SAMPLE CONTENT

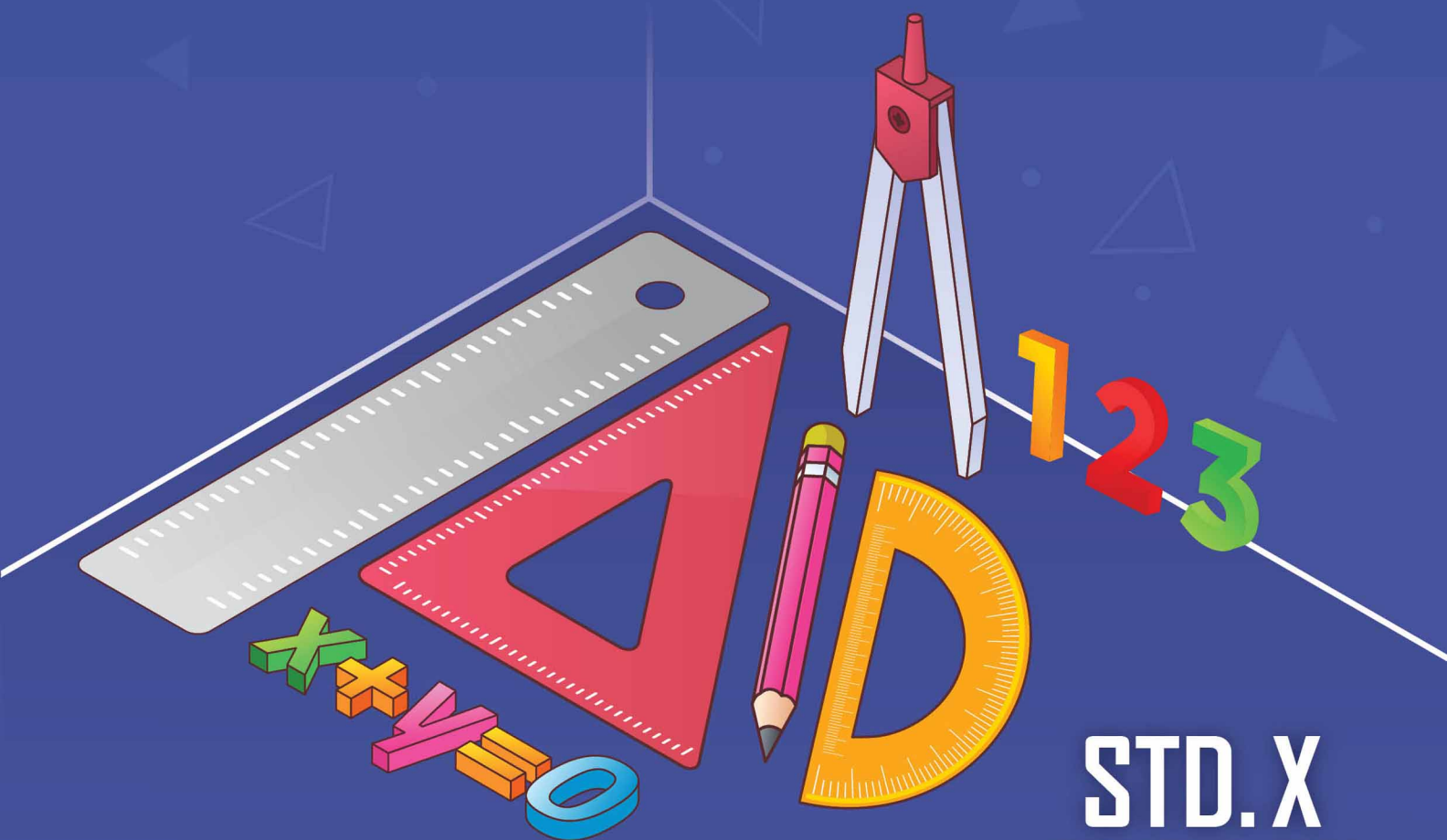
SSC MATHEMATICS

1030 MCQs

PART 1 & 2

CHAPTERWISE & SUBTOPICWISE

THE PERFECT **CONCEPT BUILDER & CONFIDENCE BOOSTER** FOR YOUR EXAM



STD. X

(ENG. & SEMI ENG. MEDIUM)

Target Publications® Pvt. Ltd.

Based on the **Latest Textbook** prescribed by the Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04

Mathematics MCQs

Chapterwise & Subtopicwise

(Part - 1 & 2)

STD. X

Salient Features

- Subtopic-wise segregation of MCQs for efficient practice
- '1030' MCQs including Questions from previous years board papers
- Quick Review of each chapter to facilitate quick revision
- Topic Test along with solutions at the end of every chapter for self-evaluation
- Answers are provided to all the questions and Solutions are provided for difficult questions
- Important inclusions: Shortcut, Connections and Caution
- Ⓡ symbol represents Topics/Subtopics/Questions that are part of the Reduced Syllabus 2021-22.

Please scan the adjacent QR code to see the reduced syllabus of Mathematics (Part 1& 2) for year 2021 - 22.

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PREFACE

Target's **"Std. X: Mathematics MCQs"** is a complete, thorough, critically analysed and extensively drafted book to offer students practice of Multiple Choice Questions (MCQs) *with answers*.

The book contains MCQs based on all the textual chapters of Mathematics (Part 1 & 2). The aim of this book is to provide conceptual preparedness to the students by giving them ample practice of MCQs. It also gives them a hang of competitive examinations which are mostly MCQ-based. Complete coverage of topics in this book ensures strong foundation of the subject. MCQs which are part of reduced syllabus are marked as (R) to keep students focused on the preparation of topics/subtopics listed for the examination to be held in year 2021-22.The **Subtopic-wise** segregation of each chapter of this book helps the students to practice questions smoothly and as per their own pace.

Each chapter begins with a **Synopsis** which acts as a revision tool for the students in efficient form of pointers, tables, charts etc. followed by **Quick Review** of the chapter.

Section of **'Multiple Choice Questions'** consists of specially created and compiled MCQs as well as textual MCQs and the MCQs appeared in previous board examination. The section is intended to fulfill following objectives – to help students revise concepts as well as to prepare them for solving complex questions which require strenuous effort and understanding of multiple-concepts. The assortment of MCQs is a beautiful blend of straight forward, average and higher order thinking questions.

To aid students, Solutions are provided for difficult questions. **'Shortcut'** helps students to save time while dealing with a lengthy solution of a question. **'Caution'** is added to make students watchful against commonly made mistakes. Also, **'Connections'** are furnished to enable students perceive the interlinking of concepts covered in different chapters and preparing them for possible coalition questions.

Topic Test along with solutions at the end of the chapter allows students to gauge their grasp of chapter.

We hope that the book builds up necessary knowledge and skillset in the students and boost their confidence required to succeed in the examination.

- Publisher

Edition: First

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

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A book affects eternity; one can never tell where its influence stops.

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Note: *Textual exercise questions are represented by * mark.*
Questions belonging to the reduced syllabus for year 2021-22 are represented with ®*mark.*

3 Arithmetic Progression

Synopsis

3.1 Sequence, Arithmetic Progression

Sequence:
A sequence is a collection of numbers arranged in a definite order according to some definite rule.

Terms in a sequence:
Each number in the sequence is called a term of the sequence.
The number in the first position is called the first term and is denoted by t_1.
The number in the second position is called the second term and is denoted by t_2.
In general, the number in the 'n^{th}' position is called the n^{th} term and is denoted by t_n.

$\therefore$ In a sequence, ordered terms are represented as
$t_1, t_2, t_3, \ldots, t_n$

Arithmetic Progression:
An arithmetic progression (A.P.) is a sequence in which the difference between any two consecutive terms $(t_{n+1} - t_n)$ is constant. This constant is called the common difference of the A.P. and is denoted by 'd'.

