N^{th} term of an arithmetic progression

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

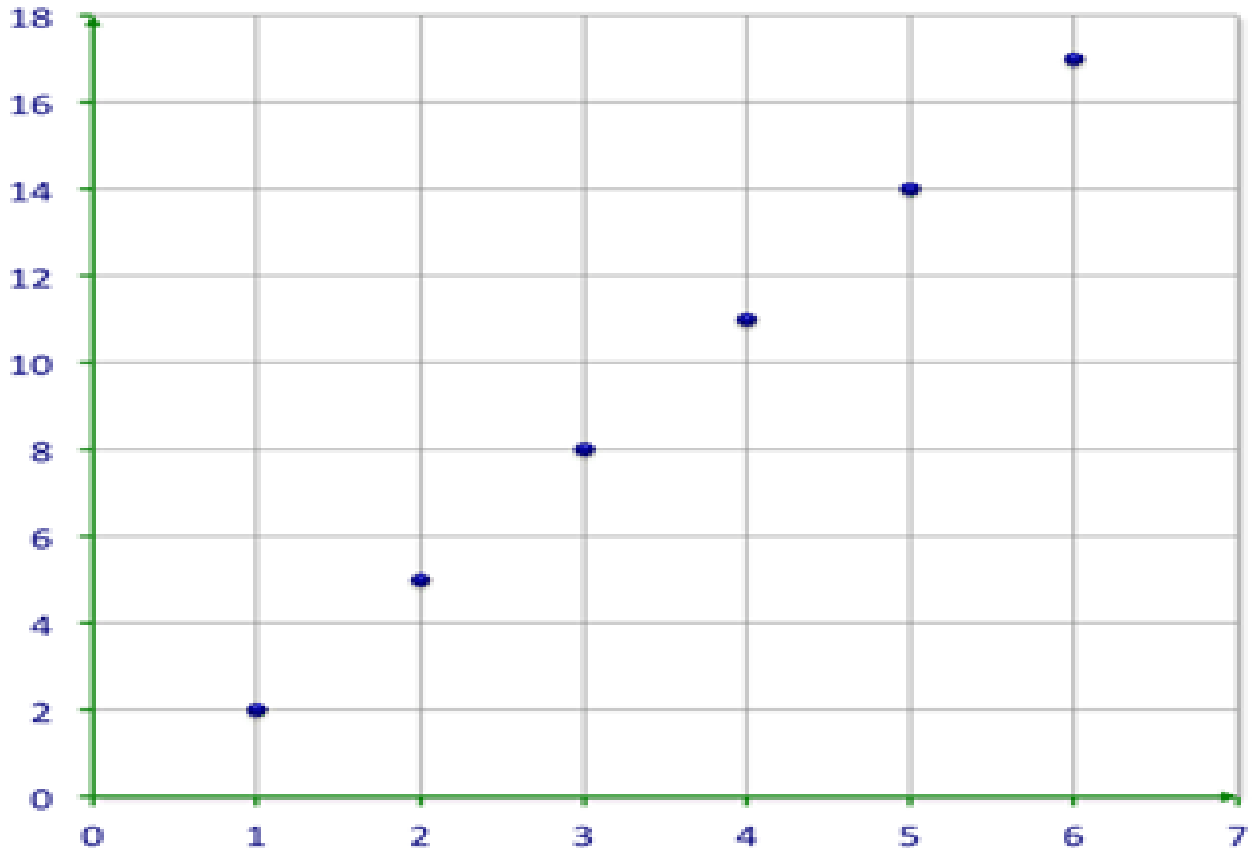
So,

1^{st} term, $T1 = a + (1-1)d$

2^{nd} term, $T2 = a + (2-1)d$

3^{rd} term, $T3 = a + (3-1)d$

⋮



n^{th} term of AP

cuemath
THE MATH EXPERT

The n^{th} term (T_n) of an AP

$a , a + d , a + 2d , ... $ is,

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

n^{th} term — T_n

first term — a

common difference — d

CHAPTER 3: ARITHMETIC PROGRESSION (AP)

Introduction | ପରିଚୟ

English:

An **Arithmetic Progression (AP)** is a sequence of numbers in which the **difference between consecutive terms remains constant**.

Arithmetic Progression is not only important for the Board exam but also forms the foundation for higher mathematics and competitive examinations.

