+b)^2(a^2+b^2), (a-b)^2, \ldots$ is an A.P.

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8. Show that the sequence $\log a, \log\left(\frac{a^2}{b}\right), \log\left(\frac{a^3}{b^2}\right), \log\left(\frac{a^4}{b^3}\right),$ forms an A.P.

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9. How many terms are there in the A.P. 20, 25, 30, ... 100.

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10. Find the A.P. whose 7th and 13th terms are respectively 34 and 64

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11. The 11th term of an A.P. is 80 and the 16th term is 110. Find the 31st term.

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12. Is 55 a term of te seqwuence 1,3,5,7..? If yes find which term it is.

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13. Find the first negative termof the sequence 2000, 1995, 1990, 1985,.....

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14. How many terms are identical in the two arithmetic progressions $2, 4, 6, 8, \ldots\ldots$ up to 100 terms and $3, 6, 9, \ldots.$ up to 80 terms.

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15. If m times the mth term of an AP is equal to n times its nth term, then show that (m + n)th term of an AP is zero.

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16. If pth,qth and rth terms of an A.P. are a, b, c respectively, then show that (i) a(q-r)+b(r-p)+c(p-q)=0

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17. Find the numberof integer between 100 and 1000 that are i. divisible by 7 ii. not divisible by 7.

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18. Show that in an A.P. the sum of the terms equidistant from the beginning and end is always same and equal to the sum of first and last terms.

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19. The sum of three numbers in A.P. is 27 and the sum of their squares is 293. Find the numbers.

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20. The sum of four integers in $A.P$, is 24, and their product is 945 find

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21. Divide 69 into three parts which are in A.P. and the product of the two smaller parts is 483.

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22. If the sum of n tems of a series be $5n^2 + 3n$, find its nth term. Are the terms of this series in

A.P.?

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23. Find the sum to n terms of an A.P. whose nth terms is $t_n = 5 + 6n, n \in N$.

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24. Find the sum of the series 99+95+91+87+... to 20 terms.

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25. Find the sum of n terms of the series $(a+b)^2 + a^2 + b^2 + (a-b)^2 + \ldots\ldots\ldots\ldots\ldots\ldots.$

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26. If the sum of a certain number of terms of the AP 5,22,19.. is 116. Find the last term.

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27. How many terms of the series 54,51, 48,.. be taken so that their sum is 513? Explain the double

answer

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28. Find the sum of all even integers between 101 and 999.

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29. Solve: $1 + 4 + 7 + 10 + \ + x = 590.$

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30. Let the sum of n, 2n, 3n terms of an A.P. be S_1, S_2 and S_3 , respectively, show that $S_3 = 3(S_2 - S_1)$.

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31. Let S_1, S_2 and S_3 be the sum of n terms of 3 arithmetic series, the first termof each being 1 and the respective common differences are 1,2,3,then prove that $S_1 + S_3 = 2S_2$.

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32. If there are $(2n+1)$ terms in A.P. , then prove that the ratio of the sum of odd terms and the sum of even terms is $(n+1):n$

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33. The sum of the first p, q, r terms of an A.P. are a, b, c respectively. Show that $\frac{a}{p}(q-r)+\frac{b}{q}(r-p)+\frac{c}{r}(p-q)=0$

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34. The ratio of the sumsof p and q terms of an A.P.is $p^2 : q^2$. Show that the ratio of its pth and qth terms is $2p - 1 : 2q - 1$

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35. The interior angles of a polygon are in AP The smallest angle is 120 and the common difference is 5. Find the number of sides of the polygon.

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36. The ratio of the sum of n terms of two A.P.'s is $(3n+1):(4n+3)$. Find the ratio of their mth terms.

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37. Prove that a sequence in an A.P., if the sum of its n terms is of the form $An^2 + Bn, where A, B$ are constants.

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38. Find the sum of the integers between 1 and 200 which are multiples of 3.

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39. If a,b,c are in A.P. prove that $b+c, c+a, a+b$ are also in A.P.