Examples:
i. 18, 16, 14, ...
Here, $t_2 - t_1 = t_3 - t_2 = \ldots = -2 = d$ = constant

ii. $\frac{2}{5}, \frac{3}{5}, \frac{4}{5}, \ldots$

Here, $t_2 - t_1 = t_3 - t_2 = \ldots = \frac{1}{5} = d$ = constant

In an A.P., if the first term is 'a' and common difference is 'd', then the terms in the sequence are a, (a + d), (a + 2d), (a + 3d), …

Finite A.P.:
The arithmetic progression having finite number of terms is called a finite A.P.

Examples:
i. 3, 6, 9, ..., 21
ii. 7, 14, 21, ..., 49

Infinite A.P.:
The arithmetic progression having infinite number of terms is called an infinite A.P.

Examples:
i. 5, 10, 15, ...
ii. 6, 3, 0, ...,

Remember This

i. In an A.P.,
$t_{n+1} - t_n = t_n - t_{n-1} = \ldots = d$, where $n \in N$.

ii. In an A.P. common difference d can be positive, negative or zero.

3.2 n^{th} term of an A.P.

In an A.P., if the first term is 'a' and common difference is 'd', then the n^{th} term is given by
$t_n = a + (n - 1)\, d$.

Remember This

In an A.P.,
n^{th} term from the end $= t_n - (n - 1)d$, where t_n is the last term and d is the common difference.

3.3 Sum of first n terms of an A.P.

In an A.P., if the first term is 'a' and common difference is 'd', then the sum of the first n terms is given by

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

OR

$S_n = \frac{n}{2}(t_1 + t_n)$, where t_1 = first term, t_n = last term

Selection of terms in an A.P.:

Number of terms	Terms to be taken
3	a – d, a, a + d
4	a – 3d, a – d, a + d, a + 3d

Remember This

i. Sum of first n natural numbers $(S_n) = \frac{n(n+1)}{2}$

ii. Sum of first n even natural numbers $(S_n) = n(n + 1)$

iii. Sum of first n odd natural numbers $(S_n) = n^2$

iv. In case of Arithmetic Progression of consecutive natural numbers divisible by any specific number e.g. 5, then the common difference (d) = 5.

QUICK REVIEW

Arithmetic Progression

General form of an A.P.

The general form of an A.P. is given by
a, a + d, a + 2d, a + 3d, …,
where a = first term
d = common difference

n^{th} term of an A.P.

$t_n = a + (n - 1)d$,
where a = first term
d = common difference
n = number of terms

Sum of first n terms of an A.P.

$S_n = \frac{n}{2}[2a + (n - 1)d]$
where a = first term
d = common difference
n = number of terms

or

$S_n = \frac{n}{2}(t_1 + t_n)$
where t_1 = first term
t_n = last term
n = number of terms

MULTIPLE CHOICE QUESTIONS

3.1 Sequence, Arithmetic Progression

1. A set of numbers where the numbers are arranged in a definite order, like the natural numbers, is called a_____.
   (A) index (B) numbers
   (C) line (D) sequence

2. For an A.P. 5, 12, 19, 26,… a = ?
   (A) 12 (B) 26
   (C) 19 (D) 5

3. Find t_3 = ? in an A.P. 9, 15, 21, 27,…
   (A) 27 (B) 21
   (C) 15 (D) 9

4. In an A.P., 0, – 4, – 8, – 12,... find t_2 = ?
   (A) – 8 (B) – 4
   (C) – 12 (D) 0

5. For an A.P. if d = _____, then the sequence is a constant sequence.
   (A) 0 (B) 1
   (C) –1 (D) 2

*6. The sequence –10, – 6, – 2, 2, …
   (A) is an A.P. Reason d = – 16
   (B) is an A.P. Reason d = 4
   (C) is an A.P. Reason d = – 4
   (D) is not an A.P.

7. Which of the following is not an A.P.?
   (A) $2, \frac{5}{2}, 3, \frac{7}{2}, \ldots$
   (B) 0.4, 0.44, 0.444, …
   (C) $\sqrt{2}, \sqrt{8}, \sqrt{18}, \sqrt{32}, \ldots$
   (D) $-7, -\frac{13}{2}, -6, -\frac{11}{2}, \ldots$

8. Which of the following is not an A.P.?
   (A) 2, 4, 6, 8, 10,….
   (B) –17, –12, –7, –2, 3, ….
   (C) 1.5, 4, 6.5, 9, ….
   (D) 1, 4, 9, 16, 25, ….

9. Which of the following is not an A.P.?
   (A) $a + k, a + 2k^2, a + 3k^2, a + 4k^2, \ldots$.
   (B) ak, ak + dk, ak + 2dk, ak + 3dk, ….
   (C) a + d + k, a + 2d+ k, a + 3d + k, a + 4d + k,….
   (D) a + k, a + 2k, a + 3k, a + 4k, ….

10. For what values of m and k, does the sequence '0, m, k, –12, …' becomes an A.P.?
   (A) k = –4, m = –8 (B) m = –4, k = –8
   (C) m = –3, k = –6 (D) k = –5, m = –10

11. If a = –1.25 and d = 3, then the A.P. is
   (A) –1.25, –4.25, –7.25, –10.25 …
   (B) –1.25, 1.75, 4.75, 7.75, ...
   (C) –1.25, –3.25, –6.25, –9.25 …
   (D) –1.25, 3.75, 6.75, 9.75, ...

*12. First four terms of an A.P. are ..., whose first term is –2 and common difference is –2.
   (A) – 2, 0, 2, 4
   (B) – 2, 4, – 8, 16
   (C) – 2, – 4, – 6, – 8
   (D) – 2, – 4, – 8, – 16

13. The first five terms of the A.P. with a = 6 and d = –3 are
(A) 6, 9, 12, 15, 18
(B) –6, –9, –12, –15, –18
(C) 6, 3, 0, –3, –6
(D) 6, 3, –3, –6, –9

14. 1, 4, 7, 10, 13,... Next two terms of this A.P. are _____.
(A) 16, 19 (B) 10, 7
(C) 19, 22 (D) 16, 18

15. The next term of the A.P. $\sqrt{7}, \sqrt{28}, \sqrt{63}, \ldots$ is
(A) $\sqrt{70}$ (B) $\sqrt{84}$
(C) $\sqrt{97}$ (D) $\sqrt{112}$

16. In an Arithmetic Progression 2, 4, 6, 8,... the common difference d is _____.
(A) 8 (B) 6
(C) 2 (D) – 2

17. In the A.P. 2, –2, –6, –10, ... common difference (d) is: **[Mar 19]**
(A) –4 (B) 2
(C) –2 (D) 4

18. The common difference of the A.P. 0.6, 1.7, 2.8, 3.9, … is
(A) 0.8 (B) 0.9
(C) 1.1 (D) 1.3

19. If the given A.P. is 2, $\frac{5}{2}$, 3, $\frac{7}{2}$, …, then the common difference d =
(A) $\frac{5}{2}$ (B) 2
(C) $\frac{2}{5}$ (D) $\frac{1}{2}$

20. Find common difference (d) of an A.P. whose first two terms are – 3 and 4.
(A) 7 (B) 4
(C) – 7 (D) – 3

21. In an A.P., if $t_6 = -21$ and $t_7 = -25$, then d =
(A) 3 (B) – 3
(C) 4 (D) – 4

22. For the A.P. 9, 16, 23, 30, 37 …,
(A) a = 9, d = 3 (B) a = 9, d = 6
(C) a = 9, d = 9 (D) a = 9, d = 7

23. For the A.P. $\frac{1}{6}, \frac{1}{4}, \frac{1}{3}, \frac{5}{12}, \ldots$,
(A) $a = \frac{1}{6}, d = \frac{1}{3}$ (B) $a = \frac{1}{6}, d = \frac{1}{6}$
(C) $a = \frac{1}{6}, d = \frac{1}{9}$ (D) $a = \frac{1}{6}, d = \frac{1}{12}$

24. First term and the common difference for A.P. $\frac{1}{4}, \frac{3}{4}, \frac{5}{4}, \frac{7}{4}, \ldots$ are respectively
(A) $\frac{1}{4}$ and $\frac{1}{2}$ (B) $\frac{1}{2}$ and $\frac{1}{4}$
(C) $\frac{1}{4}$ and $\frac{1}{4}$ (D) $\frac{1}{4}$ and $\frac{3}{4}$

25. For what value of k; k + 2, 4k – 6, 3k – 2 are three consecutive terms of an A.P.?
(A) 1 (B) – 1
(C) 3 (D) – 3

26. The first three terms of an A.P. respectively are $3y - 1$, $3y + 5$ and $5y + 1$. Then y equals
(A) – 3 (B) 4
(C) 5 (D) 2

3.2 n^{th} term of an A.P.

