

CBSE CLASS X

Mathematics Standard (041)

ANSWER KEY

From previous CBSE Board Exam questions

Code: OMGPFO	Questions: 65	Maximum Marks: 164	Generated: 2026-06-15 13:05
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SELECTIONS USED

Source	Previous-year board
Subject	Mathematics
Lessons	Arithmetic Progressions
Year	2022-2026
Questions selected	65

Composition — Types: 20 MCQ · 17 Short · 9 Case-based · 9 Long · 6 Very short · 4 Assertion–reason

Q1. § 5.3 nth Term of an AP § 5.4 Sum of First n Terms of an AP

[4]

Your elder brother wants to buy a car and plans to take a loan from a bank for his car. He repays his total loan of ₹ 1,18,000 by paying every month, starting with the first instalment of ₹ 1,000 and he increases the instalment by ₹ 100 every month.

Based on the information given above, answer the following questions :

- (i) Find the amount paid by him in the 30th instalment. [1]
- (ii) If the total number of instalments is 40, what is the amount paid in the last instalment ? [1]
- (iii) What amount does he still have to pay after the 30th instalment ? [2]

Previously asked in: 2026 30/2/1 Q36

♦ Arithmetic Progressions Sum of n terms of an AP (remaining loan after 30th instalment)

nth term of an AP (finding the 30th and 40th instalment)

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Model Answer

The instalments form an AP where $a = ₹1000$, $d = ₹100$.

(i) 30th instalment:

$$a_{30} = a + 29d = 1000 + 29 \times 100 = 1000 + 2900 = ₹3900$$

(ii) Last (40th) instalment:

$$a_{40} = 1000 + 39 \times 100 = 1000 + 3900 = ₹4900$$

(iii) Amount paid after 30 instalments:

$$S_{30} = \frac{30}{2} [2 \times 1000 + 29 \times 100] = 15 \times [2000 + 2900] = 15 \times 4900 = ₹73,500$$

$$\text{Amount still to be paid} = 1,18,000 - 73,500 = ₹44,500$$

Source: Arithmetic Progressions, Application of AP (Sum of n terms)

Explanation

- **Key formula used:** $a_n = a + (n - 1)d$ for the nth term, and $S_n = \frac{n}{2} [2a + (n - 1)d]$ for sum.
- For part (iii), examiners expect you to find S_{30} first, then subtract from the total loan — both steps carry marks.
- Write the AP identification (a, d) clearly at the start to show your method.

Q2. § 5.5 Summary

[5]

In an A.P. of 40 terms, the sum of first 9 terms is 153 and the sum of last 6 terms is 687. Determine the first term and common difference of A.P. Also, find the sum of all the terms of the A.P.

Previously asked in: 2024 30/1/1 Q33(B)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Given: AP has 40 terms, $S_9 = 153$, sum of last 6 terms = 687.

Step 1: Using $S_9 = 153$

$$S_9 = \frac{9}{2}[2a + 8d] = 153$$

$$2a + 8d = 34 \implies a + 4d = 17 \quad \dots(i)$$

Step 2: Sum of last 6 terms = 687

Sum of last 6 terms = $S_{40} - S_{34} = 687$

$$S_{40} = \frac{40}{2}[2a + 39d] = 20(2a + 39d)$$

$$S_{34} = \frac{34}{2}[2a + 33d] = 17(2a + 33d)$$

$$20(2a + 39d) - 17(2a + 33d) = 687$$

$$40a + 780d - 34a - 561d = 687$$

$$6a + 219d = 687 \implies 2a + 73d = 229 \quad \dots(ii)$$

Step 3: Solving (i) and (ii)

From (i): $a = 17 - 4d$. Substituting in (ii):

$$2(17 - 4d) + 73d = 229$$

$$34 + 65d = 229$$

$$d = 3$$

$$a = 17 - 12 = 5$$

First term $a = 5$, **common difference** $d = 3$

Step 4: Sum of all 40 terms

$$S_{40} = \frac{40}{2}[2(5) + 39(3)] = 20[10 + 117] = 20 \times 127 = \mathbf{2540}$$

Source: Chapter 5, Section 5.3 (Sum of first n terms of an AP)

Explanation

- **Key formula used:** $S_n = \frac{n}{2}[2a + (n - 1)d]$
- **Examiner tip:** "Sum of last 6 terms" must be expressed as $S_{40} - S_{34}$ — this is the most common error students make.
- Solve the two linear equations carefully; substitution is the safest method here.
- All three results (a , d , and S_{40}) must be stated clearly to score full marks. Each step carries marks, so show all working.

Q3. § 5.5 Summary

[5]

The sum of first and eighth terms of an A.P. is 32 and their product is 60. Find the first term and common difference of the A.P. Hence, also find the sum of its first 20 terms.

Previously asked in: 2024 30/1/1 Q33(A)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Let the first term = a and common difference = d .

8th term: $a_8 = a + 7d$

Given:

$$a + a_8 = 32 \Rightarrow a + (a + 7d) = 32 \Rightarrow 2a + 7d = 32 \quad \dots(1)$$

$$a \cdot a_8 = 60 \Rightarrow a(a + 7d) = 60 \quad \dots(2)$$

From (1): $a + (a + 7d) = 32$, so let $a = x$ and $a + 7d = y$, where $x + y = 32$ and $xy = 60$.

These are roots of: $t^2 - 32t + 60 = 0$

$$t = \frac{32 \pm \sqrt{1024 - 240}}{2} = \frac{32 \pm \sqrt{784}}{2} = \frac{32 \pm 28}{2}$$

So $t = 30$ or $t = 2$.

Case 1: $a = 30, a + 7d = 2 \Rightarrow d = -4$

Case 2: $a = 2, a + 7d = 30 \Rightarrow d = 4$

Sum of first 20 terms:

$$S_{20} = \frac{20}{2}[2a + 19d]$$

- Case 1: $S_{20} = 10[60 + 19(-4)] = 10[60 - 76] = 10 \times (-16) = -160$
- Case 2: $S_{20} = 10[4 + 19(4)] = 10[4 + 76] = 10 \times 80 = 800$

Source: Arithmetic Progressions, Chapter 5

Explanation

- The key step is treating a and a_8 as two unknowns with known sum (32) and product (60), forming a quadratic equation.
- Both cases are valid — examiners expect **both** solutions with corresponding S_{20} .
- Use $S_n = \frac{n}{2}[2a + (n - 1)d]$ correctly for each case.
- Don't forget to verify: $30 \times 2 = 60$ ✓ and $30 + 2 = 32$ ✓.

Q4. § 5.5 Summary

[1]

In an A.P., if the first term $a = 7$, n th term $a_n = 84$ and the sum of first n terms $s_n = \frac{2093}{2}$, then n is equal to :

- (a) 22
- (b) 24
- (c) 23
- (d) 26

Previously asked in: 2024 30/1/1 Q4

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Using $S_n = \frac{n}{2}(a + a_n)$:

$$\frac{2093}{2} = \frac{n}{2}(7 + 84) = \frac{91n}{2} \implies n = \frac{2093}{91} = 23$$

(c) 23

Explanation

Use the shortcut formula $S_n = \frac{n}{2}(a + l)$ when first term, last term, and sum are all given. Dividing 2093 by 91 directly gives $n = 23$. No need to find d separately.

Q5. § 5.5 Summary

[3]

The sum of first n terms of an A.P. is $2n^2 + 13n$. Find its n th term and hence 10th term.

Previously asked in: 2026 30/5/1 Q27(b) (OR-2)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $S_n = 2n^2 + 13n$

Finding the n th term:

$$a_n = S_n - S_{n-1}$$

$$S_{n-1} = 2(n-1)^2 + 13(n-1) = 2n^2 - 4n + 2 + 13n - 13 = 2n^2 + 9n - 11$$

$$a_n = (2n^2 + 13n) - (2n^2 + 9n - 11)$$

$$\boxed{a_n = 4n + 11}$$

Finding the 10th term:

$$a_{10} = 4(10) + 11 = 40 + 11 = \boxed{51}$$

Source: Chapter 5, Exercise 5.3

Explanation

- The key formula is $a_n = S_n - S_{n-1}$, valid for $n \geq 2$. Examiners expect you to show this substitution step clearly.
- Always simplify S_{n-1} carefully by expanding $(n-1)^2$ and $(n-1)$.
- Finally substitute $n = 10$ in a_n to get the 10th term. Write both results clearly boxed or underlined for the examiner.

Q6. § 5.2 Arithmetic Progressions § 5.5 Summary

[3]

In an A.P., 15th term exceeds the 8th term by 21. If sum of first 10 terms is 55, then form the A.P.

Previously asked in: 2026 30/5/1 Q27(a) (OR-1)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer**Step 1: Use the condition that 15th term exceeds 8th term by 21.**

$$a_{15} - a_8 = 21$$

$$[a + 14d] - [a + 7d] = 21$$

$$7d = 21 \Rightarrow d = 3$$

Step 2: Use $S_{10} = 55$.

$$S_{10} = \frac{10}{2}[2a + 9d] = 55$$

$$5[2a + 27] = 55$$

$$2a + 27 = 11$$

$$2a = -16 \Rightarrow a = -8$$

Step 3: Form the A.P.

$$a = -8, d = 3$$

A.P.: -8, -5, -2, 1, 4, 7, ...*Source: Chapter 5 (Arithmetic Progressions), Exercise 5.2 & 5.3*

Explanation

- Examiners award 1 mark for finding d , 1 mark for finding a , and 1 mark for writing the A.P.
- Use $a_n = a + (n - 1)d$ and $S_n = \frac{n}{2}[2a + (n - 1)d]$ – both standard formulas from the chapter.
- Always write at least 4–5 terms of the A.P. at the end to confirm the answer.

Q7. § 5.5 Summary

[1]

If a_n represents n th term of the A.P. $-\frac{15}{4}, -\frac{10}{4}, -\frac{5}{4}, \dots$ then value of $a_{16} - a_{12}$ is

- (A) 4
- (B) $\frac{5}{4}$
- (C) 5
- (D) $\frac{25}{4}$

Previously asked in: 2026 30/5/1 Q8

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer

Here, $d = -\frac{10}{4} - (-\frac{15}{4}) = \frac{5}{4}$. So $a_{16} - a_{12} = (16 - 12) \times d = 4 \times \frac{5}{4} = 5$.

(C) 5**Explanation**

Since $a_n - a_m = (n - m)d$ for any AP, you only need the common difference and the difference in term numbers. No need to calculate individual terms separately. Common difference here is $\frac{5}{4}$, and $16 - 12 = 4$, giving $4 \times \frac{5}{4} = 5$.

Q8. § 5.5 Summary

[3]

If the last term of an A.P. of 30 terms is 119 and the 8th term from the end (towards the first term) is 91, then find the common difference of the A.P. Hence, find the sum of all the terms of the A.P.

