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NCERT Solutions For Class 10 Maths Chapter 4 Quadratic Equations

4. Quadratic Equations
4.1 Introduction
4.2 Quadratic Equations
4.3 Solution Of A Quadratic Equation By Factorisation
4.4 Solution Of A Quadratic Equation By Completing The Square
4.5 Nature Of Roots
4.6 Summary

We have also solved 168 problems of Chapter 8 - Quadratic Equations from RD Sharma Class 10 maths textbook.

Formulae Handbook for Class 10 Maths and Science

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NCERT Solutions for Class 10 Maths
NCERT Solutions For Class 10 Maths Chapter 5 Arithmetic Progressions

5. Arithmetic Progressions
5.1 Introduction
5.2 Arithmetic Progressions
5.3 Nth Term Of An AP
5.4 Sum Of First N Terms Of An AP
5.5 Summary

We also solved 106 questions from Chapter 9 - Arithmetic Progressions of RD Sharma Class 10 Maths Textbook.

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

**Question-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 `15 for the first km and `8 for each additional km.
(ii) The amount of air present in a cylinder when a vacuum pump removes $\frac{1}{4}$ of the air remaining in the cylinder at a time.
(iii) The cost of digging a well after every metre of digging, when it costs `150 for the first metre and rises by `50 for each subsequent metre.
(iv) The amount of money in the account every year, when `10000 is deposited at compound interest at 8% per annum.

**Solution:**

(i) The taxi fare after each km when the fare is `15 for the first km and `8 for each additional km.
The taxi fare will be 15, 15 + 8, 15 + 16, 15 + 24, 15 + 32, 15 + 40 etc. (i.e.,) 15, 23, 31, 39, 47, 55 etc.
This is an AP as every succeeding term is obtained by adding 8 in its preceding term.

(ii) The amount of air present in a cylinder when a vacuum pump removes $\frac{1}{4}$ of the air remaining in the cylinder at a time.
Let amount of air present in the cylinder be "a".
The vacuum removes $\frac{1}{4}$ of air remaining in the cylinder.

\[ \text{a, } \frac{3a}{4}, \frac{9a}{16}, \ldots \]
This is not an AP because the difference between second term and first term is not the same as the difference between the third term and the second term.
(iii) The cost of digging a well after every metre of digging, when it costs `150 for the first metre and rises by `50 for each subsequent metre.
The cost of digging the well will be `150, `(150 + 50), `(150 + 100), `(150 + 150) etc.
(i.e.) `150, `200, `250, `300, `350 etc
This is an AP as every succeeding term is obtained by adding `50 in its preceding term.

(iv) The amount of money in the account every year, when `10000 is deposited at compound interest at 8% per annum.
Initial amount of money = `10,000
Compound Interest = 8% p.a
Amount every year increase by 8% Compound Interest p.a.
In the second year amount increases to 10,000\left(1 + \frac{8}{100}\right)
In the 3rd year amount increases to 10,000\left(1 + \frac{8}{100}\right)^2
In the 4th year amount increases to 10,000\left(1 + \frac{8}{100}\right)^3
This is not an AP as the difference is not the same in this problem.

(v) a = -1, d = \frac{1}{2}
Let a_1, a_2, a_3, a_4 be the first four terms of the A.P
Here a = a_1 = -1
a_2 = a_1 + d = -1 + \frac{1}{2} = -\frac{1}{2}
a_3 = a_2 + d = -\frac{1}{2} + \frac{1}{2} = 0
a_4 = a_3 + d = 0 + \frac{1}{2} = \frac{1}{2}
The first 4 terms of the A.P are -1, -\frac{1}{2}, 0, \frac{1}{2}.

(v) a = -1.25, d = -0.25
Let a_1, a_2, a_3, a_4 be the first four terms of the A.P
Here a = a_1 = -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) = -2.0
The first 4 terms of the A.P are -1.25, -1.50, -1.75, -2.0.

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**Question-2**

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

(i) \( a = 10, \ d = 10 \)  
(ii) \( a = -2, \ d = 0 \)  
(iii) \( a = 4, \ d = -3 \)  
(iv) \( a = -1, \ d = \frac{1}{2} \)  
(v) \( a = -1.25, \ d = -0.25 \)

**Solution:**

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

Let \( a_1, \ a_2, \ a_3, \ a_4 \) be the first four terms of the A.P.

Here \( a = a_1 = 10 \)

\( a_2 = a_1 + d = 10 + 10 = 20 \)

\( a_3 = a_2 + d = 20 + 10 = 30 \)

\( a_4 = a_3 + d = 30 + 10 = 40 \)

\( \therefore \) The first four terms of the A.P are 10, 20, 30, 40.

(ii) \( a = -2, \ d = 0 \)

Let \( a_1, \ a_2, \ a_3, \ a_4 \) be the first four terms of the A.P.

Here \( a = a_1 = -2 \)

\( a_2 = a_1 + d = -2 + 0 = -2 \)

\( a_3 = a_2 + d = -2 + 0 = -2 \)

\( a_4 = a_3 + d = -2 + 0 = -2 \)

Thus first four terms of the A.P are -2, -2, -2, -2

(iii) \( a = 4, \ d = -3 \)

Let \( a_1, \ a_2, \ a_3, \ a_4 \) be the first four terms of the A.P.

Here \( a = a_1 = 4 \)

\( a_2 = a_1 + d = 4 + (-3) = 1 \)

\( a_3 = a_2 + d = 1 + (-3) = -2 \)

\( a_4 = a_3 + d = -2 + (-3) = -5 \)

The first 4 terms of the A.P are 4, 1, -2, -5
Question-3

For the following A.Ps, write the first term and the common difference:
(i) 3, 1, -1, -3, ... (ii) -5, -1, 3, 7, ... (iii) \(\frac{1}{3}, \frac{5}{3}, \frac{9}{3}, \frac{13}{3}, \ldots\) (iv) 0.6, 1.7, 2.8, 3.9, ...

Solution:
(i) The first term is 3 and common difference = \(a_2 - a_1 = 1 - 3 = -2\).
(ii) The first term is -5 and common difference = \(a_2 - a_1 = (-1) - (-5) = 4\).
(iii) The first term is \(\frac{1}{3}\) and common difference = \(a_2 - a_1 = \frac{5}{3} - \frac{1}{3} = \frac{4}{3}\).
(iv) The first term is 0.6 and common difference = \(a_2 - a_1 = (1.7) - (0.6) = 1.1\).

Question-4

Which of the following are A.Ps? If they form an A.P, find the common difference \(d\) and write three more terms.
(i) 2, 4, 8, 16, ... (ii) 2, \(\frac{5}{2}\), 3, \(\frac{7}{2}\), ... (iii) -1, 2, -3, 2, -5, 2, -7, 2, ...
(iv) -10, -6, -2, 2, ... (v) 3, 3 + \(\sqrt{2}\), 3 + 2\(\sqrt{2}\), 3 + 3\(\sqrt{2}\), ...

Solution:
(i) 2, 4, 8, 16, ...
Here \(a_2 - a_1 = 4 - 2 = 2\)
\(a_3 - a_2 = 8 - 4 = 4\)
\(a_4 - a_3 = 16 - 8 = 8\)
Since \(a_{k+1} - a_k\) is not the same throughout, it is not an A.P.

(ii) 2, \(\frac{5}{2}\), 3, \(\frac{7}{2}\), ...
Here
\(a_2 - a_1 = \frac{5}{2} - 2 = \frac{1}{2}\)
\(a_3 - a_2 = 3 - \frac{5}{2} = \frac{1}{2}\)
\(a_4 - a_3 = \frac{7}{2} - 3 = \frac{1}{2}\)
As \(a_{k+1} - a_k\) is the same throughout, it is an A.P with first term = 2 and common difference = \(\frac{1}{2}\)
The next three terms are \(4, 4 + \frac{1}{2} = \frac{9}{2}, \frac{9}{2} + \frac{1}{2} = \frac{10}{2} = 5\).
(ii) $-1.2, -3.2, -5.2, -7.2, \ldots$
Here
\[a_2 - a_1 = -3.2 - (-1.2) = -3.2 + 1.2 = -2\]
\[a_3 - a_2 = -5.2 - (-3.2) = -2\]
\[a_4 - a_3 = -7.2 - (-5.2) = -2\]
Since $a_{k+1} - a_k$ is the same throughout it is an A.P with first term $(a) = -1.2$ and common difference, $(d) = -2$
Thus the next three terms are
\[a_5 = a_4 + d = -7.2 - 2 = -9.2\]
\[a_6 = a_5 + d = -9.2 - 2 = -11.2\]
\[a_7 = a_6 + d = -11.2 - 2 = -13.2\]

(iv) $-10, -6, -2, 2, \ldots$
Here
\[a_2 - a_1 = -6 - (-10) = 4\]
\[a_3 - a_2 = -2 - (-6) = 4\]
\[a_4 - a_3 = 2 - (-2) = 4\]
As $a_{k+1} - a_k$ is the same throughout it is an A.P with $1^\text{st}$ term as $-10$ and common difference as $4$.
Thus the next three terms are
\[a_5 = a_4 + d = 2 + 4 = 6\]
\[a_6 = a_5 + d = 6 + 4 = 10\]
\[a_7 = a_6 + d = 10 + 4 = 14\]

(v) $3, 3 + \sqrt{2}, 3 + 2\sqrt{2}, 3 + 3\sqrt{2}, \ldots$
Here
\[a_2 - a_1 = 3 + \sqrt{2} - 3 = \sqrt{2}\]
\[a_3 - a_2 = 3 + 2\sqrt{2} - (3 + \sqrt{2}) = \sqrt{2}\]
\[a_4 - a_3 = 3 + 3\sqrt{2} - (3 + 2\sqrt{2}) = \sqrt{2}\]
In this problem, $a_{k+1} - a_k$ is the same throughout thus the given list is an A.P with $1^\text{st}$ term as $3$ and common difference $(d)$ as $\sqrt{2}$.
Thus the next three terms are
\[a_5 = a_4 + d = (3 + 3\sqrt{2}) + \sqrt{2} = 3 + 4\sqrt{2}\]
\[a_6 = a_5 + d = (3 + 4\sqrt{2}) + \sqrt{2} = 3 + 5\sqrt{2}\]
\[a_7 = a_6 + d = (3 + 5\sqrt{2}) + \sqrt{2} = 3 + 6\sqrt{2}\]
Question-5

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

(i) 0.2, 0.22, 0.222, 0.2222, ...  
(ii) 0, -4, -8, -12, ...  
(iii) \(\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \ldots\)  
(iv) 1, 3, 9, 27, ...  
(y) a, 2a, 3a, 4a, ...

