UDAAN

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Arithmetic Progression

Mathematics | Lecture - 06

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Topics

to be covered

1. Application Based Questions
2. Case Study Based Question
3. NCERT Miscellaneous Exercise Question


WORK HARD
DREAM BIG
NEVER GIVE UP !!

Topic : Sum of n terms of an AP

#Q. An A.P. Consists of 37 terms. The sum of the three middle most terms is 225 and the sum of the last three terms is 429. Find the A.P.

$a_{37} + a_{36} + a_{35} = 429.$

$a+36d + a+35d + a+34d = 429$

$3a + 105d = 429$

$3(a + 35d) = 429$

$a + 35d = 143$ — (1)

Middle most term $= \left(\frac{n+1}{2}\right)^{th}$

$= \left(\frac{37+1}{2}\right)^{th}$

$= 19^{th}$

$a_{18} + a_{19} + a_{20} = 225$

$a+17d + a+18d + a+19d = 225$

$3a + 54d = 225$

$a + 18d = 75$ — (2)

Odd no. of terms

$$M.T = \left(\frac{n+1}{2}\right)^{th}$$

Even no of terms

$$\left(\frac{n}{2}\right)^{th}, \left(\frac{n}{2}+1\right)^{th}$$

Topic : Sum of n terms of an AP

#Q. If the ratio of the sum of the first n terms of A.P.s is (7n + 1) : (4n + 27), then find the ratio of their 9th term.

(I)	(II)
a	a'
d	d'
S_n	S_n'
n	n

$$S_n = \frac{n}{2}[2a+(n-1)d]$$

$$S_n' = \frac{n}{2}[2a'+(n-1)d']$$

$$\frac{\frac{n}{2}[2a+(n-1)d]}{\frac{n}{2}[2a'+(n-1)d']} = \frac{7n+1}{4n+27}$$

$$\frac{2a+(n-1)d}{2a'+(n-1)d'} = \frac{7n+1}{4n+27}$$

Put $n = 17$

$$\frac{2a+16d}{2a'+16d'} = \frac{7(17)+1}{4(17)+27}$$

$$\frac{a+8d}{a'+8d'} = \frac{120}{95} = \frac{24}{19}$$

To Find: $\frac{a_9}{a_9'} = \frac{a+8d}{a'+8d'}$

$$\frac{a_9}{a_9'} = \frac{24}{19}$$

$n = 9$

A) 207

B) 205

C) 206

D) NOTA

$$\frac{a_{103}}{a_{103}'} = \frac{a+102d}{a+102d'}$$

Topic : Sum of n terms of an AP

#Q. If the ratio of sum of first n terms of two A.P.s is (7n + 1) : (4n : 27), find the ratio of their m^{th} terms.

$$\frac{2a+(n-1)d}{2a'+(n-1)d'} = \frac{7n+1}{4n+27}$$

To Find:

$$\frac{a_m}{a_{m'}} = \frac{a+(m-1)d}{a'+(m-1)d'}$$

$n = 2m-1$

$$\frac{2a+(2m-1-1)d}{2a'+(2m-1-1)d'} = \frac{7(2m-1)+1}{4(2m-1)+27}$$

$2(m-1)$

$2m-2+1$

$2m-1$

$$\frac{a+(m-1)d}{a'+(m-1)d'} = \frac{14m-6}{8m+23}$$

CASE BASED - I

There are total 810 apples which are arranged in such a way that 5 apples are in the first basket, 12 in the second basket, 19 in the third basket and so on.

a_1 a_2 a_3

5, 12, 19, 26, - - - - - - - - -

$a = 5, d = 7$

Topic : Application Based

#Q. Based on the above information, answer the following questions:

1. Find the number of apples in the 9th basket

$a_9 = a + 8d$

$= 5 + 8(7)$

$a_9 = 61$

Topic : Application Based

#Q. Based on the above information, answer the following questions:

2. Find the sum of apples in the first 13 baskets.

$S_{13} = \frac{1}{6}$

CASE BASED - II

Your father wants to buy a flat and plans to take loan from a bank for that. He repays his total loan of Rs. 15, 34,000 by paying every month starting with the first installment of Rs. 13000. Also he increases the installment by Rs. 1300 every month,

13000, 14300, 15600, 16900 - - - - - - - - - -

$a = 13000$

$d = 1300$

Topic : Application Based

#Q. Find the amount paid by him in 20^{th} installment.