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40. If a^2, b^2, c^2 are in A.P. prove that $\frac{1}{b+c}, \frac{1}{c+a}, \frac{1}{a+b}$ are in A.P.

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41. If $ab + bc + ca \neq 0$ and a, b, c are in A.P. prove that $a^2(b+c), b^2(c+a), c^2(a+b)$ are also in A.P.

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42. If a,b,c are in A.P. prove that: $a\left(\frac{1}{b}+\frac{1}{c}\right), b\left(\frac{1}{c}+\frac{1}{a}\right), c\left(\frac{1}{a}+\frac{1}{b}\right)$ are in A.P.

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43. If $a^2(b+c), b^2(c+a), c^2(a+b)$ are in A.P., then prove that a,b,c are in A.P. or $ab+bc+ca=0$

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44. Insert five arithetic means between 5 and 29.

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45. n A.M.'s are inserted between 1 and 31 such that the ratio of the 7th and $(n-1)$ th means terms is

5:9. Find n.

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46. For what value of n, $\frac{a^{n+1}+b^{n+1}}{a^n+b^n}$, $a \neq b$ is the A.M. of a and b.

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47. Prove that the sum of n arithmetic means between two numbers in n times the single. A.M. between them.

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48. If x, y, z are in A.P. and A_1 is the A.M. of $x and y and A_2$ is the A.M. of $y and z$, then prove that the A.M. of $A_1 and A_2 is y$.

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49. The sum of two numbers is $\frac{13}{6}$. An even number of arithmetic means are being inserted between them and sum exceeds their number by 1. find the number of means inserted.

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50. n arlithmetic means are inserted between $xand2y$ and then between $2xandy$. If the rth means in each case be equal, then find the ratio x/y.

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Exercise

1. Write the indicated terms in each of the following sequences whose nth terms are:

$t_n = 3n + 1$

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2. Write the Ap in each of the following sequences whose nth terms are: 2^n

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3. Write the indicated terms in each of the following sequences whose nth terms are: $t_n = n^2 + 1 : t_1, t_2, t_3$

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4. Write the indicated terms in each of the following sequences whose nth terms are:

$t_n = n(n+2) : t_5, t_7$

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5. Write the indicated terms in each of the following sequences whose nth terms are:

$t_n = \frac{n^2}{n+1} : t_1, t_{10}$

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6. Write the indicated terms in each of the following sequences whose nth terms are:

$$t_n = \frac{n-3}{4} : t_6, t_7$$

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7. Write the indicated terms in each of the following sequences whose nth terms are:

$$t_n = \frac{2n-3}{6} : t_1, t_2, t_3$$

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8. Write the indicated terms in each of the following sequences whose nth terms are:

$$t_n = \frac{n}{n+1} : t_4, t_5$$

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9. Write the indicated terms in each of the following sequences whose nth terms are:

$$t_n = n^2(n+1) : t_4, t_5$$

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10. Write the indicated terms in each of the following sequences whose nth terms are:

$$t_n = \frac{n(n^2+5)}{4} : t_4, t_5$$

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11. Find the indicated terms in each of the following sequences whose nth nth terms are:

$$t_n = (-1)^{n-1} t^{n-1}, t_3$$

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12. Find the indicated terms in each of the following sequences whose nth nth terms are: $t_n = \frac{n^2}{2^n}, t_4, t_6$

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13. Find the indicated terms in each of the following sequences whose nth nth terms are: $4n - 3, t_{17}, t_{24}$

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14. Find the indicated terms in each of the following sequences whose nth nth terms are: $t_n = (-1)^{n-1}.n^3, t_9$

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15. Find the indicated terms in each of the following sequences whose nth nth terms are: $t_n = \frac{n^2(n+1)}{3}, t_1, t_2$

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16. Find the indicated terms in each of the following sequences whose nth nth terms are:

$$t_n = \frac{n(n-2)}{n+3}, t_{20}$$

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17. Find the indicated terms in each of the following sequences whose nth nth terms are:

$$t_n = (n-1)(2-n)(3+n), t_{20}$$

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18. Find the indicated terms in each of the following sequences whose nth nth terms are: $\frac{t_{n-1}}{n^2}, t_1 = 3, t_2, t_3 (n \geq 2)$