Solution:

(i) 0.2, 0.22, 0.222, 0.2222, ...
Here,
\[a_2 - a_1 = 0.22 - 0.2 = 0.02\]
\[a_3 - a_2 = 0.222 - 0.22 = 0.002\]
\[a_4 - a_3 = 0.2222 - 0.222 = 0.0002\]
Hence \(a_{k+1} - a_k\) is not the same throughout, hence it is not an A.P.

(ii) 0, -4, -8, -12
Here
\[a_2 - a_1 = -4 - 0 = -4\]
\[a_3 - a_2 = -8 - (-4) = -4\]
\[a_4 - a_3 = -12 - (-8) = -4\]
Here \(a_{k+1} - a_k\) is the same throughout hence it is an A.P with 1st term = 0 and common difference = -4
Thus the next three terms are
\[a_5 = a_4 + d = -12 + (-4) = -16\]
\[a_6 = a_5 + d = -16 + (-4) = -20\]
\[a_7 = a_6 + d = -20 + (-4) = -24\]

(iii) \(\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \ldots\)
Here
\[a_2 - a_1 = \frac{1}{2} - \frac{1}{2} = 0\]
\[a_3 - a_2 = \frac{1}{2} - \frac{1}{2} = 0\]
\[a_4 - a_3 = \frac{1}{2} - \frac{1}{2} = 0\]
Here \( a_{k+1} - a_k = 0 \) is the same throughout hence the list is an A.P with 1st term = \( -\frac{1}{2} \) and common difference \( d = 0 \).
Thus the next three terms are
\[
\begin{align*}
a_5 &= a_4 + d = \frac{-1}{2} + 0 = -\frac{1}{2} \\
a_6 &= a_5 + d = \frac{-1}{2} + 0 = -\frac{1}{2} \\
a_7 &= a_6 + d = \frac{-1}{2} + 0 = -\frac{1}{2}
\end{align*}
\]
(iv) 1, 3, 9, 27, ...
Here the 1st term \( a = 1 \)
\[
\begin{align*}
a_2 - a_1 &= 3 - 1 = 2 \\
a_3 - a_2 &= 9 - 3 = 6 \\
a_4 - a_3 &= 27 - 9 = 18
\end{align*}
\]
Since \( a_{k+1} - a_k \) is not the same throughout this is not an A.P.

(v) a, 2a, 3a, 4a
Here
\[
\begin{align*}
a_2 - a_1 &= 2a - a = a \\
a_3 - a_2 &= 3a - 2a = a \\
a_4 - a_3 &= 4a - 3a = a
\end{align*}
\]
Since \( a_{k+1} - a_k \) is the same throughout this is an A.P with first term = \( a \) and common difference = \( a \)
Thus the next three terms are
\[
\begin{align*}
a_5 &= a_4 + d = 4a + a = 5a \\
a_6 &= a_5 + d = 5a + a = 6a \\
a_7 &= a_6 + d = 6a + a = 7a
\end{align*}
\]
Which of the following are A.Ps? If they form an A.P, find the common difference \(d\) and write three more terms.

(i) \(a, a^2, a^3, a^4, \ldots\)  
(ii) \(\sqrt{2}, \sqrt{6}, \sqrt{18}, \sqrt{32}, \ldots\)  
(iii) \(\sqrt{5}, \sqrt{6}, \sqrt{7}, \sqrt{8}, \ldots\)  
(iv) \(1^{2}, 3^{2}, 5^{2}, 7^{2}, \ldots\)  
(v) \(1^{2}, 5^{2}, 7^{2}, 73, \ldots\)

**Solution:**

(i) \(a, a^2, a^3, a^4, \ldots\)

Here

\[a_2 - a_1 = a^2 - a = a(a - 1)\]
\[a_3 - a_2 = a^3 - a^2 = a^2(a - 1)\]
\[a_4 - a_3 = a^4 - a^3 = a^3(a - 1)\]

Since \(a_{k+1} - a_k\) is not the same throughout this is not an A.P.

(ii) \(\sqrt{2}, \sqrt{6}, \sqrt{18}, \sqrt{32}, \ldots\)

Here

\[a_2 - a_1 = \sqrt{6} - \sqrt{2} = 2\sqrt{2} - \sqrt{2} = \sqrt{2}\]
\[a_3 - a_2 = \sqrt{18} - \sqrt{6} = 3\sqrt{2} - 2\sqrt{2} = \sqrt{2}\]
\[a_4 - a_3 = \sqrt{32} - \sqrt{18} = 4\sqrt{2} - 3\sqrt{2} = \sqrt{2}\]

Since \(a_{k+1} - a_k\) is the same throughout it is an A.P with the first term as \(\sqrt{2}\) and common difference \(d = \sqrt{2}\).

Thus the next three terms are

\[a_5 = a_4 + d = 5\sqrt{2} + \sqrt{2} = 6\sqrt{2}\]
\[a_6 = a_5 + d = 6\sqrt{2} + \sqrt{2} = 7\sqrt{2}\]
\[a_7 = a_6 + d = 7\sqrt{2} + \sqrt{2} = 8\sqrt{2}\]

(iii) \(\sqrt{5}, \sqrt{6}, \sqrt{7}, \sqrt{8}\)

Here

\[a_2 - a_1 = \sqrt{6} - \sqrt{5} = \sqrt{5} (\sqrt{2} - 1)\]
\[a_3 - a_2 = \sqrt{7} - \sqrt{6} = 3 (\sqrt{2} - 1)\]
\[a_4 - a_3 = \sqrt{8} - \sqrt{7} = 2 (\sqrt{2} - 1)\]

Here \(a_{k+1} - a_k\) is not the same throughout hence the list is not an A.P.
(iv) $1^2, 3^2, 5^2, 7^2$

Here

\[ a_2 - a_1 = 3^2 - 1^2 = 9 - 1 = 8 \]
\[ a_3 - a_2 = 5^2 - 3^2 = 25 - 9 = 16 \]
\[ a_4 - a_3 = 7^2 - 5^2 = 49 - 25 = 24 \]

Since $a_{k+1} - a_k$ is not the same throughout hence the list not an A.P.

(v) $1^2, 5^2, 7^2, 73, ...$

Here

\[ a_2 - a_1 = 5^2 - 1^2 = 25 - 1 = 24 \]
\[ a_3 - a_2 = 7^2 - 5^2 = 49 - 25 = 24 \]
\[ a_4 - a_3 = 73 - 7^2 = 73 - 49 = 24 \]

Since $a_{k+1} - a_k = 24$ is the same throughout this list is an A.P. with first term $= 1^2$ and common difference $= 24$.

Thus the next three terms are

\[ a_5 = a_4 + d = 73 + 24 = 97 \]
\[ a_6 = a_5 + d = 97 + 24 = 121 \]
\[ a_7 = a_6 + d = 121 + 24 = 145 \]
Fill in the blanks in the following table, given that $a$ is the first term, $d$ the common difference and $a_n$, the $n^{th}$ term of the A.P:

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<td>3</td>
<td>8</td>
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<tr>
<td>(ii)</td>
<td>18</td>
<td></td>
<td>10</td>
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<tr>
<td>(iii)</td>
<td>-3</td>
<td>18</td>
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<td>(iv)</td>
<td>-18.9</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>(v)</td>
<td>3.5</td>
<td>0</td>
<td>105</td>
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**Solution:**

(i) $a = 7, d = 3, n = 8, a_n = \ ?$

$a_n = a + (n - 1) \times d = 7 + (8 - 1) \times 3$

$= 7 + 7 \times 3 = 21 + 21 = 28.$

(ii) $a = 18$

$n = 10, a_n = 0, d = \ ?$

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

$0 = 18 + (10 - 1) \times d$

$0 = 18 + 9 \times d$

$0 = 18 + 9d$

$9d = 18$

$d = 2.$

(iii) $a = \ ?, d = -3, n = 18, a_n = -5$

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

$-5 = a + (18 - 1) \times (-3)$

$-5 = a + 17 \times (-3)$

$-5 = a + 51$

$a = 51 - 5 = 46.$

(iv) $a = -18.9$

$d = 2.5, a_n = 3.6, n = \ ?$

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

$3.6 = -18.9 + (n - 1) \times 2.5$

$(n - 1) \times 2.5 = 3.6 + 18.9$

$(n - 1) = \frac{22.5}{2.5} = \frac{225}{25}$

$= n - 1 = 9$

$\therefore n = 10.$

(v) $a = 3.5, d = 0, n = 105$

$a_n = \ ?$

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

$= 3.5 + (105 - 1) \times 0$

$a_n = 3.5.$

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Choose the correct choice in the following and justify:

(i) 30th term of the A.P: 10, 7, 4, ..., is
(A) 97 (B) 77 (C) -77 (D) -87

(ii) 11th term of the A.P: -3, -\frac{1}{2}, 2, ..., is
(A) 28 (B) 22 (C) -38 (D) -48 \frac{1}{2}

Solution:

(i) 30th term of the A.P: 10, 7, 4, ..., is

n^{th} term = a + (n - 1)d, where n = 30

30^{th} term = 10 + (30 - 1) \times (-3)
= 10 + (29 \times -3)
= 10 - 87 = -77

(C) is the correct answer.