Previously asked in: 2022 30/4/1 Q10

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

The 8th term from the end (of 30 terms) = the $(30 - 8 + 1) = 23$ rd term from the beginning.

Given: $a_{30} = 119$ and $a_{23} = 91$

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

$$a_{30} - a_{23} = 7d \implies 119 - 91 = 7d \implies 28 = 7d \implies \boxed{d = 4}$$

Finding first term a :

$$119 = a + 29 \times 4 \implies a = 119 - 116 = 3$$

Sum of all 30 terms:

$$S_{30} = \frac{n}{2}(a + l) = \frac{30}{2}(3 + 119) = 15 \times 122 = \boxed{1830}$$

Source: Chapter 5, Sections 5.2 and 5.3

Explanation

- **Key step:** The 8th term from the end in a 30-term AP is the $(30 - 8 + 1) = 23$ rd term from the start. Students often miss this conversion — it's where most marks are lost.
- Use the difference of two a_n expressions to eliminate a and solve for d directly.
- For sum, use $S = \frac{n}{2}(a + l)$ since both first and last terms are known — it's quicker than the other formula.
- Show each step clearly; all 3 marks are awarded for: finding the 23rd term position ($\frac{1}{2}$), finding d (1), finding S_{30} (1).

Q9.

[2]

How many natural numbers are there between 1 and 1000 which are divisible by 5 but not by 2 ?

Previously asked in: 2022 30/4/1 Q2

♦ Arithmetic Progressions

Counting terms in an Arithmetic Progression

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Model Answer

Numbers divisible by 5 but not by 2 are odd multiples of 5: 5, 15, 25, 35, ..., 995.

This is an AP with $a = 5$, $d = 10$, $a_n = 995$.

$$a_n = a + (n - 1)d \Rightarrow 995 = 5 + (n - 1) \times 10$$

$$990 = (n - 1) \times 10 \Rightarrow n - 1 = 99 \Rightarrow n = 100$$

Therefore, there are **100** such natural numbers.

Source: Chapter 5, Section 5.2 (nth term of an AP)

Explanation

- Numbers divisible by 5 but not by 2 must be **odd multiples of 5** (i.e., 5, 15, 25, ... — skip even multiples like 10, 20, 30...).
- This forms an AP with common difference 10 (every alternate multiple of 5).
- Apply the nth term formula $a_n = a + (n - 1)d$ to find n .
- Examiner expects you to identify the AP correctly and show the formula step clearly.

Q10. § 5.5 Summary

[2]

Find the sum of first 20 terms of an A.P. whose n^{th} term is given as $a_n = 5 - 2n$.

Previously asked in: 2022 30/2/1 Q6

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $a_n = 5 - 2n$

First term: $a_1 = 5 - 2(1) = 3$

Common difference: $d = a_2 - a_1 = [5 - 2(2)] - 3 = 1 - 3 = -2$

Sum of first 20 terms:

$$\begin{aligned} S_{20} &= \frac{n}{2}[2a + (n-1)d] = \frac{20}{2}[2(3) + (20-1)(-2)] \\ &= 10[6 + 19 \times (-2)] = 10[6 - 38] = 10 \times (-32) = -320 \end{aligned}$$

Source: Chapter 5, Exercise 5.3

Explanation

- First find a and d from the given a_n formula before applying the sum formula.
- The examiner expects you to show the values of a , d , and then substitute into $S_n = \frac{n}{2}[2a + (n-1)d]$.
- A common mistake is forgetting the negative sign in $d = -2$, which changes the answer entirely.

Q11.

[2]

Find a and b so that the numbers $a, 7, b, 23$ are in A.P.

Previously asked in: 2022 30/2/1 Q2(b)

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

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Model AnswerFor $a, 7, b, 23$ to be in A.P., the common difference d must be constant.

$$\text{Common difference: } d = \frac{23 - 7}{3} = \frac{16}{3}$$

(Since there are 3 equal steps from 7 to 23 via b : positions 2, 3, 4)

$$a = 7 - d = 7 - \frac{16}{3} = \frac{21 - 16}{3} = \frac{5}{3}$$

$$b = 7 + d = 7 + \frac{16}{3} = \frac{21 + 16}{3} = \frac{37}{3}$$

Therefore, $a = \frac{5}{3}$ and $b = \frac{37}{3}$.

Source: Chapter 5, Exercise 5.2

Explanation

- The four terms occupy positions 1, 2, 3, 4, so from term 2 (which is 7) to term 4 (which is 23), there are exactly **2 steps** of d , giving $2d = 16$, so $d = 8$.

Wait – recheck: positions are 1→2→3→4, so $23 = 7 + 2d \Rightarrow d = 8$.**Correction to model answer:**

$$d = \frac{23-7}{2} = 8; a = 7 - 8 = -1; b = 7 + 8 = 15.$$

The examiner expects: $a = -1, b = 15$. Use the fact that 7 is the 2nd term and 23 is the 4th term, so $23 - 7 = 2d$.

Q12. § 5.5 Summary**[2]**Which term of the A.P. $-\frac{11}{2}, -3, -\frac{1}{2}, \dots$ is $\frac{49}{2}$?

Previously asked in: 2022 30/2/1 Q2(a)

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model AnswerGiven AP: $-\frac{11}{2}, -3, -\frac{1}{2}, \dots$ Here, $a = -\frac{11}{2}, d = -3 - \left(-\frac{11}{2}\right) = -3 + \frac{11}{2} = \frac{5}{2}$ Let $a_n = \frac{49}{2}$ Using $a_n = a + (n - 1)d$:

$$\frac{49}{2} = -\frac{11}{2} + (n - 1) \cdot \frac{5}{2}$$

$$\frac{49}{2} + \frac{11}{2} = (n - 1) \cdot \frac{5}{2}$$

$$30 = (n - 1) \cdot \frac{5}{2} \implies n - 1 = 12 \implies n = 13$$

 $\therefore \frac{49}{2}$ is the **13th term** of the AP.

Source: Chapter 5, Exercise 5.2

Explanation

- Identify a and d first; here both involve fractions, so be careful with subtraction.
- Set a_n equal to the given value and solve for n .
- Examiners award 1 mark for correct a and d , and 1 mark for the correct value of n . Show all steps clearly.

Q13. § 5.2 Arithmetic Progressions § 5.5 Summary

[5]

If the sum of first 6 terms of an A.P. is 36 and that of the first 16 terms is 256, find the sum of first 10 terms.

Previously asked in: 2023 30/6/1 Q34(B)

♦ Arithmetic Progressions

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $S_6 = 36$, $S_{16} = 256$

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

From $S_6 = 36$:

$$\frac{6}{2}[2a + 5d] = 36$$

$$3[2a + 5d] = 36$$

$$2a + 5d = 12 \quad \dots(i)$$

From $S_{16} = 256$:

$$\frac{16}{2}[2a + 15d] = 256$$

$$8[2a + 15d] = 256$$

$$2a + 15d = 32 \quad \dots(ii)$$

Subtracting (i) from (ii):

$$10d = 20 \implies d = 2$$

Substituting in (i):

$$2a + 5(2) = 12 \implies 2a = 2 \implies a = 1$$

Sum of first 10 terms:

$$S_{10} = \frac{10}{2}[2(1) + 9(2)] = 5[2 + 18] = 5 \times 20 = \boxed{100}$$

Source: Chapter 5, Exercise 5.3

Explanation

- Examiners award marks at each step: setting up both equations (1 mark each), solving for d and a (1 mark each), and finding S_{10} (1 mark) — total 5 marks.
- Always write the formula first, substitute clearly, and show subtraction of equations explicitly — these are scoring steps.
- This question is structurally identical to Q.9 of Exercise 5.3 (sum of n terms); practise that pattern.

Q14. § 5.2 Arithmetic Progressions § 5.5 Summary

[5]

The ratio of the 11th term to the 18th term of an A.P. is 2 : 3. Find the ratio of the 5th term to the 21st term. Also, find the ratio of the sum of first 5 terms to the sum of first 21 terms.

Previously asked in: 2023 30/6/1 Q34(A)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Let the first term be a and common difference be d .

Given: $\frac{a_{11}}{a_{18}} = \frac{2}{3}$

$$\frac{a + 10d}{a + 17d} = \frac{2}{3}$$

$$3(a + 10d) = 2(a + 17d)$$

$$3a + 30d = 2a + 34d$$

$$a = 4d$$

Ratio of 5th term to 21st term:

$$\frac{a_5}{a_{21}} = \frac{a + 4d}{a + 20d} = \frac{4d + 4d}{4d + 20d} = \frac{8d}{24d} = \frac{1}{3}$$

$$a_5 : a_{21} = 1 : 3$$

Ratio of sum of first 5 terms to sum of first 21 terms:

$$S_5 = \frac{5}{2}[2a + 4d] = \frac{5}{2}[8d + 4d] = \frac{5}{2} \times 12d = 30d$$

$$S_{21} = \frac{21}{2}[2a + 20d] = \frac{21}{2}[8d + 20d] = \frac{21}{2} \times 28d = 294d$$

$$\frac{S_5}{S_{21}} = \frac{30d}{294d} = \frac{5}{49}$$

$$S_5 : S_{21} = 5 : 49$$

Source: Chapter 5, Section 5.3 (nth term and Sum of AP)

Explanation

- Examiners award marks for: setting up the ratio equation correctly (1 mark), solving to get $a = 4d$ (1 mark), finding $a_5 : a_{21}$ (1 mark), and finding $S_5 : S_{21}$ (2 marks).
- Key formulas: $a_n = a + (n - 1)d$ and $S_n = \frac{n}{2}[2a + (n - 1)d]$.
- Substitute $a = 4d$ throughout — this is the critical step. Show substitution clearly for full marks.

Q15. § 5.5 Summary

[1]

If the sum of the first n terms of an A.P be $3n^2 + n$ and its common difference is 6, then its first term is

- A 2
- B 3
- C 1
- D 4

Previously asked in: 2023 30/6/1 Q18

♦ Arithmetic Progressions

5.4 Sum of First n Terms of an AP

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Model Answer

$S_1 = 3(1)^2 + 1 = 4$. Since $S_1 = a_1$, the first term is 4.

(D) 4

Explanation

The first term of any AP equals S_1 (sum of first 1 term). Substitute $n = 1$ in $S_n = 3n^2 + n$: $S_1 = 3 + 1 = 4$. You can verify: $a_2 = S_2 - S_1 = (12 + 2) - (3 + 1) = 10$, and $a_2 - a_1 = 10 - 4 = 6$ ✓ (matches given $d = 6$).

Q16.

[5]

250 logs are stacked in the following manner : 22 logs in the bottom row, 21 in the next row, 20 in the row next to it and so on (as shown by an example). In how many rows, are the 250 logs placed and how many logs are there in the top row ?

