NCERT Solutions Class 10 Maths
Chapter 5: Arithmetic Progressions
Exercise 5.4 (Optional)

Quick Summary: In NCERT Solutions Class 10 Maths Chapter 5 Exercise 5.4, students learn real-world applications of arithmetic progressions through practical word problems. This exercise covers step-by-step problem-solving techniques using AP formulas to solve scenarios involving ladders, shapes, and natural number sequences, which are essential for building strong conceptual understanding and scoring well in CBSE board exams.

Key Takeaways:

- Apply the nth term formula $a_n = a + (n-1)d$ to identify unknown terms in real-world contexts
- Use the sum formula $S_n = \frac{n}{2}[2a + (n-1)d]$ for calculating totals in practical problems
- Convert word problems into mathematical AP sequences by identifying first term and common difference
- Master systematic problem-solving approach: identify given data, apply appropriate formula, and verify solutions

Complete Solutions

Question 1

QUESTION

Which term of the AP: 121, 117, 113, …, is its first negative term?

Hint: Find n for a_n < 0.

SOLUTION

Step 1: Identify the first term and common difference.

The AP is:

First term:

Common difference:

Step 2: Write the nth term.

For an AP, the nth term is:

So here:

Step 3: Use the condition that the term is negative.

We want the first term that is negative, so we need:

Substitute :

Step 4: Solve the inequality.

Since must be a positive integer, the smallest integer greater than 31.25 is:

Step 5: Conclusion.

The 32nd term is the first negative term of the AP.

ANSWER

32nd term

Question 2

QUESTION

The sum of the third and the seventh terms of an AP is 6 and their product is 8. Find the sum of first sixteen terms of the AP.

SOLUTION

Step 1: Express the given terms in terms of and .

Let the first term be and common difference be .

Third term:

Seventh term:

Given:

Step 2: Use the sum condition.

Divide by 2:

Step 3: Use the product condition.

Notice that and are symmetric around . Let:

Then:

From (1), we already have .

Now the product condition becomes:

Substitute :

So:

Step 4: Find for each value of .

From (1): .

Case I:

Case II:

So two possible APs:

• AP1:
• AP2:

Step 5: Find for each AP.

Formula:

Here .

For AP1:

For AP2:

Conclusion: There are two possible APs satisfying the given conditions, so the sum of the first sixteen terms can be or .

Question 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(1)/(2) m apart, what is the length of the wood required for the rungs?

Hint: Number of rungs = (250)/(25) + 1.

SOLUTION

Step 1: Convert the distance between top and bottom rungs into cm.

Distance between top and bottom rungs is m:

Step 2: Find the number of rungs.

The rungs are 25 cm apart. So the number of intervals between top and bottom rungs is:

Number of rungs = number of intervals + 1:

Step 3: Observe that rung lengths form an AP.

The lengths decrease uniformly from 45 cm at the bottom to 25 cm at the top. So the rung lengths form an arithmetic progression:

First term (bottom rung):

Last term (top rung):

Number of terms (rungs):

Step 4: Use the sum formula for an AP.

Sum of terms of an AP:

Here,

Conclusion: The total length of wood required for the rungs is **385 cm**.

ANSWER

385 cm

Question 4

The houses of a row are numbered consecutively from 1 to 49. Show that there is a value of x such that the sum of the numbers of the houses preceding the house numbered x is equal to the sum of the numbers of the houses following it. Find this value of x.

Hint: $S_{x-1} = S_{49} - S_x$.

SOLUTION

Step 1: Use the sum formula for natural numbers.

The house numbers form an AP: .

Sum of first natural numbers is:

Step 2: Translate the condition into an equation.

Let the required house number be .

• Sum of the house numbers *before* house :

• Sum of the house numbers *after* house :

Given condition: these two sums are equal:

Step 3: Substitute the formulas.

First, find :

Also,

So the condition becomes:

Step 4: Clear the denominator and simplify.

Multiply both sides by 2:

Expand both sides:

Left:

Right:

So the equation is:

Bring all terms to one side:

Step 5: Solve for .

But is a house number from 1 to 49, so .

Step 6: Quick check.

Sum of houses before 35:

Sum of houses after 35:

Both sums are equal.

Conclusion: The required house number is .

Question 5

QUESTION

A small terrace at a football ground comprises of 15 steps each of which is 50 m long and built of solid concrete. Each step has a rise of (1)/(4) m and a tread of (1)/(2) m (see Fig. 5.8). Calculate the total volume of concrete required to build the terrace.