(ii) 11th term of the A.P: -3, -\frac{1}{2}, 2, ..., is

Here n = 11, a = -3

d = -\frac{1}{2} - (-3)
= -\frac{1}{2} + 3
= \frac{5}{2} = 2 \frac{1}{2}

a_n = a + (n - 1)d

a_{11} = -3 + (11 - 1) \times (2 \frac{1}{2})
= -3 + 10 \times \frac{5}{2}
= -3 + 25 = 22

(B) is the correct answer.
In the following A.Ps, find the missing terms in the boxes:

(i) 2, □ , 26 (ii) □, 13, □, 3 (iii) 5, □, □, 9\frac{1}{2} 
(iv) -4, □, □, □, 6 (v) □, 38, □, □, □, -22

**Solution:**

(i) Let x be the missing term

\[ x - 2 = 26 - x \]
\[ 2x = 28 \]
\[ x = 14 \]

∴ Missing term = 14

(ii) □, 13, □, 3

Let missing term in 1\textsuperscript{st} box be x, missing term in the 2\textsuperscript{nd} box be y,

\[ 13 - x = y - 13 = 3 - y \]

Now, considering the last two,

\[ y - 13 = 3 - y \]
\[ 2y = 16 \]
\[ y = 8 \]

The value of y = 8.

Here 13 - x = y - 13

\[ \Rightarrow 13 - x = 8 - 13 \]
\[ x = 26 - 8 = 18. \]
(iii) \(5, \frac{9}{2}, 9\frac{1}{2}\)

Here \(a = 5, a_4 = 9\frac{1}{2}, n = 4, d = ?\)

\[a_n = a + (n-1) \times d\]
\[9\frac{1}{2} = 5 + (4 - 1) \times d\]
\[\frac{19}{2} = 5 + 3d\]

\[3d = \frac{19}{2} - 5 = \frac{19 - 10}{2} = \frac{9}{2}\]
\[d = \frac{9}{2} \times \frac{1}{3} = \frac{3}{2}\]

\. If \(a_1 = 5\)

\[a_2 = a_1 + d = 5 + \frac{3}{2} = \frac{10 + 3}{2} = \frac{13}{2} = 6\frac{1}{2}\]
\[a_3 = 6\frac{1}{2} + \frac{3}{2} = 8\]

(iv) \(-4, \text{ }, \text{ }, \text{ }, \text{ }, \text{ }, 6\)

\[a_n = 6\]
\[a = -4\]
\[d = ?\]

\[a_n = a + (n-1) \times d\]
\[6 = -4 + (6 - 1) \times d\]
\[6 = -4 + 5d\]
\[5d = 6 + 4 = 10\]
\[d = \frac{10}{5} = 2\]

\. \(-4, -2, 0, 2, 4, 6\) is the A.P series.

(v) \(38, \text{ }, \text{ }, \text{ }, \text{ }, -22\)

\[a_2 = 38, n = 6, a_6 = -22\]

\[a_n = a + (n-1) \times d\] if \(n = 6,\)

\[-22 = a + 5d \quad \ldots \ldots \quad (1)\]

If \(n = 2,\)

\[38 = a + d \quad \ldots \ldots \quad (2)\]

\[-(2) \rightarrow 4d = -60\]
\[d = \frac{-60}{4} = -15\]

Thus \(a_2 = a + d = a + (-15)\)

\[38 = a - 15\]
\[a = 38 + 15 = 53\]

\[a_3 = 38 + (15) = 23\]
\[a_4 = 23 + (-15) = 8\]
\[a_5 = 8 + (-15) = -7\]

\. \(53, 38, 23, 8, -7, -22\) is the A.P series.
Which term of the A.P: 3, 8, 13, 18, ... is 78

Solution:
Let 78 be the nth term
Here \(a = 3\)
\(d = 5\), \(a_n = 78\)
\(a_n = a + (n - 1) \times d\)
\(78 = 3 + (n - 1) \times 5\)
\(78 - 3 = (n - 1) \times 5\)
\(75 = (n - 1) \times 5\)
\(\frac{75}{5} = (n - 1)\)
\(n - 1 = 15\)
\(n = 16\)
78 is the 16th term.

Find the number of terms in each of the following A.Ps:
(i) 7, 13, 19, ..., 205 (ii) 18, 15 1/2, 13, ..., 47

Solution:
(i) Let the number of terms be \(n\)
Here \(a = 7\), \(d = 6\), \(a_n = 205\)
\(a_n = a + (n - 1) d\)
\(205 = 7 + (n - 1) \times 6\)
\((n - 1) \times 6 = 205 - 7\)
\(n - 1 = \frac{198}{6}\)
\(n = 33 + 1 = 34\)
\(\therefore\) Number of terms = 34.

(ii) 18, 15 1/2, 13, ..., 47
Here \(a = 18\)
\(d = 18 - 15 1/2 = -2 1/2\)
\(a_n = -47\)
Let the number of terms be \(n\)
\(a_n = a + (n - 1) d\)
\(-47 = 18 + (n - 1) (-2 1/2)\)
\(-47 - 18 = (n - 1) \left(-\frac{5}{2}\right)\)
\(-65 \times \left(-\frac{2}{5}\right) = (n - 1)\)
\(26 + 1 = n\)
\(\therefore\) Number of terms = 27
Question-12

Check whether \(-150\) is a term of the A.P: 11, 8, 5, 2 ........

Solution:
Here \(a = 11, d = -3\)
If \(a_n = -150\) be the \(n^{th}\) term of the A.P
\(a_n = a + (n - 1) \times d\)
\(-150 = 11 + (n - 1) \times (-3)\)
\(-150 - 11 = (n - 1) \times (-3)\)
\(-161 = (n - 1)\)
\(n = \frac{-161}{-3} \times 1 = \frac{53}{3} + 1\)
which is not a whole number
\(\therefore -150\) is not a term of the A.P.

Find the 31\(^{st}\) term of an A.P whose 11\(^{th}\) term is 38 and the 16\(^{th}\) term is 73.

Solution:
11\(^{th}\) term is 38 and
16\(^{th}\) term is 73
\(a_{11} = 38 = a + 10d \) ..............(1)
\(a_{16} = 73 = a + 15d \) ..............(2)
\(a + 10d = 38\)
\(a + 15d = 73\)
\(-5d = -35\)
\(d = 7\)
sub \(d = 7\) in (1)
\(a + 10 \times 7 = 38\)
a + 70 = 38
\(a = -32\)
Thus 31\(^{st}\) term = \(a + (31 - 1) \times d\)
\(= -32 + 30 \times 7\)
\(= -32 + 210\)
\(= 178.\)
Find the 31\textsuperscript{st} term of an A.P whose 11\textsuperscript{th} term is 38 and the 16\textsuperscript{th} term is 73.

**Solution:**

11\textsuperscript{th} term is 38 and 
16\textsuperscript{th} term is 73  
\[ a_{11} = 38 = a + 10d \] \quad (1)  
\[ a_{16} = 73 = a + 15d \] \quad (2)  
\[ a + 10d = 38 \]  
\[ a + 15d = 73 \]  
\[ -5d = -35 \]  
\[ d = 7 \]  
\[ \text{sub} \ d = 7 \text{ in (1)} \]  
\[ a + 10(7) = 38 \]  
\[ a + 70 = 38 \]  
\[ a = -32 \]  
Thus 31\textsuperscript{st} term = \[ a + (31 - 1) \times d \]  
\[ = -32 + 30 \times 7 \]  
\[ = -32 + 210 \]  
\[ = 178. \]  

An A.P consists of 50 terms of which 3\textsuperscript{rd} term is 12 and the last term is 106. Find the 29\textsuperscript{th} term.

**Solution:**

3\textsuperscript{rd} term is \[ a_3 = a + (3 - 1)d = 12 \] \quad (1)  
50\textsuperscript{th} term is \[ a_{50} = a + (50 - 1)d = 106 \] \quad (2)  
\[ (1) \implies a + 2d = 12 \] \quad (3)  
\[ (2) \implies a + 49d = 106 \] \quad (4)  
\[ (3) - (4) \implies 47d = 94 \]  
\[ d = 2 \]  

\[ \text{sub} \ d = 2 \text{ in (3)} \]  
\[ a + 2(2) = 12 \]  
\[ a = 12 - 4 = 8 \]  
\[ \therefore \ 29\textsuperscript{th} \text{ term of an A.P is } a + (29 - 1)d \] \quad (5)  

Substituting for \( a = 8 \) and \( d = 2 \) in (5),  
\[ a + 28d = 8 + 28 \times 2 \]  
\[ = 8 + 56 \]  
\[ = 64. \]
The 17th term of an A.P exceeds its 10th term by 7. Find the common difference.

**Solution:**
17th term of the A.P = \( a + (17 - 1)d \)
\[ = a + 16d \] \[ \quad \text{(1)} \]
10th term of the A.P = \( a + (10 - 1)d = a + 9d \) \[ \quad \text{(2)} \]
Given (1) exceeds (2) by 7
\[ [a + 16d] - [a + 9d] = 7 \]
16d - 9d = 7
7d = 7
\[ d = 1 \]

If the 3rd and the 9th terms of an A.P are 4 and -8 respectively, which term of this A.P is zero?

**Solution:**
3rd term of the A.P is \( a + (3 - 1)d = 4 \)
(i.e.,) \( a + 2d = 4 \) \[ \quad \text{(1)} \]
9th term of the A.P is \( a + (9 - 1)d = -8 \)
\[ a + 8d = -8 \] \[ \quad \text{(2)} \]
\[ a + 2d = 4 \] \[ \quad \text{(1)} \]
\[ a + 8d = -8 \] \[ \quad \text{(2)} \]
\[ (1) - (2) \Rightarrow 6d = 12 \]
d = -2
substituting \( d = -2 \) in (1) \[ a - 4 = 4 \]
a = 8
Let the \( n \)th term be 0 then \( a + (n - 1) d = 0 \)
(i.e.,) \( 8 + (n - 1)(-2) = 0 \)
\[ -2n + 2 = -8 \]
\[ -2n = -10 \]
\[ n = 5 \]
Thus \( n = 5 \). Hence the 5th term is zero.
Which term of the A.P: 3, 15, 27, 39, … will be 132 more than its 54th term?

