



MATHS

BOOKS - RS AGGARWAL MATHS (HINGLISH)

ARITHMETIC PROGRESSION

Example

1. Write first terms for the sequence given by the rule $a_n = (2n + 1)$ and obtain the corresponding series.

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2. Write first four terms of the sequence given by $a_n = \frac{1}{6}(2n - 3)$ and obtain the corresponding series.

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3. The fibonacct sequence is defined by

$$1 = a_1 = a_2 \text{ and } a_n = a_{n-1} + a_{n-2}, n > 2$$

Find $\frac{a_{n+1}}{a_n}$ for $n = 1, 2, 3, 4, 5,$

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4. Show that the sequence defined by $T_n = 3n + 5$ is an AP. Find the common difference .

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5. 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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6. Show that the the sequence defined by $T_n = 3n^2 + 2$ is not an AP.

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7. Find the sum of 23 terms of the AP 5,9,13,17,.....

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

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10. solve: $1 + 6 + 11 + 16 + \dots + x = 148$

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11. Find the sum of all odd integers from 1 to 1001.

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

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

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

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15. 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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16. In an AP, the first is 2 and the sum of first five terms is one - fourth of the sum of next five terms. show that its 20th term is -112 and the sum of its frist 20 terms is -1100.

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17. The difference between any two consecutive interior angles of a polygon is 50° . If the smallest angle is 120° , find the number of the sides of the polygon.

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18. The income of a man is ₹40000 in the first year and he receives an increase of ₹ 1000 to his income per year for 19 years. Find the total amount he received in 20 years.

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19. A man saved ₹6, 60, 000 in 20 years. In each succeeding year after the first year he saves ₹2, 000 more than he saved in the previous year. How much did he save in the first year?

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20. In a potato race 20 potatoes are placed in a line at intervals of 4 meters with first potato 24 metres from the starting point. A constant is required to bring the potatoes back to the starting place one at a time. How far would he run in bringing back all the potatoes?

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21. In a cricket tournament 16 school teams participated. A sum of ₹ 1600 is to be awarded among themselves as prize money. If the team in the last place is awarded ₹ 500 in prize money and the award increases by the same amount for successive finishing places, how much amount will the team in the first place receive ?

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22. The first term of an A.P. is a and the sum of first p terms is zero, show tht the sum of its next q terms is $\frac{a(p+q)q}{p-1}$.

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23. If the m th term of an AP is a and its n th term is b , show that the sum of its

$$(m+n) \text{ term is } \frac{(m+n)}{2} \cdot \left\{ a + b + \frac{(a-b)}{(m-n)} \right\}$$

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24. The ratio of the sum of m and n terms of an A.P. is $m^2 : n^2$. Show that the ratio of the m^{th} and n^{th} terms is $(2m-1) : (2n-1)$.

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25. Find the arithmetic mean between

(i) 14 and -6, (ii) (a-b) and (a+b)



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26. If $\frac{a^n + b^n}{a^{n-1} + b^{n-1}}$ is the GM between a and b, then the value of n is



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27. Insert six A.M.s between 15 and -13.



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28. Between 1 and 31 are inserted m arithmetic mean so that the ratio of the 7th and $(m - 1)th$ means is 5:9. Find the value of m .

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29. 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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30. If the A.M. between p th and q th terms of an A.P. be equal to the A.M. between r th and s th terms of the A.P., then show that

$$p + q = r + s$$

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

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32. If n A.Ms are inserted between two numbers, prove that the sum of the means equidistant from the beginning and the end is constant.

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

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34. If a, b, c are in AP, show that

(i) $(b+c)$, $(c+a)$ and $(a+b)$ are in AP.

(ii) $a^2(b+c)$, $b^2(c+a)$ and $c^2(a+b)$ are in AP.

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35. If a, b, c are in AP, show that

$$\frac{1}{(\sqrt{b} + \sqrt{c})}, \frac{1}{(\sqrt{c} + \sqrt{a})}, \frac{1}{(\sqrt{a} + \sqrt{b})} \text{ are in AP.}$$

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36. if a, b, c are in AP, show that

$$\left[(b + c)^2 - a^2 \right], \left[(c + a)^2 - b^2 \right], \left[(a + b)^2 - c^2 \right] \text{ are in AP.}$$

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37. If a, b, c are in AP show that (i) $\frac{1}{bc}, \frac{1}{ca}, \frac{1}{ab}$ are in AP.

