# Case Study Questions on Arithmetic Progression Chapter 5 for Class 10

## Case Study 1: Meera's Savings Jar

Meera decides to save money in a jar to buy a bicycle. In the first week she saves ₹50. Every week after that, she saves ₹15 more than the week before, to push herself to save faster as her confidence grows.

**1. How much will Meera save in the 9th week?**

(a) ₹165
(b) ₹170
(c) ₹185
(d) ₹150

**Solution**: $a_9 = 50 + (9-1)(15) = 50 + 120 = 170$

Answer: (b) ₹170

**2. Fill in the Blank**

The total amount Meera saves over the first 10 weeks is ₹_____.

**Solution**: $S_{10} = 10/2\ [2(50) + 9(15)] = 5\ [100 + 135] = 5 \times 235 = 1,175$

Answer: ₹1,175

**3. True / False**

Meera will have saved enough to buy a ₹3,000 bicycle by the end of week 16.

**Solution:** $S_{16} = 16/2\ [2(50) + 15(15)] = 8\ [100 + 225] = 8 \times 325 = 2,600$, which is less than ₹3,000.

Answer: False, she has only saved ₹2,600 by week 16

**4. In which week will Meera's savings for that single week first cross ₹200?**

**Solution**: $a_{\square} > 200$: $50 + (n-1)(15) > 200$

$\Rightarrow (n-1)(15) > 150$

$\Rightarrow n-1 > 10$

$\Rightarrow n > 11$

Smallest whole n is 12. Check: $a_{12} = 50 + 11(15) = 50 + 165 = 215$.

Answer: Week 12

**5. Show that the amount saved in week 6 is the arithmetic mean of the amounts saved in week 5 and week 7.**

**Solution**: $a_5 = 50 + 4(15) = 110$, $a_6 = 50 + 5(15) = 125$, $a_7 = 50 + 6(15) = 140$

Mean of $a_5$ and $a_7$ = (110 + 140)/2 = 250/2 = 125 = $a_6$

**Case Study 2: The Library Book Drive**

For a school library book donation drive spread across 15 days, the librarian sets a target where students donate 12 books on Day 1. To keep momentum going, the daily target is set to increase by 3 books each day compared to the day before.

**1. What is the target number of books on Day 7?**

(a) 27

(b) 30

(c) 33

(d) 21

**Solution**: $a_7 = 12 + (7-1)(3) = 12 + 18 = 30$

Answer: (b) 30

**2. The total number of books targeted across all 15 days is _____.**

**Solution**: $S_{15} = 15/2\ [2(12) + 14(3)] = 7.5\ [24 + 42] = 7.5 \times 66 = 495$

Answer: 495 books

**3. True / False**

The library's overall goal of 500 books will be met by the end of Day 15.

**Solution**: The total over 15 days is 495 books (calculated above), which falls short of the 500-book goal by 5 books.

Answer: False

**4. On which day does the daily target first exceed 50 books?**

**Solution**: $a_n > 50$: $12 + (n-1)(3) > 50$

$\Rightarrow (n-1)(3) > 38$

$\Rightarrow n-1 > 12.67$

$\Rightarrow n > 13.67$

Smallest whole n = 14. Check: $a_{14} = 12 + 13(3) = 12 + 39 = 51$

Answer: Day 14

**5. The librarian decides to extend the drive by a few more days to reach exactly the 500-book goal. Find the minimum number of days needed for the cumulative total to reach at least 500 books.**

**Solution**: We need $S_n \geq 500$: $n/2\ [2(12) + (n-1)(3)] \geq 500$

$\Rightarrow n[24 + 3n - 3] \geq 1000$

$\Rightarrow n(3n + 21) \geq 1000$

$\Rightarrow 3n^2 + 21n - 1000 \geq 0$

Using the quadratic formula: $n = [-21 + \sqrt{(441 + 12000)}] / 6 = [-21 + \sqrt{12441}] / 6$

$\approx [-21 + 111.5] / 6 \approx 15.08$

Since n must be a whole number, round up.

Answer: 16 days (one extra day beyond the original plan)