NCERT Solution for AP Exercise 2

Question 1
Fill in the blanks in the following table, given that a is the first term, d the common difference and the nth term of the A.P.

	a	d	n	a_n
(i)	7	3	8	…….
(ii)	– 18	…..	10	0
(iii)	…..	– 3	18	– 5
(iv)	– 18.9	2.5	…..	3.6
(v)	3.5	0	105	…..

Answer
Formula to consider for solving these questions

$a_n = a + (n - 1) d$
Where d -> common difference
A -> first term
n-> term
a_n -> nth term

(i) $a = 7, d = 3, n = 8, a_n = ?$
We know that,
For an A.P. $a_n = a + (n - 1) d$
$= 7 + (8 - 1) 3$
$= 7 + 21 = 28$
Hence, $a_n = 28$

(ii) Given that
$a = -18, n = 10, a_n = 0, d = ?$
We know that,
$a_n = a + (n - 1) d$
$0 = - 18 + (10 - 1) d$
$d = 18/9 = 2$
Hence, common difference, $d = 2$

(iii) Given that
$d = -3, n = 18, a_n = -5$
We know that,
$a_n = a + (n - 1) d$
$-5 = a + (18 - 1) (-3)$
$-5 = a - 51$

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$a = 51 - 5 = 46$
Hence, $a = 46$

(iv) $a = -18.9$, $d = 2.5$, $a_n = 3.6$, $n = ?$
We know that,
$a_n = a + (n - 1) d$
$3.6 = - 18.9 + (n - 1) 2.5$
$22.5 = (n - 1) 2.5$
$(n - 1) = 22.5/2.5$
$n - 1 = 9$
$n = 10$
Hence, $n = 10$

(v) $a = 3.5$, $d = 0$, $n = 105$, $a_n = ?$
We know that,
$a_n = a + (n - 1) d$
$a_n = 3.5 + (105 - 1) 0$
$a_n = 3.5$
Hence, $a_n = 3.5$

Question 2
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, -1/2, ,2 .... is
(A) 28
(B) 22
(C) - 38
(D)-97/2

Answer

(i) Given that
A.P. 10, 7, 4, …
First term, $a = 10$
Common difference, $d = a_2 - a_1 = 7 - 10 = -3$
We know that, $a_n = a + (n - 1) d$
$a_{30} = 10 + (30 - 1) (-3)$
$a_{30} = 10 - 87 = -77$
Hence, the correct answer is option C.

(ii) Given that A.P. is -3, -1/2, ,2 ...

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First term a = - 3
Common difference, d = $a_2 - a_1$ = (-1/2) - (-3)
= (-1/2) + 3 = 5/2
We know that, $a_n = a + (n - 1) d$
a_{11} = 3 + (11 -1)(5/2)
a_{11} = -3 + 25
a_{11} = 22
Hence, the answer is option B.

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

(i) 2, □, 26

(ii) □, 13, □, 3

(iii) 5, □, □, $9\frac{1}{2}$

(iv) −4, □, □, □, □, 6

(v) □, 38, □, □, □, −22

Answer
Formula to consider for solving these questions

$a_n = a + (n - 1) d$
Where d -> common difference
A -> first term
n-> term
a_n -> nth term

(i) For this A.P.,
a = 2
a_3 = 26
We know that, $a_n = a + (n - 1) d$
a_3 = 2 + (3 - 1) d
26 = 2 + 2d
24 = 2d
d = 12
a_2 = 2 + (2 - 1) 12
= 14
Therefore, 14 is the missing term.

(ii) For this A.P.,
a_2 = 13 and

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$a_4 = 3$
We know that, $a_n = a + (n - 1) d$
$a_2 = a + (2 - 1) d$
$13 = a + d$ ... (i)
$a_4 = a + (4 - 1) d$
$3 = a + 3d$ ... (ii)
Now solving these equations from the lesson of linear equations
On subtracting (i) from (ii), we get
$- 10 = 2d$
$d = - 5$
From equation (i), we get
$13 = a + (-5)$
$a = 18$
$a_3 = 18 + (3 - 1) (-5)$
$= 18 + 2 (-5) = 18 - 10 = 8$
Therefore, the missing terms are 18 and 8 respectively.

(iii) For this A.P.,
$a_2 = 13$ and
$a_4 = 3$
We know that, $a_n = a + (n - 1) d$
$a_2 = a + (2 - 1) d$
$13 = a + d$ ... (i)
$a_4 = a + (4 - 1) d$
$3 = a + 3d$ ... (ii)
On subtracting (i) from (ii), we get,
$- 10 = 2d$
$d = - 5$
From equation (i), we get,
$13 = a + (-5)$
$a = 18$
$a_3 = 18 + (3 - 1) (-5)$
$= 18 + 2 (-5) = 18 - 10 = 8$
Therefore, the missing terms are 18 and 8 respectively.