*1. For an A.P. $t_7 = 4$, d = – 4, then a = ….
(A) 6 (B) 7
(C) 20 (D) 28

2. In an A.P. if a = – 7.2, d = 3.6, $t_n = 7.2$, then n is equal to
(A) 3 (B) 4 (C) 5 (D) 6

3. For an A.P. a = 101, d = –4, then what is the value of n, if $t_n = 57$.
(A) 9 (B) 10 (C) 11 (D) 12

*4. For an A.P. a = 3.5, d = 0, n = 101, then t_n = …. **[July 19]**
(A) 0 (B) 3.5
(C) 103.5 (D) 104.5

5. If a = –9, d = –7, then t_{19} =
(A) 117 (B) 135
(C) –117 (D) –135

6. What is the n^{th} term of the A.P. a, a + d, a + 2d, a + 3d, …?
(A) a + nd (B) a + (n + 1)d
(C) a + (n – 1)d (D) a + (2n – 1)d

7. Find the 19^{th} term of the A.P. 7, 13, 19, 25, ...
(A) 115 (B) 121
(C) 109 (D) 127

8. The 27^{th} term of the A.P. 9, 4, –1, –6, –11, ...
(A) – 111 (B) –121
(C) – 106 (D) –116

9. Given Arithmetic Progression is 12, 16, 20, 24, ... Then the 24^{th} term of this progression is
(A) 96 (B) 100
(C) 104 (D) 108

*10. In an A.P. first two terms are – 3, 4, then 21^{st} term is ….
(A) – 143 (B) 143
(C) 137 (D) 17

11. Which of the following cannot be a term of the A.P. whose n^{th} term is given by $t_n = 6n - 2$?
(A) 4 (B) 10
(C) 14 (D) 16

*12. If for any A.P. d = 5, then $t_{18} - t_{13} = ...$
(A) 5 (B) 20
(C) 25 (D) 30

13. If the common difference of an A.P. is $\frac{5}{2}$, then $t_{12} - t_8 =$
(A) 10 (B) 15
(C) 24 (D) 28

14. What is the common difference of an A.P. in which $t_{24} - t_{17} = -28$?
(A) 3 (B) – 4
(C) 5 (D) – 6

15. 149 is the _____ term of the given A.P. 5, 11, 17, 23, 29, ...
(A) 24^{th} (B) 25^{th}
(C) 30^{th} (D) 31^{st}

16. Which term of the A.P. 92, 88, 84, 80, …is 0?
(A) 23^{rd} (B) 32^{nd}
(C) 22^{nd} (D) 24^{th}

17. The number of terms in the A.P. 7, 13, 19,…, 205 is
(A) 32 (B) 33
(C) 34 (D) 35

18. The 4^{th} term from the end of the A.P. –11, –8, –5, ..., 49 is
(A) 37 (B) 40
(C) 43 (D) 58

19. Which term of the A.P. $20, 19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}, ...$ is the first negative term?
(A) 25^{th} (B) 26^{th}
(C) 27^{th} (D) 28^{th}

20. In an A.P. 17^{th} term is 7 more than its 10^{th} term. Then the common difference is
(A) 1 (B) 2
(C) 3 (D) 4

21. For any given A.P., if $t_{30} = 2t_{15}$, then
(A) a – d = 0 (B) a + d = 0
(C) a – 2d = 0 (D) a + 2d = 0

22. If 7 times the 7^{th} term of an A.P. is equal to 11 times its 11^{th} term, then its 18^{th} term will be
(A) 0 (B) 7
(C) 11 (D) 18

23. If the 9^{th} term of an A.P. is zero, then the ratio of its 29^{th} term and 19^{th} term is
(A) 1 : 2 (B) 2 : 1
(C) 1 : 3 (D) 3 : 1

24. If the numbers a, 7, b, 23, c are in A.P., then
(A) a = 1, b = 15, c = 31
(B) a = –1, b = 15, c = 31
(C) a = –2, b = 12, c = 29
(D) a = 2, b = 13, c = 29

25. If the ninth term of an A.P. is – 32 and the sum of its eleventh and thirteenth terms is –94, then the common difference of the A.P. is
(A) –1 (B) –3
(C) –5 (D) –7

26. If third term and fifth term of an A.P. are 13 and 25 respectively, find its 7th term.
(A) 30 (B) 33
(C) 37 (D) 38

27. If the 11^{th} term and the 16^{th} term of an A.P. are 38 and 73 respectively, then its 21^{st} term is
(A) 94 (B) 101
(C) 108 (D) 115

28. If the 3^{rd} and the 9^{th} terms of an A.P. are 4 and – 8 respectively, which term of this A.P. is zero?
(A) 4^{th} (B) 5^{th}
(C) 6^{th} (D) 7^{th}

29. If the sum of the 4^{th} and 8^{th} terms of an A.P. is 24 and the sum of the 6^{th} and 10^{th} terms is 44, then the first three terms of the A.P. are
(A) 13, 8, 3 (B) –13, –8, –3
(C) 2,7, 12 (D) –8, –3, 2

30. The n^{th} term of even natural numbers is
(A) 2n (B) 2n – 1
(C) 2n + 1 (D) 2n + 2

31. Find how many three digit natural numbers are divisible by 7?
(A) 130 (B) 118
(C) 128 (D) 127

32. In the natural numbers from 10 to 250, how many are divisible by 4?
(A) 58 (B) 59
(C) 61 (D) 60

33. Two A.P.'s have the same common difference. The first term of one of these is –1 and that of the other is – 8. Then the difference between their 4^{th} terms is
(A) –1 (B) –8
(C) 7 (D) –9

34. For what value of n, are the n^{th} terms of two A.P.'s 18, 21, 24, … and 2, 7, 12, … equal?
(A) 8 (B) 9
(C) 10 (D) 11

3.3 Sum of first n terms of an A.P.

1. If the first term of an A.P. 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

2. For an A.P., if the first term is 8 and the common difference is 8, then S_n =
(A) 2n(n – 1) (B) 4n(n – 1)
(C) 2n(n + 1) (D) 4n(n + 1)

*3. 15, 10, 5, … In this A.P. sum of first 10 terms is
(A) – 75 (B) – 125 (C) 75 (D) 125

4. If a = 3, n = 8 and S_8 = 192, then d =
(A) 3 (B) 4 (C) 5 (D) 6

5. In an A.P. if a = 2, d = 8, S_n = 90, then n is equal to
(A) 5 (B) 6 (C) 7 (D) 8

6. In an A.P. if t_9 = 28 and S_9 = 144, then a is
(A) 4 (B) 5 (C) 6 (D) 7

*7. In an A.P. 1st term is 1 and the last term is 20. The sum of all terms is 399, then n = …
(A) 42 (B) 38 (C) 21 (D) 19

8. If the first and last term of an A.P. are 18 and 82 respectively, then S_{25} =
(A) 2500 (B) 1250
(C) 800 (D) 625

9. If the n^{th} term of an A.P. is (2n + 1), then the sum of its first three terms is
(A) 18 (B) 15 (C) 12 (D) 21

*10. Sum of first five multiples of 3 is ...
(A) 45 (B) 55 (C) 15 (D) 75

11. What is the sum of the first 10 natural numbers? **[Dec 20]**
(A) 55 (B) 20 (C) 65 (D) 11

*12. What is the sum of the first 30 natural numbers?
(A) 464 (B) 465
(C) 462 (D) 461

