# UDAAN

2026

# Arithmetic Progression

MATHS LECTURE-6

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# Topics *to be covered*

A Remaining Questions

B CBSE 2025 Case-based Questions

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

$$S_q = \frac{q}{2}\left[2a + (q-1)d\right]$$

$$S_m = \frac{m}{2}\left[2a + (m-1)d\right]$$

$$S_p = \frac{p}{2}\left[2a + (p-1)d\right]$$

$$S_{m+n} = \frac{m+n}{2}\left[2a + (m+n-1)d\right]$$

$$S_{mn} = \frac{mn}{2}\left[2a + (mn-1)d\right]$$

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

CBSE 2015, 17

Tob: $S_{mn} = \frac{1}{2}(mn+1)$

$a_m = \frac{1}{n}$ $\quad a_n = \frac{1}{m}$

$a+(m-1)d = \frac{1}{n}$

$a+(n-1)d = \frac{1}{m}$

$(m-1)d - (n-1)d = \frac{1}{n} - \frac{1}{m}$

$md - d - nd + d = \frac{m-n}{mn}$

$md - nd = \frac{m-n}{mn}$

$d(m-n) = \frac{m-n}{mn}$

$d = \frac{1}{mn}$

$a+(m-1)d = \frac{1}{n}$

$a+(m-1)\frac{1}{mn} = \frac{1}{n}$

$a+\frac{1}{n}-\frac{1}{mn} = \frac{1}{n}$

$a = \frac{1}{n} - \frac{1}{n} + \frac{1}{mn}$

$a = \frac{1}{mn}$

$$S_{mn} = \frac{mn}{2}\left[2a + (mn-1)d\right]$$

$$= \frac{mn}{2}\left[2\left(\frac{1}{mn}\right) + (mn-1)\frac{1}{mn}\right]$$

$$= \frac{mn}{2}\left[\frac{2}{mn} + 1 - \frac{1}{mn}\right]$$

$$= \frac{mn}{2}\left[\frac{1}{mn} + 1\right]$$

$$= \frac{mn}{2}\left[\frac{1+mn}{mn}\right]$$

$$\boxed{S_{mn} = \frac{1}{2}(1+mn)}$$

#Q. If the sum of m terms of an A.P. is the same as the sum of its n terms, show that the sum of its (m + n) terms is zero. $(m \neq n)$

CBSE 2017

$S_m = S_n$

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

$m[2a+md-d] = n[2a+nd-d]$

$2am + m^2d - md = 2an + n^2d - nd$

$2am - 2an + m^2d - n^2d - md + nd = 0$

$2a(m-n) + d(m^2-n^2) + d(-m+n) = 0$

$2a(m-n) + d(m+n)(m-n) - d(m-n) = 0$

To show: $S_{m+n} = 0$

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

$(m-n)[2a+d(m+n)-d] = 0$

$\left(\frac{m+n}{2}\right)\times[2a+(m+n-1)\,d] = 0 \times \frac{m+n}{2}$

$S_{m+n} = 0$

HP

#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.

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

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

#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 200 logs are placed and how many logs are in the top row?

CBSE 2023

20, 19, 18, 17 .....

$a = 20$
$d = -1$

$a_1$ ← no. of logs in the first row

Total logs = 200
no. of rows = ?

Let, $S_n = 200$

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

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

$n(40 - n + 1) = 400$

$n(41 - n) = 400$

$41n - n^2 = 400$

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

Sum = −41, P = 400

$-25, -16$

$n = 25, 16$

$n = 16$

$a_{25} = a + 24d = 20 + 24(-1) = -4$ ✗

no. of logs in the $25^{th}$ row.

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

no. of logs in $16^{th}$ row.