(iv) For this A.P.,
$a = -4$ and
$a_6 = 6$
We know that,
$a_n = a + (n - 1) d$
$a_6 = a + (6 - 1) d$
$6 = - 4 + 5d$
$10 = 5d$
$d = 2$
$a_2 = a + d = - 4 + 2 = -2$
$a_3 = a + 2d = - 4 + 2 (2) = 0$
$a_4 = a + 3d = - 4 + 3 (2) = 2$

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$a_5 = a + 4d = -4 + 4(2) = 4$
Therefore, the missing terms are −2, 0, 2, and 4 respectively.

(v)
For this A.P.,
$a_2 = 38$
$a_6 = -22$
We know that
$a_n = a + (n - 1) d$
$a_2 = a + (2 - 1) d$
$38 = a + d$ ... (i)
$a_6 = a + (6 - 1) d$
$-22 = a + 5d$ ... (ii)
On subtracting equation (i) from (ii), we get
$-22 - 38 = 4d$
$-60 = 4d$
$d = -15$
$a = a_2 - d = 38 - (-15) = 53$
$a_3 = a + 2d = 53 + 2(-15) = 23$
$a_4 = a + 3d = 53 + 3(-15) = 8$
$a_5 = a + 4d = 53 + 4(-15) = -7$
Therefore, the missing terms are 53, 23, 8, and −7 respectively.

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

Answer

We have
$a = 3$
$d = a_2 - a_1 = 8 - 3 = 5$
Let n^{th} term of this A.P. be 78.
$a_n = a + (n - 1) d$
$78 = 3 + (n - 1) 5$
$75 = (n - 1) 5$
$(n - 1) = 15$
$n = 16$
Hence, 16th term of this A.P. is 78.

Question 5
Find the number of terms in each of the following A.P.
(i) 7, 13, 19, …, 205
(ii) 18,31/2, 13,...., -47

Answer

(i) For this A.P.,

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$a = 7$
$d = a_2 - a_1 = 13 - 7 = 6$
Let there are n terms in this A.P.
$a_n = 205$
We know that
$a_n = a + (n - 1) d$
Therefore, $205 = 7 + (n - 1) 6$
$198 = (n - 1) 6$
$33 = (n - 1)$
$n = 34$
Therefore, this given series has 34 terms in it.

(ii) For this A.P.,
$a = 18$

$d=a_2 - a_1 = 31/2 - 18=-5/2$

Let there are n terms in this A.P.
$a_n = 205$
$a_n = a + (n - 1) d$
$-47 = 18 + (n - 1) (-5/2)$
$-47 - 18 = (n - 1) (-5/2)$
$-65 = (n - 1)(-5/2)$
$(n - 1) = -130/-5$
$(n - 1) = 26$
$n = 27$
Therefore, this given A.P. has 27 terms in it.

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

Answer

For this A.P.,
$a = 11$
$d = a_2 - a_1 = 8 - 11 = -3$
Let -150 be the nth term of this A.P.
We know that,
$a_n = a + (n - 1) d$
$-150 = 11 + (n - 1)(-3)$
$-150 = 11 - 3n + 3$
$-164 = -3n$
$n = 164/3$
Clearly, n is not an integer.
Therefore, - 150 is not a term of this A.P.

Question 7

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Find the 31st term of an A.P. whose 11th term is 38 and the 16th term is 73.

Answer

Given that,
$a_{11} = 38$
$a_{16} = 73$
We know that,
$a_n = a + (n - 1) d$
$a_{11} = a + (11 - 1) d$
$38 = a + 10d$ ... (i)
Similarly,
$a_{16} = a + (16 - 1) d$
$73 = a + 15d$ ... (ii)
On subtracting (i) from (ii), we get
$35 = 5d$
$d = 7$
From equation (i),
$38 = a + 10 \times (7)$
$38 - 70 = a$
$a = -32$
Now that we know a and d of the A.P
$a_{31} = a + (31 - 1) d$
$= - 32 + 30 (7)$
$= - 32 + 210$
$= 178$
Hence, 31st term is 178.

Question 8
An A.P. consists of 50 terms of which 3rd term is 12 and the last term is 106. Find the 29th term.

Answer

Given that,
$a_3 = 12$
$a_{50} = 106$
We know that,
$a_n = a + (n - 1) d$
$a_3 = a + (3 - 1) d$
$12 = a + 2d$ ... (i)
Similarly, $a_{50} = a + (50 - 1) d$
$106 = a + 49d$ ... (ii)
On subtracting (i) from (ii), we get
$94 = 47d$
$d = 2$
From equation (i), we get

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$12 = a + 2(2)$
$a = 12 - 4 = 8$
$a_{29} = a + (29 - 1)d$
$a_{29} = 8 + (28)2$
$a_{29} = 8 + 56 = 64$
Therefore, 29th term is 64.

