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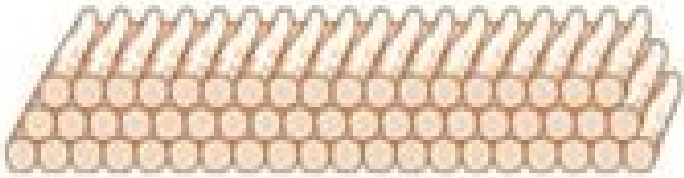
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Mathematics

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(Chapter - 5) (Arithmetic Progressions)
(Class 10)

Question 19:

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 (see Figure). In how many rows are the 200 logs placed and how many logs are in the top row?



Answer 19:

Number of logs in bottom row = 20, logs in next row = 19, logs in next row = 18
Similarly, the series of number of logs is 20, 19, 18, 17, ...

Here, $a = 20, d = 19 - 20 = -1$ and $S_n = 200$.

The sum of n terms of an AP is given by $S_n = \frac{n}{2} [2a + (n - 1)d]$

$\Rightarrow 200 = \frac{n}{2} [2(20) + (n - 1)(-1)]$

$\Rightarrow 400 = n[40 - n + 1] \Rightarrow 400 = 41n - n^2$

$\Rightarrow n^2 - 41n + 400 = 0 \Rightarrow n^2 - 16n - 25n + 400 = 0$

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

$\Rightarrow n - 16 = 0 \quad \text{or} \quad n - 25 = 0$

$\Rightarrow n = 16 \quad \text{or} \quad n = 25$

If, $n = 16, a_{16} = a + 15d = 20 + 15(-1) = 5$

If, $n = 25, a_{25} = a + 24d = 20 + 24(-1) = -4$, which is not possible.

Hence, the 200 logs are placed in 16 rows and 5 logs are in the top row.

Question 20:

In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato, and the other potatoes are placed 3 m apart in a straight line. There are ten potatoes in the line (see Figure).



A competitor starts from the bucket, picks up the nearest potato, runs back with it, drops it in the bucket, runs back to pick up the next potato, runs to the bucket to drop it in, and she continues in the same way until all the potatoes are in the bucket. What is the total distance the competitor has to run?

[Hint: To pick up the first potato and the second potato, the total distance (in metres) run by a competitor is $2 \times 5 + 2 \times (5 + 3)$]

Answer 20:

Total distance travel to pick the first potato = $2 \times 5 = 10$

Total distance travel to pick the second potato = $2 \times (5 + 3) = 16$

Similarly, the series of distances travelled to pick the potatoes are 10, 16, 22, 28, ...

Here, $a = 10, d = 16 - 10 = 6$ and $n = 10$.

The sum of n terms of an AP is given by $S_n = \frac{n}{2} [2a + (n - 1)d]$

$\Rightarrow S_{10} = \frac{10}{2} [2(10) + (10 - 1)(6)] = 5[20 + 54] = 5(74) = 370 \text{ m}$

Hence, total distance travelled by the competitor is 370 m.

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	a	d	n	a_n
(i)	7	3	8	
(ii)	- 18		10	0
(iii)		- 3	18	- 5
(iv)	- 18.9	2.5		3.6
(v)	3.5	0	105	



NCERT Solutions Class 10 Maths Chapter 5 Arithmetic Progressions

$a + 4d = 3$
or
 $a = 3 - 4d$ (v)

Again putting the eq (iii) and (v), in eq. (ii), we get,

$(a + 2d)(a + 6d) = 8$

Putting the value of a from equation (v), we get,

$(3 - 4d + 2d)(3 - 4d + 6d) = 8$

$(3 - 2d)(3 + 2d) = 8$

$9 - 2d^2 = 8$

$9 - 4d^2 = 8$

$4d^2 = 1$

$d = 1/2 \text{ or } -1/2$

Now, by putting both the values of d, we get,

$a = 3 - 4d = 3 - 4(1/2) = 3 - 2 = 1$, when $d = 1/2$

$a = 3 - 4d = 3 - 4(-1/2) = 3 + 2 = 5$, when $d = -1/2$

We know, the sum of nth term of AP is;

$S_n = n/2 [2a + (n - 1)d]$

So, when $a = 1$ and $d = 1/2$

Then, the sum of first 16 terms are;

$S_{16} = 16/2 [2 \times 1 + (16 - 1)(1/2)] = 8(2 + 15/2) = 76$

And when $a = 5$ and $d = -1/2$

Then, the sum of first 16 terms are;

$S_{16} = 16/2 [2 \times 5 + (16 - 1)(-1/2)] = 8(5/2) = 20$

3. A ladder has rungs 25 cm apart. (see Fig. 5.7). The rungs decrease uniformly in length from 45 cm at the bottom to 25 cm at the top. If the top and the bottom rungs are $2\frac{1}{2}$ m apart, what is the length of the wood required for the rungs? [Hint: Number of rungs = $\frac{250}{25}$].

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