Solution:
54th term of the A.P is \( a + (54 - 1)d \)
Here \( a = 3 \)
\( d = a_2 - a_1 = 15 - 3 = 12 \)
\( \therefore 54^{th} \text{ term} = 3 + (54 - 1) \times 12 \)
\( = 3 + 53 \times 12 \)
\( = 3 + 636 = 639 \)
132 more than 54th term = 639 + 132 = 771
To find out which term of the A.P is 771, let us assume it is the \( n^{th} \) term
\( a + (n - 1) \times d = 771 \)
substituting for \( a = 3 \) and \( d = 12 \)
\( 3 + (n - 1) \times 12 = 771 \)
\( (n - 1) \times 12 = 771 - 3 \)
\( (n - 1) = \frac{768}{12} = 64 \)
\( n = 65 \)
Hence the 65th term is 132 more than its 54th term.

Two A.Ps have the same common difference. The difference between their 100th terms is 100, what is the difference between their 1000th terms?

Solution:
Let \( a_1 \) and \( a_2 \) be the 1st term of the 2 A.Ps and "d" be the common difference.
100th term of 1st A.P = \( a_1 + (100 - 1)d \) ....................... (1)
100th term of 2nd A.P = \( a_2 + (100 - 1)d \) ....................... (2)
Difference between (1) and (2) = 100
\( a_1 + 99d - (a_2 + 99d) = 100 \)
(i.e.,) \( a_1 - a_2 = 100 \) ...................... (3)
Difference between then 1000th terms = \( (a_1 + 999d) - (a_2 + 999d) \)
\( = a_1 - a_2 = 100 \) (from (3))
Thus the difference between their 1000th terms = 100.
How many three-digit numbers are divisible by 7?

Solution:
The list of 3 digit numbers divisible by 7 are 105, 112, 119, ..., 994.
This is an A.P. with \( a = 105 \), \( d = 7 \)

\[ a_n = 994 \]
\[ \therefore 994 = a + (n - 1) \times d \]
\[ = 105 + (n - 1) \times 7 \]
\[ 7(n - 1) = 994 - 105 \]
\[ = 889 \]
\[ n - 1 = \frac{889}{7} = 127 \]
\[ n = 128 \]
Thus the number of three-digit numbers divisible by 7 are 128.

How many multiples of 4 lie between 10 and 250?

Solution:
Multiples of 4 between 10 and 250 are 12, 16, 20, ..., 248.
Here
\( a = 12 \)
\( d = 4 \)
\( a_n = 248 \)
\[ \therefore 248 = 12 + (n - 1) \times 4 \]
\[ (n - 1) \times 4 = 248 - 12 \]
\[ (n - 1) = \frac{236}{4} \]
\[ n = 59 + 1 \]
\[ = 60 \]
\[ \therefore \] Number of multiples of 4 between 10 and 250 = 60.
For what value of \( n \), are the \( n^{th} \) terms of two A.Ps: 63, 65, 67, ..., and 3, 10, 17, ..., equal?

**Solution:**

\( n^{th} \) term of the 1\(^{st} \) A.P. = \( a + (n - 1) \times d \)
Here \( a = 63, d = 2 \)
\[ 63 + (n - 1) \times 2 \quad \text{..................(1)} \]

\( n^{th} \) term of the 2\(^{nd} \) A.P. = \( a + (n - 1) \times d \)
Here \( a = 3, d = 7 \)
\[ 3 + (n - 1) \times 7 \quad \text{..................(2)} \]
\[ 63 + (n - 1) \times 2 = 3 + (n - 1) \times 7 \quad \text{(Given)} \]
\[ 63 - 3 = 7n - 7 - 2n + 2 \]
\[ 60 + 5 = 5n \]
\[ 5n = 65 \]
\[ n = \frac{65}{5} = 13. \]

13\(^{th} \) term of the 2 A.Ps are equal.

Determine the A.P whose third term is 16 and the 7\(^{th} \) term exceeds the 5\(^{th} \) term by 12.

**Solution:**

3\(^{rd} \) term = \( a + (3 - 1) \times d \)
\[ = a + 2d = 16 \quad \text{...............(1)} \]

7\(^{th} \) term = \( a + 6d \)
5\(^{th} \) term = \( a + 4d \)
Given \( (a + 6d) - (a + 4d) = 12 \)
\[ 2d = 12 \Rightarrow d = 6 \]
substitute \( d = 6 \) in (1)
\[ a + 2(6) = 16 \]
\[ a + 12 = 16 \]
\[ a = 16 - 12 = 4. \]
\[ a = 4, d = 6 \]
\[ \therefore \text{The A.P is } 4, 10, 16, ... \]
Find the 20\(^{th}\) term from the last term of the A.P: 3, 8, 13, ..., 253.

**Solution:**
Here
\(a = 3, d = 5\)
Last term of the A.P is 253
Let 253 be the \(n^{th}\) term of A.P
\(n^{th}\) term = \(a + (n - 1) \times d\)
\[= 3 + 5(n - 1)\]
5\(n\) - 5 = 250
5\(n\) = 255
\(n\) = 51
\(\therefore\) 253 is the 51\(^{st}\) term.
20\(^{th}\) term from the 51\(^{st}\) term is 32\(^{nd}\) term
32\(^{nd}\) term = \(a + (32 - 1)d\)
\[= 3 + 31 \times 5\]
\[= 3 + 155\]
\[= 158.\]

The sum of the 4\(^{th}\) and 8\(^{th}\) terms of an A.P is 24 and the sum of the 6\(^{th}\) and 10\(^{th}\) terms is 44. Find the first three terms of the A.P.

**Solution:**
4\(^{th}\) term = \(a + 3d\)
8\(^{th}\) term = \(a + 7d\)
Sum of the 4\(^{th}\) term and 8\(^{th}\) term = \(a + 3d + a + 7d = 24\)
\[= 2a + 10d = 24\]
\[a + 5d = 12\] \((1)\)
Sum of 6\(^{th}\) term and 10\(^{th}\) term = 44
\[= a + 5d + a + 9d = 44\]
2\(a + 14d = 44\)
a + 7d = 22 \((2)\)
a + 5d = 12 \((1)\)
a + 7d = 22 \((2)\)
subtracting (1) - (2) \(= 2d = 10\)
d = 5
substituting d = 5 in (1)
a + 5d = 12
a + 5(5) = 12
a = 12 - 25 = -13.
\(\therefore\) The 1\(^{st}\) 3 terms are -13, -13 + 5, -13 + 10
(i.e.) -13, -8, -3
Subba Rao started work in 1995 at an annual salary of ₹5000 and received an increment of ₹200 each year. In which year did his income reach ₹7000?

Solution:
Annual salary = ₹5000
Increment = ₹200
Total salary after n years = ₹7000
If the A.P. was of the form 5000, 5200, 5400, ...
When 1st term a = 5000, d = 200
nth term = a + (n − 1) d = 7000
= 5000 + (n − 1) × 200 = 7000
200(n − 1) = 7000 − 5000 = 2000
∴ (n − 1) = \frac{2000}{200}
n = 10 + 1
His income reached ₹7000 in the 11th year

Ramkali saved ₹5 in the first week of a year and then increased her weekly savings by ₹1.75. If in the nth week, her weekly savings become ₹20.75, find n.

Solution:
Here
a = 5
d = 1.75
In the nth week savings = 5 + 1.75(n − 1) = 20.75

1.75(n − 1) = 20.75 − 5
n − 1 = \frac{15.75}{1.75}
n − 1 = 9
n = 10

NCERT Solutions For Class 10 Chapter 5 Maths Arithmetic Progressions Exercise 5.3
In an A.P:
(i) Given \( a = 5, \ d = 3, \ a_n = 50, \) find \( n \) and \( S_n. \)
(ii) Given \( a = 7, \ a_{13} = 35, \) find \( d \) and \( S_{13}. \)
(iii) Given \( a_{12} = 37, \ d = 3, \) find \( a \) and \( S_{12}. \)
(iv) Given \( a_3 = 15, \ S_{10} = 125, \) find \( d \) and \( a_{10}. \)
(v) Given \( d = 5, \ S_9 = 75, \) find \( a \) and \( a_9. \)

Solution:
(i) Given \( a = 5, \ d = 3, \ a_n = 50, \) find \( n \) and \( S_n. \)
\[
a = 5, \ d = 3, \ a_n = 50
\]
\[
n = \frac{1 - a}{d} \cdot 1 = \frac{50 - 5}{3} = \frac{45}{3} = 15
\]
\[
S_n = \frac{n}{2} [a + l]
\]
\[
S_{15} = \frac{15}{2} [5 + 50] = 8 \times 55 = 440.
\]
Thus \( n = 15 \) and \( S_{15} = 440. \)

(ii) Given \( a = 7, \ a_{13} = 35, \) find \( d \) and \( S_{13}. \)
\[
a = 7, \ d = 35 \text{ find } d \text{ and } S_{13}
\]
\[
a = 7, \ l = 35, \ n = 13
\]

We know that \( n = \frac{1 - a}{d} \cdot 1 \)
\[
13 = \frac{35 - 7}{d} \cdot 1
\]
\[
13 - 1 = \frac{28}{d}
\]
\[
\therefore d = \frac{28}{13} = \frac{7}{3}
\]
\[
S_{13} = \frac{13}{2} [7 + 35]
\]
\[
= \frac{13}{2} \times 42 = 273.
\]
Thus \( d = \frac{7}{3} \) and \( S_{13} = 273. \)
(iii) Given \(a_{12} = 37, d = 3\), find \(a\) and \(S_{12}\).

\[
\begin{align*}
a_{12} &= l = 37, \quad d = 3, \\
n &= 12, \quad a = ?
\end{align*}
\]

\[
\begin{align*}
n &= \frac{l - a}{d} + 1 \\
12 &= \frac{37 - a}{3} + 1 \\
\frac{37 - a}{3} &= 12 - 1 \\
37 - a &= 11 \times 3 \\
-a &= 33 - 37 = -4 \\
\therefore \quad a &= 4
\end{align*}
\]

\[
\begin{align*}
S_n &= \frac{n}{2}[2a + (n - 1)d] \\
S_{12} &= \frac{12}{2}[4 + 37] \\
&= \frac{12}{2} \times 41 = 246
\end{align*}
\]

Thus \(a = 4\) and \(S_{12} = 246\).