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38. If a^2, b^2, c^2 are in AP then prove that $\frac{1}{a+b}, \frac{1}{c+b}, \frac{1}{a+c}$ are also in AP.

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39. If a^2, b^2, c^2 are in AP then prove that $\frac{1}{a+b}, \frac{1}{c+b}, \frac{1}{a+c}$ are also in AP.

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40. Show that $(a^2 + ab + b^2), (c^2 + ac + a^2)$ and $(b^2 + bc + c^2)$ are in AP, if a, b, c are in AP.

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41. if $(b - c)^2$, $(c - a)^2$, $(a - b)^2$ are in AP, prove that

$\frac{1}{(b - c)}$, $\frac{1}{(c - a)}$, $\frac{1}{(a - b)}$ are in AP.

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42. if $(a^2 + 2bc)$, $(b^2 + 2ac)$, $(c^2 + 2ab)$ are in AP, show that

$\frac{1}{(b-c)}$, $\frac{1}{(c-a)}$, $\frac{1}{(a-b)}$ are in AP.

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43. if $\frac{(b + c - a)}{a}$, $\frac{(c + a - b)}{b}$, $\frac{(a + b - c)}{c}$ are in AP, prove that

$\frac{1}{a}$, $\frac{1}{b}$, $\frac{1}{c}$ are in AP.

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44. If $a^2(b + c)$, $b^2(c + a)$, $c^2(a + b)$, are in A.P. show that either a, b, c are in A.P., or $ab + bc + ca = 0$.

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45. if a, b, c are in AP, prove that $(a - c)^2 = 4(b^2 - ac)$

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46. If a, b, c , are in AP, prove that $a^3 + 4b^3 + c^3 = 3b(a^2 + c^2)$

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Solved Examples

1. Show that the progression $7, 12, 17, 22, 27, \dots$, is an AP. Find its general term and the 14^{th} term.



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2. Show that the progression $\log a, \log(ab), \log(ab^2), \log(ab^3), \dots$ is an AP. Find its general term and the 10th term.



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3. Show that the progression $21, 16, 11, 6, 1, \dots$, is an AP. Write its first term and the common difference. Which term of this AP is -54 ?



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4. Show that the progression $-11, -7, -3, 1, 5, \dots$, 161 is an AP. How many terms does it have ?

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5. Is 319 a term of the AP $11, 17, 23, 29, 35, \dots$?

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6. Which term of the AP $30, 29\frac{1}{4}, 28\frac{1}{2}, 27\frac{3}{4}, \dots$, is the first negative term ?

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7. Find the 10^{th} common term between the arithmetic series $3 + 7 + 11 + 15 + \dots$ and $1 + 6 + 11 + 16 + \dots$.

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8. If $a_1, a_2, a_3, \dots, a_n$ are in A.P. with common difference d (where $d \neq 0$), then the sum of series $\sin d \cos a_1 \cos a_2 + \sin d \cos a_2 \cos a_3 + \dots + \sin d \cos a_{n-1} \cos a_n$ is equal to $\cot a_1 - \cot a_n$.

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9. If $a_1, a_2, a_3, \dots, a_n$ are in A.P., where $a_i > 0$ for all i , show that
$$\frac{1}{\sqrt{a_1} + \sqrt{a_2}} + \frac{1}{\sqrt{a_1} + \sqrt{a_3}} + \dots + \frac{1}{\sqrt{a_{n-1}} + \sqrt{a_n}} = \frac{n-1}{\sqrt{a_1} + \sqrt{a_n}}.$$

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10. If $a_1, a_2, a_3, \dots, a_n$ are an A.P. of non-zero terms, prove that
$$\frac{1}{a_1 + a_2} + \frac{1}{a_1 + a_3} + \dots + \frac{1}{a_{n-1} + a_n} = \frac{n-1}{a_1 + a_n}.$$



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11. In an AP, the p th term is q and $(p + q)$ term is 0. Then, prove that its q th term is p .



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12. Find the 17th from the end of the AP-36,-31,-26,-21,...., 79



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13. If the sum of three numbers in A.P., is 24 and their product is 440, find the numbers.



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14. The product of three numbers in A.P. is 224, and the largest number is 7 times the smallest. Find the numbers.

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15. Find the four numbers in A.P. whose sum is 20 and the sum of whose squares is 120.

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16. Divide 32 into four parts which are in A.P. such that the product of extremes is to the product of means is 7: 15.