13. 1 + 2 + 3 + 4 + …. + 100 =
(A) 5000 (B) 5050
(C) 5500 (D) 5555

14. Find the sum of the first 10 natural numbers which are divisible by 3.
(A) 155 (B) 135 (C) 145 (D) 165

15. Sum of 1 to n natural numbers is 45, then find the value of n.
(A) 7 (B) 8 (C) 9 (D) 10

16. The sum of first 'n' even natural numbers is
(A) n(n + 1) (B) $\frac{n^2}{2}$
(C) $\frac{n(n+1)}{2}$ (D) n^2

17. Find the sum of first 123 even natural numbers.
(A) 15256 (B) 15254
(C) 15252 (D) 15250

18. Find the sum of all odd numbers between 1 and 350.
(A) 30452 (B) 30450
(C) 30624 (D) 30626

19. If the sum of first 55 terms in an A.P. is 3300, then its 28^{th} term is
(A) 60 (B) 62 (C) 64 (D) 68

20. In an A.P. 19^{th} term is 52 and 38^{th} term is 128, the sum of first 56 terms is
(A) 3020 (B) 4096
(C) 5040 (D) 5320

21. The sum of all the 11 terms of an A.P. whose middle most term is 30 is
(A) 290 (B) 330
(C) 360 (D) 390

22. In an A.P., sum of three consecutive terms is 30 and their product is 750, then the terms are
(A) 5, 10, 15 (B) 4, 10, 16
(C) 6, 10, 14 (D) 7, 10, 13

23. The angles of a triangle are in A.P. If the greatest angle is twice the least, then the angles of the triangle are
(A) 30°, 60°, 90° (B) 45°, 45°, 90°
(C) 40°, 60°, 80° (D) 30°, 50°, 100°

3.4 Application of A.P.

1. Ramkali saved ₹ 5 in the first week of a year and then increased her weekly savings by ₹ 1.75. If in the n^{th} week, her weekly savings become ₹ 20.75, then n is equal to
(A) 9 (B) 10 (C) 11 (D) 12

2. Sachin invested in a national saving certificate scheme. In the first year he invested ₹ 5000, in the second year ₹ 7000, in the third year ₹ 9000 and so on. Find the total amount that he invested in 12 years.
(A) ₹ 1,68,000 (B) ₹ 1,80,000
(C) ₹ 1,92,000 (D) ₹ 2,04,000

3. On the world environment day tree plantation programme was arranged on a land which is triangular in shape. Trees are planted such that in the first row there is one tree, in the second row there are two trees, in the third row three trees and so on. Find the total number of trees in the 25 rows.
(A) 400 (B) 375
(C) 350 (D) 325

4. A man repays a loan of ₹ 3250 by paying ₹ 20 in the first month and then increases the payment by ₹ 15 every month. How long will it take him to clear the loan?
(A) 18 months (B) 19 months
(C) 20 months (D) 21 months

ANSWERS TO MCQs

3.1 Sequence, Arithmetic Progression

1.	(D)	2.	(D)	3.	(B)	4.	(B)	5.	(A)	6.	(B)	7.	(B)	8.	(D)	9.	(A)	10.	(B)
11.	(B)	12.	(C)	13.	(C)	14.	(A)	15.	(D)	16.	(C)	17.	(A)	18.	(C)	19.	(D)	20.	(A)
21.	(D)	22.	(D)	23.	(D)	24.	(A)	25.	(C)	26.	(C)								

3.2 n^{th} term of an A.P.

1.	(D)	2.	(C)	3.	(D)	4.	(B)	5.	(D)	6.	(C)	7.	(A)	8.	(B)	9.	(C)	10.	(C)
11.	(C)	12.	(C)	13.	(A)	14.	(B)	15.	(B)	16.	(D)	17.	(C)	18.	(B)	19.	(D)	20.	(A)
21.	(A)	22.	(A)	23.	(B)	24.	(B)	25.	(C)	26	(C)	27.	(C)	28.	(B)	29.	(B)	30.	(A)
31.	(C)	32.	(D)	33.	(C)	34.	(B)												

3.3 Sum of first n terms of an A.P.

1.	(A)	2.	(D)	3.	(A)	4.	(D)	5.	(A)	6.	(A)	7.	(B)	8.	(B)	9.	(B)	10.	(A)
11.	(A)	12.	(B)	13.	(B)	14.	(D)	15.	(C)	16.	(A)	17.	(C)	18.	(C)	19.	(A)	20.	(C)
21.	(B)	22.	(A)	23.	(C)														

3.4 Application of A.P.

1.	(B)	2.	(C)	3.	(D)	4.	(C)		

SOLUTIONS TO MCQs

3.1 Sequence, Arithmetic Progression

6. $-10, -6, -2, 2, \ldots$
Here, $t_1 = -10$, $t_2 = -6$, $t_3 = -2$
$\therefore$ $t_2 - t_1 = -6 - (-10) = 4$
$t_3 - t_2 = -2 - (-6) = 4$
$\therefore$ $t_2 - t_1 = t_3 - t_2 = \ldots = 4 = d$
Since the difference between two consecutive terms is constant, the given sequence is an A.P.

7. Consider option (B),
0.4, 0.44, 0.444, …
Here, $t_1 = 0.4$, $t_2 = 0.44$, $t_3 = 0.444$
$\therefore$ $t_2 - t_1 = 0.44 - 0.4 = 0.04$
$t_3 - t_2 = 0.444 - 0.44 = 0.004$
$\therefore$ $t_2 - t_1 \neq t_3 - t_2$
Since the difference between two consecutive terms is not constant, the given sequence is not an A. P.

8. Consider option (D),
1, 4, 9, 16, 25, …
Here, $t_1 = 1$, $t_2 = 4$, $t_3 = 9$
$\therefore$ $t_2 - t_1 = 4 - 1 = 3$ and $t_3 - t_2 = 9 - 4 = 5$
$\therefore$ $t_2 - t_1 \neq t_3 - t_2$
Since the difference between two consecutive terms is not constant, the given sequence is not an A. P.

9. Consider option (A),
Here, $t_1 = a + k$, $t_2 = a + 2k^2$, $t_3 = a + 3k^2$
$\therefore$ $t_2 - t_1 = a + 2k^2 - a - k = 2k^2 - k$ and
$t_3 - t_2 = a + 3k^2 - a - 2k^2 = k^2$
$\therefore$ $t_2 - t_1 \neq t_3 - t_2$
Since the difference between two consecutive terms is not constant, the given sequence is not an A. P.

10. Consider option (B).
The given sequence becomes, 0, –4, –8, –12, …
This is an A.P., with common difference – 4.

11. $a = -1.25$ and $d = 3$
$\therefore$ $t_1 = a = -1.25$
$t_2 = t_1 + d = -1.25 + 3 = 1.75$
$t_3 = t_2 + d = 1.75 + 3 = 4.75$
$t_4 = t_3 + d = 4.75 + 3 = 7.75$
$\therefore$ The required A.P. is –1.25, 1.75, 4.75, 7.75, ...

12. First term (a) = –2, common difference (d) = –2
$\therefore$ $t_1 = -2$
$t_2 = -2 - 2 = -4$
$t_3 = -4 - 2 = -6$
$t_4 = -6 - 2 = -8$

13. Here, $a = 6$ and $d = -3$
$\therefore$ $t_1 = 6$
$t_2 = 6 - 3 = 3$
$t_3 = 3 - 3 = 0$
$t_4 = 0 - 3 = -3$
$t_5 = -3 - 3 = -6$

14. Common difference (d) = 4 – 1 = 3
Next two terms of the given A.P. are
13 + 3 = 16 and 16 + 3 = 19

15. The given A. P. is $\sqrt{7}, \sqrt{28}, \sqrt{63}, \ldots$
i.e., $\sqrt{7}, 2\sqrt{7}, 3\sqrt{7}, \ldots$
Here, $t_1 = \sqrt{7}$, $t_2 = 2\sqrt{7}$
$\therefore$ Common difference $= 2\sqrt{7} - \sqrt{7} = \sqrt{7}$
$\therefore$ Required term $= 3\sqrt{7} + \sqrt{7} = 4\sqrt{7} = \sqrt{112}$