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19. Write the next three terms of the following sequences: $t_2 = 2, t_n = t_{n-1} + 1, (n \geq 3)$

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20. Write the next three terms of the following sequences: $t_1 = 3, t_n = 3t_{n-1} + 2f \text{ or } alln > 1$

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21. Write the next three terms of the following sequences: $t_1 = 1, t_n = \frac{t_{n-1}}{n}, (n \geq 2)$

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22. Write the next three terms of the following sequences: $t_1 = 2, t_n = t_{n-1} - 1, n > 2$

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23. Find the first five terms of the following sequences and write down the coresponding series: $t_1 = 1, t_n = t_{n-1} + 2f \text{ or } n \geq 2$

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24. Write the next three terms of the following sequences: $t_1 = 1, t_n = \frac{t_{n-1}}{n}, (n \geq 2)$

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25. The Fibonacci sequence is defence by $t_1 = t_2 = 1, t_n = t_{n-1} + t_{n-2}(n > 2). If t_{n+1} = kt_n$ then find the values of k for $n = 1, 2, 3 \text{ and } 4.$

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26. If nth term of a sequences is $4n^2 + 1,$ find the sequence. Is this sequences at A.P.?

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27. If nth term of a sequences is $2n + b, wherea, b$ are constants, is the this sequence an A.P.?

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28. If the nth term of a sequence is an expressionof first degree in n, show that it is an A.P.

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29. A sequence $\{t_n\}$ is given by $t_n = n^2 - 1, n \in N,$ show that it is not an A.P.

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30. Find the indicated terms in each of the following arithmetic progression $16, 11, 16, . . , t_{61}$

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31. Find the indicated terms in each of the following arithmetic progression $a = 3, d = 2, t_n, t_{10}$

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32. Find the indicated terms in each of the following arithmetic progression $5, 2, -1. \ldots . t_{10}$

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33. Find the indicated terms in each of the following arithmetic progressions $a = 21, d = -5, t_n, t_{25}$

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34. Find the 10th term of the sequence 10,5,0,-5,-10,...

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35. Find the 10th term of the sequence whose 7th and 12th terms are 34 and 64 respectively.

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36. If pth, qth, and rth terms of an A.P. are $a, b, c,$ respectively, then show that

$$a(q-r)+b(r-p)+c(p-q)=0$$

$$(a-b)r+(b-c)p+(c-a)q=0$$

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37. find the first negative term of the sequence 999,995,991,987,...

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38. In an A.P. if m^{th} term is n and the nth term is m, where $m \neq n$, find the pth term.

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39. Each of the sequences 3,5,7,... and 4,7,10, is continued to 100 terms. Find how many terms are identical.

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40. Find the number of all positive integers of 3 digits which are divisibleby 5.

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41. For an $A.\ P$, show that $t_m + t_{2n} + m = 2t_{m+n}$

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42. For an A.P. show that $t_{m+n} + t_{m-n} = 2t_m$

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43. Determine the number of terms in the A.P. 3,7,11,...,399. Also find its 20th term from the end.

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44. If $\{t_n\}$ is n A.p. such that $\frac{t_4}{t_1} = \frac{2}{3}$, find $\frac{t_8}{t_9}$.

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45. Show that the sequence $\log a, \log(ab), \log\left(ab^2\right), \log\left(ab^3\right),$ is an A.P. Find its nth term.

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46. A man starts repaying a loan as first instalment of Rs. 100. If he increases the instalments by Rs. 5

every month, what amount he will pay in the 30th instalment?

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47. Three numbers are in A.P., their sum is 27 and the sum of their squares is 275. Find the numbers.

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48. The sum of three numbers in A.P. is 12 and the sum of their cubes is 408 find them.

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49. Divide 15 into three parts which aere in A.P. and the sum of their squares is 83.