Ans: no. of rows = 16

no. of logs in the top row = 5

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

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

| (I) | (II) |
|---|---|
| a | a' |
| d | d' |
| $S_n$ | $S_n'$ |
| $a_9$ | $a_9'$ |

$$\frac{S_n}{S_n'} = \frac{7n+1}{4n+27}$$

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

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

Put $n = 17$,

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

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

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

$$\frac{a_{10}}{a_{10'}} = \frac{a+9d}{a'+9d'}$$

$$n = 19$$

$$\frac{a_{21}}{a_{21'}} = \frac{a+20d}{a'+20d'}$$

$$n = 41$$

#Q. The ratio of the sum of n terms of two A.P's is (7n + 1) : (4n + 27). Find the ratio of their $m^{th}$ terms.

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

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

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

$n = 2m-1$

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

$$\frac{2a+(2m-2)d}{2a'+(2m-2)d'} = \frac{14m-6}{8m+23}$$

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

$$\frac{a_m}{a_{m'}} = \frac{14m-6}{8m+23}$$

#Q. The ratio of the sums 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 $(2m - 1) : (2n - 1)$.

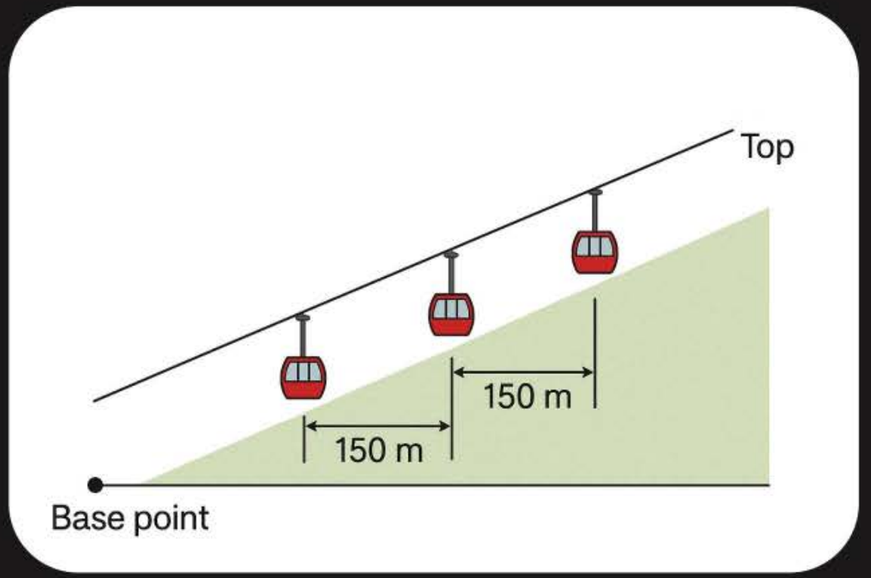
#GPK

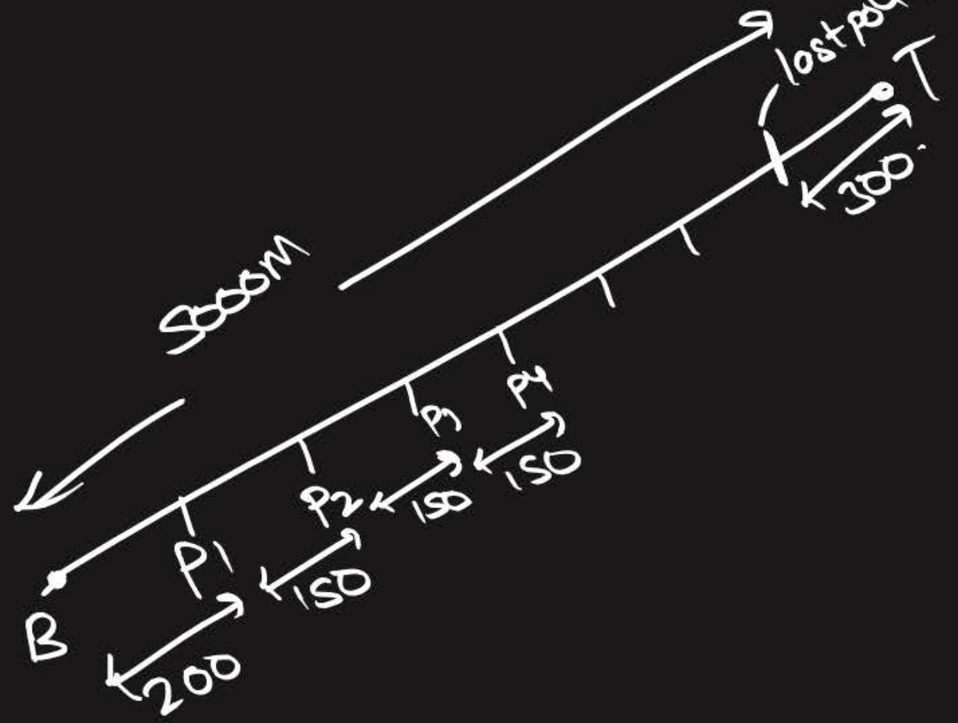
CBSE 2016, 17

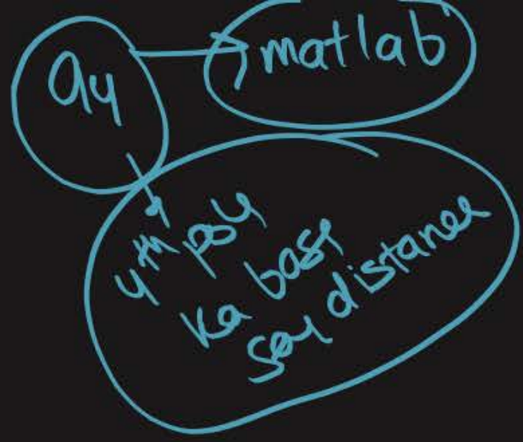
#Q. Cable cars at hill stations are one of the major tourist attractions. On a hill station, the length of cable car ride from base point to top most point on the hill is 5000 m. Poles are installed at equal intervals on the way to provide support to the cables on which car moves.

The distance of the first pole from base point is 200 m and subsequent poles are installed at equal interval of 150 m. Further, the distance of last pole from the top is 300 m.

CBSE 2025

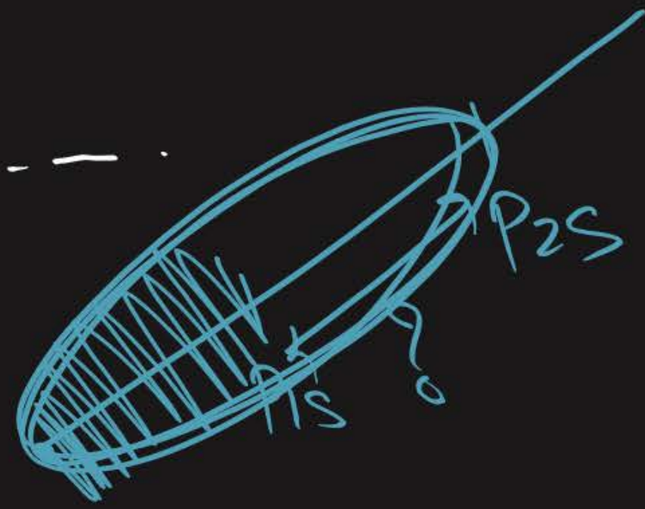





200, 350, 500, 650 - - - - - - - - - - - - - - - - - - - -

q=200
d=180



Based on above information, answer the following questions using Arithmetic Progression :

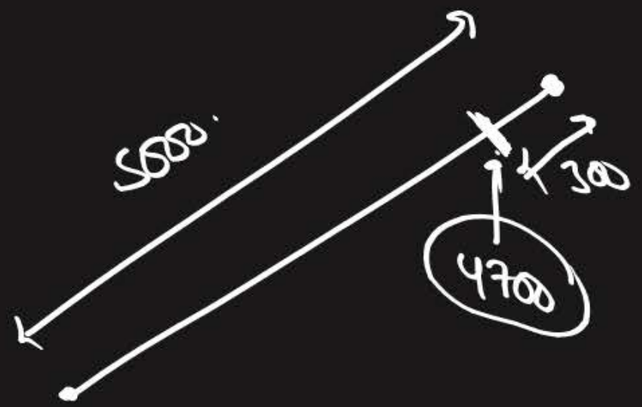
(i) Find the distance of $10^{th}$ pole from the base.