16. Here, $t_1 = 2$, $t_2 = 4$
$\therefore$ Common difference $= t_2 - t_1 = 4 - 2 = 2$

17. Here, $t_1 = 2$, $t_2 = -2$
$\therefore$ Common difference (d) $= t_2 - t_1 = (-2) - 2 = -4$

18. Here, $t_1 = 0.6$, $t_2 = 1.7$
$\therefore$ Common difference $= t_2 - t_1$
$= 1.7 - 0.6 = 1.1$

19. $d = \frac{5}{2} - 2 = \frac{5-4}{2} = \frac{1}{2}$

20. Here, $t_1 = -3$, $t_2 = 4$
$\therefore$ Common difference (d) $= t_2 - t_1$
$= 4 + 3 = 7$

21. $d = t_{n+1} - t_n$
$\therefore$ $d = t_7 - t_6 = -25 - (-21) = -25 + 21$
$= -4$

22. Here, $a = 9$ and $d = 16 - 9 = 7$

23. Here, $t_1 = \frac{1}{6}$, $t_2 = \frac{1}{4}$
$\therefore$ $a = t_1 = \frac{1}{6}$ and
$d = t_2 - t_1 = \frac{1}{4} - \frac{1}{6} = \frac{1}{12}$

24. Common difference (d) $= \frac{3}{4} - \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$

25. $k + 2$, $4k - 6$, $3k - 2$ are three consecutive terms of an A.P.
$\therefore$ $(4k - 6) - (k + 2) = (3k - 2) - (4k - 6)$
$\therefore$ $3k - 8 = -k + 4$
$\therefore$ $4k = 12$
$\therefore$ $k = 3$

26. $3y - 1$, $3y + 5$ and $5y + 1$ are in A.P.
$\therefore$ $(3y + 5) - (3y - 1) = (5y + 1) - (3y + 5)$
$\therefore$ $6 = 2y - 4$
$\therefore$ $y = 5$

3.2 n^{th} term of an A.P.

1. $t_n = a + (n - 1)d$
$\therefore$ $t_7 = a + (7 - 1)(-4)$
$\therefore$ $4 = a + 6(-4)$
$\therefore$ $4 = a - 24$
$\therefore$ $a = 4 + 24$
$\therefore$ $a = 28$

2. $t_n = a + (n - 1)d$
$\therefore$ $7.2 = -7.2 + (n - 1)(3.6)$
$\therefore$ $7.2 = 3.6n - 10.8$
$\therefore$ $3.6n = 18$
$\therefore$ $n = 5$

3. $t_n = a + (n - 1)d$
$\therefore$ $57 = 101 + (n - 1)(-4)$
$\therefore$ $4n = 48$
$\therefore$ $n = 12$

4. $t_n = a + (n - 1)d$
$= 3.5 + (101 - 1)(0) = 3.5$

5. $t_n = a + (n - 1)d$
$\therefore$ $t_{19} = -9 + (19 - 1)(-7)$
$= -9 + 18 \times (-7)$
$= -9 - 126$
$= -135$

6. Here 1^{st} term is a and common difference is d.
$\therefore$ n^{th} term is $a + (n - 1)d$

7. The given A.P. is 7, 13, 19, 25, ...
Here, $a = 7$, $d = 13 - 7 = 6$
$t_n = a + (n - 1)d$
$\therefore$ $t_{19} = 7 + (19 - 1)6$
$= 7 + 18 \times 6$
$= 7 + 108$
$\therefore$ $t_{19} = 115$

8. The given A.P. is 9, 4, –1, –6, –11, ...
Here, $a = 9$, $d = 4 - 9 = -5$
$t_n = a + (n - 1)d$
$\therefore$ $t_{27} = 9 + (27 - 1)(-5)$
$= 9 + 26 \times (-5)$
$= 9 - 130$
$\therefore$ $t_{27} = -121$

9. $t_n = a + (n - 1)d$
$\therefore$ $t_{24} = 12 + (24 - 1)4$ ...[$\because a = 12, d = 4$]
$= 12 + 23 \times 4$
$= 12 + 92$
$\therefore$ $t_{24} = 104$

10. $a = -3$
$d = 4 - (-3) = 7$
$t_n = a + (n - 1)d$
$\therefore$ $t_{21} = -3 + (21 - 1)7$
$\therefore$ $t_{21} = -3 + (20)7$
$\therefore$ $t_{21} = -3 + 140$
$\therefore$ $t_{21} = 137$

11. Consider option (C),
Let $t_n = 14$
$\therefore$ $6n - 2 = 14$
$\therefore$ $6n = 16$
$\therefore$ $n = \frac{8}{3}$, which is not a natural number.

12. $t_{18} - t_{13} = (18 - 13)d$
$= 5d = 5 \times 5 = 25$

Shortcut

In an A.P.,
$t_m - t_n = (m - n)d$

13. $t_{12} - t_8 = (12 - 8)d$
$= 4d = 4\left(\frac{5}{2}\right) = 10$

14. $t_{24} - t_{17} = -28$
$\therefore$ $(a + 23d) - (a + 16d) = -28$
$\therefore$ $7d = -28$
$\therefore$ $d = -4$

15. Here, $a = 5$, $d = 11 - 5 = 6$
Let the n^{th} term be 149.
$t_n = a + (n - 1)d$
$\therefore$ $149 = 5 + (n - 1)6$
$\therefore$ $6(n - 1) = 144$
$\therefore$ $n - 1 = \frac{144}{6}$
$\therefore$ $n - 1 = 24$
$\therefore$ $n = 25$

16. Here, $a = 92$, $d = 88 - 92 = -4$
Let the n^{th} term be 0.
$t_n = a + (n - 1)d$
$\therefore$ $0 = 92 + (n - 1)(-4)$
$\therefore$ $n - 1 = 23$
$\therefore$ $n = 24$

17. Here, $a = 7$, $d = 13 - 7 = 6$,
$t_n = 205$
$\therefore$ $a + (n - 1)d = 205$
$\therefore$ $7 + (n - 1)(6) = 205$
$\therefore$ $6(n - 1) = 198$
$\therefore$ $n - 1 = 33$
$\therefore$ $n = 34$

18. The given A.P. is $-11, -8, -5, ..., 49$
$a = -11$, $d = -8 - (-11) = 3$, $t_n = 49$
$\therefore$ 4^{th} term from the end
$= 49 - (4 - 1)(3)$
$= 49 - 9$
$= 40$

Shortcut

In an A.P.,
n^{th} term from the end $= t_n - (n - 1)d$, where t_n is the last term and d is the common difference.

Alternate Method:
To find the 4^{th} term from the last term, we write the given A.P. in reverse order as
$49, 46, 43, \ldots, -11$
Here, $a = 49$, $d = 46 - 49 = -3$
$t_n = a + (n - 1)d$
$\therefore$ $t_4 = 49 + (4 - 1)(-3)$
$= 49 - 9 = 40$

19. $a = 20$, $d = 19\frac{1}{4} - 20 = \frac{77}{4} - 20 = \frac{-3}{4}$
Let n^{th} term of the given A.P. be the first negative term. Then
$t_n < 0$
$\Rightarrow a + (n - 1)d < 0$
$\Rightarrow 20 + (n - 1)\left(\frac{-3}{4}\right) < 0$
$\Rightarrow 20 - \frac{3n}{4} + \frac{3}{4} < 0$
$\Rightarrow \frac{83 - 3n}{4} < 0$
$\Rightarrow 3n > 83$
$\Rightarrow n > 27\frac{2}{3}$
$\Rightarrow n \geq 28$

20. According to the given condition,
$t_{17} = t_{10} + 7$
$\therefore$ $a + (17 - 1)d = a + (10 - 1)d + 7$
$\therefore$ $a + 16d = a + 9d + 7$
$\therefore$ $7d = 7$
$\therefore$ $d = 1$

21. $t_{30} = 2t_{15}$
$\therefore$ $a + (30 - 1)d = 2[a + (15 - 1)d]$
$\therefore$ $29d = a + 28d$
$\therefore$ $a - d = 0$

22. According to the given condition,
$7t_7 = 11t_{11}$
$\therefore$ $7(a + 6d) = 11(a + 10d)$
$\therefore$ $7a + 42d = 11a + 110d$
$\therefore$ $4a + 68d = 0$
$\therefore$ $4(a + 17d) = 0$
$\therefore$ $a + 17d = 0$
$\therefore$ $a + (18 - 1)d = 0$
$\therefore$ $t_{18} = 0$

Alternate Method:

Shortcut

If $pt_p = qt_q$ of an A.P.,
then $t_{p+q} = 0$.