(A) Rs. 38, 700

(B) Rs. 37, 700

(C) Rs. 36, 000

(D) Rs. 39, 900

Topic : Application Based

#Q. Find the amount paid by him upto 30 installments

(A) Rs. 5, 20, 000

(B) Rs. 95, 000

(C) Rs. 9, 55, 500

(D) Rs. 8, 55, 000

$S_{30} = ?$

Topic : Application Based

#Q. Find the total number of installments he has to pay.

A. 40

B. 59

C. 39

D. 45

let, n = no. of installments.

$S_n = 15,34,000$

$15,34,000 = \frac{n}{2}[2a + (n-1)d]$

$30,68,000 = n[26000 + (n-1)1300]$

$30,68,000 = n[26000 + 1300n - 1300]$

$30,68,000 = n[24700 + 1300n]$

$30,68,000 = 24700n + 1300n^2$

$30,68,000 = 1300[19n + n^2]$

$2360 = 19n + n^2$

Topic : Application Based

#Q. Find the ratio of the 1st installment to the 20th installment.

A 10 : 39

B 10 : 29

C 1 : 49

D 39 : 53

Topic : Application Based ★★★★

a_4 = 4th row - no. of logs

#Q. 200 logs are stacked in the following manner: 20 logs in the bottom row, 19 in the next row, 18 in the row next to it and so on. In how many rows are the 200 logs placed and how many logs are in the top row?

[NCERT Intext]

$20, 19, 18, 17 \ldots\ldots\ldots$

$a = 20, d = -1$

Let total no. of rows $= n$.

$S_n = 200$.

$\frac{n}{2}[2a + (n-1)d] = 200$

$n[40 - n + 1] = 400$

$n[41 - n] = 400$

$41n - n^2 = 400$

$-n^2 + 41n - 400 = 0$

$\boxed{n^2 - 41n + 400 = 0}$

$n^2 - 41n + 400 = 0$

$S = -41, \quad P = 400$

$-25, -16$

$n^2 - 25n - 16n + 400 = 0$

$n(n-25) - 16(n-25) = 0$

$(n-25)(n-16) = 0$

$n = 25$

$n = 16$

$a_{25} = a + 24d$

$= 20 + 24(-1)$

$a_{25} = -4$

no. of logs can't be -ve.

$\therefore$ 25 is not possible.

Ans $n = 16$

no. of logs in the top row $= a_{16}$.

$= a + 15d$

$= 20 + 15(-1) = 5$ logs

CASE BASED - III

Manpreet Kaur is the national record holder for women in the shot-put discipline. Her throw of 18.86m at the Asian Grand Prix in 2017 is the maximum distance for an Indian female athlete. Keeping her as a role model, Sanjitha is determined to earn gold in Olympics one day. Initially her throw reached 7.56 m only. Being an athlete in school, she regularly practiced both in the mornings and in the evenings and was able to improve the distance by 9 cm every week. → 0.09m

During the special camp for 15 days, she started with 40 throws and every day kept increasing the number of throws by 12 to achieve this remarkable progress.

distance of throw - - -

7.56

7.65, 7.74, - - - - - - - - - -

initial throw.

no. of throws -

40, 52, 64 - - - - - - - - - -

Topic : Case Based

#Q. (i) How many throws Sanjitha practiced on 11^{th} day of the camp?

$$a_{11} = a + 10d$$

$$= 40 + 10(12)$$

$$a_{11} = 160$$

total throws $= 160$

Topic : Case Based

#Q. (ii) What would be Sanjitha's throw distance at the end of 6 weeks?

(or)

When will she be able to achieve a throw of 11.16 m?

7.56 initial throw.

7.65, 7.74 - - - - - - - - -

$a = 7.65$

$d = 0.09$

$a_6 = a + 5d$

$= 7.65 + 5(0.09)$

$= 7.65 + 0.45$

$\boxed{a_6 = 8.1\text{m}}$

Let $a_n = 11.16$

$a + (n-1)d = 11.16$

$7.65 + (n-1)0.09 = 11.16$

$(n-1)0.09 = 11.16 - 7.65$

Topic : Case Based

#Q. (iii) How many throws did she do during the entire camp of 15 days?

$S_{15} = ?$

CASE BASED - IV

The school auditorium was to be constructed to accommodate at least 1500 people. The chairs are to be placed in concentric circular arrangement in such a way that each succeeding circular row has 10 seats more than the previous one.