ଓଡ଼ିଆ:
ଯେଉଁ ସଂଖ୍ୟାମାଳାରେ ପରପରା ଦୁଇଟି ପଦର **ତାରତମ୍ୟ ସମାନ ଥାଏ**, ସେହି ସଂଖ୍ୟାମାଳାକୁ **ସାମାନ୍ତର ପ୍ରଗତି (Arithmetic Progression – AP)** କୁହାଯାଏ।

Arithmetic Progression – Definition

(ସାମାନ୍ତର ପ୍ରଗତିର ପରିଭାଷା)

English:
An arithmetic progression is a sequence like:

a, a+d, a+2d, a+3d, …a,\; a+d,\; a+2d,\; a+3d,\; \dotsa,a+d,a+2d,a+3d,…
where

- **a** = first term
- **d** = common difference

ଓଡ଼ିଆ:

ସାମାନ୍ତର ପ୍ରଗତିର ସାଧାରଣ ରୂପ—
a, a+d, a+2d, a+3d, …a,\; a+d,\; a+2d,\; a+3d,\; \dotsa,a+d,a+2d,a+3d,…
ଯେଉଁଠାରେ—

- **a** = ପ୍ରଥମ ପଦ
- **d** = ସାଧାରଣ ତାରତମ୍ୟ

Key Formulae | ମୁଖ୍ୟ ସୂତ୍ର

nth Term of an AP
(n-ତମ ପଦ)

English:
The nth term of an arithmetic progression is:
an=a+(n−1)da_n = a + (n - 1)dan=a+(n−1)d
Where:

- ana_nan = nth term
- aaa = first term
- ddd = common difference
- nnn = term number

ଓଡ଼ିଆ:

ସାମାନ୍ତର ପ୍ରଗତିର n-ତମ ପଦ—
n-ତମ ପଦ=ପ୍ରଥମ ପଦ+(n−1)×ତାରତମ୍ୟ\text{n-ତମ ପଦ} = \text{ପ୍ରଥମ ପଦ} + (n-1) \times \text{ତାରତମ୍ୟ}n-ତମ ପଦ=ପ୍ରଥମ ପଦ+(n−1)×ତାରତମ୍ୟ

Sum of n Terms of an AP
(n-ଟି ପଦର ଯୋଗ)

English:
The sum of first n terms of an AP is:
Sn=n2[2a+(n−1)d]S_n = \frac{n}{2}[2a + (n - 1)d]Sn=2n[2a+(n−1)d]

ଓଡ଼ିଆ:
ସାମାନ୍ତର ପ୍ରଗତିର ପ୍ରଥମ n-ଟି ପଦର ଯୋଗ—

Sn=n2[2a+(n−1)d]S_n = \frac{n}{2}[2a + (n - 1)d]Sn=2n[2a+(n−1)d]

Board-Type Solved Example

Example:
Find the 10th term of the AP:
2, 5, 8, 11, …2,\; 5,\; 8,\; 11,\; \dots2,5,8,11,…

English Solution:

- First term, a=2a = 2a=2
- Common difference, d=3d = 3d=3
- n=10n = 10n=10

a10=2+(10−1)×3=2+27=29a_{10} = 2 + (10 - 1) \times 3 = 2 + 27 = 29a10 =2+(10−1)×3=2+27=29

Answer:
29\boxed{29}29

ଓଡ଼ିଆ ସମାଧାନ:

- ପ୍ରଥମ ପଦ a=2a = 2a=2
- ତାରତମ୍ୟ d=3d = 3d=3
- n=10n = 10n=10

a10=2+(10−1)×3=29a_{10} = 2 + (10 - 1) \times 3 = 29a10=2+(10−1)×3=29

ଉତ୍ତର:
29\boxed{29}29

Board Examination Focus
(ବୋର୍ଡ ପରୀକ୍ଷା ଗୁରୁତ୍ୱ)

English:

nth term problems (3–4 marks)
Sum of AP questions (4–5 marks)
Word problems based on real-life situations

ଓଡ଼ିଆ:
n-ତମ ପଦ ଗଣନା
AP ର ଯୋଗ ସମସ୍ୟା
ଜୀବନ ଆଧାରିତ ପ୍ରଶ୍ନ

Important MCQs (AP)

MCQ 1:
What is the common difference of the AP:
3, 7, 11, 15, … ?
A) 2
B) 3
C) 4
D) 5
Answer: C – 4 **ଉତ୍ତର:** 4