23. $t_9 = 0$
$\therefore$ $a + (9 - 1)d = 0$ …$[t_n = a + (n - 1)d]$
$\therefore$ $a + 8d = 0$
$\therefore$ $a = -8d$ ...(i)
$t_{19} = a + (19 - 1)d$
$= a + 18d$
$= -8d + 18d$ ...[From (i)]

$\therefore$ $t_{19} = 10d$

$t_{29} = a + (29 - 1)d$

$= a + 28d$

$= -8d + 28d$ ...[From (i)]

$\therefore$ $t_{29} = 20d$

$\therefore$ $t_{29} : t_{19} = 20d : 10d = 2 : 1$

24. Given, a, 7, b, 23, c are in A.P.

$\Rightarrow t_2 = 7$ and $t_4 = 23$

$\Rightarrow a + (2 - 1)d = 7$ and $a + (4 - 1)d = 23$

$\Rightarrow a + d = 7$ …(i)

and $a + 3d = 23$ …(ii)

Subtracting (i) from (ii), we get

$2d = 16$ $\Rightarrow d = 8$

Substituting d = 8 in (i), we get

$a + 8 = 7$

$\Rightarrow a = -1$

$\Rightarrow b = t_3 = t_2 + d = 7 + 8 = 15$

and $c = t_5 = t_4 + d = 23 + 8 = 31$

Connections

In chapter 1: Linear equations in two variables, we have studied how to solve simultaneous linear equations.

25. According to the given conditions,

$t_9 = -32$

$\Rightarrow a + 8d = -32$ …(i)

and $t_{11} + t_{13} = -94$

$\Rightarrow (a + 10d) + (a + 12d) = -94$

$\Rightarrow 2a + 22d = -94$

$\Rightarrow a + 11d = -47$ ...(ii)

Subtracting (i) from (ii), we get

$3d = -15$

$\Rightarrow d = \frac{-15}{3} = -5$

26. $t_3 = 13$

$\therefore$ $a + (3 - 1)d = 13$

$\therefore$ $a + 2d = 13$ …(i)

$t_5 = 25$

$\therefore$ $a + (5 - 1)d = 25$

$\therefore$ $a + 4d = 25$ …(ii)

Solving (i) and (ii), we get

$a = 1, d = 6$

$\therefore$ $t_7 = a + 6d$

$= 1 + 6(6) = 37$

27. $t_{11} = 38$

$\therefore$ $a + (11 - 1)d = 38$

$\therefore$ $a + 10d = 38$ …(i)

$t_{16} = 73$

$\therefore$ $a + (16 - 1)d = 73$

$\therefore$ $a + 15d = 73$ …(ii)

Subtracting equation (i) from (ii), we get

$5d = 35$

$\therefore$ $d = 7$

Substituting d = 7 in equation (i), we get

$a + 70 = 38$

$\therefore$ $a = -32$

$t_{21} = a + (21 - 1)d$

$= -32 + (20)7$

$= -32 + 140$

$= 108$

28. $t_3 = 4$

$\Rightarrow a + (3 - 1)d = 4$

$\Rightarrow a + 2d = 4$ …(i)

$t_9 = -8$

$\Rightarrow a + (9 - 1)d = -8$

$\Rightarrow a + 8d = -8$ …(ii)

Subtracting (i) from (ii), we get

$6d = -12$

$\Rightarrow d = \frac{-12}{6} = -2$

Substituting d = –2 in (i), we get

$a - 4 = 4$

$\Rightarrow a = 8$

Let the n^{th} term of the A.P. be zero. Then

$t_n = 0$

$\Rightarrow a + (n - 1)d = 0$

$\Rightarrow 8 + (n - 1)(-2) = 0$

$\Rightarrow -2(n - 1) = -8$

$\Rightarrow n - 1 = \frac{-8}{-2} = 4$

$\Rightarrow n = 5$

$\Rightarrow 5^{th}$ term of the A.P. is zero.

29. According to the given conditions,

$t_4 + t_8 = 24$

$\Rightarrow a + (4 - 1)d + a + (8 - 1)d = 24$

$\Rightarrow a + 3d + a + 7d = 24$

$\Rightarrow 2a + 10d = 24$

$\Rightarrow a + 5d = 12$ …(i)

Also, $t_6 + t_{10} = 44$

$\Rightarrow a + (6 - 1)d + a + (10 - 1)d = 44$

$\Rightarrow a + 5d + a + 9d = 44$

$\Rightarrow 2a + 14d = 44$

$\Rightarrow a + 7d = 22$ … (ii)

Subtracting (i) from (ii), we get

$2d = 10$

$\Rightarrow d = 5$

Substituting d = 5 in (i), we get

$a + 25 = 12$

$\Rightarrow a = -13$

The first three terms of the A.P. are

a, a + d, a + 2d

i.e., –13, –8, –3

31. The three digit natural numbers divisible by 7 are 105, 112, 119, …, 994

The above sequence is an A.P.

$\therefore$ $a = 105, d = 7$

Let the number of terms in the A.P. be n.
Then, $t_n = 994$
$t_n = a + (n - 1)d$
$\therefore$ $994 = 105 + (n - 1)7$
$\therefore$ $889 = (n - 1)7$
$\therefore$ $n - 1 = 127$
$\therefore$ $n = 128$

32. The natural numbers from 10 to 250 divisible by 4 are 12, 16, 20, ..., 248
The above sequence is an A.P.
$\therefore$ $a = 12, d = 4$
Let the number of terms in the A.P. be n.
Then, $t_n = 248$
$t_n = a + (n - 1)d$
$\therefore$ $248 = 12 + (n - 1)4$
$\therefore$ $236 = (n - 1)4$
$\therefore$ $n - 1 = 59$
$\therefore$ $n = 60$

33. Let the first term of the two A.P.'s be a_1 and b_1 respectively.
For the first A.P.,
4^{th} term $= a_1 + (4 - 1)d = -1 + 3d$
For the second A.P.,
4^{th} term $= b_1 + (4 - 1)d = -8 + 3d$
Difference between 4^{th} terms of the two A.P.'s $= (-1 + 3d) - (-8 + 3d) = 7$

34. The first A.P. is 18, 21, 24, ...
Here, $a = 18, d = 21 - 18 = 3$
$\therefore$ n^{th} term $= a + (n - 1)d$
$= 18 + (n - 1)(3)$
$= 18 + 3n - 3 = 3n + 15$
The second A.P. is 2, 7, 12, ...
Here, $a = 2, d = 7 - 2 = 5$
$\therefore$ n^{th} term $= a + (n - 1)d$
$= 2 + (n - 1)(5)$
$= 2 + 5n - 5 = 5n - 3$
Since the n^{th} terms of the two A.P.'s are equal,
$3n + 15 = 5n - 3$
$\therefore$ $2n = 18$
$\therefore$ $n = 9$

3.3 Sum of first n terms of an A.P.

1. $a = -5, d = 2$

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

$$\Rightarrow S_6 = \frac{6}{2}[2(-5) + (6 - 1)(2)]$$

$$\Rightarrow S_6 = 3(-10 + 10) = 0$$

2. $a = 8, d = 8$

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

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

$$= n(8 + 4n - 4)$$

$$= 4n(n + 1)$$

3. Here, $a = 15, d = 10 - 15 = -5$

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

$$\therefore \quad S_{10} = \frac{10}{2}[2(15) + (10 - 1)(-5)]$$

$$= 5[30 + (9)(-5)]$$

$$= 5(30 - 45)$$

$$= 5(-15)$$

$\therefore$ $S_{10} = -75$

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

$$\therefore \quad S_8 = \frac{8}{2}[2(3) + (8 - 1)d]$$

$\therefore$ $192 = 4(6 + 7d)$
$\therefore$ $7d = 42$
$\therefore$ $d = 6$

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

$$\Rightarrow 90 = \frac{n}{2}[2(2) + (n - 1)(8)]$$

$\Rightarrow 90 \times 2 = n(4 + 8n - 8)$
$\Rightarrow 180 = n(8n - 4)$
$\Rightarrow 8n^2 - 4n - 180 = 0$
$\Rightarrow 2n^2 - n - 45 = 0$
$\Rightarrow 2n^2 - 10n + 9n - 45 = 0$
$\Rightarrow 2n(n - 5) + 9(n - 5) = 0$
$\Rightarrow (n - 5)(2n + 9) = 0$

$$\Rightarrow n = 5 \text{ or } n = \frac{-9}{2}$$

$\Rightarrow n = 5$ …[$\because$ n cannot be negative]