Topic : Case Based

#Q. (i) If the first circular row has 30 seats. How many sets will be there in the 10th row?

30, 40, 50, 60, 70 - - - - - - - -

$a = 30$

$d = 10$

$a_{10} = a + 9d$

$= 30 + 9(10)$

$a_{10} = 120$

10th row = 120 seats

Topic : Case Based

#Q. (ii) For 1500 seats in the auditorium, how many rows need to be there?

OR

If 1500 seats are to be arrange in the auditorium, how many seats are still left to be put after 10th row?

(i) let $S_n = 1500$

$\frac{n}{2}[2a+(n-1)d] = 1500$

$n[60+10n-10] = 3000$

$50n+10n^2 = 3000$

$n^2+5n-300 = 0$

$n = 15$

Total no. of rows = 15.

(ii) $S_{10} = \frac{10}{2}[2(30)+(10-1)10]$

$= 5[60+90]$

$S_{10} = 750$

Remaining seats = $1500-750 = 750$

Topic : Case Based

#Q. (iii) If there were 17 rows in the auditorium, how many seats will be there in the middle row?

$$\text{Middle Row} = \left(\frac{17+1}{2}\right)^{th}$$

$$= \boxed{9^{th}}$$

$$a_9 = a + 8d$$

$$= 30 + 8(10)$$

$$\boxed{a_9 = 110}$$

CASE BASED - V

Answer the questions based on the given information.

An interior designer, Sana, hired two painters, Manan and Bhima to make paintings for her buildings. Both painters were asked to make 50 different paintings each.

The prices quoted by both the painters are given below:

- Manan asked for ₹6000 for the first painting, and an increment of ₹200 for each following painting. 6000, 6200, 6400, -
- Bhima asked for ₹4000 for the first painting, and an increment of ₹400 for each following painting. 4000, 4400, 4800,

Topic : Case Based

#Q. (i) How much money did Manan get for his 25th painting? Show your work.

$a_{25} = a + 24d$

$= 6000 + 24(200)$

$= 6000 + 4800$

$\boxed{a_{25} = 10800}$

Money For 25th painting = 10800 Rs

Topic : Case Based

#Q. (ii) How much money did Bhima get in all? Show your work.

Topic : Case Based

Ans (12th painting)

#Q. (iii) If both Manan and Bhima make paintings at the same pace, find the first painting for which Bhima will get more money than Manan. Show your steps.

Let For n^{th} painting, they both get equal amounts.

$a_n = a_n'$

$a+(n-1)d = a'+(n-1)d'$

$6000+(n-1)200 = 4000+(n-1)400$

$6000 + 200n - 200 = 4000 + 400n - 400$

$2000 - 200n + 200 = 0$

$2200 - 200n = 0$

$2200 = 200n$

$\frac{2200}{200} = n$

$11 = n$

CASE BASED - VI

Sehaj Batra gets pocket money from his father every day. Out of pocket money, he save money for poor people in his locality. On 1st day he saves Rs. 27.5 On each succeeding day he increase his saving by Rs. 2.5.

Topic : Case Based

#Q. Find the amount saved by Sehaj on 10^{th} day.

Topic : Case Based

#Q. Find the amount saved by Sehaj on 25^{th} day.

OR

Find in how many days Sehaj saves Rs. 1400.

Topic : Case Based

#Q. Find the total amount saved by Sehaj in 30 days.

When you try to cover whole syllabus in one night before exam.

CASE BASED - VII

H.W

Bacteria are one-celled organisms. There are many different kinds of bacteria. They live just about everywhere in your body and on your skin. Some types of bacteria are harmless or even helpful. Others can cause infections and disease. A bacteria culture test can help your doctor to find out harmful bacteria in your body that may be making you sick. The test checks a sample of your blood for bacteria or yeast that might be causing the infection. To do the test, you will need to give a sample of your blood, urine, skin, or other tissue. The type of sample depends on where the infection seems to be located.

In the test, it is found out that the number of bacteria at the start is 10, 000 and they are increasing by 2000 after every 2 hours.

Topic : Case Based

#Q. Find out the number of bacteria present in the sample after 8 hours?

Topic : Case Based

#Q. Find the difference in number of bacteria present after 4 hours & 10 hours?

OR

Find the difference in number of bacteria present after 6 hours & 10 hours?

Topic : Case Based

#Q. After how many hours the number of bacteria present in the sample is 28000?

THANK YOU