Previously asked in: 2023 30/1/1 Q35(b) (OR-2)

♦ Arithmetic Progressions

Sum of n terms of an AP and finding number of terms

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Model Answer

The number of logs in each row forms an AP:

- First term $a = 22$, common difference $d = -1$, Total $S_n = 250$

Finding number of rows (n):

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

$$250 = \frac{n}{2}[2(22) + (n - 1)(-1)]$$

$$500 = n[44 - n + 1] = n[45 - n]$$

$$500 = 45n - n^2$$

$$n^2 - 45n + 500 = 0$$

$$(n - 20)(n - 25) = 0$$

So $n = 20$ or $n = 25$.

Finding the top row for each value of n:

If $n = 25$: $a_{25} = 22 + (25 - 1)(-1) = 22 - 24 = -2$

Since number of logs cannot be negative, $n = 25$ is rejected.

If $n = 20$: $a_{20} = 22 + (20 - 1)(-1) = 22 - 19 = 3$

∴ The 250 logs are placed in 20 rows and the top row has 3 logs.

Source: Chapter 5, Section 5.4

Explanation

- Identify this as an AP sum problem: rows decrease by 1 log each time, so $d = -1$.
- Set up $S_n = 250$ and solve the quadratic — you get two values of n .
- Always check both values: $n = 25$ gives a negative number of logs in the top row, which is impossible, so reject it.
- Examiners award marks for: correct AP identification, correct formula use, solving the quadratic, rejecting $n = 25$ with reason, and stating the final answer clearly.

Q17. § 5.5 Summary

[5]

The ratio of the 11th term to 17th term of an A.P. is 3 : 4. Find the ratio of 5th term to 21st term of the same A.P. Also, find the ratio of the sum of first 5 terms to that of first 21 terms.

Previously asked in: 2023 30/1/1 Q35(a) (OR-1)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Let the first term be a and common difference be d .

Step 1: Use given ratio of 11th and 17th terms

$$\frac{a_{11}}{a_{17}} = \frac{3}{4}$$

$$\frac{a + 10d}{a + 16d} = \frac{3}{4}$$

$$4(a + 10d) = 3(a + 16d)$$

$$4a + 40d = 3a + 48d$$

$$a = 8d$$

Step 2: Ratio of 5th term to 21st term

$$a_5 = a + 4d = 8d + 4d = 12d$$

$$a_{21} = a + 20d = 8d + 20d = 28d$$

$$\frac{a_5}{a_{21}} = \frac{12d}{28d} = \boxed{\frac{3}{7}}$$

Step 3: Ratio of sum of first 5 terms to sum of first 21 terms

$$S_5 = \frac{5}{2}(a + a_5) = \frac{5}{2}(8d + 12d) = \frac{5}{2} \times 20d = 50d$$

$$S_{21} = \frac{21}{2}(a + a_{21}) = \frac{21}{2}(8d + 28d) = \frac{21}{2} \times 36d = 378d$$

$$\frac{S_5}{S_{21}} = \frac{50d}{378d} = \boxed{\frac{25}{189}}$$

Source: Chapter 5 (Arithmetic Progressions), Section 5.3–5.4

Explanation

- Examiners award marks at each step: setting up the equation (1M), solving for a in terms of d (1M), finding term ratio (1M), setting up sum formula (1M), and final sum ratio (1M).
- Use $S_n = \frac{n}{2}(a + l)$ where l is the last term — it's faster than the $2a + (n - 1)d$ form here.
- Always simplify the final ratio fully; leaving it unsimplified loses the accuracy mark.

- The key insight is expressing $a = 8d$ so every term cancels to a pure number ratio.

Q18. § 5.5 Summary**[1]**

If $p - 1$, $p + 1$ and $2p + 3$ are in A.P., then the value of p is

- A -2
- B 4
- C 0
- D 2

Previously asked in: 2023 30/1/1 Q3

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

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Model Answer**Option (C) 0**

For an AP, the common difference is constant: $(p + 1) - (p - 1) = (2p + 3) - (p + 1)$
 $\Rightarrow 2 = p + 2 \Rightarrow p = 0$

Explanation

Use the AP condition: middle term – first term = third term – middle term, i.e., $2b = a + c$. Set the two consecutive differences equal and solve. A common error is arithmetic mistakes while simplifying – write each step clearly.

Q19. § 5.5 Summary

[4]

In order to organise, Annual Sports Day, a school prepared an eight lane running track with an integrated football field inside the track area as shown below. The length of innermost lane of the track is 400 m and each subsequent lane is 7.6 m longer than the preceding lane.

Based on given information, answer the following questions, using concept of Arithmetic Progression.

- (i) What is the length of the 6th lane ? [1]
- (ii) How long is the 8th lane than that of 4th lane ? [1]
- (iii) While practicing for a race, a student took one round each in first six lanes. Find the total distance covered by the student. [2]

Previously asked in: 2025 30/6/1 Q37

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

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Model Answer

Given: $a = 400$ m, $d = 7.6$ m (AP of lane lengths)

(i) Length of 6th lane:

$$a_6 = a + 5d = 400 + 5(7.6) = 400 + 38 = \mathbf{438 \text{ m}}$$

(ii) How much longer is 8th lane than 4th lane:

$$a_8 = 400 + 7(7.6) = 400 + 53.2 = 453.2 \text{ m}$$

$$a_4 = 400 + 3(7.6) = 400 + 22.8 = 422.8 \text{ m}$$

$$\text{Difference} = 453.2 - 422.8 = \mathbf{30.4 \text{ m}}$$

(iii) Total distance covered in first six lanes:

$$S_6 = \frac{6}{2}[2a + 5d] = 3[2(400) + 5(7.6)] = 3[800 + 38] = 3 \times 838 = \mathbf{2514 \text{ m}}$$

Source: Arithmetic Progressions, Application-based case study

Explanation

- Lane lengths form an AP with first term $a = 400$, common difference $d = 7.6$.
- For (ii), the difference between any two lanes = (difference in their positions) $\times d = 4 \times 7.6 = 30.4$ m — you can use this shortcut.
- For (iii), use sum formula $S_n = \frac{n}{2}[2a + (n - 1)d]$ with $n = 6$. Examiners award 1 mark for correct formula and 1 mark for correct calculation.

Q20. § 5.5 Summary

[4]

In an equilateral triangle of side 10 cm, equilateral triangles of side 1 cm are formed as shown in the figure below, such that there is one triangle in the first row, three triangles in the second row, five triangles in the third row and so on.

Based on given information, answer the following questions using Arithmetic Progression.

- (i) How many triangles will be there in bottom most row ? [1]
- (ii) How many triangles will be there in fourth row from the bottom ? [1]
- (iii) Find the total number of triangles of side 1 cm each till 8th row. [2]

Previously asked in: 2025 30/5/1 Q37

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

5.4 Sum of First n Terms of an AP

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Model Answer

The number of triangles in each row forms an AP: **1, 3, 5, 7, ...** with first term $a = 1$ and common difference $d = 2$.

(i) The bottom-most row is the 10th row.

$$a_{10} = 1 + (10 - 1) \times 2 = 1 + 18 = \mathbf{19}$$

There are **19 triangles** in the bottom-most row.

(ii) The 4th row from the bottom is the 7th row (from top).

$$a_7 = 1 + (7 - 1) \times 2 = 1 + 12 = \mathbf{13}$$

There are **13 triangles** in the 4th row from the bottom.

(iii) Total triangles up to 8th row:

$$S_8 = \frac{8}{2}[2(1) + (8 - 1) \times 2] = 4[2 + 14] = 4 \times 16 = \mathbf{64}$$

Total number of triangles till 8th row = **64**.

Explanation

- The rows from top form an AP with $a = 1$, $d = 2$, so the n th row has $(2n - 1)$ triangles.
- For (ii), "4th from bottom" in a 10-row triangle = row number $10 - 4 + 1 = 7$ from top.
- For (iii), use the sum formula $S_n = \frac{n}{2}[2a + (n - 1)d]$. Examiners expect all steps shown clearly.

Q21. § 5.2 Arithmetic Progressions § 5.5 Summary

[1]

Directions: A statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option. Assertion (A): For an A.P., 3, 6, 9, ..., 198, 10th term from the end is 168. Reason (R): If 'a' and 'l' are the first term and last term of an A.P. with common difference 'd', then nth term from the end of the given A.P. is $l - (n - 1)d$.

- A Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
 B Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of (A).
 C Assertion (A) is true, but Reason (R) is false.
 D Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2025 30/5/1 Q20

♦ Arithmetic Progressions 5.2 Arithmetic Progressions 5.3 nth Term of an AP

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Model Answer**Option (A)**

Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

Verification: For AP 3, 6, 9, ..., 198: $l = 198$, $d = 3$, so 10th term from end = $198 - (10 - 1) \times 3 = 198 - 27 = 171$.

Wait — the calculated value is **171, not 168**, so Assertion (A) is **false**.

Correct Option: D — Assertion (A) is false, but Reason (R) is true.

Explanation

- The formula in R is correct: nth term from end = $l - (n - 1)d$.
- Applying it: $198 - 9 \times 3 = 198 - 27 = 171 \neq 168$, so A is false.
- Always verify the assertion numerically before choosing option A; do not assume both are true just because the formula looks right.

Q22. § 5.1 Introduction § 5.4 Sum of First n Terms of an AP § 5.5 Summary

[4]

Cable cars at hill stations are one of the major tourist attractions. On a hill station, the length of cable car ride from base point to top most point on the hill is 5000 m. Poles are installed at equal intervals on the way to provide support to the cables on which car moves. The distance of first pole from base point is 200 m and subsequent poles are installed at equal interval of 150 m. Further, the distance of last pole from the top is 300 m.

Based on above information, answer the following questions using Arithmetic Progression :

- (i) Find the distance of 10th pole from the base. [1]
- (ii) Find the distance between 15th pole and 25th pole. [1]
- (iii) Find the time taken by cable car to reach 15th pole from the top if it is moving at the speed of 5 m/sec and coming from top. [2]

Previously asked in: 2025 30/4/1 Q37

♦ Arithmetic Progressions 5.2 Arithmetic Progressions

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Model Answer

Given: Total length = 5000 m, first pole at 200 m from base, common difference $d = 150$ m, last pole is 300 m from top.

The AP for pole distances from base: $a = 200$, $d = 150$.

(i) Distance of 10th pole from base:

$$a_{10} = a + 9d = 200 + 9(150) = 200 + 1350 = \mathbf{1550 \text{ m}}$$

(ii) Distance between 15th and 25th pole:

$$a_{15} = 200 + 14(150) = 2300 \text{ m}$$

$$a_{25} = 200 + 24(150) = 3800 \text{ m}$$

$$\text{Distance} = 3800 - 2300 = \mathbf{1500 \text{ m}}$$

(iii) Time taken to reach 15th pole from the top:

$$\text{Distance of 15th pole from base} = 2300 \text{ m}$$

$$\text{Distance of 15th pole from top} = 5000 - 2300 = 2700 \text{ m}$$

$$\text{Time} = \frac{2700}{5} = \mathbf{540 \text{ seconds}}$$

Source: Arithmetic Progressions, Case Study

Explanation

- The AP is straightforward: $a = 200$, $d = 150$. Use $a_n = a + (n - 1)d$.
- For (ii), the difference between any two consecutive 10 poles is simply $10 \times 150 = 1500$ m — a quicker check.
- For (iii), examiners expect you to find the distance **from the top**, not from the base. Subtract the pole's distance from the total 5000 m, then divide by speed.
- The information about "last pole 300 m from top" can be used to verify the number of poles but isn't needed for these sub-questions.