6. $$S_n = \frac{n}{2}(t_1 + t_n)$$

$$\Rightarrow 144 = \frac{9}{2}(t_1 + 28)$$

$$\Rightarrow 144 \times \frac{2}{9} = t_1 + 28$$

$\Rightarrow 32 = t_1 + 28$
$\Rightarrow t_1 = a = 4$

7. $$S_n = \frac{n}{2}(t_1 + t_n)$$

$$\therefore \quad 399 = \frac{n}{2}(1 + 20)$$

$\therefore$ $399 \times 2 = 21n$

$$\therefore \quad n = \frac{798}{21} = 38$$

8. $$S_n = \frac{n}{2}(t_1 + t_n)$$

$$\therefore \quad S_{25} = \frac{25}{2}(18 + 82)$$

$$= \frac{25}{2}(100) = 1250$$

9. Given: $t_n = 2n + 1$
$\therefore$ $t_1 = 3, t_2 = 5, t_3 = 7$
$\therefore$ Required sum = 3 + 5 + 7 = 15

10. First five multiples of 3 are 3, 6, 9, 12, 15.
The above sequence is an A.P.
$\therefore$ $t_1 = 3, \ t_5 = 15$

$$S_n = \frac{n}{2}(t_1 + t_n)$$

$$\therefore \quad S_5 = \frac{5}{2}(3 + 15)$$

$$\therefore \quad S_5 = \frac{5}{2}(18)$$

$$\therefore \quad S_5 = 45$$

11. First 10 natural numbers are 1, 2, 3, …., 10.
The above sequence is an A.P.
$\therefore$ $t_1 = 1, t_n = 10$

$$S_n = \frac{n}{2}(t_1 + t_n)$$

$$\therefore \quad S_{10} = \frac{10}{2}(1 + 10)$$
$$= 5 \times 11 = 55$$

Alternate Method:

$$S_{10} = \frac{10(10+1)}{2}$$
$$= 55$$

Shortcut

Sum of first n natural numbers = $\frac{n(n+1)}{2}$

12. First 30 natural numbers are 1, 2, 3, …, 30.
The above sequence is an A.P.
$\therefore$ $t_1 = 1, t_n = 30$

$$S_n = \frac{n}{2}(t_1 + t_n)$$

$$\therefore \quad S_{30} = \frac{30}{2}(1 + 30)$$
$$= 15 \times 31$$
$$= 465$$

Alternate Method:

$$S_{30} = \frac{30(30+1)}{2}$$
$$= 465$$

13. In given A.P., a = 1, d = 1, n = 100

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

$$\therefore \quad S_{100} = \frac{100}{2}[2(1) + (100-1)1]$$
$$= 50(2 + 99)$$
$$= 50 \times 101$$
$$= 5050$$

Alternate Method:

$$S_{100} = \frac{100(100+1)}{2}$$
$$= 5050$$

14. Natural numbers divisible by 3 are 3, 6, 9, …, 30
The above sequence is an A.P.
$\therefore$ $t_1 = 3, t_n = 30$

$$S_n = \frac{n}{2}(t_1 + t_n)$$

$$\therefore \quad S_{10} = \frac{10}{2}(3 + 30) = 5 \times 33 = 165$$

15. We have a = 1 and d = 1,
Consider option (C),
For n = 9,

$$S_9 = \frac{9}{2}[2(1) + (9-1)1] = 45$$

i.e., n = 9 satisfy the given condition.

16. First n even natural numbers are 2, 4, 6, …, 2n
The above sequence is an A.P.
$\therefore$ $t_1 = 2, t_n = 2n$

$$S_n = \frac{n}{2}(t_1 + t_n)$$
$$= \frac{n}{2}(2 + 2n)$$
$$= n(n + 1)$$

17. $S_{123} = 123 \times 124$
$= 15252$

Shortcut

Sum of first n even natural numbers = n(n + 1)

18. The odd numbers between 1 and 350 are 3, 5, ..., 349.
The above sequence is an A.P.
$\therefore$ $a = 3, d = 2, t_n = 349$
$t_n = a + (n - 1)d$
$\therefore$ $349 = 3 + (n - 1)(2)$
$\therefore$ $346 = 2(n - 1)$

$$\therefore \quad n - 1 = \frac{346}{2} = 173$$

$$\therefore \quad n = 174$$

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

$$\therefore \quad S_{174} = \frac{174}{2}[2(3) + (174-1)2]$$
$$= 87(6 + 173 \times 2)$$
$$= 87(6 + 346)$$
$$= 87 \times 352$$
$\therefore$ $S_{174} = 30624$

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

$\therefore \quad S_{55} = \frac{55}{2}[2a + (55-1)d]$

$\therefore \quad 3300 = \frac{55}{2}(2a + 54d)$

$\therefore \quad 3300 = \frac{55}{2} \times 2(a + 27d)$

$\therefore \quad 3300 = 55(a + 27d)$

$\therefore \quad a + 27d = \frac{3300}{55}$

$\therefore \quad a + 27d = 60 \quad \ldots(i)$

Now, $t_n = a + (n-1)d$

$\therefore \quad t_{28} = a + (28-1)d = a + 27d$

$\therefore \quad t_{28} = 60 \quad \ldots$[From (i)]

20. $t_n = a + (n-1)d$

$\therefore \quad t_{19} = a + (19-1)d$

$\therefore \quad 52 = a + 18d$

i.e., $a + 18d = 52 \quad \ldots(i)$

Also, $t_{38} = a + (38-1)d$

$\therefore \quad 128 = a + 37d$

i.e., $a + 37d = 128 \quad \ldots(ii)$

Adding equations (i) and (ii), we get

$2a + 55d = 180 \quad \ldots(iii)$

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

$\therefore \quad S_{56} = \frac{56}{2}[2a + (56-1)d]$

$= 28(2a + 55d)$

$= 28 \times 180 \quad \ldots$[From (iii)]

$\therefore \quad S_{56} = 5040$

21. The number of terms n = 11, which is an odd number.

$\therefore$ the middle term is $\left(\frac{n+1}{2}\right)^{th}$ term

i.e., $\left(\frac{11+1}{2}\right)^{th}$ term i.e., 6^{th} term

According to the given condition,

$t_6 = 30$

$\therefore \quad a + (6-1)d = 30$

$\therefore \quad a + 5d = 30 \quad \ldots(i)$

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

$\therefore \quad S_{11} = \frac{11}{2}[2a + (11-1)d]$

$= \frac{11}{2}(2a + 10d)$

$= 11(a + 5d)$

$= 11(30) \quad \ldots$[From (i)]

$= 330$

22. Consider option (A),

$5 + 10 + 15 = 30$

$\therefore$ Sum of three consecutive terms is 30.

$5 \times 10 \times 15 = 750$

$\therefore$ Their product is 750.

Thus, both the given conditions are satisfied.

23. Let the angles of the triangle be a – d, a, a + d.

The sum of the angles of a triangle is 180°.

