

Most Important Questions: Arithmetic Progression

Class 10 Mathematics - Comprehensive Practice Paper

Based on the Latest Exam Pattern

Quick Revision: Key Formulas

- **General form of an AP:** $a, a + d, a + 2d, a + 3d, \dots$
- **n^{th} term of an AP:** $a_n = a + (n - 1)d$
(Where a is the first term, d is the common difference, and n is the number of terms)
- **Sum of first n terms of an AP:** $S_n = \frac{n}{2}[2a + (n - 1)d]$
- **Alternative formula for Sum:** $S_n = \frac{n}{2}[a + l]$
(Where l is the last term, i.e., $l = a_n$)
- **Common difference:** $d = a_n - a_{n-1}$

Part A: Objective Type Questions (1 Mark Each)

- Q1. Find the 10th term of the Arithmetic Progression: 2, 7, 12, ...
- Q2. If the common difference of an AP is -4 and the 7th term is 4, then find the first term.

Part B: Short Answer Type Questions (2-3 Marks Each)

- Q3. Which term of the AP: 3, 8, 13, 18, ... is 78?
- Q4. Find the number of terms in the following Arithmetic Progression: 7, 13, 19, ..., 205.
- Q5. Find the sum of the first 51 terms of an AP whose second and third terms are 14 and 18 respectively.
- Q6. If the sum of the first 7 terms of an AP is 49 and that of the first 17 terms is 289, find the sum of the first n terms.

Part C: Long Answer Type Questions (4-5 Marks Each)

- Q7. The sum of the 4th and 8th terms of an AP is 24 and the sum of the 6th and 10th terms is 44. Find the first three terms of the AP.

Q8. A manufacturer of TV sets produced 600 sets in the third year and 700 sets in the seventh year. Assuming that the production increases uniformly by a fixed number every year, find:

- (i) The production in the 1st year.
- (ii) The production in the 10th year.
- (iii) The total production in the first 7 years.

Q9. Case Study Based Question: Ramkali required Rs 2500 after 12 weeks to send her daughter to school. She saved Rs 100 in the first week and increased her weekly saving by Rs 20 every week. Find her total savings after 12 weeks and determine whether she will be able to send her daughter to school.

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Detailed Step-by-Step Solutions

Solution 1:

Given AP: 2, 7, 12, ...

First term (a) = 2

Common difference (d) = $7 - 2 = 5$

We know, $a_n = a + (n - 1)d$

For 10th term ($n = 10$):

$$a_{10} = 2 + (10 - 1)5 = 2 + 9(5) = 2 + 45 = 47.$$

Answer: The 10th term is 47.

Solution 2:

Given: $d = -4$ and $a_7 = 4$.

We know, $a_n = a + (n - 1)d$

$$a_7 = a + (7 - 1)d \implies a + 6d = 4$$

Substitute $d = -4$:

$$a + 6(-4) = 4 \implies a - 24 = 4 \implies a = 28.$$

Answer: The first term is 28.

Solution 3:

Given AP: 3, 8, 13, 18, ...

Here, $a = 3$, $d = 8 - 3 = 5$. Let the n^{th} term be 78.

$$a_n = a + (n - 1)d \implies 78 = 3 + (n - 1)5$$

$$78 - 3 = (n - 1)5 \implies 75 = (n - 1)5$$

$$n - 1 = \frac{75}{5} \implies n - 1 = 15 \implies n = 16.$$

Answer: The 16th term is 78.

Solution 4:

Given AP: 7, 13, 19, ..., 205.

Here, $a = 7$, $d = 13 - 7 = 6$, and last term $a_n = 205$.

$$a_n = a + (n - 1)d \implies 205 = 7 + (n - 1)6$$

$$205 - 7 = (n - 1)6 \implies 198 = (n - 1)6$$

$$n - 1 = \frac{198}{6} \implies n - 1 = 33 \implies n = 34.$$

Answer: There are 34 terms in the AP.

Solution 5:

Given: $a_2 = 14$ and $a_3 = 18$.

