NCERT Solutions for Class 10 Maths Chapter 5 Exercise 5.1: Chapter 5 of Class 10 Maths, Arithmetic Progressions (APs), introduces students to sequences where each term increases or decreases by a fixed value. Exercise 5.1 identifies whether a given sequence forms an AP and determines its common difference, d.

Students learn to analyze patterns and apply the AP formula for nth term, where a is the first term and n is the term number. This foundational exercise helps develop logical reasoning and problem-solving skills, essential for tackling higher-order AP problems in the subsequent exercises.

NCERT Solutions for Class 10 Maths Chapter 5 Exercise 5.1 Overview

Chapter 5 of Class 10 Maths, Arithmetic Progressions (APs), is vital for understanding sequences with a constant difference between consecutive terms. Exercise 5.1 introduces the concept of APs and focuses on identifying sequences as APs and determining their common difference (d).

Mastering this exercise builds a strong foundation for solving complex problems involving nth terms and sums of APs in later exercises. Understanding APs is not only crucial for academic success but also has practical applications in real-world scenarios, such as financial calculations, pattern recognition, and data analysis, making it an essential concept in both mathematics and daily life.

NCERT Solutions for Class 10 Maths Chapter 5 Exercise 5.1 Arithmetic Progressions

Below is the NCERT Solutions for Class 10 Maths Chapter 5 Exercise 5.1 Arithmetic Progressions -

1. In which of the following situations does the list of numbers involved make an arithmetic progression and why?

(i) The taxi fare after each km when the fare is Rs 15 for the first km and Rs 8 for each additional km.

Solution:

We can write the given condition as

Taxi fare for 1 km = 15

Taxi fare for first 2 kms = 15+8 = 23

Taxi fare for first 3 kms = 23+8 = 31

Taxi fare for first 4 kms = 31+8 = 39

And so on……

Thus, 15, 23, 31, 39 … forms an A.P. because every next term is 8 more than the preceding term.

(ii) The amount of air present in a cylinder when a vacuum pump removes 1/4 of the air remaining in the cylinder at a time.

Solution:

Let the volume of air in a cylinder initially be V litres.

In each stroke, the vacuum pump removes 1/4th of the remaining air in the cylinder at a time. Or we can say after every stroke, 1-1/4 = 3/4th part of the air will remain.

Therefore, volumes will be V, $3V/4$, $(3V/4)^2$, $(3V/4)^3$…and so on

Clearly, we can see here the adjacent terms of this series do not have a common difference between them. Therefore, this series is not an A.P.

(iii) The cost of digging a well after every metre of digging, when it costs Rs 150 for the first metre and rises by Rs 50 for each subsequent metre.

Solution:

We can write the given condition as;

Cost of digging a well for first metre = Rs.150

Cost of digging a well for first 2 metres = Rs.150+50 = Rs.200

Cost of digging a well for first 3 metres = Rs.200+50 = Rs.250

Cost of digging a well for first 4 metres =Rs.250+50 = Rs.300

And so on…

Clearly, 150, 200, 250, 300 … forms an A.P. with a common difference of 50 between each term.

(iv) The amount of money in the account every year, when Rs 10,000 is deposited at compound interest at 8% per annum.

Solution:

We know that if Rs. P is deposited at *r*% compound interest per annum for n years, the amount of money will be

$P(1+r/100)^n$

Therefore, after each year, the amount of money will be

$10000(1+8/100)$, $10000(1+8/100)^2$, $10000(1+8/100)^3$……

Clearly, the terms of this series do not have a common difference between them. Therefore, this is not an A.P.

2. Write the first four terms of the A.P. when the first term a, and the common difference are given as follows:

(i) *a* = 10, *d* = 10
(ii) *a* = -2, *d* = 0
(iii) *a* = 4, *d* = – 3
(iv) *a* = -1 *d* = 1/2
(v) *a* = – 1.25, *d* = – 0.25

Solutions:

(i) $a = 10$, $d = 10$

Let us consider, the Arithmetic Progression series be a_1, a_2, a_3, a_4, a_5 …

$a_1 = a = 10$

$a_2 = a_1+d = 10+10 = 20$

$a_3 = a_2+d = 20+10 = 30$

$a_4 = a_3+d = 30+10 = 40$

$a_5 = a_4+d = 40+10 = 50$

And so on…

Therefore, the A.P. series will be 10, 20, 30, 40, 50 …

And the first four terms of this A.P. will be 10, 20, 30, and 40.