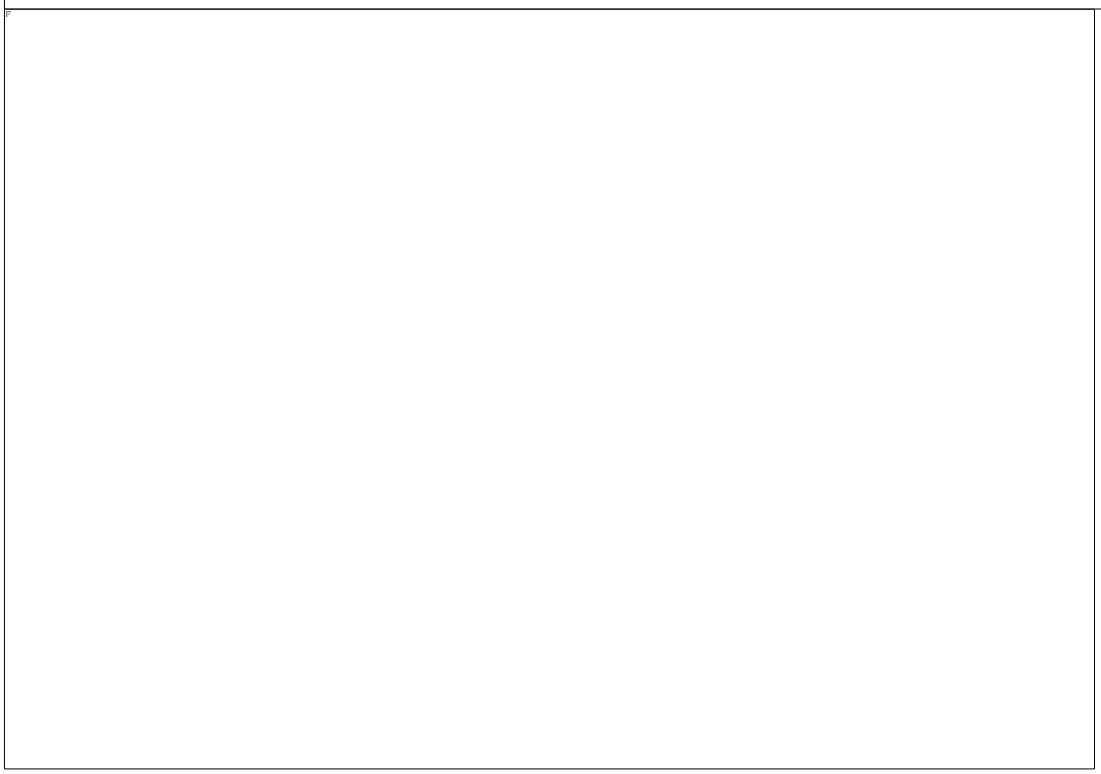
MCQ 2:
The nth term of an AP is given by:
A) a+nda + nda+nd
B) a+(n−1)da + (n - 1)da+(n−1)d
C) a−nda - nda−nd
D) a+da + da+d
Answer: B **ଉତ୍ତର:** B