Common difference $d = a_3 - a_2 = 18 - 14 = 4$.

Also, $a_2 = a + d \implies 14 = a + 4 \implies a = 10$.

We need to find S_{51} .

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

$$S_{51} = \frac{51}{2}[2(10) + (51 - 1)4] = \frac{51}{2}[20 + 50(4)]$$

$$S_{51} = \frac{51}{2}[20 + 200] = \frac{51}{2}[220] = 51 \times 110 = 5610.$$

Answer: The sum of the first 51 terms is 5610.

Solution 6:

Given: $S_7 = 49$ and $S_{17} = 289$.

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

$$\text{For } n = 7: \frac{7}{2}[2a + 6d] = 49 \implies 7(a + 3d) = 49 \implies a + 3d = 7 \quad \text{---(Eq 1)}$$

$$\text{For } n = 17: \frac{17}{2}[2a + 16d] = 289 \implies 17(a + 8d) = 289 \implies a + 8d = 17 \quad \text{---(Eq 2)}$$

Subtracting Eq 1 from Eq 2:

$$(a + 8d) - (a + 3d) = 17 - 7 \implies 5d = 10 \implies d = 2.$$

Substitute $d = 2$ in Eq 1:

$$a + 3(2) = 7 \implies a + 6 = 7 \implies a = 1.$$

Now, finding S_n :

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

Answer: The sum of the first n terms is n^2 .

Solution 7:

Given: $a_4 + a_8 = 24$ and $a_6 + a_{10} = 44$.

Using $a_n = a + (n-1)d$:

$$(a + 3d) + (a + 7d) = 24 \implies 2a + 10d = 24 \implies a + 5d = 12 \quad \text{---(Eq 1)}$$

$$(a + 5d) + (a + 9d) = 44 \implies 2a + 14d = 44 \implies a + 7d = 22 \quad \text{---(Eq 2)}$$

Subtracting Eq 1 from Eq 2:

$$(a + 7d) - (a + 5d) = 22 - 12 \implies 2d = 10 \implies d = 5.$$

Substitute $d = 5$ in Eq 1:

$$a + 5(5) = 12 \implies a + 25 = 12 \implies a = -13.$$

The first three terms are $a, a + d, a + 2d$:

$$-13, -13 + 5, -13 + 10 \implies -13, -8, -3.$$

Answer: The first three terms are $-13, -8, -3$.

Solution 8:

Let the production in the 1st year be a and the uniform increase be d .

$$\text{Given: } a_3 = 600 \implies a + 2d = 600 \quad \text{---(Eq 1)}$$

$$a_7 = 700 \implies a + 6d = 700 \quad \text{---(Eq 2)}$$

Subtracting Eq 1 from Eq 2:

$$4d = 100 \implies d = 25.$$

Substitute $d = 25$ in Eq 1:

$$a + 2(25) = 600 \implies a + 50 = 600 \implies a = 550.$$

(i) Production in the 1st year (a) = 550 sets.

(ii) Production in the 10th year (a_{10}):

$$a_{10} = a + 9d = 550 + 9(25) = 550 + 225 = 775 \text{ sets.}$$

(iii) Total production in the first 7 years (S_7):

$$S_7 = \frac{7}{2}[2(550) + (7-1)25] = \frac{7}{2}[1100 + 150] = \frac{7}{2}[1250] = 7 \times 625 = 4375 \text{ sets.}$$

Solution 9:

Ramkali's weekly savings form an AP: Rs 100, Rs 120, Rs 140, ...

Here, first term (a) = 100, common difference (d) = 20.

We need to find her total savings after 12 weeks, which is the sum of the first 12 terms (S_{12}).

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

$$S_{12} = \frac{12}{2}[2(100) + (12-1)20] = 6[200 + 11(20)]$$

$$S_{12} = 6[200 + 220] = 6[420] = 2520.$$

Her total savings after 12 weeks will be Rs 2520.

Since her requirement is Rs 2500 and she saved Rs 2520 (which is > 2500),

Answer: Yes, she will be able to send her daughter to school.