(ii) $a = – 2$, $d = 0$

Let us consider, the Arithmetic Progression series be a_1, a_2, a_3, a_4, a_5 …

$a_1 = a = -2$

$a_2 = a_1+d = – 2+0 = – 2$

$a_3 = a_2+d = – 2+0 = – 2$

$a_4 = a_3+d = – 2+0 = – 2$

Therefore, the A.P. series will be – 2, – 2, – 2, – 2 …

And the first four terms of this A.P. will be – 2, – 2, – 2 and – 2.

(iii) $a = 4$, $d = – 3$

Let us consider, the Arithmetic Progression series be a_1, a_2, a_3, a_4, a_5 …

$a_1 = a = 4$

$a_2 = a_1+d = 4-3 = 1$

$a_3 = a_2+d = 1-3 = – 2$

$a_4 = a_3+d = -2-3 = – 5$

Therefore, the A.P. series will be 4, 1, – 2 – 5 …

And the first four terms of this A.P. will be 4, 1, – 2 and – 5.

(iv) $a = – 1$, $d = 1/2$

Let us consider, the Arithmetic Progression series be a_1, a_2, a_3, a_4, a_5 …

$a_2 = a_1+d = -1+1/2 = -1/2$

$a_3 = a_2+d = -1/2+1/2 = 0$

$a_4 = a_3+d = 0+1/2 = 1/2$

Thus, the A.P. series will be-1, -1/2, 0, 1/2

And First four terms of this A.P. will be -1, -1/2, 0 and 1/2.

(v) $a = – 1.25$, $d = – 0.25$

Let us consider, the Arithmetic Progression series be a_1, a_2, a_3, a_4, a_5 …

$a_1 = a = – 1.25$

$a_2 = a_1 + d$ = – 1.25-0.25 = – 1.50

$a_3 = a_2 + d$ = – 1.50-0.25 = – 1.75

$a_4 = a_3 + d$ = – 1.75-0.25 = – 2.00

Therefore, the A.P series will be 1.25, – 1.50, – 1.75, – 2.00 ……..

And the first four terms of this A.P. will be – 1.25, – 1.50, – 1.75 and – 2.00.

3. For the following A.P.s, write the first term and the common difference.
(i) 3, 1, – 1, – 3 …
(ii) -5, – 1, 3, 7 …
(iii) 1/3, 5/3, 9/3, 13/3 ….
(iv) 0.6, 1.7, 2.8, 3.9 …

Solutions

(i) Given series,

3, 1, – 1, – 3 …

The first term, *a* = 3

The common difference, *d* = Second term – First term

⇒ 1 – 3 = -2

⇒ d = -2

(ii) Given series, – 5, – 1, 3, 7 …

The first term, *a* = -5

The common difference, *d* = Second term – First term

⇒ (– 1)-(– 5) = – 1+5 = 4

(iii) Given series, 1/3, 5/3, 9/3, 13/3 ….

The first term, *a* = 1/3

The common difference, *d* = Second term – First term

⇒ 5/3 – 1/3 = 4/3

(iv) Given series, 0.6, 1.7, 2.8, 3.9 …

The first term, $a = 0.6$

The common difference, d = Second term – First term

⇒ 1.7 – 0.6

⇒ 1.1

4. Which of the following are APs? If they form an A.P., find the common difference *d* and write three more terms.

(i) 2, 4, 8, 16 …
(ii) 2, 5/2, 3, 7/2 ….
(iii) -1.2, -3.2, -5.2, -7.2 …
(iv) -10, – 6, – 2, 2 …
(v) 3, 3 + √2, 3 + 2√2, 3 + 3√2
(vi) 0.2, 0.22, 0.222, 0.2222 ….
(vii) 0, – 4, – 8, – 12 …
(viii) -1/2, -1/2, -1/2, -1/2 ….
(ix) 1, 3, 9, 27 …
(x) a, $2a$, $3a$, $4a$ …
(xi) a, a^2, a^3, a^4 …
(xii) √2, √8, √18, √32 …
(xiii) √3, √6, √9, √12 …
(xiv) 1^2, 3^2, 5^2, 7^2 …
(xv) 1^2, 5^2, 7^2, 7^3 …

Solution

(i) Given to us,

2, 4, 8, 16 …

Here, the common difference is

$a_2 – a_1 = 4 – 2 = 2$

$a_3 – a_2 = 8 – 4 = 4$

$a_4 – a_3 = 16 – 8 = 8$

$a_{n+1} – a_n$ or the common difference is not the same every time.