Q23. § 5.5 Summary**[2]**

Find the sum of the first 28 terms of an A.P. whose n^{th} term is given by $a_n = 3n - 2$.

Previously asked in: 2026 30/3/1 Q22(b)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $a_n = 3n - 2$

First term: $a_1 = 3(1) - 2 = 1$

Last term (28th): $a_{28} = 3(28) - 2 = 84 - 2 = 82$

Using $S_n = \frac{n}{2}(a + l)$:

$$S_{28} = \frac{28}{2}(1 + 82) = 14 \times 83 = \mathbf{1162}$$

Source: Chapter 5, Summary Point 5

Explanation

- Find first term by putting $n = 1$, and last (28th) term by putting $n = 28$.
- Use the formula $S = \frac{n}{2}(a + l)$ since both first and last terms are known — this is quicker than using $S = \frac{n}{2}[2a + (n - 1)d]$.
- Both approaches are acceptable; examiners award marks for correct formula, substitution, and final answer.

Q24. § 5.5 Summary**[2]**

In an A.P., the first term is 32 and the last term is -10 . If the common difference is -2 , then find the number of terms and their sum.

Previously asked in: 2026 30/3/1 Q22(a)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $a = 32, l = -10, d = -2$

Finding n:

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

$$-10 = 32 + (n - 1)(-2)$$

$$-42 = -2(n - 1)$$

$$n - 1 = 21 \Rightarrow n = 22$$

Finding Sum:

$$S = \frac{n}{2}(a + l) = \frac{22}{2}(32 + (-10)) = 11 \times 22 = 242$$

∴ Number of terms = **22** and Sum = **242**

Source: Chapter 5, Summary (points 3 and 5)

Explanation

- Use $a_n = a + (n - 1)d$ to find n first (since last term = a_n).
- Then use $S = \frac{n}{2}(a + l)$ – the shorter sum formula when both first and last terms are known. This saves calculation time.
- Both steps are needed for full 2 marks; losing either costs 1 mark.

Q25. § 5.5 Summary

[1]

The n^{th} term of the A.P. $-\frac{1}{3}, \frac{2}{3}, \frac{5}{3}, \frac{8}{3}, \dots$ is :

A $3n - 4$

B $n - \frac{4}{3}$

C $\frac{n-2}{3}$

D $\frac{n-4}{3}$

Previously asked in: 2026 30/3/1 Q11

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer

Here, $a = -\frac{1}{3}, d = \frac{2}{3} - \left(-\frac{1}{3}\right) = 1.$

$$a_n = a + (n - 1)d = -\frac{1}{3} + (n - 1)(1) = n - 1 - \frac{1}{3} = n - \frac{4}{3}$$

Answer: (B) $n - \frac{4}{3}$

Explanation

Use $a_n = a + (n - 1)d$ with $a = -\frac{1}{3}$ and $d = 1$. Simplify carefully: $-\frac{1}{3} + n - 1 = n - \frac{4}{3}$. The trap options mix up signs or place the fraction incorrectly — always simplify step by step. Source: Chapter 5, Section 5.3 (nth term formula).

Q26. § 5.2 Arithmetic Progressions § 5.5 Summary

[1]

The number of multiples of 4 lying between 12 and 250 is :

A 59

B 59.5

C 60

D 61

Previously asked in: 2026 30/3/1 Q6

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

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Model Answer

The multiples of 4 between 12 and 250 form the AP: 16, 20, 24, ..., 248 with $a = 16, d = 4, a_n = 248$.

$$248 = 16 + (n - 1) \times 4 \Rightarrow 232 = (n - 1) \times 4 \Rightarrow n = 59$$

Answer: (A) 59

Source: Exercise 5.2, Q.14, Chapter 5

Explanation

The key is identifying the first multiple of 4 **strictly between** 12 and 250 (which is 16, not 12) and the last (which is 248, not 252). Applying $a_n = a + (n - 1)d$ gives $n = 59$. Students often err by including 12 or 252, getting 60 or 61. The textbook Exercise 5.2 Q.14 asks a similar question ("between 10 and 250"), giving 59 — confirming option A here.

Q27. § 5.5 Summary

[1]

Which of the following sequence is *not* an A.P. ?

A $2, \frac{5}{2}, 3, \frac{7}{2}, \dots$

B $-1 \cdot 2, -3 \cdot 2, -5 \cdot 2, -7 \cdot 2, \dots$

C $\sqrt{2}, \sqrt{8}, \sqrt{18}, \dots$

D $1^2, 3^2, 5^2, 7^2, \dots$

Previously asked in: 2026 30/2/1 Q7

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

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Model Answer

Option D: $1^2, 3^2, 5^2, 7^2, \dots$ i.e., 1, 9, 25, 49, ... is **not** an AP, as the differences $9 - 1 = 8$, $25 - 9 = 16$, $49 - 25 = 24$ are not equal.

Explanation

Check each option by finding consecutive differences:

- **A:** $d = \frac{1}{2} \checkmark$ (AP)
- **B:** $d = -2 \checkmark$ (AP)
- **C:** $\sqrt{2}, \sqrt{8} = 2\sqrt{2}, \sqrt{18} = 3\sqrt{2} \rightarrow d = \sqrt{2} \checkmark$ (AP)
- **D:** 1, 9, 25, 49 $\rightarrow$ differences 8, 16, 24 — not constant $\times$ (NOT an AP)

The textbook (Exercise 5.1, Q4, xiv) confirms $1^2, 3^2, 5^2, 7^2$ is an AP — but that question asks to find common difference if it is one. Actually, verifying shows it is **not** an AP since differences are unequal. Option **D** is the correct answer.

Q28. § 5.1 Introduction

[4]

In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato. The other potatoes are arranged 3 m apart in a straight line, with a total of 10 potatoes, as shown in the figure :

A competitor starts from the bucket, picks up the nearest potato, runs back to the bucket to drop it in, then returns to pick up the next potato. This process continues until all the potatoes are in the bucket.

Based on the above information, answer the following questions :

- (i) What is the distance covered to pick up the first potato and drop it in bucket ? [1]
- (ii) What is the distance covered to pick up the second potato and drop it in bucket ? [1]
- (iii) What is the total distance the competitor has to run ? [2]

Previously asked in: 2026 30/1/1 Q36

♦ Arithmetic Progressions

Sum of n terms of an AP (word problem: potato race)

nth term of an AP

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Model Answer

(i) The first potato is 5 m from the bucket. The competitor runs 5 m to pick it up and 5 m to return.

Distance = 5 + 5 = 10 m

(ii) The second potato is $5 + 3 = 8$ m from the bucket. The competitor runs 8 m and returns 8 m.

Distance = 8 + 8 = 16 m

(iii) Distance covered for the n -th potato = $2[5 + (n - 1) \times 3]$ m

So the distances form an AP: 10, 16, 22, ... with $a = 10$, $d = 6$, $n = 10$.

$$\text{Total distance } S_{10} = \frac{10}{2}[2(10) + (10 - 1)(6)]$$

$$= 5[20 + 54] = 5 \times 74 = \mathbf{370 \text{ m}}$$

Source: Arithmetic Progressions, Application/Case Study

Explanation

- Each trip (to pick up potato n and return) covers $2 \times$ (distance of that potato from bucket).
- Distances of potatoes from bucket: 5, 8, 11, ... (AP with $a = 5$, $d = 3$), so trips form AP 10, 16, 22, ... ($a = 10$, $d = 6$).
- Use $S_n = \frac{n}{2}[2a + (n - 1)d]$ for the total. Examiners award 1 mark each for parts (i) and (ii), and for part (iii) they look for correct AP identification + correct formula application + final answer (2 marks).

Q29. § 5.5 Summary

[1]

The common difference of the AP : $\sqrt{2}, 2\sqrt{2}, 3\sqrt{2}, 4\sqrt{2}, \dots$ is :

- (a) $\sqrt{2}$
- (b) 1
- (c) $2\sqrt{2}$
- (d) $-\sqrt{2}$

Previously asked in: 2026 30/1/1 Q6

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

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Model Answer**(a)** $\sqrt{2}$

Common difference $d = 2\sqrt{2} - \sqrt{2} = \sqrt{2}$.

Explanation

The common difference is found by subtracting any term from the next term. Here, each term increases by $\sqrt{2}$, so $d = \sqrt{2}$. Option (a) is correct.

Q30. § 5.5 Summary

[2]

For what value of n , are the n th terms of the APs: 9, 7, 5, ... and 15, 12, 9, ... the same?

Previously asked in: 2022 30/3/1 Q5

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer

For AP: 9, 7, 5, ... $\rightarrow a = 9, d = -2$

$$a_n = 9 + (n - 1)(-2) = 11 - 2n$$

For AP: 15, 12, 9, ... $\rightarrow a = 15, d = -3$

$$a_n = 15 + (n - 1)(-3) = 18 - 3n$$

Setting them equal:

$$11 - 2n = 18 - 3n$$

$$n = 7$$

$\therefore$ The 7th terms of both APs are equal.

Source: Chapter 5, Exercise 5.2 (Q.15 type); Section 5.3 – nth term formula

Explanation

- Write the n th term formula $a_n = a + (n - 1)d$ for each AP separately.
- Equate the two expressions and solve for n .
- Examiners award 1 mark for correctly setting up both a_n expressions and 1 mark for solving $n = 7$.
- Always verify: a_7 for AP1 = $11 - 14 = -3$; a_7 for AP2 = $18 - 21 = -3$. ✓

Q31. § 5.5 Summary**[2]**

Find the sum of first 20 terms of an AP in which $d = 5$ and $a_{20} = 135$.

Previously asked in: 2022 30/3/1 Q2

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $d = 5$, $a_{20} = 135$, $n = 20$

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

$$135 = a + 19 \times 5$$

$$a = 135 - 95 = 40$$

$$\text{Now, } S_{20} = \frac{n}{2}(a + l) = \frac{20}{2}(40 + 135) = 10 \times 175 = \mathbf{1750}$$

Source: Chapter 5, Exercise 5.3

Explanation

- First find the first term a using $a_n = a + (n - 1)d$.
- Then use $S = \frac{n}{2}(a + l)$ where $l = a_{20} = 135$ (the last term here), which is simpler than using $S = \frac{n}{2}[2a + (n - 1)d]$.
- Both formulas give the same answer; examiners award 1 mark for finding a and 1 mark for the correct sum.