(ii) Find the distance between $15^{th}$ pole and $25^{th}$ pole.

(iii) (a) Find the time taken by cable car to reach $15^{th}$ pole from the top if it is moving at the speed of 5 m/sec and coming from top.

OR

(b) Find the total number of poles installed along the entire journey.




Let $a_n = 4700$

#Q. A school is organizing a charity run to raise funds for a local hospital. The run is planned as a series of rounds around a track, with each round being 300 metres. To make the event more challenging and engaging, the organizers decide to increase the distance of each subsequent round by 50 metres. For example, the second round will be 350 metres, the third round will be 400 metres and so on. The total number of rounds planned is 10.

CBSE 2025

300, 350, 400 : ⋯⋯⋯

$a = 300$

$d = 50$

$a_3$ → third round main distance.

$S_3$ → total distance in 3 rounds.

Based on the information given above, answer the following questions :

(i) Write the fourth, fifth and sixth term of the Arithmetic Progression so formed.

(ii) Determine the distance of the 8th round.

(iii) (a) Find the total distance run after completing all 10 rounds.

OR

(b) If a runner completes only the first 6 rounds, what is the total distance run by the runner?

#Q. A sum of ₹2,000 is invested at 7% per annum simple interest. Calculate the interests at the end of 1st, 2nd and 3rd year. Do these interests form an AP? If so, find the interest at the end of the 27th year.

CBSE 2025

$$S.I = \frac{P \times R \times T}{100}$$

P = 2000
R = 7%

1st year = $S.I = \frac{2000 \times 7 \times 1}{100} = 140₹$

IInd year

$S.I = \frac{2000 \times 7 \times 2}{100}$

$S.I = 280₹$

IIIrd

$S.I = \frac{2000 \times 7 \times 3}{100}$

$SI = 420₹$

140, 280, 420 ----

yes, it is an A.P.

$a_2 - a_1 = a_3 - a_2$

140 = 140

a = 140
d = 140

$a_{27} = ?$

#Q. The sum of the third term and the seventh term of an AP is 6 and their product is 8.

Find the sum of the first sixteen terms of the AP.

CBSE 2025

$a_3 + a_7 = 6$

$a + 2d + a + 6d = 6$

$2a + 8d = 6$

$a + 4d = 3$ (1)