Hint: Volume of concrete required to build the first step = (1)/(4) × (1)/(2) × 50\,\textm^3.

SOLUTION

Step 1: Understand the shape of each step.

Each step is like a solid rectangular block with:

- Length (along the terrace) = 50 m
- Rise (height) = m
- Tread (depth) = m

But as we go up, each new step extends one more tread further back than the one below it.

STEP 2: WRITE THE VOLUME OF EACH STEP.

For a rectangular block:

First step:

Depth = m, height = m, length = 50 m.

Second step:

It occupies two treads in depth: m.

Third step:

Depth = m.

Continuing in this way, the th step has depth m, so:

STEP 3: SUM THE VOLUMES OF ALL 15 STEPS.

We need:

Using the formula for :

Now,

So,

CONCLUSION

The total volume of concrete required to build the terrace is .

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📑 Key Formulas

Important Formulas for Exercise 5.4

Formula / Concept	Description
Arithmetic Progression (AP)	A sequence of numbers where the difference between any two consecutive terms is constant. The general form is a, a+d, a+2d, \dots.
Common Difference (d)	The constant difference between consecutive terms in an AP. It can be positive, negative, or zero. It is calculated as $d = a_n - a_{n-1}$.
General Term or n^th Term of an AP (a_n)	Formula to find any term in the AP. $a_n = a + (n-1)d$ Here, a is the first term, n is the term number, and d is the common difference.
Sum of the First n Terms of an AP (S_n)	Formula to find the sum of the first n terms of an AP. $S_n = (n)/(2)[2a + (n-1)d]$ Where a is the first term and d is the common difference.
Sum of the First n Terms of an AP (S_n) (When the last term is known)	An alternative formula for the sum of the first n terms when the first term (a) and the last term (l or a_n) are known. $S_n = (n)/(2)(a + l)$
Finding the nth Term from the Sum	The nth term of an AP can be found by subtracting the sum of the first n-1 terms from the sum of the first n terms. $a_n = S_n - S_{n-1}$

❓ Top FAQs

Q1. How many questions are in NCERT Solutions Class 10 Maths Chapter 5 Arithmetic Progressions Exercise 5.4?

Exercise 5.4 of NCERT Solutions for Class 10 Maths Chapter 5 Arithmetic Progressions contains exactly 5 questions. These questions focus on practical applications of AP formulas including the nth term formula and sum of n terms of AP, which are crucial for CBSE board exam 2025-26 preparation.

Q2. Where can I download free PDF of NCERT Solutions for Class 10 Maths Chapter 5 Arithmetic Progressions Exercise 5.4 with step by step solutions?

You can download the free PDF of NCERT Solutions for Class 10 Maths Chapter 5 Arithmetic Progressions Exercise 5.4 from the official NCERT website or various educational platforms offering step by step solutions. These PDFs are updated according to the latest CBSE syllabus 2025-26 and include detailed explanations for all 5 questions in Exercise 5.4.

Q3. How many marks does Arithmetic Progressions Chapter 5 Exercise 5.4 carry in CBSE Class 10 board exam 2025-26?

Arithmetic Progressions (Chapter 5) carries approximately 5 marks in CBSE Class 10 Maths board exam 2025-26 as part of Unit II - Algebra. Exercise 5.4 specifically covers application-based problems that are frequently asked in board exams, making it essential for scoring full marks in this chapter.

Q4. Which is the most difficult question in NCERT Solutions Class 10 Maths Chapter 5 Arithmetic Progressions Exercise 5.4 for CBSE board exam preparation?

Question 5 of Exercise 5.4 in NCERT Solutions Class 10 Maths Chapter 5 Arithmetic Progressions is generally considered the most challenging as it involves complex application of both nth term of AP formula and sum of n terms of AP simultaneously. However, with step by step solutions and regular practice, students can master this question for CBSE board exam 2025-26.

Q5. What is the nth term of AP formula used in NCERT Solutions for Class 10 Maths Chapter 5 Arithmetic Progressions Exercise 5.4?

The nth term of AP formula used in Exercise 5.4 is $a_n = a + (n-1)d$, where 'a' is the first term, 'd' is the common difference, and 'n' is the number of terms. This formula is extensively applied in all 5 questions of NCERT Solutions Class 10 Maths Chapter 5 Exercise 5.4 for solving real-life application problems.

📚 More Exercises

Visit all exercises from Chapter 5:

Exercise 5.1 →

Exercise 5.2 →

Exercise 5.3 →

Exercise 5.4 (Optional) ✓ →

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