Therefore, the given series is not forming an A.P.

(ii) Given, 2, 5/2, 3, 7/2 ….

Here,

$a_2 - a_1$ = 5/2-2 = 1/2

$a_3 - a_2$ = 3-5/2 = 1/2

$a_4 - a_3$ = 7/2-3 = 1/2

$a_{n+1} - a_n$ or the common difference is the same every time.

Therefore, d = 1/2 and the given series are in A.P.

The next three terms are

a_5 = 7/2+1/2 = 4

a_6 = 4 +1/2 = 9/2

a_7 = 9/2 +1/2 = 5

(iii) Given, -1.2, – 3.2, -5.2, -7.2 …

Here,

$a_2 - a_1$ = (-3.2)-(-1.2) = -2

$a_3 - a_2$ = (-5.2)-(-3.2) = -2

$a_4 - a_3$ = (-7.2)-(-5.2) = -2

$a_{n+1} - a_n$ or common difference is the same every time.

Therefore, d = -2 and the given series are in A.P.

Hence, the next three terms are

a_5 = – 7.2-2 = -9.2

a_6 = – 9.2-2 = – 11.2

a_7 = – 11.2-2 = – 13.2

(iv) Given, -10, – 6, – 2, 2 …

Here, the terms and their difference are

$a_2 - a_1$ = (-6)-(-10) = 4

$a_3 – a_2$ = (-2)-(-6) = 4

$a_4 – a_3$ = (2 -(-2) = 4

$a_{n+1} – a_n$ or the common difference is the same every time.

Therefore, d = 4, and the given numbers are in A.P.

Hence, the next three terms are

a_5 = 2+4 = 6

a_6 = 6+4 = 10

a_7 = 10+4 = 14

(v) Given, 3, 3+√2, 3+2√2, 3+3√2

Here,

$a_2 – a_1$ = 3+√2-3 = √2

$a_3 – a_2$ = (3+2√2)-(3+√2) = √2

$a_4 – a_3$ = (3+3√2) – (3+2√2) = √2

$a_{n+1} – a_n$ or the common difference is the same every time.

Therefore, d = √2, and the given series forms an A.P.

Hence, the next three terms are

a_5 = (3+√2) +√2 = 3+4√2

a_6 = (3+4√2)+√2 = 3+5√2

a_7 = (3+5√2)+√2 = 3+6√2

(vi) 0.2, 0.22, 0.222, 0.2222 ….

Here,

$a_2 – a_1$ = 0.22-0.2 = 0.02

$a_3 – a_2$ = 0.222-0.22 = 0.002

$a_4 – a_3$ = 0.2222-0.222 = 0.0002

$a_{n+1} - a_n$ or the common difference is not the same every time.

Therefore, the given series doesn't form an A.P.

(vii) 0, -4, -8, -12 …

Here,

$a_2 - a_1 = (-4)-0 = -4$

$a_3 - a_2 = (-8)-(-4) = -4$

$a_4 - a_3 = (-12)-(-8) = -4$

$a_{n+1} - a_n$ or the common difference is the same every time.

Therefore, $d = -4$ and the given series forms an A.P.

Hence, the next three terms are

$a_5 = -12-4 = -16$

$a_6 = -16-4 = -20$

$a_7 = -20-4 = -24$

(viii) -1/2, -1/2, -1/2, -1/2 ….

Here,

$a_2 - a_1 = (-1/2) - (-1/2) = 0$

$a_3 - a_2 = (-1/2) - (-1/2) = 0$

$a_4 - a_3 = (-1/2) - (-1/2) = 0$

$a_{n+1} - a_n$ or the common difference is the same every time.