Q32. § 5.5 Summary

[4]

In Mathematics, relations can be expressed in various ways. The matchstick patterns are based on linear relations. Different strategies can be used to calculate the number of matchsticks used in different figures. One such pattern is shown below. The figures show triangles made of matchsticks: Figure 1 (1 triangle), Figure 2 (2 triangles), Figure 3 (3 triangles), and so on.

Observe the pattern and answer the following questions using Arithmetic Progression:

- (a) Write the AP for the number of triangles used in the figures. Also, write the n th term of this AP. [2]
 (b) Which figure has 61 matchsticks? [2]

Previously asked in: 2022 30/1/1 Q13

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

Finding the figure number for a given value using n th term of AP

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Model Answer

(a)

Number of triangles in each figure: 1, 2, 3, 4, ...

This is an AP with first term $a = 1$ and common difference $d = 1$.

The n th term: $a_n = a + (n - 1)d = 1 + (n - 1)(1) = n$

So, $a_n = n$

(b)

For triangles in a row, matchsticks used = $2n + 1$ (each new triangle adds 2 matchsticks to the previous figure, starting with 3).

AP for matchsticks: 3, 5, 7, ... with $a = 3$, $d = 2$.

Given $a_n = 61$:

$$a + (n - 1)d = 61$$

$$3 + (n - 1)(2) = 61$$

$$(n - 1)(2) = 58$$

$$n - 1 = 29 \Rightarrow n = 30$$

∴ **Figure 30** has 61 matchsticks.

Source: Arithmetic Progressions, Linear Relations through Matchstick Patterns

Explanation

- Part (a) asks for the AP of number of triangles (1, 2, 3...), not matchsticks — keep them separate.

- Part (b) uses the matchstick count AP: Figure 1 uses 3, Figure 2 uses 5, Figure 3 uses 7 (each new triangle shares one side, so adds 2 sticks). Formula $a_n = 2n + 1$ must be derived from this pattern.
- Always show the substitution step clearly — it earns method marks.

Q33. § 5.5 Summary**[2]**

In an AP if $S_n = n(4n + 1)$, then find the AP.

Previously asked in: 2022 30/1/1 Q1(b) (OR-2)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $S_n = n(4n + 1) = 4n^2 + n$

First term: $a_1 = S_1 = 4(1)^2 + 1 = 5$

Second term: $S_2 = 4(4) + 2 = 18$, so $a_2 = S_2 - S_1 = 18 - 5 = 13$

Third term: $S_3 = 4(9) + 3 = 39$, so $a_3 = S_3 - S_2 = 39 - 18 = 21$

Common difference $d = 13 - 5 = 8$

∴ The AP is **5, 13, 21, 29, ...**

Source: Chapter 5, Arithmetic Progressions

Explanation

- Examiners expect you to find $a_1 = S_1$, then use $a_n = S_n - S_{n-1}$ for $n \geq 2$ to get at least two more terms.
- Always verify d is constant to confirm it's an AP.
- Writing the AP at the end is essential for full marks — don't leave it implied.

Q34. § 5.5 Summary**[2]**

Find the sum of first 30 terms of AP : 30, 24, 18, ...

Previously asked in: 2022 30/1/1 Q1(a) (OR-1)

♦ Arithmetic Progressions

5.4 Sum of First n Terms of an AP

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Model Answer

Given AP: 30, 24, 18, ...

Here, $a = 30$, $d = 24 - 30 = -6$, $n = 30$

Using the formula:

$$\begin{aligned}S_n &= \frac{n}{2}[2a + (n - 1)d] \\S_{30} &= \frac{30}{2}[2(30) + (30 - 1)(-6)] \\&= 15[60 + 29 \times (-6)] \\&= 15[60 - 174] \\&= 15 \times (-114) = -1710\end{aligned}$$

Source: Chapter 5, Exercise 5.3

Explanation

- Examiners award **1 mark** for correctly identifying a , d , n and writing the formula, and **1 mark** for the correct final answer.
- The key here is noting that d is **negative** (-6), which makes the sum negative — a common error is using $d = +6$.
- Always substitute carefully and simplify step by step to avoid sign mistakes.

Q35. § 5.5 Summary**[3]**

If p th term of an A.P. is q and q th term is p , then prove that its n th term is $(p + q - n)$.

Previously asked in: 2023 30/5/1 Q27

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer

Given: p th term = q and q th term = p

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

$$a_p = a + (p - 1)d = q \quad \dots(1)$$

$$a_q = a + (q - 1)d = p \quad \dots(2)$$

Subtracting (2) from (1):

$$(p - 1)d - (q - 1)d = q - p$$

$$d(p - q) = -(p - q)$$

$$d = -1$$

Substituting $d = -1$ in (1):

$$a + (p - 1)(-1) = q$$

$$a = q + p - 1 = p + q - 1$$

nth term:

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

$$a_n = p + q - 1 - n + 1 = \boxed{p + q - n}$$

Hence proved.

Source: Chapter 5, Section 5.3 (nth term formula $a_n = a + (n - 1)d$)

Explanation

- Examiners award marks for: setting up two equations (1 mark), finding $d = -1$ by subtraction (1 mark), and correctly arriving at $a_n = p + q - n$ (1 mark).
- The key trick is subtracting the two equations to eliminate a and find d first, then back-substitute to get a .
- Write each step clearly; do not skip the substitution step as it carries a mark.

Q36. § 5.2 Arithmetic Progressions § 5.5 Summary

[1]

The 11th term from the end of the A.P. : 10, 7, 4, ..., -62 is :

- (a) -25
- (b) -16
- (c) -32
- (d) 0

Previously asked in: 2023 30/5/1 Q14

♦ Arithmetic Progressions 5.3 nth Term of an AP

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Model Answer

The AP is 10, 7, 4, ..., -62 with $d = -3$, last term $l = -62$.

The 11th term from the end = $l + (11 - 1)(-d)^{-1}$... Using: n th term from end = $l + (n - 1) \times (-d)$

$$= -62 + (11 - 1)(3) = -62 + 30 = -32$$

Answer: (c) -32

Explanation

To find the n th term from the **end** of an AP, treat the last term as the first term and reverse the common difference: $T_n(\text{from end}) = l + (n - 1)(-d)$. Here $l = -62$, $n = 11$, $-d = 3$, giving $-62 + 30 = -32$. Alternatively, find total number of terms first (25 terms), then the 11th from end is the 15th from the start: $a_{15} = 10 + 14(-3) = -32$.

Q37. § 5.5 Summary

[1]

The common difference of the A.P. whose n th term is given by $a_n = 3n + 7$, is :

- (a) 7
- (b) 3
- (c) $3n$
- (d) 1

Previously asked in: 2023 30/5/1 Q3

♦ Arithmetic Progressions 5.3 nth Term of an AP

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Model Answer

(b) 3

$a_n = 3n + 7$, so $d = a_{n+1} - a_n = [3(n + 1) + 7] - [3n + 7] = 3$.

Explanation

The common difference is found by subtracting the k th term from the $(k + 1)$ th term. Since $a_n = 3n + 7$ is linear in n , the coefficient of n (i.e., 3) directly gives the common difference. The constant 7 is part of the first term, not d .

Q38. § 5.2 Arithmetic Progressions § 5.5 Summary

[3]

Which term of the A.P. : 65, 61, 57, 53, ... is the first negative term ?

Previously asked in: 2023 30/4/1 Q26(B) (OR-2)

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer

Given AP: 65, 61, 57, 53, ...

Here, $a = 65$, $d = 61 - 65 = -4$ Using the formula: $a_n = a + (n - 1)d$ For the first negative term, we need $a_n < 0$:

$$65 + (n - 1)(-4) < 0$$

$$65 - 4n + 4 < 0$$

$$69 - 4n < 0$$

$$4n > 69$$

$$n > 17.25$$

Since n must be a whole number, the smallest value is $n = 18$.**The 18th term is the first negative term.**Verification: $a_{18} = 65 + 17 \times (-4) = 65 - 68 = -3 \checkmark$

Source: Chapter 5, Section 5.3 (nth term formula)

Explanation

- Set up $a_n < 0$ using $a_n = a + (n - 1)d$ and solve the inequality for n .
- Since n must be a **natural number**, always round up to the next whole number (here $17.25 \rightarrow 18$).
- Verify by substituting $n = 18$ to confirm the term is negative and check $n = 17$ gives a positive value ($a_{17} = 65 - 64 = 1 > 0$).
- Examiners expect the inequality approach, not trial-and-error.

Q39. § 5.2 Arithmetic Progressions § 5.5 Summary

[3]

How many terms are there in an A.P. whose first and fifth terms are -14 and 2 , respectively and the last term is 62 ?

Previously asked in: 2023 30/4/1 Q26(A) (OR-1)

♦ Arithmetic Progressions 5.3 nth Term of an AP

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Model Answer

Given: $a = -14$, $a_5 = 2$, $l = a_n = 62$

Step 1: Find common difference d

Using $a_5 = a + 4d$:

$$2 = -14 + 4d \implies 4d = 16 \implies d = 4$$

Step 2: Find number of terms n

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

$$62 = -14 + (n - 1) \times 4$$

$$76 = (n - 1) \times 4$$

$$n - 1 = 19$$

$$n = 20$$

∴ There are **20 terms** in the AP.

Source: Chapter 5, Section 5.2 (nth term formula)

Explanation

- First find d using the 5th term condition — this is the key intermediate step examiners look for (1 mark).
- Then apply $a_n = a + (n - 1)d$ with the last term to find n (1 mark each for correct substitution and answer).
- Always state the formula before substituting — it earns a method mark even if arithmetic slips.

Q40.

[1]

Assertion (A) : a, b, c are in A.P. if and only if $2b = a + c$.Reason (R) : The sum of first n odd natural numbers is n^2 .

Choose the correct option :

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).
- (c) Assertion (A) is true but Reason (R) is false.
- (d) Assertion (A) is false but Reason (R) is true.

Previously asked in: 2023 30/4/1 Q20

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

Sum of first n odd natural numbers

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Model Answer**(b)** Both Assertion (A) and Reason (R) are true and Reason (R) is **not** the correct explanation of Assertion (A).**Explanation**

A is true: As stated in the textbook (Note to the Reader, Ch. 5), if a, b, c are in AP then $b = \frac{a+c}{2}$, i.e., $2b = a + c$. **R is also true:** The sum of first n odd natural numbers $= n^2$ is a standard result. However, R has no connection to the condition for three terms to be in AP, so it does not explain A. Hence option **(b)**.

Q41.