$a = 3 - 4d$

$a_3 \times a_7 = 8$

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

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

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

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

$9 - 4d^2 = 8$

$1 = 4d^2$

$\frac{1}{4} = d^2$

$\pm\frac{1}{2} = d$

2 A.P's are given.

$S_{16} = ?$

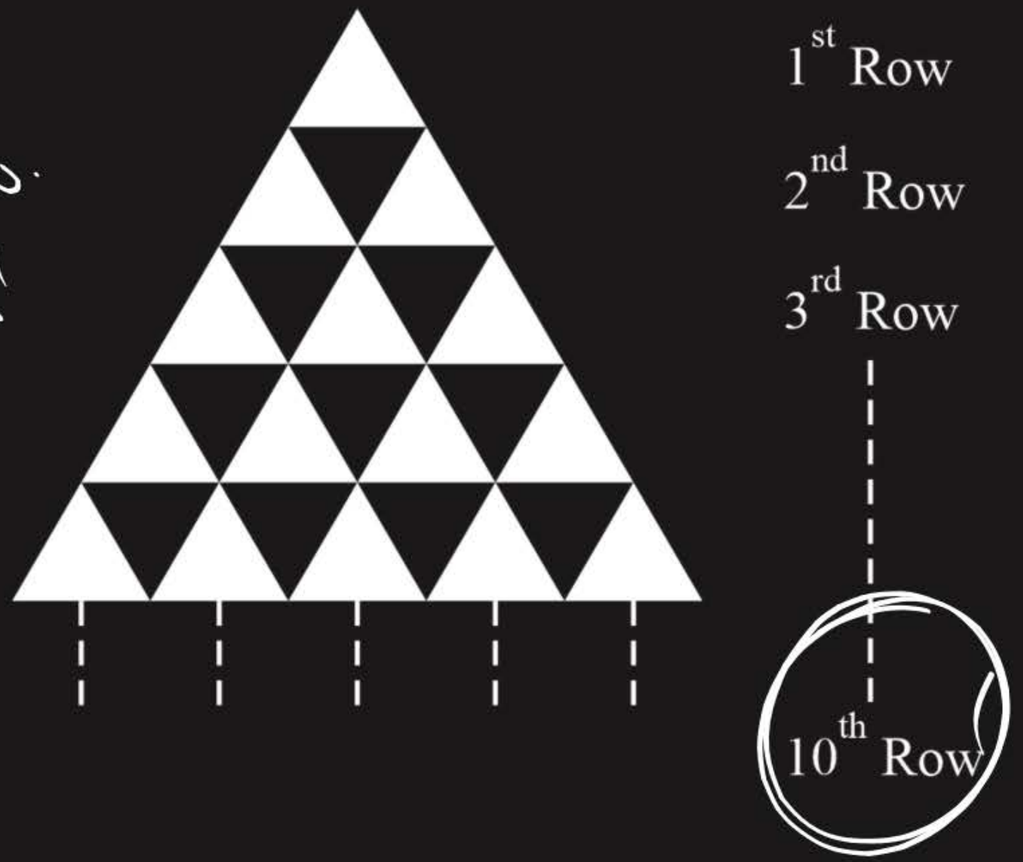
#Q. In an equilateral triangle of side 10 cm, equilateral triangles of side 1 cm are formed as shown in the figure below, such that there is one triangle in the first row, three triangles in the second row, five triangles in the third row and so on.

CBSE 2025

- 1, 3, 5, 7 .....

a = 1, d = 2

- $a_5$ = no. of Δ's in 5th row.
- $S_5$ = no. of Δ's in first 5 rows.



Based on given information, answer the following questions using Arithmetic Progression.

(i) How many triangles will be there in bottom most row?

(ii) How many triangles will be there in fourth row from the bottom?

(iii) (a) Find the total number of triangles of side 1 cm each till $8^{th}$ row.