(iv) Given \(a_3 = 15, S_{10} = 125\), find \(d\) and \(a_{10}\).

\[
\begin{align*}
a_3 &= 15, \quad S_{10} = 125 \\
a + 2d &= 15 \quad \text{................. (1)} \\
S_{10} &= 125 \\
\Rightarrow \frac{10}{2} [2a + 9d] &= 125 \\
\Rightarrow 5 (2a + 9d) &= 125 \\
2a + 9d &= \frac{125}{5} = 25
\end{align*}
\]

\[
\begin{align*}
2a + 9d &= 25 \quad \text{................. (2)} \\
(1) \times 2 \Rightarrow 2a + 4d &= 30 \quad \text{.....(3)}
\end{align*}
\]

Subtracting (2) from (3) we get:

\[-5d = 5 \quad \therefore \quad d = -1
\]
Substituting \( d = -1 \) in (1), we get,
\[
\begin{align*}
  a + 2d &= 15 \\
  a + 2(-1) &= 15 \\
  a &= 17 \\
  a_{10} &= a + 9d = 17 + 9(-1) \\
         &= 17 - 9 = 8.
\end{align*}
\]
Thus \( d = -1 \) and \( a_{10} = 8 \).

(v) Given \( d = 5 \), \( S_9 = 75 \), find \( a \) and \( a_9 \).
\[
S_9 = 75, \ n = 9 \\
a_n = a + (n - 1)d \\
a_9 = a + 8 \times 5 \Rightarrow a_9 = 40 + a \quad \text{(1)}
\]
\[
S_n = \frac{n}{2}[2a + (n - 1)d] \\
S_9 = \frac{9}{2}[2a + (9 - 5)] = 75 \\
2a + 40 = 75 \times \frac{2}{9} \quad \text{(2)}
\]
\[
2a = \frac{50}{3} - 40 \\
2a = \frac{50 - 120}{3} = \frac{-70}{3} \\
a = \frac{-70}{3 \times 2} = \frac{-35}{3}
\]
Substituting \( a = \frac{-35}{3} \) in (1), we get,
\[
a_9 = 40 + \left( \frac{-35}{3} \right) = \frac{120 - 35}{3} = \frac{85}{3}
\]
Thus \( a = \frac{-35}{3} \) and \( a_9 = \frac{85}{3} \).
In an A.P:
(i) Given \(a = 2, \ d = 8, \ S_n = 90\), find \(n\) and \(a_n\).
(ii) Given \(a = 8, \ a_n = 62, \ S_n = 210\), find \(n\) and \(d\).
(iii) Given \(a_n = 4, \ d = 2, \ S_n = -14\), find \(n\) and \(a\).
(iv) Given \(a = 3, \ n = 8, \ S = 192\), find \(d\).
(v) Given \(l = 28, \ S = 144\), and there are total 9 items. Find \(a\).

Solution:
(i) Given \(a = 2, \ d = 8, \ S_n = 90\), find \(n\) and \(a_n\).
\(a = 2, \ d = 8\)
\(S_n = 90\), find \(n\) and \(a_n\)
\[
S_n = \frac{n}{2} [2a + (n - 1)d]
\]
\[
= \frac{n}{2} [2(2) + (n - 1)8]
\]
\[
= \frac{n}{2} [4 + 8n - 8]
\]

But \(S_n = 90\),
\[
=> n[8n - 4] = 90 \times 2
\]
\(8n^2 - 4n - 180 = 0\)
Dividing throughout by 4, we get
\(2n^2 - n - 45 = 0\)
\(2n^2 - 10n + 9n - 45 = 0\)
\(2n(n - 5) + 9(n - 5) = 0\)
\(\therefore (2n + 9)(n - 5) = 0\)
\(n = 5 \) (or) \(n = -\frac{9}{2}\)
\(\therefore\) Number of terms could be positive only, thus
\(n = 5\), and \(n = -\frac{9}{2}\) not possible
\(\therefore a_n = [a + (n - 1) \times d]\)
\(a_n = [2 + (5 - 1) \times 8] = 2 + 32 = 34\).
Thus \(n = 5\) and \(a_n = 34\).
In an A.P:
(i) Given \( a = 2, \ d = 8, \ S_n = 90 \), find \( n \) and \( a_n \).
(ii) Given \( a = 8, \ a_n = 62, \ S_n = 210 \), find \( n \) and \( d \).
(iii) Given \( a_n = 4, \ d = 2, \ S_n = -14 \), find \( n \) and \( a \).
(iv) Given \( a = 3, \ n = 8, \ S = 192 \), find \( d \).
(v) Given \( l = 28, \ S = 144 \), and there are total 9 items. Find \( a \).

**Solution:**

(i) Given \( a = 2, \ d = 8, \ S_n = 90 \), find \( n \) and \( a_n \).

\[
a = 2, \ d = 8 \\
S_n = 90, \ \text{find } n \ \text{and } a_n \\
S_n = \frac{n}{2} \left[ 2a + (n - 1)d \right] \\
= \frac{n}{2} \left[ 2(2) + (n - 1)8 \right] \\
= \frac{n}{2} \left[ 4 + 8n - 8 \right] \\
= \frac{n}{2} \left[ 8n - 4 \right] \\
But \ S_n = 90, \\
\implies \frac{n}{2} \left[ 8n - 4 \right] = 90 \times 2 \\
8n^2 - 4n - 180 = 0 \\
Dividing throughout by 4, we get \\
2n^2 - n - 45 = 0 \\
2n^2 - 10n + 9n - 45 = 0 \\
2n(n - 5) + 9(n - 5) = 0 \\
\implies (2n + 9)(n - 5) = 0 \\
\implies n = 5 \ \text{or} \ n = \frac{-9}{2} \\
\therefore \ \text{Number of terms could be positive only, thus} \\
n = 5, \ \text{and } n = \frac{-9}{2} \ \text{not possible} \\
\therefore a_n = [a + (n - 1) \times d] \\
a_n = [2 + (5 - 1) \times 8] = 2 + 32 = 34. \\
\text{Thus } n = 5 \ \text{and } a_n = 34.
(ii) Given $a = 8$, $a_n = 62$, $S_n = 210$, find $n$ and $d$.
Here, $a = 8$, $a_n = 62$, $S_n = 210$
Now we have to find $n$ and $d$,
\[ a_n = a + (n - 1) \times d \]
\[ = 8 + (n - 1) \times d \]
\[ (n - 1) \times d = 62 - 8 = 54 \]
\[ \therefore \frac{S_n}{n} = \frac{n}{2} [2a + (n - 1) \times d] \]
\[ 210 = \frac{n}{2} [2 \times 8 + (n - 1) \times d] \]
\[ 420 = n[16 + (n - 1) \times d] \]
Substituting for $(n - 1) \times d = 54$ from (1) in (2)
\[ 420 = n[16 + 54] \]
\[ \therefore \frac{n}{70} = 6 \]
Substitute $n = 6$ in (1), we get,
\[ (n - 1) \times d = 54 \]
\[ (6 - 1) \times d = 54 \]
\[ 5d = 54 \]
\[ d = \frac{54}{5} \]
Thus $n = 6$ and $d = \frac{54}{5}$.

(iii) Given $a_n = 4$, $d = 2$, $S_n = -14$, find $n$ and $a$.
Here, $a_n = 4$, $d = 2$, $S_n = -14$.
\[ a_n = a + (n - 1) \times d \]
\[ 4 = a + 2(n - 1) \]
\[ \Rightarrow a = 4 - [2(n - 1)] \]
\[ S_n = \frac{n}{2} [2a + (n - 1) \times d] \]
\[ -14 = \frac{n}{2} [2a + 2(n - 1)] \]
\[ = \frac{5n}{2} [a + (n - 1)] \]

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Substitute \( a = 4 - [2(n-1)] \) from (1)

\[-14 = n[4 - 2(n - 1) + (n - 1)]\]
\[-14 = n[4 - (n - 1)]\]
\[= 4n - n^2 + n\]
\[n^2 - 5n - 14 = 0\]
\[n^2 - 7n + 2n - 14 = 0\]
\[n(n - 7) + 2(1 - 7) = 0\]
\[(n - 7)(n+2) = 0\]
\[n = 7, n = -2\]

Number of terms cannot be negative thus \( n = 7, 9; 9;\)
Substitute \( n = 7 \) in (1), we get,
\[a = 4 - [2(7 - 1)]\]
\[= 4 - (2 \times 6)\]
\[= 4 - 12 = -8\]
\[n = 7, a = -8\]
Thus \( n = 7 \) and \( a = -8.\)

(iv) Given \( a = 3, n = 8, S = 192, \) find \( d.\)
\[S_n = \frac{n}{2}[2a + (n - 1)d]\]
\[192 = \frac{8}{2}[(2 \times 3) + (8 - 1)d]\]
\[192 = 4[(2 \times 3) + (8 - 1)d]\]
\[192 = 4(6 + (8 - 1)d)\]
\[6 + 7d = \frac{192}{4}\]
\[6 + 7d = 48\]
\[7d = 42\]
\[d = \frac{42}{7} = 6\]
Thus \( d = 6.\)

(v) Given \( l = 28, S = 144, \) and there are total 9 items. Find \( a.\)
\[l = 28, S = 144, n = 9, a = ?\]
\[S = \frac{n}{2} (a+l)\]
\[144 = \frac{9}{2}(a + 28)\]
\[144 \times \frac{2}{9} = a + 28\]
\[32 = a + 28\]
\[a = 4\]
Hence \( a = 4.\)
How many terms of the A.P: 9, 17, 25, ... must be taken to give a sum of 636?