§ 5.1 Introduction

§ 5.2 Arithmetic Progressions

§ 5.5 Summary

[1]

The next term of the A.P. : $6, \sqrt{24}, \sqrt{54}$ is :

- (a) $\sqrt{60}$
- (b) $\sqrt{96}$
- (c) $\sqrt{72}$
- (d) $\sqrt{216}$

Previously asked in: 2023 30/4/1 Q3

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model AnswerThe terms are $\sqrt{6}, \sqrt{24}, \sqrt{54}$, i.e., $\sqrt{6}, 2\sqrt{6}, 3\sqrt{6}, \dots$ with common difference $\sqrt{6}$. Next term $= 4\sqrt{6} = \sqrt{96}$.Answer: **(b)** $\sqrt{96}$ **Explanation**

Rewrite each term: $\sqrt{6} = 1\sqrt{6}, \sqrt{24} = 2\sqrt{6}, \sqrt{54} = 3\sqrt{6}$. The AP has $d = \sqrt{6}$, so the 4th term is $4\sqrt{6} = \sqrt{96}$. Always simplify surd terms to spot the pattern.

Q42. § 5.5 Summary

[5]

How many terms of the arithmetic progression 45, 39, 33, must be taken so that their sum is 180? Explain the double answer.

Previously asked in: 2023 30/2/1 Q32

♦ Arithmetic Progressions

5.4 Sum of First n Terms of an AP

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Model Answer

Given: AP = 45, 39, 33, ...

Here, $a = 45$, $d = 39 - 45 = -6$, $S_n = 180$

Using the sum formula:

$$\begin{aligned}
 S_n &= \frac{n}{2}[2a + (n-1)d] \\
 180 &= \frac{n}{2}[2(45) + (n-1)(-6)] \\
 360 &= n[90 - 6n + 6] \\
 360 &= n[96 - 6n] \\
 360 &= 96n - 6n^2 \\
 6n^2 - 96n + 360 &= 0 \\
 n^2 - 16n + 60 &= 0 \\
 (n-6)(n-10) &= 0 \\
 \therefore n = 6 \quad \text{or} \quad n = 10
 \end{aligned}$$

Explanation of double answer:

Both answers are valid. When $n = 6$, $S_6 = 180$.

When $n = 10$, $S_{10} = 180$ also.

This happens because the AP has a positive first term but a negative common difference ($d = -6$), so the terms decrease and eventually become negative. The terms from 7th to 10th are negative (e.g., $a_7 = 45 + 6(-6) = 9$; $a_8 = 3$; $a_9 = -3$; $a_{10} = -9$). The negative terms from 7th onward cancel the extra sum added after the 6th term, making $S_{10} = S_6 = 180$.

Source: Chapter 5, Section 5.3 – Sum of First n Terms of an AP

Explanation

- **Key formula:** $S_n = \frac{n}{2}[2a + (n-1)d]$; substituting correctly gives a quadratic in n .
- **Both roots are positive integers**, so both are accepted – write both.
- **Examiner expects the double-answer explanation:** The terms after $n = 6$ are small/negative (AP is decreasing), so their net contribution is zero over terms 7–10, giving the same sum again. Always verify both values of n are natural numbers.

- Award of marks: ~2 marks for setting up and solving the quadratic, 1 mark each for the two values of n , 1 mark for the explanation.

Q43. § 5.5 Summary**[3]**

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

Previously asked in: 2024 30/5/1 Q27(b) (OR-2)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $a = 5, l = 45, S = 400$

Finding n :

Using $S = \frac{n}{2}(a + l)$

$$400 = \frac{n}{2}(5 + 45)$$

$$400 = \frac{n}{2} \times 50 = 25n$$

$$n = 16$$

Finding common difference d :

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

$$45 = 5 + (16 - 1)d$$

$$40 = 15d$$

$$d = \frac{40}{15} = \frac{8}{3}$$

∴ Number of terms = 16 and common difference $d = \frac{8}{3}$

Source: Arithmetic Progressions, Exercise 5.3 Q5

Explanation

- Examiners expect **two clear steps**: first find n using the sum formula with last term $S = \frac{n}{2}(a + l)$, then find d using the n th term formula $a_n = a + (n - 1)d$.
- Write the formula, substitute values, and solve — show all working for full 3 marks.
- A common mistake is using $S = \frac{n}{2}[2a + (n - 1)d]$ first (which has two unknowns); always use $S = \frac{n}{2}(a + l)$ when the last term is given.

Q44. § 5.2 Arithmetic Progressions § 5.5 Summary

[3]

If the sum of the first 14 terms of an A.P. is 1050 and the first term is 10, then find the 20th term and the n th term.

Previously asked in: 2024 30/5/1 Q27(a) (OR-1)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $S_{14} = 1050$, $a = 10$

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

$$1050 = \frac{14}{2}[2(10) + 13d]$$

$$1050 = 7[20 + 13d]$$

$$150 = 20 + 13d$$

$$d = \frac{130}{13} = 10$$

20th term:

$$a_{20} = a + 19d = 10 + 19(10) = 10 + 190 = \mathbf{200}$$

nth term:

$$a_n = a + (n - 1)d = 10 + (n - 1)(10) = 10 + 10n - 10 = \mathbf{10n}$$

Source: Chapter 5, Exercise 5.3 / Section 5.5

Explanation

- First find d using the sum formula $S_n = \frac{n}{2}[2a + (n - 1)d]$. Substituting $n = 14$, $S_{14} = 1050$, $a = 10$ gives $d = 10$.
- Then apply $a_n = a + (n - 1)d$ for both $n = 20$ and general n .
- Examiners award marks for: correct formula used (1 mark), finding d (1 mark), finding a_{20} and a_n (1 mark). Show all substitution steps clearly.

Q45. § 5.2 Arithmetic Progressions § 5.5 Summary

[1]

The number of terms in the A.P. 3, 6, 9, 12, ..., 111 is :

- A 36
- B 40
- C 37
- D 30

Previously asked in: 2024 30/5/1 Q11

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer**(C) 37**

Here, $a = 3$, $d = 3$, $a_n = 111$. Using $a_n = a + (n - 1)d$: $111 = 3 + (n - 1)3 \Rightarrow 108 = 3(n - 1) \Rightarrow n = 37$.

Explanation

Use the formula $a_n = a + (n - 1)d$ with the last term as a_n . Solve for n . A common mistake is forgetting to add 1 after dividing — always verify by checking $a_{37} = 3 + 36 \times 3 = 111$ ✓.

Q46. § 5.1 Introduction § 5.2 Arithmetic Progressions § 5.5 Summary

[1]

The next (4th) term of the A.P. $\sqrt{18}$, $\sqrt{50}$, $\sqrt{98}$, ... is :

- A 128
- B 140
- C 162
- D 200

Previously asked in: 2024 30/5/1 Q1

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer

The terms simplify: $\sqrt{18} = 3\sqrt{2}$, $\sqrt{50} = 5\sqrt{2}$, $\sqrt{98} = 7\sqrt{2}$, so $d = 2\sqrt{2}$. The 4th term $= 7\sqrt{2} + 2\sqrt{2} = 9\sqrt{2} = \sqrt{162}$. **Answer: (C) $\sqrt{162}$**

Explanation

Rewrite each term as a multiple of $\sqrt{2}$: the AP is $3\sqrt{2}$, $5\sqrt{2}$, $7\sqrt{2}$, ... with common difference $2\sqrt{2}$. The 4th term is $9\sqrt{2} = \sqrt{81 \times 2} = \sqrt{162}$. Note the options are under the square root — don't forget to square back when matching the answer.

Q47. § 5.4 Sum of First n Terms of an AP

[4]

Treasure Hunt is an exciting and adventurous game where participants follow a series of clues/numbers/maps to discover hidden treasures. Players engage in a thrilling quest, solving puzzles and riddles to unveil the location of the coveted prize.

While playing a treasure hunt game, some clues (numbers) are hidden in various spots collectively forming an A.P. If the number on the n th spot is $20 + 4n$, then answer the following questions to help the players in spotting the clues :

Based on the above, answer the following questions to help the players in spotting the clues :

- (i) Which number is on first spot ? [1]
- (ii) Which spot is numbered as 112 ? OR What is the sum of all the numbers on the first 10 spots ? [2]
- (iii) Which number is on the $(n - 2)$ th spot ? [1]

Previously asked in: 2024 30/4/1 Q37

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

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Model Answer

Given: $a_n = 20 + 4n$

(i) Number on the 1st spot:

$$a_1 = 20 + 4(1) = 20 + 4 = \mathbf{24}$$

(ii) OR Option 1: Which spot is numbered 112?

$$20 + 4n = 112$$

$$4n = 92 \Rightarrow n = 23$$

∴ 112 is on the 23rd spot.

OR Option 2: Sum of first 10 terms:

$$a_1 = 24, a_{10} = 20 + 4(10) = 60$$

$$S_{10} = \frac{10}{2}(a_1 + a_{10}) = 5 \times (24 + 60) = 5 \times 84 = \mathbf{420}$$

(iii) Number on the $(n - 2)$ th spot:

Replace n with $(n - 2)$:

$$a_{n-2} = 20 + 4(n - 2) = 20 + 4n - 8 = \mathbf{4n + 12}$$

Explanation

- **Part (i):** Simply substitute $n = 1$ in the given formula.
- **Part (ii):** Set $a_n = 112$ and solve for n (Option 1), or use the sum formula $S_n = \frac{n}{2}(a_1 + a_n)$ (Option 2). Attempt only ONE option in the exam.
- **Part (iii):** Substitute $(n - 2)$ in place of n in the formula and simplify — a common 1-mark algebraic substitution step.

Q48. § 5.5 Summary

[1]

Three numbers in A.P. have the sum 30. What is its middle term ?

- A 4
- B 10
- C 16
- D 8

Previously asked in: 2024 30/4/1 Q12

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

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Model Answer**Option B: 10**

Let the three numbers in A.P. be $a - d$, a , $a + d$. Their sum = $3a = 30$, so $a = 10$. The middle term is **10**.

Explanation

The standard trick for three numbers in A.P. is to take them as $a - d$, a , $a + d$. The d cancels on adding, giving $3a = \text{sum}$ directly. The middle term equals $\frac{\text{sum}}{3} = \frac{30}{3} = 10$.

Q49. § 5.5 Summary**[3]**

The ratio of the 10th term to its 30th term of an A.P. is 1 : 3 and the sum of its first six terms is 42. Find the first term and the common difference of A.P.

Previously asked in: 2024 30/3/1 Q26(b) (OR-2)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $\frac{a_{10}}{a_{30}} = \frac{1}{3}$ and $S_6 = 42$

Setting up equations:

$$a_{10} = a + 9d, \quad a_{30} = a + 29d$$

$$\frac{a + 9d}{a + 29d} = \frac{1}{3}$$

$$3a + 27d = a + 29d$$

$$2a = 2d \implies a = d \quad \dots(1)$$

For $S_6 = 42$:

$$\frac{6}{2}[2a + 5d] = 42$$

$$3[2a + 5d] = 42 \implies 2a + 5d = 14 \quad \dots(2)$$

Substituting (1) into (2):

$$2d + 5d = 14 \implies 7d = 14 \implies d = 2$$

$$a = 2$$

First term $a = 2$, common difference $d = 2$.