Therefore, $d = 0$ and the given series forms an A.P.

Hence, the next three terms are;

$a_5 = (-1/2)-0 = -1/2$

$a_6 = (-1/2)-0 = -1/2$

$a_7 = (-1/2)-0 = -1/2$

(ix) 1, 3, 9, 27 …

Here,

$a_2 - a_1 = 3-1 = 2$

$a_3 - a_2 = 9-3 = 6$

$a_4 - a_3 = 27-9 = 18$

$a_{n+1} - a_n$ or the common difference is not the same every time.

Therefore, the given series doesn't form an A.P.

(x) a, $2a$, $3a$, $4a$ …

Here,

$a_2 - a_1 = 2a-a = a$

$a_3 - a_2 = 3a-2a = a$

$a_4 - a_3 = 4a-3a = a$

$a_{n+1} - a_n$ or the common difference is the same every time.

Therefore, $d = a$ and the given series forms an A.P.

Hence, the next three terms are

$a_5 = 4a+a = 5a$

$a_6 = 5a+a = 6a$

$a_7 = 6a+a = 7a$

(xi) a, a^2, a^3, a^4 …

Here,

$a_2 - a_1 = a^2-a = a(a-1)$

$a_3 - a_2 = a^3 - a^2 = a^2(a-1)$

$a_4 - a_3 = a^4 - a^3 = a^3(a-1)$

$a_{n+1} - a_n$ or the common difference is not the same every time.

Therefore, the given series doesn't form an A.P.

(xii) √2, √8, √18, √32 …

Here,

$a_2 - a_1 = \sqrt{8}-\sqrt{2} = 2\sqrt{2}-\sqrt{2} = \sqrt{2}$

$a_3 - a_2 = \sqrt{18}-\sqrt{8} = 3\sqrt{2}-2\sqrt{2} = \sqrt{2}$

$a_4 - a_3 = 4\sqrt{2}-3\sqrt{2} = \sqrt{2}$

$a_{n+1} - a_n$ or the common difference is the same every time.

Therefore, $d = \sqrt{2}$, and the given series forms an A.P.

Hence, the next three terms are

$a_5 = \sqrt{32}+\sqrt{2} = 4\sqrt{2}+\sqrt{2} = 5\sqrt{2} = \sqrt{50}$

$a_6 = 5\sqrt{2}+\sqrt{2} = 6\sqrt{2} = \sqrt{72}$

$a_7 = 6\sqrt{2}+\sqrt{2} = 7\sqrt{2} = \sqrt{98}$

(xiii) √3, √6, √9, √12 …

Here,

$a_2 - a_1 = \sqrt{6}-\sqrt{3} = \sqrt{3}\times\sqrt{2}-\sqrt{3} = \sqrt{3}(\sqrt{2}-1)$

$a_3 - a_2 = \sqrt{9}-\sqrt{6} = 3-\sqrt{6} = \sqrt{3}(\sqrt{3}-\sqrt{2})$

$a_4 - a_3 = \sqrt{12} - \sqrt{9} = 2\sqrt{3} - \sqrt{3}\times\sqrt{3} = \sqrt{3}(2-\sqrt{3})$

$a_{n+1} - a_n$ or the common difference is not the same every time.

Therefore, the given series doesn't form an A.P.

(xiv) 1^2, 3^2, 5^2, 7^2 …

Or, 1, 9, 25, 49 …..

Here,

$a_2 - a_1 = 9-1 = 8$

$a_3 - a_2 = 25-9 = 16$

$a_4 - a_3 = 49-25 = 24$

$a_{n+1} - a_n$ or the common difference is not the same every time.

Therefore, the given series doesn't form an A.P.

(xv) 1^2, 5^2, 7^2, 73 …

Or 1, 25, 49, 73 …

Here,

$a_2 - a_1 = 25-1 = 24$

$a_3 - a_2 = 49-25 = 24$

$a_4 - a_3 = 73-49 = 24$

$a_{n+1} - a_n$ or the common difference is the same every time.

Therefore, $d = 24$ and the given series forms an A.P.

Hence, the next three terms are

$a_5 = 73+24 = 97$

$a_6 = 97+24 = 121$

$a_7 = 121+24 = 145$

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