LAKE MONTFORT SCHOOL, BENGALURU - 49

10| MATHS | WORKSHEET | 5. ARITHMETIC PROGRESSIONS

OBJECTIVE TYPE QUESTIONS

1. In an AP, if $d = -4, n = 7, a_n = 4$, find a.
   (a) 6 (b) 7 (c) 20 (d) 28
2. In an AP, if $a = 3.5, d = 0, n = 101$, then a_n will be
   (a) 0 (b) 3.5 (c) 103.5 (d) 104.5
3. The list of terms -10, -6, -2, 2 ... is
   (a) an A.P. with $d = -16$ (b) an A.P. with $d = 4$ (c) an A.P. with $d = -4$ (d) not an A.P.
4. The 11th term of the AP: - 5, $-\frac{5}{2}, 0, \frac{5}{2}, \ldots$ is
   (a) - 20 (b) 20 (c) - 30 (d) 30
5. The first four terms of an AP, whose first term is -2 and the common difference is -2 are
   (a) $-2, 0, 2, 4$ (b) $-2, 4, -8, 16$ (c) $-2, -4, -6, -8$ (d) $-2, -4, -8, -16$
6. The 21st term of the AP whose first two terms are -3 and 4 is
   (a) 17 (b) 137 (c) 143 (d) - 143
7. If the 2nd term of an AP is 13 and the 5th term is 25, what is its 7th term?
   (a) 30 (b) 33 (c) 37 (d) 38
8. Which term of the AP: 21, 42, 63, 84 ... is 210?
   (a) 9th (b) 10th (c) 11th (d) 12th
9. If the common difference of an AP is 5, then what is $a_{18} - a_{13}$?
   (a) 5 (b) 20 (c) 25 (d) 30
10. What is the common difference of an AP in which $a_{18} - a_{14} = 32$?
    (a) - 1 (b) - 8 (c) 7 (d) - 9
11. Two APs have the same common difference. The first term of one of these is -1 and that of the other is - 8. The difference between their 4th terms is
    (a) - 1 (b) - 8 (c) 7 (d) - 9
12. If 7 times the 7th term of an AP is equal to 11 times its 11th term, then its 18th term will be
    (a) 7 (b) 11 (c) 18 (d) 0
13. The 4th term from the end of the AP: - 11, -8, -5, ..., 49 is
    (a) 37 (b) 40 (c) 43 (d) 58
14. The famous mathematician associated with finding the sum of the first 100 natural numbers is
    (a) Pythagoras (b) Newton (c) Gauss (d) Euclid
15. If the first term of an AP is -5 and the common difference is 2, then the sum of the first 6 terms is
    (a) 0 (b) 5 (c) 6 (d) 15
16. The sum of first 16 terms of the AP: 10, 6, 2 ... is
    (a) - 320 (b) 320 (c) - 352 (d) - 400
17. In an AP if $a = 1, a_n = 20$ and $Sn = 399$, then n is
    (a) 19 (b) 21 (c) 38 (d) 42
18. The sum of first five multiples of 3 is
    (a) 45 (b) 55 (c) 65 (d) 75



Chapter 3: Arithmetic Progression (AP)

AP Practice Worksheet + Solved Answers + Previous Year BSE Odisha Questions

PART–A: AP PRACTICE WORKSHEET

Instructions | ନିର୍ଦ୍ଦେଶ

English:
Write formula first
Show all steps
Put final answer in a box

ଓଡ଼ିଆ:
ପ୍ରଥମେ ସୂତ୍ର ଲେଖନ୍ତୁ
ସମସ୍ତ ଧାପ ଦର୍ଶାନ୍ତୁ
ଶେଷ ଉତ୍ତରକୁ ବାକ୍ସରେ ଲେଖନ୍ତୁ

Worksheet – Set A (3–4 Marks Each)

Q1. Find the 15th term of the AP:

7, 10, 13, 16, …7,\; 10,\; 13,\; 16,\; \dots7,10,13,16,…

Q2. Find the nth term of the AP:

5, 8, 11, …5,\; 8,\; 11,\; \dots5,8,11,…

Q3. How many terms are there in the AP:

3, 7, 11, …, 407?3,\; 7,\; 11,\; \dots,\; 407?3,7,11,…,407?

Worksheet – Set B (5 Marks Each)

Q4. Find the sum of first 20 terms of the AP:

2, 5, 8, …2,\; 5,\; 8,\; \dots2,5,8,…

Q5. Find the sum of first 30 natural numbers using AP method.

PART–B: SOLVED ANSWERS (Step-wise)

Solution 1

AP: 7, 10, 13, …
a=7, d=3, n=15a = 7,\; d = 3,\; n = 15a=7,d=3,n=15

a15=a+(n−1)d=7+14×3=49a_{15} = a + (n-1)d = 7 + 14 \times 3 = 49a15 =a+(n−1)d=7+14×3=49

Answer / ଉତ୍ତର:

49\boxed{49}49

Solution 2

AP: 5, 8, 11, …
a=5, d=3a = 5,\; d = 3a=5,d=3

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

Answer:

an=3n+2\boxed{a_n = 3n + 2}an=3n+2

Solution 3

AP: 3, 7, 11, …, 407
a=3, d=4a = 3,\; d = 4a=3,d=4

407=3+(n−1)4407 = 3 + (n-1)4407=3+(n−1)4 404=4(n−1)⇒n=102404 = 4(n-1) \Rightarrow n = 102404=4(n−1)⇒n=102