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50. 4. (a) Divide 20 into 4 parts which are in A.P. and such that. the product of the first and fourth is to the product o the secondi.and third in the ratio 2:3.

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51. If the sum to n terms of a sequences is $2n^2 + 4$, find its nth. Is this seqwuence as AP.?

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52. Find the sum of the following series: $1 + 4 + 7 + 10 + \ldots \rightarrow 40$ terms

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53. Find the sum of the following series: $2\left(\frac{2}{3}\right) + 3\left(\frac{2}{3}\right) + 4\left(\frac{2}{3}\right) + \ldots$ 60 terms

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54. Find the sum of the following series:

$\frac{3}{\sqrt{5}} + \frac{4}{\sqrt{5}} + \ldots$ 25 terms

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55. Find the sum of the following series:

$1 + 5 + 3 + 9 + 5 + 13 + 7 + \ldots$ 20 terms

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56. How many terms of the series 15+12+9+... must be taken to make 15? Explain the double answer.

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57. Find the sum of all odd numbers between 100 and 200.

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58. Find the sum of odd integers from 1 to 2001.

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59. Find the sum of first 30 terms of an A.P. whose second term is 2 and seventh term is 22.

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60. The sum of first p- terms terms of an A.P. is q and the sum of first q terms is p, find the sum of first (p + q)

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61. How many terms of the A.P. -6, $-\frac{11}{2}$, -5.. are needed to give the sum -?

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62. solve: $1+6+11+16+\ldots\ldots\ldots+x=148$

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63. Solve : $2+22+19+16+\ +x=115$

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

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65. Find the sum of all natural numbers lying between 100 and 1000, which are multiples of 5.

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66. Find the sum of all numbers between 200 and 400 which are divisible by 7.

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67. If the sum to n terms of a sequence be $n^2 + 2n$ then prove tht the sequence is an A.P.

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68. Find the sum of n terms of an A.P. whose kth terms is $5k + 1$.

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69. Find the sum of all two digit numbers which when divided by 4, yields 1 as remainder.

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70. 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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71. If the sum of n terms of an A.P. is $(pn + qn^2)$, where p and q are constants, find the common

difference.

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72. If the sum of n terms of an A.P. in $nP \quad + \frac{1}{2}n(n-1)Q,$ where P and Q are constants, find the common difference.

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73. If the sum of 8 terms of an A.P. is 64 and the sum of 19 terms is 361, find the sum of n terms.

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74. The first , second and the last terms of an A.P. are a, b, c respectively. Prove that the sum is $\frac{(a+c)(b+c)(c-2a)}{2(b-a)}$.

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75. If the mth term of an A.P. is $\frac{1}{n}$ and the nth term is $\frac{1}{m}$, show that the sum of mn terms is $\frac{1}{2}(mn+1)$.

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76. If 12th term of an A.P. is -13 and the sum of the first four terms is 4, what is the sum of first 10 terms ?

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77. If there are $(2n+1)$ terms in A.P. , then prove that the ratio of the sum of odd terms and the sum of even terms is $(n+1):n$

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78. If the sum of first m terms of an A.P. is the same as the sum of its first n terms, show that the sum of tis $(m+n)$ terms is zero.

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79. In an A.P. the first term is 2 and the sum of the first five terms is one fourth of the next five terms. Show that 20th term is -112.

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80. the income of a person is Rs. 300,000 in the first year and he receivers in increase of Rs. 10000 to his income per year for the next 19 years. Find the total amount, he received in 20 years.

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81. A man starts repaying a loan as first instalment of Rs. 100. If he increases the instalments by Rs. 5 every month, what amount he will pay in the 30th instalment?

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82. The interior angle of polygon are in A.P., the smallest angle is 75^0 and the common difference is 10^0. Find the numberof sieds of the polygon.

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83. If S_n, be the sum of n terms of an $A.P$; the value of $S_n - 2S_{n-1} + S_{n-2}$, is

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84. The sum of first 7 terms of an A.P. is 10 and that of next 7 terms is 167. Find the progression.