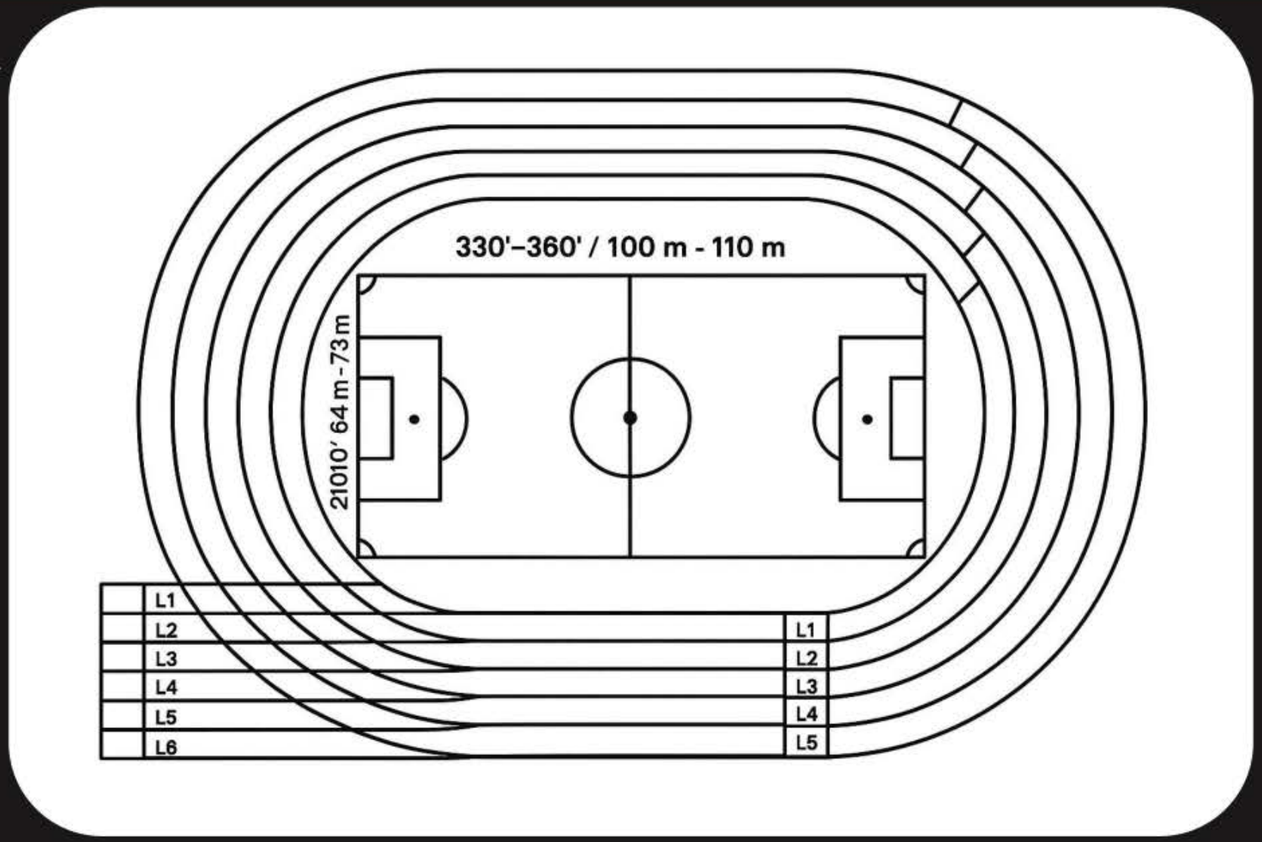
OR

(b) How many more number of triangles are there from $5^{th}$ row to $10^{th}$ row than in first 4 rows? Show working.

#Q. In order to organise, Annual Sports Day, a school prepared an eight lane running track with an integrated football field inside the track area as shown below:
The length of innermost lane of the track is 400 m and each subsequent lane is 7.6 m longer than the preceding lane.

400, 407.6, 415.2 .....

a = 400
d = 7.6




CBSE 2025

$a_7$ = 7th lane ki length

Based on given information, answer the following questions, using concept of Arithmetic Progression.

(i) What is the length of the $6^{th}$ lane ?

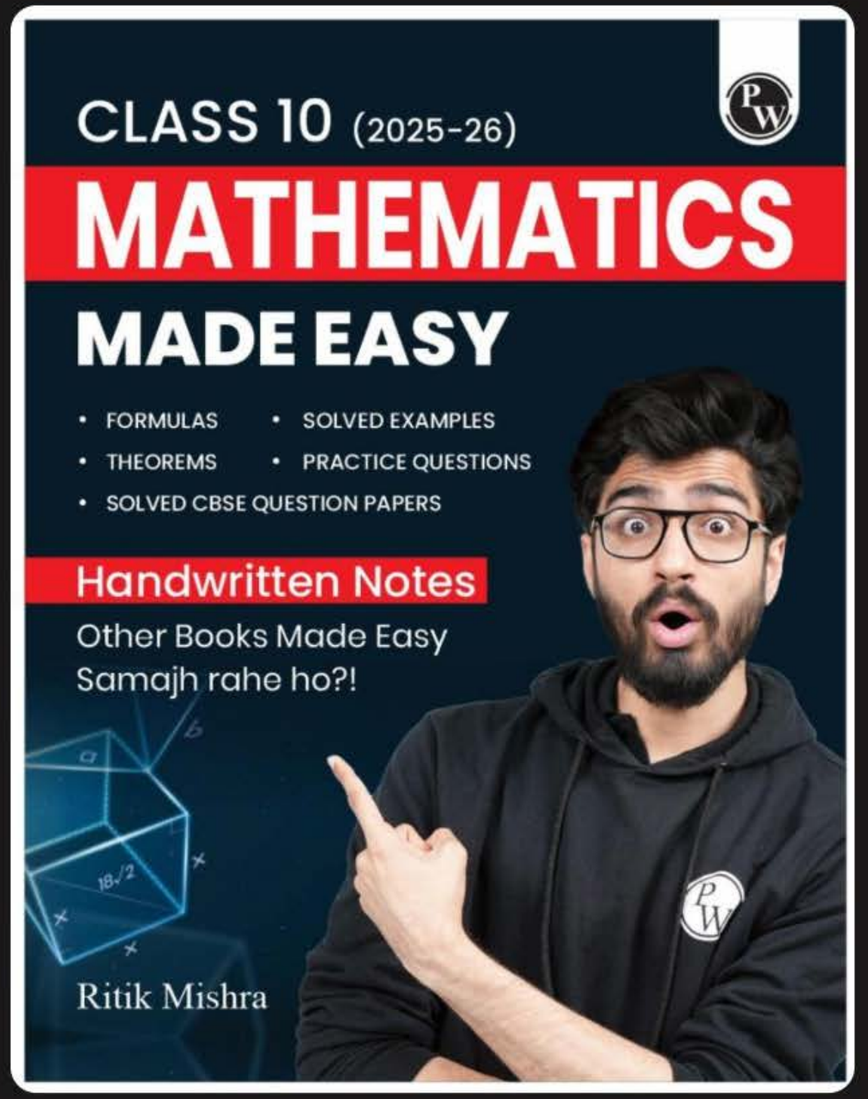
(ii) How long is the 8th lane than that of $4^{th}$ lane?

