



ARITHMETIC PROGRESSIONS

STUDY • PRACTICE • SCORE HIGH

5.2 ARITHMETIC PROGRESSIONS (AP)

An **AP** is a list of numbers in which each term is obtained by adding a **fixed number** to the preceding term except the first term.

- ✓ The first term is denoted by 'a'.
- ✓ Common difference is denoted by 'd'.
- ✓ The n^{th} term is denoted by a_n .

GENERAL FORM OF AP

$$a, a+d, a+2d, a+3d, a+4d, \dots$$

 n^{th} TERM OF AN AP :

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

SUM OF FIRST n TERMS :

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

Q2 Write the first four terms of AP for the given first term (a) and common difference (d).

- (i) $a = 10, d = 10$: **10, 20, 30, 40**
 (ii) $a = -2, d = 0$: **-2, -2, -2, -2**
 (iii) $a = 4, d = -3$: **4, 1, -2, -5**
 (iv) $a = -1, d = \frac{1}{2}$: **-1, $-\frac{1}{2}$, 0, $\frac{1}{2}$**
 (v) $a = -1.25, d = -0.25$: **-1.25, -1.50, -1.75, -2.00**

Q4 Which of the following are AP? If they form an AP, find the common difference and write the next three terms.

- (i) 2, 4, 8, 16, ...
Differences : 2, 4, 8 (not equal)
Not an AP
- (ii) $2, \frac{5}{2}, 3, \frac{7}{2}, \dots$
 $d = \frac{1}{2}$
Next three : **$4, \frac{9}{2}, 5$**
- (iii) -1.2, -3.2, -5.2, -7.2, ...
 $d = -2$
Next three : **-9.2, -11.2, -13.2**
- (iv) -10, -6, -2, 2, ...
 $d = 4$
Next three : **6, 10, 14**

EXERCISE 5.1 — SOLUTIONS

Q1 Tell whether the following are AP or not. If they form an AP, find the common difference d and write the first four terms.

(i) Taxi fare : ₹15 for first km and ₹8 for each additional km.

Fare : 15, 23, 31, 39, ...

Difference : $23 - 15 = 8, 31 - 23 = 8$

Yes, it is an AP with $d = 8$.

(ii) Air removed from cylinder : 100, 75, 56.25, ...
Differences are not equal.

No, it is not an AP.

(iii) Cost of digging a well : 150, 200, 250, 300, ...

Difference : $200 - 150 = 50$

Yes, it is an AP with $d = 50$.

(iv) Compound interest : 10000, 10800, 11664, ...
Differences are not equal.

No, it is not an AP.

MORE CONCEPTS & FORMULAS

From Page 2

Q5 Find the n^{th} term of the following APs.

(i) 3, 8, 13, 18, ...

$a = 3, d = 5$

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

$$a_n = 5n - 2$$

(ii) -10, -6, -2, 2, ...

$a = -10, d = 4$

$a_n = -10 + 4(n-1)$

$$a_n = 4n - 14$$

Q7 In an AP, if $a_7 = 17$ and $a_{13} = 35$, find a and d .

$a_7 = a + 6d = 17 \dots (i)$

$a_{13} = a + 12d = 35 \dots (ii)$

(ii) - (i): $6d = 18 \Rightarrow d = 3$

$a + 6(3) = 17 \Rightarrow a = -1$

$$a = -1, d = 3$$

Q6 In an AP, if $a_n = 3n + 7$, find the first term and the common difference.

Given $a_n = 3n + 7$

$a + (n-1)d = 3n + 7$

Compare coefficients :

Coeff. of n : $d = 3$

Constant : $a - d = 7$

$\Rightarrow a - 3 = 7 \Rightarrow a = 10$

$$a = 10, d = 3$$

IMPORTANT FORMULAS

- ✓ $a_n = a + (n-1)d$
- ✓ $S_n = \frac{n}{2} [2a + (n-1)d]$
- ✓ If $a_n = k + b$ then $d = k$, $a = b - k$
- ✓ $d = \frac{a_n - a_m}{n - m}$



EXTRA IMPORTANT QUESTIONS (From Page 2)

1. Find 50th term of 5, 9, 13, ...
 $a = 5, d = 4, n = 50$
 $a_{50} = 5 + 49(4) = 201$

Answer : 201

2. Which term of 11, 17, 23, ... is 203?
 $203 = 11 + (n-1)6$
 $n - 1 = 32 \Rightarrow n = 33$

203 is 33rd term

3. Sum of first 30 terms of 7, 13, 19, ...
 $a = 7, d = 6, n = 30$
 $S_{30} = 15[14 + 174]$

Answer : 2820

4. $a_{10} = 35, a_{20} = 65$. Find a & d .
 $10d = 30 \Rightarrow d = 3$
 $a = 8$

$a = 8, d = 3$

5. Is 999 a term of 3, 10, 17, ...?
 $999 = 3 + (n-1)7$
 $n = 143$

Yes, 143rd term

6. $a_5 = 57, a_{15} = 63$. Find d .
 $10d = 6$

$d = 3/5$



Remember :

In an AP, the difference between any two successive terms is always the same (**constant**). This constant difference is called the **common difference**.



UNDERSTAND CONCEPTS



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