Question 9
If the 3rd and the 9th terms of an A.P. are 4 and − 8 respectively. Which term of this A.P. is zero.

Answer

Given that,
$a_3 = 4$
$a_9 = -8$
We know that,
$a_n = a + (n - 1)d$
$a_3 = a + (3 - 1)d$
$4 = a + 2d$ ... (i)
$a_9 = a + (9 - 1)d$
$-8 = a + 8d$ ... (ii)
On subtracting equation (i) from (ii), we get,
$-12 = 6d$
$d = -2$
From equation (i), we get,
$4 = a + 2(-2)$
$4 = a - 4$
$a = 8$
Let nth term of this A.P. be zero.
$a_n = a + (n - 1)d$
$0 = 8 + (n - 1)(-2)$
$0 = 8 - 2n + 2$
$2n = 10$
$n = 5$
Hence, 5th term of this A.P. is 0.

Question 10
If 17th term of an A.P. exceeds its 10th term by 7. Find the common difference.

Answer

We know that,
For an A.P., $a_n = a + (n - 1)d$
So 17th term would be given as
$a_{17} = a + (17 - 1)d$

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$a_{17} = a + 16d$
Similarly 10th term would be given as
$a_{10} = a + 9d$
It is given that in the question
$a_{17} - a_{10} = 7$
$(a + 16d) - (a + 9d) = 7$
$7d = 7$
$d = 1$
Therefore, the common difference is 1.

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

Answer

Given A.P. is 3, 15, 27, 39, …
$a = 3$
$d = a_2 - a_1 = 15 - 3 = 12$
$a_{54} = a + (54 - 1) d$
$= 3 + (53) (12)$
$= 3 + 636 = 639$
$132 + 639 = 771$
We have to find the term of this A.P. which is 771.
Let n^{th} term be 771.
$a_n = a + (n - 1) d$
$771 = 3 + (n - 1) 12$
$768 = (n - 1) 12$
$(n - 1) = 64$
$n = 65$
Therefore, 65th term was 132 more than 54th term.

Question 12
Two APs have the same common difference. The difference between their 100th term is 100, what is the difference between their 1000th terms?

Answer

Let the first term of these A.P.s be a_1 and a_2 respectively and the common difference of these A.P.s be d
For first A.P.,
$a_{100} = a_1 + (100 - 1) d$
$= a_1 + 99d$
$a_{1000} = a_1 + (1000 - 1) d$
$a_{1000} = a_1 + 999d$
For second A.P.,
$a_{100} = a_2 + (100 - 1) d$

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$= a_2 + 99d$
$a_{1000} = a_2 + (1000 - 1)\, d$
$= a_2 + 999d$
Given that, difference between
100th term of these A.P.s = 100
Therefore, $(a_1 + 99d) - (a_2 + 99d) = 100$
$a_1 - a_2 = 100$ ... (i)
Difference between 1000th terms of these A.P.s
$(a_1 + 999d) - (a_2 + 999d) = a_1 - a_2$
From equation (i),
This difference, $a_1 - a_2 = 100$
Hence, the difference between 1000th terms of these A.P. will be 100.

Question 13
How many three digit numbers are divisible by 7?

Answer

It is an interesting question which can be solved using arithmetic progression
First three-digit number that is divisible by 7 = 105
Next number = 105 + 7 = 112
Therefore, 105, 112, 119, …
All are three digit numbers which are divisible by 7 and thus, all these are terms of an A.P. having first term as 105 and common difference as 7.
The maximum possible three-digit number is 999. When we divide it by 7, the remainder will be 5. Clearly, 999 − 5 = 994 is the maximum possible three-digit number that is divisible by 7.
The series is as follows.
105, 112, 119, …, 994
Let 994 be the nth term of this A.P.
$a = 105$
$d = 7$
$a_n = 994$
$n = ?$
$a_n = a + (n - 1)\, d$
$994 = 105 + (n - 1)\, 7$
$(n - 1) = 127$
$n = 128$
Therefore, 128 three-digit numbers are divisible by 7.

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

Answer

It is an interesting question which can be solved using arithmetic progression.