**Solution:**
The given A.P is 9, 17, 25, ...
\[S_n = 636\]

In this A.P, \(a = 9\)
\[d = a_2 - a_1 = 17 - 9 = 8\]
Let \(n\) be the number of terms
\[S_n = \frac{n}{2} [2a + (n - 1)d]\]
\[636 = \frac{n}{2} [2(9) + (n - 1)8]\]
\[1272 = n[9 + 8n - 8]\]
\[= n(8n + 10)\]
\[= 8n^2 + 10n\]
\[8n^2 + 10n - 1272 = 0\]
Dividing throughout by 2, we get
\[4n^2 + 5n - 636 = 0\]
\[4n^2 + 53n - 48n - 636 = 0\]
\[n(4n + 53) - 12(4n + 53) = 0\]
\[(n - 12)(4n + 53) = 0\]
\[\Rightarrow 4n = -53 \Rightarrow n = \frac{-53}{4}; n = 12\]

Only one value \(n = 12\) is admissible.
Thus the number of terms is 12.

The first term of an A.P is 5, the last term is 45 and the sum is 400. Find the number of terms and the common difference.

**Solution:**
\[a = 5, \ a_n = 45, \ S_n = 400\]
\[S_n = \frac{n}{2} (a + l) \] where \(l\) - the last term, \(a\) - first term and \(n\) - number of terms
\[400 = \frac{n}{2} (45 + 5)\]
\[= \frac{n}{2} (50)\]
\[400 = 25n\]
\[n = \frac{400}{25} = 16\]
\[\therefore \] Number of terms = 16
\[a_n = a + (n-1)d\]
\[45 = 5 + (16 - 1) d\]
\[45 - 5 = 15d\]
\[d = \frac{40}{15} = \frac{8}{3}\]
Hence the number of terms and the common difference is 16 and \(\frac{8}{3}\).
The first and the last terms of an A.P are 17 and 350 respectively. If the common difference is 9, how many terms are there and what is their sum?

Solution:
In this problem,
\( a = 17, l = 350, d = 9 \)
Let \( n \) be the no. of terms and \( S_n \) their sum
Let \( a_n = 350 \)
\[ a_n = a + (n - 1)d \]
\[ 350 = 17 + (n - 1)9 \]
\[ 350 - 17 = (n - 1)9 \]
\[ 332 = (n - 1)9 \]
\[ n - 1 = 37 \]
\[ n = 38 \]
\[ S_n = \frac{n}{2}[2a + (n - 1)d] \]
\[ = \frac{38}{2}[2 \times 17 + (38 - 1)9] \]
\[ = 19[34 + (37 \times 9)] = 6973. \]
Thus the number of terms is 38 and its sum is 6973.

Find the sum of first 22 terms of an A.P in which \( d = 7 \) and 22\(^{nd} \) term is 149.

Solution:
\( d = 7, a_{22} = 149 \)
\( n = 22 \)
As \( a_n = a + (n - 1)d \)
\[ a_{22} = a + (n - 1) \times 7 \]
\[ 149 = a + 21 \times 7 \]
\[ = a + 147 \]
\[ a = 149 - 147 \]
\[ a = 2 \]
\[ \therefore S_n = \frac{n}{2}[a + l] \]
\[ = \frac{22}{2}[2 + 149] \]
\[ = 11 \times 151 \]
\[ \therefore \text{The sum of first 22 terms} = 1661 \]
Find the sum of first 51 terms of an A.P whose second and third terms are 14 and 18 respectively.

**Solution:**

\[ a_2 = 14 \]
\[ a_3 = 18 \]
\[ a_2 = a + (2-1)d \]
\[ \Rightarrow a + d = 14 \] \[ \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \ quad
If the sum of first 7 terms of an A.P is 49 and that of 17 terms is 289, find the sum of first \(n\) terms.

**Solution:**

\[ S_7 = 49 \]
\[ S_{17} = 289 \]

\[ S_n = \frac{n}{2} [2a + (n - 1)d] \]
\[ S_7 = \frac{7}{2} [2a + (7 - 1)d] \]
\[ 49 = \frac{7}{2} [2a + 6d] \]
\[ 49 \times \frac{2}{7} = (2a + 6d) \]
\[ 7 = a + 3d \] \(\text{(1)}\) (Dividing by 2)

\[ S_{17} = \frac{17}{2} [2a + (17 - 1)d] \]
\[ 289 = \frac{17}{2} [2a + 16d] \]
\[ 289 \times \frac{2}{17} = (2a + 16d) \]
\[ 17 = a + 8d \] \(\text{(2)}\) (Dividing by 2)

\(1\) \(\Rightarrow\) \(7 = a + 3d\)

\(2\) \(-\text{(1)}\) \(\Rightarrow 5d = 10\)

\[ d = 2 \]

Substituting \(d = 2\) in \(1\), we get,

\[ a + 3d = 7 \]
\[ a + 3(2) = 7 \]
\[ a = 7 - 6 \]
\[ a = 1. \]

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

Hence the sum of first \(n\) terms is \(n^2\).
Show that \( a_1, a_2, \ldots, a_n, \ldots \) form an A.P where \( a_n \) is defined as below:
(i) \( a_n = 3 + 4n \)
(ii) \( a = 9 - 5n \)

Solution:
(i) Given, \( a_n = 3 + 4n \)
When \( n = 1 \),
\( a_1 = 3 + 4(1) = 3 + 4 = 7 \)
When \( n = 2 \),
\( a_2 = 3 + 4(2) = 3 + 8 = 11 \)
When \( n = 3 \), \( a_3 = 3 + 4(3) = 3 + 12 = 15 \)
Since \( a_2 - a_1 = 11 - 7 = 4 \) and \( a_3 - a_2 = 15 - 11 = 4 \).
i.e., \( a_{n+1} - a_n \) is the same every time, the given list forms an A.P with the common difference \( d = 4 \)
\[ S_n = \frac{n}{2} [2a + (n - 1)d] \]
\[ S_{15} = \frac{15}{2} [2(7) + (15 - 1)4] \]
\[ = \frac{15}{2} [14 + (14)4] \]
\[ = \frac{15}{2} [14 + (14)4] \]
\[ = \frac{15}{2} [14 + (56)] \]
\[ = \frac{15}{2} [70] = 525 \]
This is an A.P with \( a = 7 \), \( d = 4 \), \( S_{15} = 525 \).

(ii) Given, \( a = 9 - 5n \)
When \( n = 1 \), \( a_1 = 4 \)
When \( n = 2 \), \( a_2 = 9 - 10 = -1 \)
When \( n = 3 \), \( a_3 = 9 - 15 \)
\[ = -5 \]
Since \( a_2 - a_1 = -1 - 4 = -5 \) and \( a_3 - a_2 = -6 + 1 = -5 \).
i.e., \( a_{n+1} - a_n \) is the same every time, the given list forms an A.P with the common difference \( d = -5 \)
\[ S_n = \frac{n}{2} [2a + (n - 1)d] \]
\[ S_{15} = \frac{15}{2} [(4) + (15 - 1)(-5)] \]
\[ = \frac{15}{2} [4 + (14)(-5)] \]
\[ = \frac{15}{2} [4 + (-70)] \]
\[ = \frac{15}{2} [-66] \]
\[ = -465 \]
This is an A.P with \( a = 4 \), \( d = -5 \), \( S_{15} = -465 \)
If the sum of the first \( n \) terms of an A.P is \( 4n - n^2 \), what is the first term (that is \( S_1 \))? What is the sum of first two terms? What is the second term? Similarly, find the 3\(^{rd} \), the 10\(^{th} \) and the \( n \)\(^{th} \) terms.

**Solution:**

\[
S_n = (4n - n^2)
\]

\[
a_1 = S_1 = 4(1) - (1)^2
= 4 - 1 = 3
\]

\[
S_2 = 4(2) - 2^2 = 4
\]

\[
S_3 = 4(3) - 3^2
= 12 - 9
= 3
\]

\[
a_2 = S_2 - S_1 = 4 - 3 = 1
\]

\[
a_3 = S_3 - S_2 = 3 - 4 = -1
\]

\( a_1, a_2, a_3 \) is given by 3, 1, -1

Here \( a = 3, d = -2, n = 10 \)

\[
\therefore a_{10} = a + (n - 1)d
= 3 + 9 \times (-2)
= 3 - 18
= -15
\]

\[
a_n = 3 + (n - 1) (- 2)
\]

\[
a_n = -2n + 5 = 5 - 2n
\]

Thus \( a_1, a_2, a_3 \) is given by 3, 1, -1, the 10\(^{th} \) term is -15, and the \( n \)\(^{th} \) term is 5 - 2n.

Find the sum of the first 40 positive integers divisible by 6.

**Solution:**

First term \( a = 6, d = 6, n = 40 \)

Sum of the 40 positive integers divisible by 6

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

\[
S_{40} = \frac{40}{2}[2 \times 6 + (40 - 1)6]
= 20[12 + (39 \times 6)] = 20[12 + 234]
= 20 \times 246
\]

\[
\therefore S_{40} = 4920
\]
Find the sum of the first 15 multiples of 8.

**Solution:**
First term \( a = 8 \), \( d = 8 \), \( n = 15 \)
Sum of 15th multiples of 8:
\[
S_n = \frac{n}{2}[2a + (n - 1)d]
\]
\[
S_{15} = \frac{15}{2}[2 \times 8 + (15 - 1)8]
\]
\[
= \frac{15}{2}[16 + (14 \times 8)]
\]
\[
= \frac{15}{2} \times 128
\]
\[
= 960
\]

Find the sum of the odd numbers between 0 and 50.

**Solution:**
The list of odd numbers between 0 and 50: 1, 3, 5, …, 49.
First term \( (a) = 1 \)
Common difference \( (d) = 2 \)
Last term \( (l) = 49 \)
\[
S_n = \frac{n}{2}(a + l) \quad \ldots \quad (1)
\]

Last term is given by
\[
a_n = 1 + (n - 1) \times d
\]
\[
= 1 + (n - 1) \times 2
\]
\[
= 2n - 2 = 49 - 1
\]
\[
2n = 48 + 2
\]
\[
2n = 50
\]
\[
n = 25
\]

Substituting \( n = 25 \) in (1), we get,
\[
Sum = \frac{25}{2} \times (1 + 49) = \frac{25}{2} \times 50 = 625.
\]
\[
\therefore \text{The sum of odd numbers between 0 and 50 = 625}
\]
A contract on construction job specifies a penalty for delay of completion beyond a certain date as follows: `200 for the first day, `250 for the second day, `300 for the third day, etc., the penalty for each succeeding day being `50 more than for the preceding day. How much money the contractor has to pay as penalty, if he has delayed the work by 30 days?