Answer / ଉତ୍ତର:

102 terms\boxed{102\text{ terms}}102 terms

Solution 4

AP: 2, 5, 8, …
a=2, d=3, n=20a = 2,\; d = 3,\; n = 20a=2,d=3,n=20

S20=202[2(2)+19×3]S_{20} = \frac{20}{2}[2(2) + 19 \times 3]S20=220 [2(2)+19×3] =10(4+57)=610= 10(4 + 57) = 610=10(4+57)=610

Answer:

610\boxed{610}610

Solution 5

Natural numbers: 1, 2, 3, …
a=1, d=1, n=30a = 1,\; d = 1,\; n = 30a=1,d=1,n=30

S30=302[2+29]=15×31=465S_{30} = \frac{30}{2}[2 + 29] = 15 \times 31 = 465S30=230[2+29]=15×31=465

Answer:

465\boxed{465}465

PART–C: Previous Year BSE Odisha AP Questions (Solved)

PYQ–1 (BSE Odisha – 5 Marks)

Question:

Find the sum of first 25 terms of the AP:

6, 13, 20, …6,\; 13,\; 20,\; \dots6,13,20,…

Solution:

a=6, d=7, n=25a = 6,\; d = 7,\; n = 25a=6,d=7,n=25

S25=252[12+168]=252×180=2250S_{25} = \frac{25}{2}[12 + 168] = \frac{25}{2} \times 180 = 2250S25=225[12+168]=225×180=2250

Answer:

2250\boxed{2250}2250

PYQ–2 (BSE Odisha – 4 Marks)

Question:

Find the 20th term of the AP:

−3, −7, −11, …-3,\; -7,\; -11,\; \dots−3,−7,−11,…

Solution:

a=−3, d=−4, n=20a = -3,\; d = -4,\; n = 20a=−3,d=−4,n=20

a20=−3+19(−4)=−79a_{20} = -3 + 19(-4) = -79a20=−3+19(−4)=−79

Answer:

−79\boxed{-79}−79

PYQ–3 (BSE Odisha – 5 Marks)

Question: How many terms of the AP

18, 15, 12, …18,\; 15,\; 12,\; \dots18,15,12,… must be taken so that their sum is 0?

Solution:

a=18, d=−3a = 18,\; d = -3a=18,d=−3

Sn=n2[36−3(n−1)]=0⇒39−3n=0⇒n=13S_n = \frac{n}{2}[36 - 3(n-1)] = 0 \Rightarrow 39 - 3n = 0 \Rightarrow n = 13Sn=2n [36−3(n−1)]=0⇒39−3n=0⇒n=13

Answer: 13 terms

Q: Find the 20th term of the AP:

−3, −7, −11, …-3,\; -7,\; -11,\; \dots−3,−7,−11,…

Solution (English):

a=−3, d=−4, n=20a=-3,\;d=-4,\;n=20a=−3,d=−4,n=20

a20=a+(n−1)d=−3+19(−4)=−79a_{20} = a+(n-1)d = -3+19(-4)=-79a20 =a+(n−1)d=−3+19(−4)=−79

ଓଡ଼ିଆ:

ଅନୁଷ୍ଟାନ: a=−3, d=−4a=-3,\;d=-4a=−3,d=−4

a20=−3+19(−4)=−79a_{20} = -3+19(-4)=-79a20=−3+19(−4)=−79

✔ **Answer:** −79-79−79

Chapter 3: Arithmetic Progression (AP)
Step-by-Step Solutions (BSE Odisha Board Pattern)

Question – 1 (BSE Odisha 2019 - 24)

Find the 10th term of the AP:

3, 7, 11, …3,\; 7,\; 11,\; \dots3,7,11,…

✔ **Step-by-Step Solution (English)**

Step 1: Identify values

a=3,d=7−3=4,n=10a = 3,\quad d = 7 - 3 = 4,\quad n = 10a=3,d=7−3=4,n=10

Step 2: Write formula

an=a+(n−1)da_n = a + (n - 1)dan=a+(n−1)d

Step 3: Substitute values

a10=3+(10−1)×4a_{10} = 3 + (10 - 1)\times4a10=3+(10−1)×4

Step 4: Simplify

a10=3+36=39a_{10} = 3 + 36 = 39a10=3+36=39

Final Answer:

39\boxed{39}39

ଧାପ-ଧାପ ସମାଧାନ (ଓଡ଼ିଆ)