(iii) (a) While practicing for a race, a student took one round each in first six lanes. Find the total distance covered by the student.

OR

(b) A student took one round each in lane 4 to lane 8. Findt he total distance covered by the student.

$a_1 + a_2 + a_3 + a_4 + a_5 + a_6 + a_7 + a_8$



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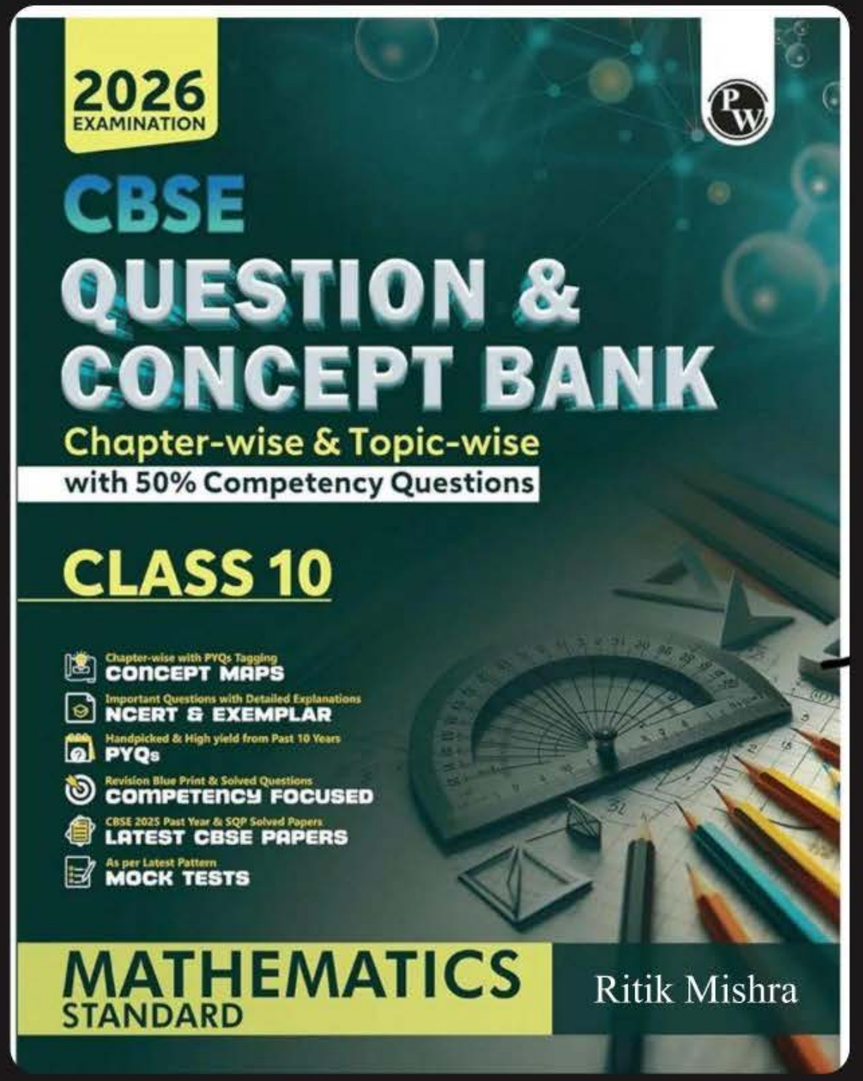