Solution:

\[ a_1 = 200, \quad a_2 = 250, \quad a_3 = 300 \]

(i.e.) \( a = 200, \quad d = 50 \)

If \( n = 30 \),

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

\[ = \frac{30}{2}[2 \times 200 + (30 - 1) \times 50] \]

\[ = 15[400 + 29 \times 50] \]

\[ = 15[400 + 1450] \]

\[ = 1850 \times 15 = `27,750 \]

If the contractor delays the work by 30 days, he has to pay `27,750 as penalty.

A contract on construction job specifies a penalty for delay of completion beyond a certain date as follows: `200 for the first day, `250 for the second day, `300 for the third day, etc., the penalty for each succeeding day being `50 more than for the preceding day. How much money the contractor has to pay as penalty, if he has delayed the work by 30 days?

Solution:

\[ a_1 = 200, \quad a_2 = 250, \quad a_3 = 300 \]

(i.e.) \( a = 200, \quad d = 50 \)

If \( n = 30 \),

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

\[ = \frac{30}{2}[2 \times 200 + (30 - 1) \times 50] \]

\[ = 15[400 + 29 \times 50] \]

\[ = 15[400 + 1450] \]

\[ = 1850 \times 15 = `27,750 \]

If the contractor delays the work by 30 days, he has to pay `27,750 as penalty.
A sum of `700 is to be used to give seven cash prizes to students of a school for their overall academic performance. If each prize is `20 less than its preceding prize, find the value the work of each of the prizes.

**Solution:**

\[ S_7 = 700 \]
\[ d = (-20) \text{ less than preceding} \]
\[ a_1 = a + d = a - 20 \]
\[ a_2 = a - 40 \]
\[ a_3 = a - 60 \]
\[ a_7 = a - 140 \]

Now

\[ S_n = \frac{n}{2} [2a + (n - 1)d] \]
\[ S_7 = \frac{7}{2} [2a - 120] \]
\[ = 7[a - 60] \]
\[ 700 = 7[a - 60] \]
\[ a - 60 = 100 \]
\[ a = 160 \]

Values of the prizes (in `) are 160, 140, 120, 100, 80, 60, 40.
In a School, students thought of planting trees in and around the school to reduce air pollution. It was decided that the number of trees, that each section of each class will plant, will be the same as the class, in which they are studying, e.g., a section of Class I will plant 1 tree, a section of Class II will plant 2 trees and so on till Class XII. There are three sections of each class. How many trees will be planted by the students?

Solution:
Hence the A.P will be of the form 1, 2, 3, 4, ..., 12
1st term (a) = 1
Last term (l) = 12
Common difference (d) = 1
Sum of trees planted by one section of each class = \( \frac{n}{2} (a + l) \)
\[ = \frac{12}{2} (1 + 12) \]
\[ = 6 \times 13 \]
\[ = 78 \, . \]
Since there are 3 sections in each class the total number of trees planted = 78 \times 3 = 234.

\[ \therefore \text{Total number of trees planted by the students} = 234. \]
A spiral is made up of successive semicircles, with centres alternately at A and B, starting with centre at A, of radii 0.5 cm, 1.0 cm, 1.5 cm, 2.0 cm, ... as shown in figure. What is the total length of such a spiral made up of thirteen consecutive semicircles? (Take $\pi = \frac{22}{7}$)

![Diagram of a spiral made up of semicircles]

**Solution:**
Length of semicircle with the centre at A = $l_1$
Length of semicircle with the centre at B = $l_2$
Length of semicircle with the centre at A = $l_3$ and so on...
Applying the formula, length of semicircle = $\frac{\pi r}{2} = \pi$
As a spiral is made up of successive semicircles, with centres alternately at A and B, starting with centre at A, of radii 0.5 cm, 1.0 cm, 1.5 cm, 2.0 cm, ... as shown in the figure.
The total length of all the semicircles = $\pi \times (0.5) + \pi \times (1.0) + \pi \times (1.5) + \ldots$
= $\pi [0.5 + 1 + 1.5 + \ldots]$
This is an AP with first term = 0.5 and $d = 0.5$
If $n = 13$,
$S_n = \frac{n}{2}[2a + (n - 1)d]$
$& S_{13} = \frac{13}{2}[2 \times 0.5 + (13 - 1) \times 0.5]$
= $\frac{13}{2}[1 + 6] = \frac{13}{2} \times 7 = \frac{91}{2}$
Total length of the thirteen consecutive semicircles = $\pi \times \frac{91}{2}$
= $\frac{22}{7} \times \frac{91}{2} = 143$ cm.
A spiral is made up of successive semicircles, with centres alternately at A and B, starting with centre at A, of radii 0.5 cm, 1.0 cm, 1.5 cm, 2.0 cm, ... as shown in figure. What is the total length of such a spiral made up of thirteen consecutive semicircles? (Take \( p = \frac{22}{7} \))

```
Solution:
Length of semicircle with the centre at A = \( l_1 \)
Length of semicircle with the centre at B = \( l_2 \)
Length of semicircle with the centre at A = \( l_3 \) and so on...
Applying the formula, length of semicircle = \( \frac{2\pi r}{2} = \pi r \)
As a spiral is made up of successive semicircles, with centres alternately at A and B, starting with centre at A, of radii 0.5 cm, 1.0 cm, 1.5 cm, 2.0 cm, ... as shown in the figure
The total length of all the semicircles = \( \pi \times (0.5) + \pi \times (1.0) + \pi \times (1.5) + ... \)
= \( \pi [0.5 + 1 + 1.5 + ...] \)
This is an AP with first term = 0.5 and d = 0.5
If n = 13,
\[ S_n = \frac{n}{2} [2a + (n - 1)d] \]
\[ S_{13} = \frac{13}{2} [2 \times 0.5 + (13 - 1) \times 0.5] \]
= \( \frac{13}{2} [1 + 2 \times 0.5] = \frac{13}{2} \times 2 \times 0.5 = \frac{91}{2} \)
Total length of the thirteen consecutive semicircles = \( \pi \times \frac{91}{2} \)
= \( \frac{22 \times 91}{7} = 143 \text{ cm.} \)
```

Number of rows is either 16 or 25 (substituting for a and d)
If n = 16,
\[ a_n = a + (n - 1) d \]
\[ a_{16} = 20 + (16 - 1)(-1) \]
\[ a_{16} = 20 - 15 = 5 \]
Substituting for a and d
If n = 25, \( a_{25} = 20 + (25 - 1) (-1) \)
= 20 - 24 = -4
Since the number of logs in the row cannot be negative (n \( \neq 25 \))
Hence the number of rows = 16, and number of logs in the top row = 5
([i.e.,] n = 16, \( a_{16} = 5 \))
In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato, and the other potatoes are placed 3 m apart in a straight line. There are ten potatoes in the line.

A competitor starts from the bucket, picks up the nearest potato, runs back with it, drops it in the bucket, runs back to pick up the next potato, runs to the bucket to drop it in, and she continues in the same way until all the potatoes are in the bucket. What is the total distance the competitor has to run?

Solution:
To pick up the 1st potato the competitor has to run 2 × 5 m. Similarly for the 2nd potato:
2 × 5 + 2 × 3 = 2 × (5 + 3)
Similarly for the 3rd potato the competitor has to run = 2 × (5 + 3 + 3) etc.
If we write down the distance traveled by the competitor for each potato it can be given by:
2 × 5, 2 × (5 + 3), 2 × (5 + 3 + 3) etc.
(i.e..) 2 times 5, 8, 11, ...
\[a = 5, \ d = 3, \ n = 10\]
\[S_n = \frac{n}{2} [2a + (n - 1)d]\]
\[S_{10} = \frac{10}{2} [2 \times 5 + (10 - 1)3]\]
\[= \frac{10}{2} [2 \times 5 + 9 \times 3]\]
\[= 5 \times (10 + 27)\]
\[= 5 \times 37\]
\[= 185\]
\[\therefore \text{Total distance traveled} = 2 \times (5 + 8 + 11 + ...)\]
\[= 2 \times 185\]
\[= 370 \text{ m}.

NCERT Solutions for Class 10 Maths Chapter 5 Arithmetic Progressions Exercise 5.1
Question 1. In which of the following situations, does the list of numbers involved make as 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.
(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.
(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.
(iv) The amount of money in the account every year, when Rs 10000 is deposited at compound interest at 8% per annum.

Question 2. Write first four terms of the A.P. when the first term a and the common difference d are given as follows
(i) \( a = 10, \quad d = 10 \)
(ii) \( a = -2, \quad d = 0 \)
(iii) \( a = 4, \quad d = -3 \)
(iv) \( a = -1 \quad d = 1/2 \)
(v) \( a = -1.25, \quad d = -0.25 \)

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

Question 4. Which of the following are APs? If they form an A.P. find the common difference \( d \) and write three more terms.
(i) \( 2, \ 4, \ 8, \ 16 \ldots \)
(ii) \( 2, \ 5/2, \ 3, \ 7/2 \ldots \)
(iii) \(-1.2, \ -3.2, \ -5.2, \ -7.2 \ldots \)
(iv) \(-10, \ -6, \ -2, \ 2 \ldots \)
(v) \( 3, \ 3 + \sqrt{2}, \ 3 + 2\sqrt{2}, \ 3 + 3\sqrt{2} \)
(vi) \(0.2, \ 0.22, \ 0.222, \ 0.2222 \ldots \)
(vii) \(0, \ -4, \ -8, \ -12 \ldots \)
(viii) \(-1/2, \ -1/2, -1/2, -1/2 \ldots \)
(ix) \(1, \ 3, \ 9, \ 27 \ldots \)
(x) \( a, \ 2a, \ 3a, \ 4a \ldots \)
(xi) \( a, \ a^2, \ a^3, \ a^4 \ldots \)
(xii) \( \sqrt{2}, \ \sqrt{8}, \ \sqrt{18}, \ \sqrt{32} \ldots \)
(xiii) \( \sqrt{3}, \ \sqrt{6}, \ \sqrt{9}, \ \sqrt{12} \ldots \)
(xiv) \( 1^2, \ 3^2, \ 5^2, \ 7^2 \ldots \)
(xv) \( 1^2, \ 2^2, \ 3^2, \ 4^2 \ldots \)
NCERT Solutions for Class 10 Maths

Question 1. Fill in the blanks in the following table, given that \( a \) is the first term, \( d \) the common difference and \( a_n \) the \( n^{th} \) term of the A.P.