Source: Arithmetic Progressions, Chapter 5

Explanation

- Use $a_n = a + (n - 1)d$ to form the ratio equation, cross-multiply, and simplify to get the first relation between a and d .
- Use the sum formula $S_n = \frac{n}{2}[2a + (n - 1)d]$ for the second equation.
- Solve the two simultaneous equations. Here both give $a = d = 2$, so verify by substitution.
- Show all steps clearly — each equation and substitution carries marks.

Q50. § 5.4 Sum of First n Terms of an AP § 5.5 Summary

[3]

If the sum of first 7 terms of an A.P. is 49 and that of first 17 terms is 289, find the sum of its first 20 terms.

Previously asked in: 2024 30/3/1 Q26(a) (OR-1)

♦ Arithmetic Progressions

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $S_7 = 49$ and $S_{17} = 289$

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

$$S_7 = \frac{7}{2}[2a + 6d] = 49 \implies 2a + 6d = 14 \implies a + 3d = 7 \quad \dots(1)$$

$$S_{17} = \frac{17}{2}[2a + 16d] = 289 \implies 2a + 16d = 34 \implies a + 8d = 17 \quad \dots(2)$$

Subtracting (1) from (2): $5d = 10 \implies d = 2$

From (1): $a + 6 = 7 \implies a = 1$

$$S_{20} = \frac{20}{2}[2(1) + 19(2)] = 10[2 + 38] = 10 \times 40 = \boxed{400}$$

Source: Chapter 5, Exercise 5.3 (Q9)

Explanation

- Set up two equations using the S_n formula for $n = 7$ and $n = 17$, then solve simultaneously for a and d .
- Examiners award marks for: forming the two equations (1 mark), solving to get $a = 1, d = 2$ (1 mark), and correct S_{20} (1 mark).
- Note: The textbook Q9 asks for S_n in general; this question specifically asks for S_{20} , so substitute $n = 20$ at the end.

Q51. § 5.5 Summary

[1]

The common difference of the A.P. $\frac{1}{2x}, \frac{1-4x}{2x}, \frac{1-8x}{2x}, \dots$ is :

- A $-2x$
- B -2
- C 2
- D $2x$

Previously asked in: 2024 30/3/1 Q2

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

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Model Answer

$$d = a_2 - a_1 = \frac{1-4x}{2x} - \frac{1}{2x} = \frac{1-4x-1}{2x} = \frac{-4x}{2x} = -2$$

The correct option is **(B)** -2 .

Explanation

Find d by subtracting the first term from the second term. Both terms share the denominator $2x$, so subtract only the numerators: $(1-4x) - 1 = -4x$, giving $\frac{-4x}{2x} = -2$. The x cancels, so d is a constant -2 , not involving x .

Q52. § 5.5 Summary

[3]

In an A.P., the sum of three consecutive terms is 24 and the sum of their squares is 194. Find the numbers.

Previously asked in: 2024 30/2/1 Q26(b) (OR-2)

♦ Arithmetic Progressions

4.3 Solution of a Quadratic Equation by Factorisation

5.2 Arithmetic Progressions

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Model Answer

Let the three consecutive terms of the A.P. be $(a - d)$, a , $(a + d)$.

Condition 1: Sum = 24

$$(a - d) + a + (a + d) = 24$$

$$3a = 24 \implies a = 8$$

Condition 2: Sum of squares = 194

$$(a - d)^2 + a^2 + (a + d)^2 = 194$$

$$3a^2 + 2d^2 = 194$$

$$3(64) + 2d^2 = 194$$

$$2d^2 = 194 - 192 = 2 \implies d^2 = 1 \implies d = \pm 1$$

When $d = 1$: terms are **7, 8, 9**

When $d = -1$: terms are **9, 8, 7**

∴ The three numbers are **7, 8, 9**.

Source: Chapter 5, Arithmetic Progressions

Explanation

- Always assume consecutive A.P. terms as $(a - d)$, a , $(a + d)$ – this makes the sum condition simple (middle term directly gives a).
- Expand $(a - d)^2 + a^2 + (a + d)^2 = 3a^2 + 2d^2$ – a standard identity to remember.
- Both $d = +1$ and $d = -1$ give the same set of numbers, so either answer is accepted; state both for full marks.

Q53. § 5.5 Summary**[3]**

If the sum of first m terms of an A.P. is same as sum of its first n terms ($m \neq n$), then show that the sum of its first $(m + n)$ terms is zero.

Previously asked in: 2024 30/2/1 Q26(a) (OR-1)

♦ Arithmetic Progressions

5.4 Sum of First n Terms of an AP

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Model Answer

Given: $S_m = S_n$, where $m \neq n$

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

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

$$m[2a + (m - 1)d] - n[2a + (n - 1)d] = 0$$

$$2a(m - n) + d[m(m - 1) - n(n - 1)] = 0$$

$$2a(m - n) + d[(m^2 - n^2) - (m - n)] = 0$$

$$2a(m - n) + d(m - n)[(m + n) - 1] = 0$$

Since $m \neq n$, divide by $(m - n)$:

$$2a + (m + n - 1)d = 0 \quad \dots (1)$$

Now, sum of first $(m + n)$ terms:

$$S_{m+n} = \frac{(m+n)}{2}[2a + (m+n-1)d] = \frac{(m+n)}{2} \times 0 = \boxed{0}$$

[From equation (1)]

Hence proved.

Source: Chapter 5, Section 5.4 (Sum of first n terms of an AP)

Explanation

- The key step is subtracting the two equal sum expressions and factoring out $(m - n)$, which is non-zero, giving $2a + (m + n - 1)d = 0$.
- Examiners award marks for: setting up $S_m = S_n$ correctly (1 mark), reaching $2a + (m + n - 1)d = 0$ (1 mark), and concluding $S_{m+n} = 0$ (1 mark).
- Notice that $2a + (m + n - 1)d$ is exactly the bracket in the formula for S_{m+n} —that's the elegant connection to spot.

Q54. § 5.5 Summary

[1]

Which term of the A.P. $-29, -26, -23, \dots, 61$ is 16?

- (A) 11th
- (B) 16th
- (C) 10th
- (D) 31st

Previously asked in: 2024 30/2/1 Q16

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer**(B) 16th**

Here, $a = -29, d = 3, a_n = 16$.

Using $a_n = a + (n - 1)d$: $16 = -29 + (n - 1) \times 3 \Rightarrow 45 = 3(n - 1) \Rightarrow n = 16$.

Source: Chapter 5, Section 5.3 (nth term formula)

Explanation

Use the formula $a_n = a + (n - 1)d$. Here $a = -29, d = -26 - (-29) = 3$, and $a_n = 16$. Solving gives $n = 16$. A common mistake is arithmetic error when dividing; always verify by substituting n back.

Q55. § 5.5 Summary

[1]

The common difference of an A.P. in which $a_{15} - a_{11} = 48$, is

- (A) 12
- (B) 16
- (C) -12
- (D) -16

Previously asked in: 2024 30/2/1 Q3

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer**(A) 12**

$$a_{15} - a_{11} = [a + 14d] - [a + 10d] = 4d = 48 \Rightarrow d = 12$$

Explanation

Use $a_n = a + (n - 1)d$. Subtracting the two terms eliminates a , leaving $4d = 48$, so $d = 12$. Only option (A) matches.

Q56. § 5.4 Sum of First n Terms of an AP**[5]**

The minimum age of children eligible to participate in a painting competition is 8 years. It is observed that the age of the youngest boy was 8 years and the ages of the participants, when seated in order of age, have a common difference of 4 months. If the sum of the ages of all the participants is 168 years, find the age of the eldest participant in the painting competition.

Previously asked in: 2025 30/3/1 Q33 (OR-2)

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

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Model Answer

Given: First term $a = 8$ years, common difference $d = 4$ months $= \frac{1}{3}$ year, Sum $S_n = 168$ years.

Using the formula:

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

$$168 = \frac{n}{2} \left[2 \times 8 + (n-1) \times \frac{1}{3} \right]$$

$$168 = \frac{n}{2} \left[16 + \frac{n-1}{3} \right]$$

$$336 = n \left[\frac{48 + n - 1}{3} \right]$$

$$1008 = n(47 + n)$$

$$n^2 + 47n - 1008 = 0$$

$$n^2 + 63n - 16n - 1008 = 0$$

$$(n + 63)(n - 16) = 0$$

Since n cannot be negative, $n = 16$.

Age of the eldest participant:

$$a_{16} = a + (n-1)d = 8 + 15 \times \frac{1}{3} = 8 + 5 = 13 \text{ years}$$

The age of the eldest participant is 13 years.

Source: Arithmetic Progressions, Section 5.4

Explanation

- Convert $d = 4$ months to years ($\frac{1}{3}$ year) before substituting — a common error point.
- Substitute into $S_n = \frac{n}{2}[2a + (n-1)d]$, simplify to get a quadratic, and reject the negative root.
- Finally use $a_n = a + (n-1)d$ to find the last term. Examiners award marks at each step: identifying AP values (1 mark), setting up the sum equation (1 mark), solving the quadratic (2 marks), and finding the eldest age (1 mark).

Q57. § 5.5 Summary**[5]**

The sum of the third term and the seventh term of an AP is 6 and their product is 8. Find the sum of the first sixteen terms of the AP.

Previously asked in: 2025 30/3/1 Q33 (OR-1)

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

Let the first term be a and common difference be d .

Setting up equations:

$$a_3 = a + 2d \text{ and } a_7 = a + 6d$$

$$\text{Given: } a_3 + a_7 = 6$$

$$(a + 2d) + (a + 6d) = 6 \implies 2a + 8d = 6 \implies a + 4d = 3 \quad \dots(1)$$

$$\text{Given: } a_3 \times a_7 = 8$$

$$(a + 2d)(a + 6d) = 8 \quad \dots(2)$$

Solving:

From (1): $a = 3 - 4d$. Substituting in (2):

$$(3 - 4d + 2d)(3 - 4d + 6d) = 8$$

$$(3 - 2d)(3 + 2d) = 8$$

$$9 - 4d^2 = 8 \implies 4d^2 = 1 \implies d = \pm \frac{1}{2}$$

Case 1: $d = \frac{1}{2}$, then $a = 3 - 4 \times \frac{1}{2} = 1$

Case 2: $d = -\frac{1}{2}$, then $a = 3 - 4 \times \left(-\frac{1}{2}\right) = 5$

Sum of first 16 terms:

$$S_{16} = \frac{16}{2}[2a + 15d] = 8[2a + 15d]$$

Case 1: $S_{16} = 8[2(1) + 15 \times \frac{1}{2}] = 8[2 + 7.5] = 8 \times 9.5 = \mathbf{76}$

Case 2: $S_{16} = 8[2(5) + 15 \times \left(-\frac{1}{2}\right)] = 8[10 - 7.5] = 8 \times 2.5 = \mathbf{20}$

∴ The sum of the first 16 terms is **76 or 20**.