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1. Write first 4 terms in each of the sequences :

(i) $a_n = (5n + 2)$ (ii) $a_n = \frac{(2n - 3)}{4}$ (iii) $a_n = (-1)^{n-1} \times 2^{n+1}$

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2. Find first five terms of the sequence, defined by

$$a_1 = 1, a_n = a_{n-1} + 3 \text{ for } n \geq 2$$

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3. find first 5 terms of the sequences, defined by

$$a_1 = -1, a_n = \frac{a_{n-1}}{n} \text{ for } n \geq 2$$

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4. Find the 23rd term of the A.P. 7,5,3,1,...

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5. Find the 20th term of the AP $\sqrt{2}, 3\sqrt{2}, 5\sqrt{2}, 7\sqrt{2}, \dots$,

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6. find the nth term of the AP 8,3,-2,-7,-12,.....,

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7. Find the nth term of the AP $1, \frac{5}{6}, \frac{3}{2}, \frac{1}{2}, \dots$,

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8. Which term of the AP 9,14,19,24,29,....., is 379 ?

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9. Which term of the AP 64, 60, 56, 48,, is 0 ?

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10. How many terms are there in the AP 11, 18, 25, 32, 39,, 207?

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11. How many terms are there in the AP $1\frac{5}{6}, 1\frac{1}{6}, \frac{1}{2}, \frac{-1}{6}, \frac{-5}{6}, \dots, -16\frac{1}{6}$?

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12. is -47 a term of the AP 5, 2, -1, -4, -7...?

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13. The 2nd, 31st and the last terms of an AP are 5 and -3 respectively.

Find the AP and its 30th term.



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14. The 2nd, 31st and last terms of an A.P. are $7\frac{3}{4}$, $\frac{1}{2}$ and $-6\frac{1}{2}$ respectively. find the first term and the number of terms



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15. If the 9th term of an AP is zero, then prove that its 29th term is twice its 19th term.



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16. The 4th term of an A.P. is three times the first and the 7th term exceeds twice the third term by 1. Find the first term and the common difference.



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17. If 7 times the 7th term of an AP is equal to 11 times its 11th term, then its 18th term will be



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18. Find the 28th term from the end of the AP 6,9,12,15,18,.....,102



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19. find the 16th term form the end of the AP 7,2,-3,-8,-13,....., -113

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20. How many three digit numbers are divisible by 7?

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21. How many numbers of two digit are divisible by 3?

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22. If $\theta_1, \theta_2, \theta_3, \dots, \theta_n$ are in AP, whose common difference is d , show that

$$\sec \theta_1 \sec \theta_2 + \sec \theta_2 \sec \theta_3 + \dots + \sec \theta_{n-1} \sec \theta_n = \frac{\tan \theta_n - \tan \theta_1}{\sin d}$$

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23. In an AP, it is being given that $\frac{T_4}{T_7} = \frac{2}{3}$. Find $\frac{T_7}{T_{10}}$

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24. Three numbers are in AP. If their sum is 27 and their product is 648, find the numbers/

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25. The sum of three consecutive terms of an AP is 21 and the sum of the squares of these terms is 165. find these terms.

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26. the angles of quadrilateral are in AP whose common difference is 10° then find the angles.

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27. The digits of a 3-digit number are in AP and their sum is 15. The number obtained by reversing the digits is 594 less than the original number. Find the number.

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28. Find the number of terms common to the two arithmetic progression 5,9,13,17,...,216 and 3,9,15,21,...,321

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29. We know that the sum of the interior angles of a triangle is 180° . Show that the sums of the interior angles of polygons with

3, 4, 5, 6, sides for an arithmetic progression. Find the sum of the interior angles of or a 21 sided polygon.

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30. A side of an equilateral triangle is 24 cm long. A second equilateral triangle is inscribed in it by joining the midpoints of the sides of the triangle. The process is continued. Find the perimeter of the sixth inscribed equilateral triangle.

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31. A man starts repaying a loan as the first instalment of ₹10000. If he increases the instalments by ₹ 500 every month, what amount will he pay in 30th instalment?

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Exercise 11 B

1. Find the sum of 23 terms of the AP 17,12,7,2,-3,....

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2. Find the sum of 16 terms of the AP , 6, $5\frac{1}{3}$, $4\frac{2}{3}$, 4,.....