<table>
<thead>
<tr>
<th></th>
<th>( a )</th>
<th>( d )</th>
<th>( n )</th>
<th>( a_n )</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>7</td>
<td>3</td>
<td>8</td>
<td>.....</td>
</tr>
<tr>
<td>II</td>
<td>.....</td>
<td>-18</td>
<td>.....</td>
<td>10</td>
</tr>
<tr>
<td>III</td>
<td>.....</td>
<td>-3</td>
<td>13</td>
<td>-5</td>
</tr>
<tr>
<td>IV</td>
<td>-18.9</td>
<td>2.5</td>
<td>.....</td>
<td>3.6</td>
</tr>
<tr>
<td>V</td>
<td>3.5</td>
<td>0</td>
<td>105</td>
<td>.....</td>
</tr>
</tbody>
</table>

Question 2. Choose the correct choice in the following and justify
(i) 30\(^{th}\) term of the A.P: 10, 7, 4, …, is
(A) 97 (B) 77 (C) -77 (D) -87

(ii) 11\(^{th}\) term of the A.P. -3, -1/2, ,2 …. is
(A) 28 (B) 22 (C) – 38 (D) -48×1/2

Question 3. In the following APs find the missing term in the boxes.

Question 4. Which term of the A.P. 3, 8, 13, 18, … is 78?

Question 5. Find the number of terms in each of the following A.P.

Question 6. Check whether -150 is a term of the A.P. 11, 8, 5, 2, …

Question 7. Find the 31\(^{st}\) term of an A.P. whose 11\(^{th}\) term is 38 and the 16\(^{th}\) term is 73.

Question 8. An A.P. consists of 50 terms of which 3\(^{rd}\) term is 12 and the last term is 106. Find the 29\(^{th}\) term.

Question 9. If the 3\(^{rd}\) and the 9\(^{th}\) terms of an A.P. are 4 and – 8 respectively. Which term of this A.P. is zero.

Question 10. If 17\(^{th}\) term of an A.P. exceeds its 10\(^{th}\) term by 7. Find the common difference.

Question 11. Which term of the A.P. 3, 15, 27, 39, … will be 132 more than its 54\(^{th}\) term?

Question 12. Two APs have the same common difference. The difference between their 100\(^{th}\) term is 100, what is the difference between their 1000\(^{th}\) terms?
Question 13. How many three digit numbers are divisible by 7?

Question 14. How many multiples of 4 lie between 10 and 250?

Question 15. For what value of \( n \), are the \( n \)th terms of two APs 63, 65, 67, and 3, 10, 17, \( \ldots \) equal?

Question 16. Determine the A.P. whose third term is 16 and the 7th term exceeds the 5th term by 12.

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Question 17. Find the 20th term from the last term of the A.P. 3, 8, 13, \( \ldots \), 253.

Question 18. The sum of 4th and 8th terms of an A.P. is 24 and the sum of the 6th and 10th terms is 44. Find the first three terms of the A.P.

Question 19. 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?

Question 20. Ramkali saved Rs 5 in the first week of a year and then increased her weekly saving by Rs 1.75. If in the \( n \)th week, her week, her weekly savings become Rs 20.75, find \( n \).

NCERT Solutions for Class 10 Maths Chapter 5 Arithmetic Progressions Exercise 5.3

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Question 1. Find the sum of the following APs.
(i) 2, 7, 12 \ldots, \text{to} 10 \text{ terms}.
(ii) \(-37, -33, -29, \ldots, \text{to} 12 \text{ terms}\)
(iii) \(0.6, 1.7, 2.8, \ldots, \text{to} 100 \text{ terms}\)
(iv) \(1/15, 1/12, 1/10, \ldots, \text{to} 11 \text{ terms}\)

Question 2. Find the sums given below
(i) \(7 + 10\times1/2 + 14 + \ldots \ldots \ldots \ldots + 84\)
(ii) \(+ 14 + \ldots \ldots \ldots \ldots + 84\)
(iii) \(34 + 32 + 30 + \ldots \ldots \ldots + 10\)
(iv) \(- 5 + ( -8 ) + ( -11 ) + \ldots \ldots \ldots + ( -230)\)

Question 3. In an AP
(i) Given \( a = 5, d = 3, a_n = 50, \) find \( n \) and \( S_n \).
(ii) Given \( a = 7, a_{13} = 35, \) find \( d \) and \( S_{13} \).
(iii) Given \( a_{12} = 37, d = 3, \) find \( a \) and \( S_{12} \).
(iv) Given \( a_3 = 15, S_{10} = 125, \) find \( d \) and \( a_{10} \).
(v) Given \( d = 5, S_9 = 75, \) find \( a \) and \( a_9 \).
(vi) Given \( a = 2, d = 8, S_n = 90, \) find \( n \) and \( a_n \).
(vii) Given \( a = 8, a_n = 62, S_n = 210, \) find \( n \) and \( d \).
(viii) Given \( a_n = 4, d = 2, S_n = -14, \) find \( n \) and \( a \).
(ix) Given \( a = 3, n = 8, S = 192, \) find \( d \).
(x) Given \( l = 28, S = 144 \) and there are total 9 terms. Find \( a \).
Question 4. How many terms of the AP. 9, 17, 25 … must be taken to give a sum of 636?

Question 5. 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.

Question 6. The first and the last term of an AP are 17 and 350 respectively. If the common difference is 9, how many terms are there and what is their sum?

Question 7. Find the sum of first 22 terms of an AP in which \( d = 7 \) and 22\(^{nd}\) term is 149.

Question 8. Find the sum of first 51 terms of an AP whose second and third terms are 14 and 18 respectively.

Question 9. If the sum of first 7 terms of an AP is 49 and that of 17 terms is 289, find the sum of first \( n \) terms.

Question 10. Show that \( a_1, a_2, \ldots, a_n, \ldots \) form an AP where \( a_n \) is defined as below
(i) \( a_n = 3 + 4n \)
(ii) \( a_n = 9 - 5n \)
Also find the sum of the first 15 terms in each case.

Question 11. If the sum of the first \( n \) terms of an AP is \( 4n - n^2 \), what is the first term (that is \( S_1 \))? What is the sum of first two terms? What is the second term? Similarly find the 3\(^{rd}\), the 10\(^{th}\) and the \( n \)\(^{th}\) terms.

Question 12. Find the sum of first 40 positive integers divisible by 6.

Question 13. Find the sum of first 15 multiples of 8.

Question 14. Find the sum of the odd numbers between 0 and 50.

Question 15. A contract on construction job specifies a penalty for delay of completion beyond a certain date as follows: Rs. 200 for the first day, Rs. 250 for the second day, Rs. 300 for the third day, etc., the penalty for each succeeding day being Rs. 50 more than for the preceding day. How much money the contractor has to pay as penalty, if he has delayed the work by 30 days.

Question 16. A sum of Rs 700 is to be used to give seven cash prizes to students of a school for their overall academic performance. If each prize is Rs 20 less than its preceding prize, find the value of each of the prizes.

Question 17. In a school, students thought of planting trees in and around the school to reduce air pollution. It was decided that the number of trees, that each section of each class will plant, will be the same as the class, in which they are studying, e.g., a section of class I will plant 1 tree, a section of class II will plant 2 trees and so on till class XII. There are three sections of each class. How many trees will be planted by the students?
Question 18. A spiral is made up of successive semicircles, with centres alternately at A and B, starting with centre at A of radii 0.5 cm, 1.0 cm, 1.5 cm, 2.0 cm, ……… as shown in figure. What is the total length of such a spiral made up of thirteen consecutive semicircles? (Take $\pi = \frac{22}{7}$)

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![Diagram]

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Question 19. 200 logs are stacked in the following manner: 20 logs in the bottom row, 19 in the next row, 18 in the row next to it and so on. In how many rows are the 200 logs placed and how many logs are in the top row?

200 logs are stacked in the following manner: 20 logs in the bottom row, 19 in the next row, 18 in the row next to it and so on. In how many rows are the 200 logs placed and how many logs are in the top row?

![Diagam]

Question 20. In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato and other potatoes are placed 3 m apart in a straight line. There are ten potatoes in the line.
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A competitor starts from the bucket, picks up the nearest potato, runs back with it, drops it in the bucket, runs back to pick up the next potato, runs to the bucket to drop it in, and she continues in the same way until all the potatoes are in the bucket. What is the total distance the competitor has to run?

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**NCERT Solution for Class 10 Mathematics Chapter 5 Arithmetic Progressions Exercise 5.4**

**Question 1.** Which term of the AP 121, 117, 113, .... is its first negative term?

**Question 2.** 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.

**Question 3.** A ladder has rungs 25 cm apart. The rungs decrease uniformly in length from 45 cm at the bottom to 25 cm at the top. If the top and bottom rungs are 2 1/2 m apart what is the length of the wood required for the rungs?

**Question 4.** The houses of a row are number consecutively from 1 to 49. Show that there is a value of x such that the sum of numbers of the houses preceding the house numbered x is equal to the sum of the number of houses following it. Find this value of x.
Question 5. 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 $\frac{1}{4}$m and a tread of $\frac{1}{2}$m. Calculate the total volume of concrete required to build the terrace.