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85. if the pth term of an A.P. is x and qth term is y, show tht the sum of $(p+q)$ terms is $\frac{p+q}{2}\left[x+y+\left(\frac{x-y}{p-q}\right)\right]$

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86. The sum of n terms of two arithmetic progressions are in the ratio $(3n+8):(7n+15)$. Find the ratio of their 12th terms.

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87. The sum of n terms of two arithmetic progressions are in the ratio $5n+4:9n+6$. Find the ratio of their 18th terms.

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88. If in an A.P, $S_n = n^2 p$ and $S_m = m^2 p$, then S_p is equal to

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89. If $\frac{a}{b+c}, \frac{b}{c+a}, \frac{c}{a+b}$ are in A.P. and $a+b+c \neq 0$ prove that $\frac{1}{b+c}, \frac{1}{c+a}, \frac{1}{a+b}$ are in A.P.

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90. If a^2, b^2, c^2 are in A.P, show that: $\frac{a}{b+c}, \frac{b}{c+a}, \frac{c}{a+b}$ are in A.P.

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91. If a, b, c are in A.P., prove that: (i) $\frac{1}{bc}, \frac{1}{ca}, \frac{1}{ab}$ are in A.P. (ii) $(b+c)^2 - a^2, (a+c)^2 - b^2, (b+a)^2 - c^2$ are in A.P.

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92. If a, b, c are in A.P., prove that: (i) $\frac{1}{bc}, \frac{1}{ca}, \frac{1}{ab}$ are in A.P. (ii) $(b+c)^2 - a^2, (a+c)^2 - b^2, (b+a)^2 - c^2$ are in A.P.

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93. If a, b, c are in A.P., then prove that the following are also in A.P.

$$\frac{1}{\sqrt{b}+\sqrt{c}}, \frac{1}{\sqrt{c}+\sqrt{a}}, \frac{1}{\sqrt{a}+\sqrt{b}}$$

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94. If $\frac{b+c-a}{a}, \frac{c+a-b}{b}, \frac{a+b-c}{c}$ are in A.P., show that $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P. provided $a+b+c \neq 0$

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95. If $(b-c)^2, (c-a)^2, (a-b)^2$ are in A.P., then show that $\frac{1}{b-c}, \frac{1}{c-a}, \frac{1}{a-b}$ are in A.P.

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96. If a,b,c are in A.P. show that

$(a-c)^2 = 4(a-b)(b-c)$

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97. If a, b, c are in A.P, show that

$(i) a^3 + b^3 + 6abc = 8b^3$ (ii)

$(a+2b-c)(2b+c-a)(a+c-b) = 4abc$

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98. If a, b, c are in A.P, show that

$(i) a^3 + b^3 + 6abc = 8b^3$ (ii)

$(a + 2b - c)(2b + c - a)(a + c - b) = 4abc$

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99. Find the single arithmetic mean between:

$7 \text{ and } 31$

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100. Findthe single arithmetic mean between: $(a-b)$ and $(a+b)$

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101. Findthe single arithmetic mean between: 6 and -18

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102. Insert 6 numbers between 3 and 24 such that the resulting sequence is an A. P.

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103. Insert 7 A.M.'s between 2 and 34.

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104. Insert five numbers between 8 and 26 such that the resulting sequence is an A.P.

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105. Insert 4 A.M.s between 4 and 19.

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106. If A_1, A_2, A_3, A_2 and A_5 are the five A.M.'s between 2 and 8, then find the value of $A_1 + A_2 + A_3 + A_4 + A_5$.

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107. If n arithemetic means are inserted between $20 and 80$ such tht the ratio of first mean to the last mean is $1:3,$ then find the value of n.

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108. If $\frac{x^p + y^p}{x^{p-1} + y^{p-1}}$ be the A.M. between x and y then find the value of p.

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109. if the A.M. between pth and qth terms of an A.P. be equal to the A.M. between rth and sth terms of the A.P., then show that $p + q = r + s$

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110. Show that in an A.P. the sum of the terms equidistant from the beginning and end is always same and equal to the sum of first and last terms.

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