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First multiple of 4 that is greater than 10 is 12. Next will be 16.
Therefore, 12, 16, 20, 24, …
All these are divisible by 4 and thus, all these are terms of an A.P. with first term as 12 and common difference as 4.
When we divide 250 by 4, the remainder will be 2. Therefore, 250 − 2 = 248 is divisible by 4.
The series is as follows.
12, 16, 20, 24, …, 248
Let 248 be the nth term of this A.P.
$a = 12$
$d = 4$
$a_n = 248$
$a_n = a + (n - 1) d$
$248 = 12 + (n - 1) \times 4$
$59 = n - 1$
$n = 60$
Therefore, there are 60 multiples of 4 between 10 and 250.

Question 15
For what value of n, are the nth terms of two APs 63, 65, 67, and 3, 10, 17, … equal?

Answer

<u>First series</u>
63, 65, 67, …
$a = 63$
$d = a_2 - a_1 = 65 - 63 = 2$
n^{th} term of this A.P. $= a_n = a + (n - 1) d$
$a_n = 63 + (n - 1) 2 = 63 + 2n - 2$
$a_n = 61 + 2n$ ... (i)

<u>Second Series</u>
3, 10, 17, …
$a = 3$
$d = a_2 - a_1 = 10 - 3 = 7$
n^{th} term of this A.P. $= 3 + (n - 1) 7$
$a_n = 3 + 7n - 7$
$a_n = 7n - 4$ ... (ii)
It is given that, n^{th} term of these A.P.s are equal to each other.
Equating both these equations, we obtain
$61 + 2n = 7n - 4$
$5n = 65$
$n = 13$
Therefore, 13th terms of both these A.P.s are equal to each other.

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

Answer
We know that, nth term of the A.P is given by the expression

$a_n = a + (n - 1) d$
Then 3th ,5th and 7th terms are
$a_3 = 16$
$a + (3 - 1) d = 16$
$a + 2d = 16$ ... (i)

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

$a_5 = a + (5 - 1) d = a + 4d$

Then
$a_7 - a_5 = 12$
$[a + 6d] - [a + 4d] = 12$
$2d = 12$
$d = 6$
From equation (i), we get,
$a + 2 (6) = 16$
$a + 12 = 16$
$a = 4$
Therefore, A.P. will be
4, 10, 16, 22, …

Question 17

Find the 20th term from the last term of the A.P. 3, 8, 13, …, 253.

Answer

Given A.P. is
3, 8, 13, …, 253
d=5.
Therefore, this A.P. can be written in reverse order as
253, 248, 243, …, 13, 8, 5
For this reverse A.P.,

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$a = 253$
$d = 248 - 253 = -5$
$n = 20$
$a_{20} = a + (20 - 1) d$
$a_{20} = 253 + (19) (-5)$
$a_{20} = 253 - 95$
$a = 158$
Therefore, 20th term from the last term is 158.

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.

Answer

We know that, nth term of the A.P is given by the expression

$a_n = a + (n - 1) d$
Then 4th term

$a_4 = a + (4 - 1) d$
$a_4 = a + 3d$
Similarly,8th,6th and 10th terms are
$a_8 = a + 7d$
$a_6 = a + 5d$
$a_{10} = a + 9d$
Given that,

$a_4 + a_8 = 24$
$a + 3d + a + 7d = 24$
$2a + 10d = 24$
$a + 5d = 12$ ... (i)

$a_6 + a_{10} = 44$
$a + 5d + a + 9d = 44$
$2a + 14d = 44$
$a + 7d = 22$ ... (ii)
Equation (i) and (ii) are linear equation in two variable

On subtracting equation (i) from (ii), we get,
$2d = 22 - 12$

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$2d = 10$
$d = 5$
From equation (i), we get
$a + 5d = 12$
$a + 5(5) = 12$
$a = -13$
$a_2 = a + d = -13 + 5 = -8$
$a_3 = a_2 + d = -8 + 5 = -3$
Therefore, the first three terms of this A.P. are −13, −8, and −3.

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?

Answer

It can be observed that the incomes that Subba Rao obtained in various years are in A.P. as every year, his salary is increased by Rs 200.
Therefore, the salaries of each year after 1995 are
5000, 5200, 5400, …
Here, $a = 5000$
$d = 200$
Let after n^{th} year, his salary be Rs 7000.
Therefore, $a_n = a + (n - 1)d$
$7000 = 5000 + (n - 1)200$
$200(n - 1) = 2000$
$(n - 1) = 10$
$n = 11$
Therefore, in 11th year, his salary will be 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 nth week, her week, her weekly savings become Rs 20.75, find n.

Answer

Given that for the A.P
$a = 5$

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$d = 1.75$
$a_n = 20.75$

We need to find out
$n = ?$

Now nth term is given by the expression
$a_n = a + (n - 1) d$
$20.75 = 5 + (n - 1) \times 1.75$
$(n - 1) = 15.75/1.75 = 1575/175$
$= 63/7 = 9$
$n - 1 = 9$
$n = 10$

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