

CBSE Class 10 Mathematics

Chapter 5: Arithmetic Progressions (AP)

Comprehensive Study Notes, Formulas & Practice Questions

1 Introduction to Arithmetic Progressions

An **Arithmetic Progression (AP)** is a sequence of numbers in which the difference between any two consecutive terms is always constant. This constant difference is known as the *common difference* of the AP.

1.1 General Form of an AP

If a is the first term and d is the common difference, then the general form of an Arithmetic Progression is given by:

$$a, a + d, a + 2d, a + 3d, \dots$$

1.2 Common Difference (d)

The common difference can be positive, negative, or zero. It is calculated by subtracting any term from its succeeding term:

$$d = a_n - a_{n-1}$$

For example, in the AP: 2, 5, 8, 11, $\dots$, the common difference $d = 5 - 2 = 3$.

2 Important Formulas

Mastering the following formulas is crucial for solving problems in Chapter 5.

2.1 1. The n -th Term of an AP

The n -th term (or general term) a_n of an AP with first term a and common difference d is given by:

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

Note: If there are m terms in the AP, then a_m represents the last term, often denoted by l .

2.2 2. Sum of First n Terms of an AP (S_n)

The sum of the first n terms of an AP can be calculated using two formulas, depending on the given information:

Formula A (When first term and common difference are known):

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

Formula B (When first term and last term l are known):

$$S_n = \frac{n}{2} [a + l]$$

2.3 3. Finding the n -th Term from the Sum

If the sum of the first n terms (S_n) is given, the n -th term can be found using:

$$a_n = S_n - S_{n-1}$$

3 Key Properties of an AP

- If a constant is added to or subtracted from each term of an AP, the resulting sequence is also an AP with the same common difference.
- If each term of an AP is multiplied or divided by a non-zero constant k , the resulting sequence is also an AP with a common difference of kd or d/k , respectively.
- **Selection of terms in an AP:**
 - 3 terms: $a - d, a, a + d$ (Common difference = d)
 - 4 terms: $a - 3d, a - d, a + d, a + 3d$ (Common difference = $2d$)
 - 5 terms: $a - 2d, a - d, a, a + d, a + 2d$ (Common difference = d)

Need Help Mastering Class 10 Mathematics?

Struggling with Arithmetic Progressions or other Math chapters?
Find top-rated, experienced Class 10 Math tutors on UrbanPro.

[Click Here to Book a Free Demo Class Today!](#)

4 Practice Questions (Based on Latest Exam Pattern)

4.1 Section A: Objective Type Questions (1 Mark Each)

- Q1.** Find the 10th term of the AP: 2, 7, 12, ...
- Q2.** Write the first four terms of the AP, when the first term $a = 4$ and the common difference $d = -3$.
- Q3.** Check whether -150 is a term of the AP: 11, 8, 5, 2, ...

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

- Q4.** Which term of the AP: 3, 15, 27, 39, ... will be 132 more than its 54th term?
- Q5.** How many two-digit numbers are divisible by 3?
- Q6.** Find the sum of the first 22 terms of the AP: 8, 3, -2 , ...
- Q7.** The first term of an AP is 5, the last term is 45 and the sum is 400. Find the number of terms and the common difference.

4.3 Section C: Long Answer & Word Problems (4-5 Marks Each)

- Q8.** 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.
- Q9.** Subba Rao started work in 1995 at an annual salary of Rs 5000 and received an increment of Rs 200 each year. In which year did his income reach Rs 7000?
- Q10.** 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 first 7 years

5 Detailed Solutions

Solution 1:

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

First term (a) = 2

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

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

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

Answer: The 10th term is 47.

Solution 2:

Given: $a = 4$, $d = -3$

First term = 4

Second term = $4 + (-3) = 1$

Third term = $1 + (-3) = -2$

Fourth term = $-2 + (-3) = -5$

Answer: The first four terms are 4, 1, -2, -5.

Solution 3:

Given AP: 11, 8, 5, 2, ...

$$a = 11, d = 8 - 11 = -3$$

Let -150 be the n -th term of this AP.

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

$$-150 = 11 + (n - 1)(-3)$$

$$-161 = -3(n - 1)$$

$$n - 1 = \frac{161}{3} = 53.66$$

Since n must be a positive integer, -150 cannot be a term of this AP.