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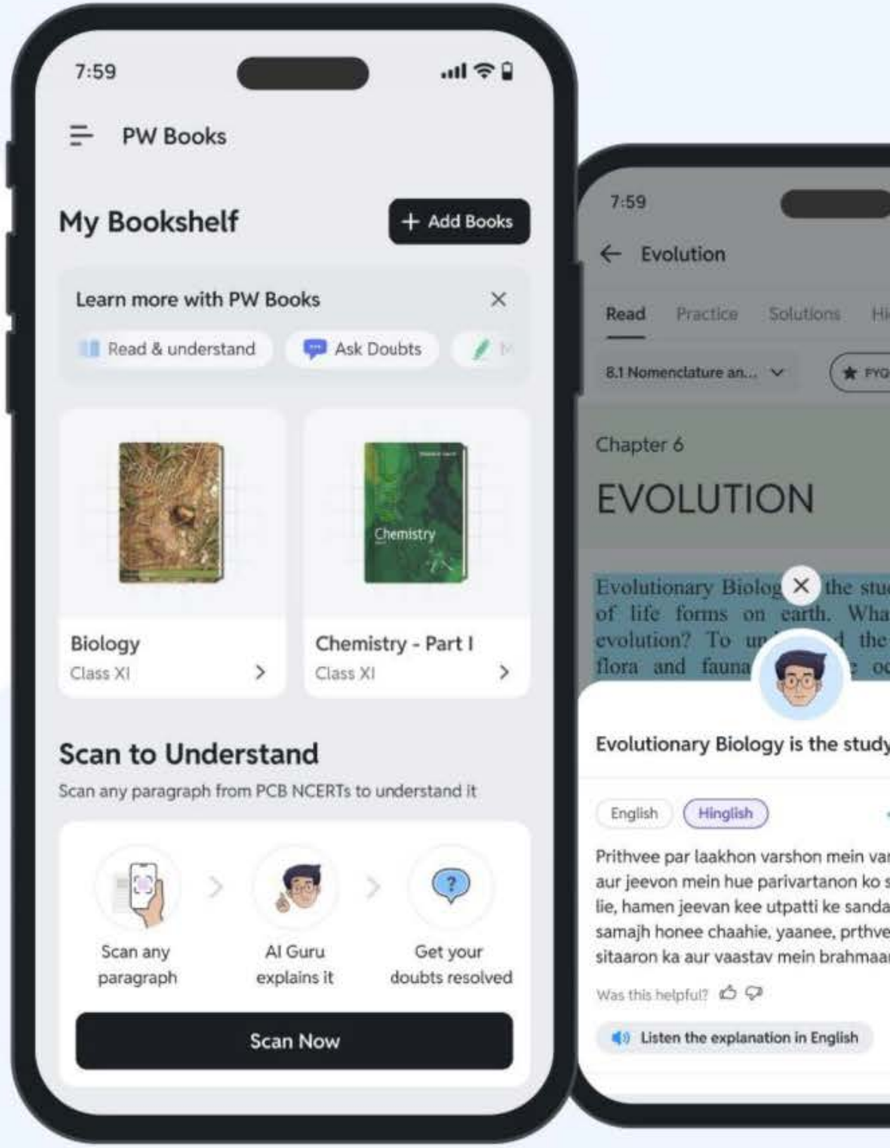


by PHYSICS WALLAH


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