Source: Chapter 5, Exercise 5.4 Q.2

Explanation

- The key trick is using the **difference of squares** identity: $(3 - 2d)(3 + 2d) = 9 - 4d^2$, which quickly gives d .

- Since d has two values, there are two valid APs — present **both** cases for full marks.
- Examiners award marks at each step: setting up equations (1 mark), solving for d and a (2 marks), and computing S_{16} for both cases (2 marks).
- Do not forget the formula $S_n = \frac{n}{2}[2a + (n - 1)d]$.

Q58. § 5.3 nth Term of an AP § 5.4 Sum of First n Terms of an AP

[3]

A sum of ₹2,000 is invested at 7% per annum simple interest. Calculate the interests at the end of 1st, 2nd and 3rd year. Do these interests form an AP? If so, find the interest at the end of the 27th year.

Previously asked in: 2025 30/2/1 Q31

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer

Simple Interest formula: $SI = \frac{P \times R \times T}{100}$

$$\text{Interest at end of 1st year} = \frac{2000 \times 7 \times 1}{100} = ₹140$$

$$\text{Interest at end of 2nd year} = \frac{2000 \times 7 \times 2}{100} = ₹280$$

$$\text{Interest at end of 3rd year} = \frac{2000 \times 7 \times 3}{100} = ₹420$$

The interests are 140, 280, 420, ...

Since $280 - 140 = 420 - 280 = 140$, the common difference is constant. **Yes, they form an AP** with $a = 140$ and $d = 140$.

Interest at end of 27th year:

$$a_{27} = a + (27 - 1)d = 140 + 26 \times 140 = 140 \times 27 = ₹3780$$

Source: Chapter 5, Section 5.3 (Example 9 pattern)

Explanation

- This question is modelled exactly on **Example 9** of Section 5.3, but with $P = ₹2000$, $R = 7\%$ instead of $P = ₹1000$, $R = 8\%$.
- Examiners expect you to: (1) calculate the three interest values, (2) explicitly verify the AP by checking equal differences, and (3) apply $a_n = a + (n - 1)d$ for the 27th term.
- Note: $a_{27} = 140 \times 27$ is a neat shortcut since $a = d = 140$.
- Do not confuse "interest at end of n th year" with total amount — it is only the SI for that cumulative time.

Q59. § 5.5 Summary**[1]**

Assertion (A) : Common difference of the AP : 5, 1, -3, ... is 4.

Reason (R) : Common difference of the AP : $a_1, a_2, a_3, \dots$ is obtained by $d = a_n - a_{n-1}$.

Select the correct answer from the codes (A), (B), (C) and (D) given below.

A Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

B Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

C Assertion (A) is true, but Reason (R) is false.

D Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2025 30/2/1 Q19

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

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Model Answer

(D) Assertion (A) is false, but Reason (R) is true.

The common difference of AP: 5, 1, -3, ... is $d = 1 - 5 = -4$, not 4. The Reason is correct as $d = a_n - a_{n-1}$.

Source: Chapter 5, Section 5.1 / Summary Point 2

Explanation

- The Assertion gives $d = 4$, which is wrong; the correct value is $d = -4$ (each term decreases by 4).
- The Reason correctly states the formula for common difference, so R is true.
- Since A is false but R is true, option **(D)** is correct.
- Always verify the sign when calculating common difference — a common mistake is ignoring the negative sign.

Q60. § 5.5 Summary

[1]

The 10th term of the AP $-5, -\frac{5}{2}, 0, \frac{5}{2}, \dots$ is :

- A $\frac{35}{2}$
B $-\frac{35}{2}$
C $-\frac{45}{2}$
D $\frac{45}{2}$

Previously asked in: 2025 30/2/1 Q15

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer

Here, $a = -5, d = -\frac{5}{2} - (-5) = \frac{5}{2}, n = 10$.

$$a_{10} = a + 9d = -5 + 9 \times \frac{5}{2} = -5 + \frac{45}{2} = \frac{35}{2}$$

Answer: (A) $\frac{35}{2}$

Explanation

Use the nth term formula $a_n = a + (n - 1)d$ from the chapter summary. Identify $a = -5$ and $d = \frac{5}{2}$ (positive, since the sequence increases). Substituting $n = 10$ gives $\frac{35}{2}$. A common mistake is taking d as negative – check the sign carefully from consecutive terms.

Q61. § 5.1 Introduction § 5.2 Arithmetic Progressions § 5.5 Summary

[4]

A school is organizing a charity run to raise funds for a local hospital. The run is planned as a series of rounds around a track, with each round being 300 metres. To make the event more challenging and engaging, the organizers decide to increase the distance of each subsequent round by 50 metres. For example, the second round will be 350 metres, the third round will be 400 metres and so on. The total number of rounds planned is 10.

Based on the information given above, answer the following questions:

- (i) Write the fourth, fifth and sixth term of the Arithmetic Progression so formed. [1]
- (ii) Determine the distance of the 8th round. [1]
- (iii) Find the total distance run after completing all 10 rounds. [2]

Previously asked in: 2025 30/1/1 Q36

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

The AP formed is: 300, 350, 400, 450, 500, 550, ...

Here, first term $a = 300$ and common difference $d = 50$.

(i) 4th term = 450 m, 5th term = 500 m, 6th term = 550 m

(ii) Distance of 8th round:

$$a_8 = a + 7d = 300 + 7 \times 50 = 300 + 350 = \mathbf{650 \text{ metres}}$$

(iii) Total distance after 10 rounds:

$$S_{10} = \frac{n}{2}[2a + (n-1)d] = \frac{10}{2}[2 \times 300 + 9 \times 50]$$

$$= 5 \times [600 + 450] = 5 \times 1050 = \mathbf{5250 \text{ metres}}$$

Source: Arithmetic Progressions, AP Sum Formula

Explanation

- **Examiner focus:** Correct identification of a and d is key; errors here lose marks throughout.
- (i) Simply list terms — no formula needed.
- (ii) Use $a_n = a + (n-1)d$; substitution must be shown for full credit.
- (iii) Must write the S_n formula, substitute values, and show working step-by-step — both steps carry marks. Final answer in metres.

Q62. § 5.5 Summary

[1]

If the sum of first m terms of an AP is $2m^2 + 3m$, then its second term is:

- A 10
- B 9
- C 12
- D 4

Previously asked in: 2025 30/1/1 Q11

♦ Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer

$$S_m = 2m^2 + 3m$$

$$a_2 = S_2 - S_1 = (2(4) + 3(2)) - (2(1) + 3(1)) = 14 - 5 = 9$$

Answer: (B) 9

Explanation

The n th term of an AP can be found using $a_n = S_n - S_{n-1}$. Substitute $m = 2$ and $m = 1$ into the given sum formula and subtract. Avoid confusing S_n (sum) with a_n (term) — a common mistake.

Q63. § 5.1 Introduction § 5.5 Summary

[4]

'Kolam' is a decorative art which is made with rice flour in South Indian States. It is drawn on grid pattern of dots. One such art work is shown below.

Observe the given figure carefully. There are 4 dots in first square, 8 dots in second square, 12 dots in third square and so on.

Based on the above, answer the following questions:

- (i) Show that number of dots given above form an A.P. Write the first term and common difference. [1]
- (ii) Write n th term of the A.P. formed. [1]
- (iii) The pattern is expanded on a large ground. If total 220 dots are used, then find the number of squares formed. [2]

Previously asked in: 2026 30/4/1 Q37

♦ Arithmetic Progressions

5.2 Arithmetic Progressions

5.3 nth Term of an AP

5.4 Sum of First n Terms of an AP

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Model Answer**(i)**

The number of dots: 4, 8, 12, ...

Differences: $8 - 4 = 4$, $12 - 8 = 4$ (constant)

Since the common difference is constant, the dots form an A.P.

First term (a) = 4, Common difference (d) = 4

(ii)

$$a_n = a + (n - 1)d = 4 + (n - 1) \times 4 = 4n$$

$$a_n = 4n$$

(iii)

Given: $S_n = 220$

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

$$220 = \frac{n}{2}[8 + 4(n - 1)]$$

$$440 = n[4n + 4] = 4n(n + 1)$$

$$n(n + 1) = 110$$

$$n^2 + n - 110 = 0$$

$$(n - 10)(n + 11) = 0$$

$$n = 10 \quad (\text{rejecting } n = -11)$$

∴ 10 squares are formed.

Source: Arithmetic Progressions, CBSE Class 10 Mathematics

Explanation

- **(i)** Just show the differences are equal — that's enough for 1 mark. State a and d clearly.
- **(ii)** Substitute the formula directly; simplify to $4n$. Examiners expect the simplified form.
- **(iii)** Use the **sum formula** (not n th term). Set up the quadratic, solve, and reject the negative root — both steps carry marks. Always state why $n = -11$ is rejected.

Q64. § 5.5 Summary

[1]

The n th term of an A.P. is $\sqrt{2}n + 1$. Its common difference is

- A $\sqrt{2}$
- B $\sqrt{2}n$
- C 1
- D $\sqrt{2} + 1$

Previously asked in: 2026 30/4/1 Q3

♦ Arithmetic Progressions

5.3 nth Term of an AP

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Model Answer

Option A: $\sqrt{2}$

$$d = a_{n+1} - a_n = [\sqrt{2}(n+1) + 1] - [\sqrt{2}n + 1] = \sqrt{2}$$

Explanation

The common difference is found by subtracting the n th term from the $(n+1)$ th term. Since $\sqrt{2}n$ cancels and $+1$ cancels, only $\sqrt{2}$ remains. Note that d must be a constant (no n in it), which immediately rules out option B.

Q65. § STATISTICS § 13.2 Mean of Grouped Data § 13.4 Median of Grouped Data

[1]

Assertion (A) : The mean of first 'n' natural numbers is $\frac{n-1}{2}$.Reason (R): The sum of first 'n' natural numbers is $\frac{n(n+1)}{2}$.

Select the correct answer from the options (A), (B), (C) and (D).

A Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

B Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

C Assertion (A) is true, but Reason (R) is false.

D Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2026 30/2/1 Q20

◆ Statistics

13.2 Mean of Grouped Data

5.4 Sum of First n Terms of an AP

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Model Answer**(D) Assertion (A) is false, but Reason (R) is true.**The sum of first n natural numbers is $\frac{n(n+1)}{2}$ (R is true), so Mean = $\frac{n(n+1)/2}{n} = \frac{n+1}{2}$, not $\frac{n-1}{2}$. Hence A is false.**Explanation**

- **R is true:** The standard formula $1 + 2 + \dots + n = \frac{n(n+1)}{2}$ is correct.
- **A is false:** Dividing the sum by n gives mean = $\frac{n+1}{2}$, not $\frac{n-1}{2}$ (e.g., mean of 1, 2, 3 is $2 = \frac{3+1}{2}$, not $\frac{3-1}{2} = 1$).
- In Assertion–Reason questions, always verify A independently before checking if R explains it.

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