ଧାପ-1:

a=3, d=4, n=10a = 3,\; d = 4,\; n = 10a=3,d=4,n=10

ଧାପ-2:

n-ତମ ପଦ=a+(n−1)dn\text{-ତମ ପଦ} = a + (n - 1)dn-ତମ ପଦ=a+(n−1)d

ଧାପ-3:

a10=3+9×4=39a_{10} = 3 + 9 \times 4 = 39a10=3+9×4=39

ଉତ୍ତର:

39\boxed{39}39

Question – 2 (BSE Odisha 2020)

Find the sum of first 20 terms of the AP:

2, 5, 8, …2,\; 5,\; 8,\; \dots2,5,8,…

✔ **Step-by-Step Solution (English)**

Step 1:

a=2, d=3, n=20a = 2,\; d = 3,\; n = 20a=2,d=3,n=20

Step 2: Formula for sum

Sn=n2[2a+(n−1)d]S_n = \frac{n}{2}[2a + (n - 1)d]Sn=2n[2a+(n−1)d]

Step 3: Substitute

S20=202[4+19×3]S_{20} = \frac{20}{2}[4 + 19 \times 3]S20=220[4+19×3]

Step 4: Simplify

S20=10×61=610S_{20} = 10 \times 61 = 610S20=10×61=610

Final Answer:

610\boxed{610}610

ଓଡ଼ିଆ ସମାଧାନ

a=2, d=3, n=20a = 2,\; d = 3,\; n = 20a=2,d=3,n=20
S20=202[4+57]=10×61=610S_{20} = \frac{20}{2}[4 + 57] = 10 \times 61 = 610S20=220[4+57]=10×61=610

ଉତ୍ତର:

610\boxed{610}610

Question – 3 (BSE Odisha 2021)

How many terms of the AP

18, 15, 12, …18,\; 15,\; 12,\; \dots18,15,12,…

have sum = 0?

✔ **Step-by-Step Solution (English)**

Step 1:

a=18, d=−3a = 18,\; d = -3a=18,d=−3

Step 2: Use sum formula

Sn=n2[2a+(n−1)d]S_n = \frac{n}{2}[2a + (n - 1)d]Sn=2n[2a+(n−1)d]

Step 3: Given Sn=0S_n = 0Sn=0

n2[36−3(n−1)]=0\frac{n}{2}[36 - 3(n - 1)] = 02n[36−3(n−1)]=0

Step 4: Solve

36−3n+3=0⇒39=3n⇒n=1336 - 3n + 3 = 0 \Rightarrow 39 = 3n \Rightarrow n = 1336−3n+3=0⇒39=3n⇒n=13

Final Answer:

13 terms\boxed{13\text{ terms}}13 terms

ଓଡ଼ିଆ ସମାଧାନ

a=18, d=−3a = 18,\; d = -3a=18,d=−3 Sn=0⇒39−3n=0⇒n=13S_n = 0 \Rightarrow 39 - 3n = 0 \Rightarrow n = 13Sn=0⇒39−3n=0⇒n=13

ଉତ୍ତର:

13\boxed{13}13

Question – 4 (BSE Odisha 2022)

Find the 20th term of the AP:

−3, −7, −11, …-3,\; -7,\; -11,\; \dots−3,−7,−11,…

✔ **Step-by-Step Solution (English)**

a=−3, d=−4, n=20a = -3,\; d = -4,\; n = 20a=−3,d=−4,n=20
a20=a+(n−1)da_{20} = a + (n - 1)da20=a+(n−1)d a20=−3+19(−4)=−79a_{20} = -3 + 19(-4) = -79a20=−3+19(−4)=−79

Final Answer:

−79\boxed{-79}−79

Question – 5 (BSE Odisha 2023)

Find the sum of first 25 terms of the AP:

6, 13, 20, …6,\; 13,\; 20,\; \dots6,13,20,…

Step-by-Step Solution (English)

a=6, d=7, n=25a = 6,\; d = 7,\; n = 25a=6,d=7,n=25 S25=252[12+168]S_{25} = \frac{25}{2}[12 + 168]S25=225[12+168] S25=252×180=2250S_{25} = \frac{25}{2} \times 180 = 2250S25=225×180=2250

Final Answer:

2250\boxed{2250}2250

JAI HIND! - BINAYA