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3. Find the sum of 25 terms of the AP $\sqrt{2}$, $2\sqrt{2}$, $3\sqrt{2}$, $4\sqrt{2}$,....,

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4. Find the sum of 100 terms of the AP 0.6,0.61,0.62,0.63 ,.....,

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5. Find the sum of 20 terms of the AP $(x+y)$, $(x-y)$, $(x-3y)$,.....,

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6. Find the sum of the following arithmetic progression:

$$\frac{x-y}{x+y}, \frac{3x-2y}{x+y}, \frac{5x-3y}{x+y}, \dots \rightarrow n \text{ terms.}$$

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7. Find the sum of the series $2+5+8+11+\dots+191$.

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8. Find the sum of the series $101+99+97+95+\dots+43$

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9. find the value of x such that $1+4+7+10+\dots+x = 715$

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10. Find the value of x such that $25+22+19+16 +\dots+ x=112$

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11. Find the rth term of an AP, the sum of whose first n terms is $(3n^2 + 2n)$

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12. find the sum of n terms of an AP whose rth term is $(5r+1)$

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13. if the sum of certain number of terms of the AP 27,24,21,18,....., is -30 . Find the last term.

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14. How many terms of the AP 26,21,16,11,.... Ar needed to give the sum the sum 11 ?

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15. How many terms of the AP 18,16,14,12 ,..... Are needed to given the sum 78 ?

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16. How many terms of the AP $20, 19\frac{1}{3}, 18\frac{2}{3}, \dots$, must be taken to make the sum 300 ? Explain the double answer.

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17. The sums of n terms of two arithmetic progressions are in the ratio $(7n-5) : (5n+17)$. Show that their 6th terms are equal.

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18. IF the ratio between the sums of n terms of two arithmetic progressions is $(7n+1) : (4n+27)$, find the ratio of their 11th terms.

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19. Find the sum of all odd integers from 1 to 201.

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20. Find the sum of all even integers between 101 and 199.

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21. Find the sum of all integers between 101 and 500, which are divisible by 9.

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22. Find the sum of all integers between 100 and 600, each of which when divided by 5 leaves 2 as remainder.

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

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25. Find the sum of all natural numbers from 1 and 100 which are divisible by 4 or 5.

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

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27. If $S_m = m^2p$ and $S_n = n^2p$, where $m \neq n$ in an AP then prove that $S_p = P^3$

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28. A carpenter was hired to build 192 window frames. The first day he made five frames and each day thereafter he made two more frames than he made the day before. How many days did it take him to finish the job?

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Exercise 11 C

1. The interior angles of a polygon are in AP. The smallest angle is 52° and the common difference is 8° . Find the number of sides of the polygon.

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2. A circle is completely divided into n sectors in such a way that the angles of the sectors are in AP. If the smallest of these angles is 8° and the largest is 72° , calculate n and the angle in the fifth sector.

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3. There are 30 trees at equal distances of 5 meters in a line with a well, the distance of the well from the nearest tree being 10 meters.

A gardener waters all the trees separately starting from the well and he returns to the well after watering each tree to get water for the next. find the total distance the garden will cover in order to water all the trees.

- A. 4799 m
- B. 4695 m
- C. 4790 m
- D. 4795 m

Answer: D

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4. Two cars start together from the same place in same direction. The first goes with uniform speed of 60 km/hr. The second goes at a speed of 48km/hr in the first hour and increases the speed by 1km

each succeeding hour. After hour and many hours will the second car overtake the first car if both cars go non-stop?

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5. Arun buys a scooter for ₹44000. He pays ₹ 8000 in cash and agrees to pay the balance in annual instalments of ₹ 4000 each plus 10% interest on the unpaid amount. How much did he pay for it ?

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6. A man accepts a position with an initial salary of ₹ 26000 per month. It is understood that he will receive an automatic increase of ₹ 250 in the very next month and each month thereafter.

find[his (i) salary for the 10th month ,(ii) total earnings during the first year.

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7. A man saved ₹660000 in 20 years. In each succeeding year after the first year he saves ₹ 2000 more than he saved in the previous year. How much did he save in the first year?

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8. 150 workers were engaged to finish a piece of work in a certain number of days. Four workers dropped the second day, four more workers dropped the third day and so on. It takes 8 more days to finish the work now. Find the number of days in which the work was completed.

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9. A man saves ₹ 4000 during first, year, ₹ 5000 during second year and in this way he increases his savings by ₹ 1000 every year. Find in

what time his savings will be ₹ 85000.

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10. A man arranges to pay off a debt of ₹ 36000 by, 40 annual instalments which form an AP. When 30 of the instalments are paid, he dies, leaving one-third of the debt unpaid. Find the value of first instalment.