Answer: No, -150 is not a term of the given AP.

Solution 4:

Given AP: 3, 15, 27, 39, ...

$$a = 3, d = 12$$

$$a_{54} = a + 53d = 3 + 53(12) = 3 + 636 = 639$$

Let a_n be 132 more than a_{54} .

$$a_n = 639 + 132 = 771$$

$$\text{Now, } 771 = a + (n - 1)d \implies 771 = 3 + (n - 1)12$$

$$768 = 12(n - 1) \implies n - 1 = 64 \implies n = 65$$

Answer: The 65th term will be 132 more than its 54th term.

Solution 5:

Two-digit numbers divisible by 3 are: 12, 15, 18, ..., 99.

This forms an AP where $a = 12$, $d = 3$, and last term $l = 99$.

$$l = a + (n - 1)d \implies 99 = 12 + (n - 1)3$$

$$87 = 3(n - 1) \implies n - 1 = 29 \implies n = 30$$

Answer: There are 30 two-digit numbers divisible by 3.

Solution 6:

Given AP: 8, 3, -2, ...

$$a = 8, d = 3 - 8 = -5, n = 22$$

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

$$S_{22} = \frac{22}{2}[2(8) + (22-1)(-5)] = 11[16 + 21(-5)]$$

$$S_{22} = 11[16 - 105] = 11[-89] = -979$$

Answer: The sum of the first 22 terms is -979.

Solution 7:

Given: $a = 5, l = 45, S_n = 400$

$$S_n = \frac{n}{2}(a + l) \implies 400 = \frac{n}{2}(5 + 45)$$

$$400 = \frac{n}{2}(50) \implies 400 = 25n \implies n = 16$$

$$\text{Now, } l = a + (n-1)d \implies 45 = 5 + (16-1)d$$

$$40 = 15d \implies d = \frac{40}{15} = \frac{8}{3}$$

Answer: The number of terms is 16 and the common difference is $\frac{8}{3}$.

Solution 8:

$$a_4 + a_8 = 24 \implies (a + 3d) + (a + 7d) = 24 \implies 2a + 10d = 24 \implies a + 5d = 12 \dots (\text{Eq 1})$$

$$a_6 + a_{10} = 44 \implies (a + 5d) + (a + 9d) = 44 \implies 2a + 14d = 44 \implies a + 7d = 22 \dots (\text{Eq 2})$$

Subtracting Eq 1 from Eq 2:

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

$$\text{Substitute } d = 5 \text{ in Eq 1: } a + 25 = 12 \implies a = -13$$

First three terms: -13, $-13 + 5 = -8$, $-8 + 5 = -3$.

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

Solution 9:

Starting salary $a = 5000$

Annual increment $d = 200$

Target income $a_n = 7000$

$$a_n = a + (n-1)d \implies 7000 = 5000 + (n-1)200$$

$$2000 = 200(n-1) \implies n-1 = 10 \implies n = 11$$

His salary will reach Rs 7000 in the 11th year.

$$\text{Year} = 1995 + (11-1) = 2005.$$

Answer: His income reached Rs 7000 in the year 2005.

Solution 10:

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

$$a_3 = 600 \implies a + 2d = 600 \dots (\text{Eq 1})$$

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

$$\text{Subtracting Eq 1 from Eq 2: } 4d = 100 \implies d = 25$$

$$\text{Substituting } d = 25 \text{ in Eq 1: } a + 50 = 600 \implies a = 550$$

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

(ii) Production in the 10th year (a_{10}) = $a + 9d = 550 + 9(25) = 550 + 225 = 775$

(iii) Total production in first 7 years (S_7) = $\frac{7}{2}[2(550) + (7-1)25] = \frac{7}{2}[1100 + 150] = \frac{7}{2} \times 1250 = 7 \times 625 = 4375$

Answer: (i) 550 sets, (ii) 775 sets, (iii) 4375 sets.

Need Help Mastering Class 10 Mathematics?

Ready to score 95%+ in your Board Exams?

Join thousands of students who have improved their grades with UrbanPro's expert tutors.

Find Your Perfect Math Tutor Now!