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11. A manufacturer of TV sets produced 6000 units in the third year and 7000 units in the seventh year. Assuming that the production increases uniformly by fixed number every year, find the production increases uniformly, by a fixed number every year, find the production (i) in the first year, (ii) in the 10th year, (iii) in 7 years.

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12. A farmer buys a used tractor for ₹ 180000. He pays ₹ 90000 in cash and agrees to pay the balance in annual instalments of ₹ 9000 plus 12% interest on the unpaid amount. How much did the tractor cost him ?

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Exercise 11 D

1. Find the arithmetic mean between

(i) 9 and 19 (ii) 15 and -17 (iii) -16 and -8.

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2. Insert four arithmetic means between 4 and 29



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3. Insert three arithmetic means between 23 and 7.

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4. Insert six arithmetic means between 11 and -10.

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5. There are n arithmetic means between 9 and 27 . If the ratio of the last mean to the first mean is 2:1, find the value of n .

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6. Insert arithmetic means between 16 and 65 such that the 5th AM is 51. find the number of arithmetic means.

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7. Insert five numbers between 11 and 29 such that the resulting sequence is an AP.

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8. Prove that the sum of m arithmetic means between the two numbers is to the sum of n arithmetic means between them as $m:n$.

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1. If a, b, c are in A.P., prove that: $(a - c)^2 = 4(a - b)(b - c)$

$$a^2 + c^2 + 4ac = 2(ab + bc + ca) \quad a^3 + c^3 + 6abc = 8b^3$$



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2. If a, b, c are in AP, show that

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



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3. If a, b, c are in Ap, show that

(i) $(b + c - a), (c + a - b), (a + b - c)$ are $\in AP$. $(bc - a^2), (ca - b^2), (ab - c^2)$ are in AP.



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4. If $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in AP, prove that

(i) $\frac{(b+c)}{a}, \frac{(c+a)}{b}, \frac{(a+b)}{c}$ are in AP. (ii) $\frac{(b+c-a)}{a}, \frac{(c+a-b)}{b}, \frac{(a+b-c)}{c}$ are in AP.

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5. If $a\left(\frac{1}{b} + \frac{1}{c}\right), b\left(\frac{1}{c} + \frac{1}{a}\right), c\left(\frac{1}{a} + \frac{1}{b}\right)$ are in AP, prove that $a^2(b+c), b^2(c+a), c^2(a+b)$ are in AP.

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6. If a, b, c are in AP, show that $\frac{a(b+c)}{bc}, \frac{b(c+a)}{ca}, \frac{c(a+b)}{ab}$ are also in AP.

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Exercise 11 F Very Short Answer Type Questions

1. If the sum of n terms of an AP is given by $S_n = (2n^2 + 3n)$ then find its common difference.

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2. If 9 times the 9th term of an AP is equal to 13 times the 13th term, show that its 22nd term is 0.

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3. In an AP it is given that $S_n = qn^2$ and $S_m = qm^2$. prove that $s_q = q^3$

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4. Find three arithmetic means between 6 and -6

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5. If 9^{th} term of an A.P. is zero, prove that its 29^{th} term is double the 19^{th} term.

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6. How many terms are there in the AP 13,16,19,...., 43?

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7. Find the 8th term from the end of the AP 7,9,11,...., 201

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8. How many numbers of two digits are divisible by 7?



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9. If 7th and 13th terms of an A.P. be 34 and 64 respectively, then its 18th term is (a) 87 (b) 88 (c) 89 (d) 90



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10. The 10th common term between the A.P.s 3,7,11,15, and 1,6,11,16,.. is 191 b. 193 c. 211 d. none of these



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11. The first and last terms of an A.P. are 1 and 11. If the sum of its terms is 36, then the number of terms will be (a) 5 (b) 6 (c) 7 (d) 8



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12. In an AP, the p th term is q and $(p + q)$ term is 0. Then, prove that its q th term is p .

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13. if $\frac{3 + 5 + 7 + 9 + \dots \text{ up to } 35 \text{ terms}}{5 + 8 + 11 + \dots \text{ up to } n \text{ terms}} = 7$, find the value of n .

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14. Write the sum of first n even natural numbers.

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15. Write the sum of first n odd natural numbers.



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16. The sum of n terms of an AP is $\frac{1}{2}an^2 + bn$. Find the common difference.



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17. If the sums of n terms of two APs are in the ratio $(2n+3):(3n+2)$, find the ratio of their 10th terms.



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