$\Rightarrow a - d + a + a + d = 180°$

$\Rightarrow 3a = 180°$

$\Rightarrow a = \frac{180^0}{3} \Rightarrow a = 60° \quad \ldots(i)$

According to the given condition,

greatest angle = 2 (least angle)

$\Rightarrow a + d = 2(a - d)$

$\Rightarrow a + d = 2a - 2d$

$\Rightarrow 3d = a$

$\Rightarrow 3d = 60° \quad \ldots$[From (i)]

$\Rightarrow d = \frac{60°}{3} = 20°$

$\Rightarrow$ The angles of the triangle are

$60° - 20°, 60°, 60° + 20°$

i.e., 40°, 60° , 80°

3.4 Application of A.P.

1. Given a = ₹ 5, d = ₹ 1.75, t_n = ₹ 20.75

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

$\Rightarrow 20.75 = 5 + (n-1)(1.75)$

$\Rightarrow (1.75)(n-1) = 20.75 - 5$

$\Rightarrow (1.75)(n-1) = 15.75$

$\Rightarrow n - 1 = \frac{15.75}{1.75}$

$\Rightarrow n - 1 = 9$

$\Rightarrow n = 10$

2. Amounts invested by Sachin in each year are as follows:

5000, 7000, 9000, …

The above sequence is an A.P.

$\therefore \quad a = 5000, d = 2000, n = 12$

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

$\therefore \quad S_{12} = \frac{12}{2}[2(5000) + (12-1)2000]$

$= 6(10000 + 11 \times 2000)$

$= 6(10000 + 22000)$

$= 6(32000)$

$\therefore \quad S_{12} = 192000$

3. Number of trees in rows are given as 1, 2, 3, …

The above sequence is an A.P.

$\therefore \quad a = 1, d = 1, n = 25$

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

$\therefore \quad S_{25} = \frac{25}{2}[2(1) + (25-1)1]$

$= \frac{25}{2}(2 + 24)$

$= \frac{25}{2} \times 26$

$= 25 \times 13 = 325$

4. $a = 20, d = 15$

Let the time required to clear the loan be n months. Then

$S_n = 3250$

$\Rightarrow \frac{n}{2}[2a + (n-1)d] = 3250$

$\Rightarrow \frac{n}{2}[2(20) + (n-1)(15)] = 3250$

$\Rightarrow n(40 + 15n - 15) = 3250 \times 2$

$\Rightarrow n(25 + 15n) = 6500$

$\Rightarrow 25n + 15n^2 = 6500$

$\Rightarrow 15n^2 + 25n - 6500 = 0$

$\Rightarrow 3n^2 + 5n - 1300 = 0$

$\Rightarrow 3n^2 + 65n - 60n - 1300 = 0$

$\Rightarrow n(3n + 65) - 20(3n + 65) = 0$

$\Rightarrow (3n + 65)(n - 20) = 0$

$\Rightarrow n = -\frac{65}{3}$ or $n = 20$

$\Rightarrow n = 20$ …[$\because$ n cannot be negative]

TOPIC TEST

Total Marks: 15

1. The sum of first 16 terms of the A.P. 10, 6, 2,... is **[1]**
(A) –320 (B) 320 (C) –352 (D) –400

2. What is the common difference of the sequence 0, – 4, – 8, – 12? **[1]**
(A) 4 (B) – 4 (C) 8 (D) – 8

3. Find the 20^{th} term of the progression –12, –5, 2, 9, ... **[1]**
(A) 128 (B) 121 (C) 114 (D) 135

4. The sum of first 10 multiples of 3 is **[1]**
(A) 111 (B) 138 (C) 165 (D) 198

5. Which of the following is not an A.P.? **[1]**
(A) 2, 4, 6, 8, … (B) $2, \frac{5}{2}, 3, \frac{7}{2}, \ldots$ (C) –10, –6, –2, 2, … (D) 0.6, 0.66, 0.666, …

6. In an A.P. the first term is –5 and last term is 45. If sum of all numbers in the A.P. is 120, then how many terms are there? **[1]**
(A) 8 (B) 5 (C) 7 (D) 6

7. Which term of the A.P. 21, 42, 63, 84, ... is 210? **[1]**
(A) 9^{th} (B) 10^{th} (C) 11^{th} (D) 12^{th}

8. The sequence –10, – 13, – 16, –19, … **[1]**
(A) is an A.P. Reason d = 3 (B) is an A.P. Reason d = –3
(C) is an A.P. Reason d = 4 (D) is not an A.P.

9. Sum of first 55 terms in an A.P. is 3355, find its 28^{th} term. **[1]**
(A) 61 (B) 60 (C) 59 (D) 58

10. The tenth term from the end of the A.P. 4, 9, 14, …, 254 is **[1]**
(A) 214 (B) 209 (C) 208 (D) 204

11. For the A.P. $\sqrt{2}, \frac{3}{\sqrt{2}}, \frac{4}{\sqrt{2}}, \ldots,$ **[1]**

(A) $a = \sqrt{2}, d = \sqrt{2}$ (B) $a = \sqrt{2}, d = \frac{1}{\sqrt{2}}$

(C) $a = \sqrt{2}, d = 2\sqrt{2}$ (D) $a = \sqrt{2}, d = \frac{3}{\sqrt{2}}$

12. In an A.P., if $t_{18} - t_{14} = 32$, then d = **[1]**
(A) 4 (B) – 4 (C) 8 (D) – 8

13. In year 2012, Mrs. Singh got a job with salary ₹ 1,40,000 per year. Her employer agreed to give ₹ 10,000 per year as increment. Then in how many years will her annual salary be ₹ 2,20,000? **[1]**
(A) 7 (B) 8 (C) 9 (D) 10

14. If 5 times the 5^{th} term of an A.P. is equal to 8 times its 8^{th} term, then its 13^{th} term will be **[1]**
(A) 5 (B) 8 (C) 13 (D) 0

15. In an A.P., 19^{th} term is 53 and 38^{th} term is 129, find sum of first 56 terms. **[1]**
(A) 5040 (B) 5096 (C) 5060 (D) 5076

ANSWERS

1.	(A)	2.	(B)	3.	(B)	4.	(C)	5.	(D)	6.	(D)	7.	(B)	8.	(B)	9.	(A)	10.	(B)
11.	(B)	12.	(C)	13.	(C)	14.	(D)	15.	(B)										

SOLUTIONS

1. $a = 10, d = 6 - 10 = -4, n = 16$

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

$\Rightarrow S_{16} = \frac{16}{2}[2(10) + (16-1)(-4)]$

$\Rightarrow S_{16} = 8(20 - 60)$

$= -320$

2. Here, $t_1 = 0, t_2 = -4$

$\therefore$ Common difference $= t_2 - t_1 = -4 - 0 = -4$

3. $t_n = a + (n-1)d$

$\therefore$ $t_{20} = -12 + (20-1)7$ ...[$\because a = -12, d = 7$]

$= -12 + 19 \times 7$

$= -12 + 133$

$\therefore$ $t_{20} = 121$

4. The first 10 multiples of 3 are 3, 6,…, 30.
The above sequence is an A.P.

$\therefore$ $t_1 = 3, t_n = 30$

$S_n = \frac{n}{2}(t_1 + t_n)$

$\Rightarrow S_{10} = \frac{10}{2}(3 + 30) = 5(33) = 165$

5. Consider option (D),
0.6, 0.66, 0.666, …
Here, $t_1 = 0.6, t_2 = 0.66, t_3 = 0.666$

$\therefore$ $t_2 - t_1 = 0.66 - 0.6 = 0.06$

$t_3 - t_2 = 0.666 - 0.66 = 0.006$

$\therefore$ $t_2 - t_1 \neq t_3 - t_2$

Since the difference between two consecutive terms is not constant, the given sequence is not an A.P.

6. Given, $t_1 = -5, t_n = 45, S_n = 120$

$S_n = \frac{n}{2}(t_1 + t_n)$

$\therefore$ $120 = \frac{n}{2}(-5 + 45)p$

$\therefore$ $120 = \frac{n}{2}(40)$

$\therefore$ $20n = 120$

$\therefore$ $n = \frac{120}{20} = 6$

7. The given A.P. is 21, 42, 63, 84, ...
Here, $a = 21, d = 42 - 21 = 21$
Let the n^{th} term of the given A.P. be 210. Then
$t_n = 210$

$\Rightarrow a + (n-1)d = 210$

$\Rightarrow 21 + (n-1)(21) = 210$

$\Rightarrow 21(n-1) = 189$

$\Rightarrow n - 1 = \frac{189}{21}$

$\Rightarrow n - 1 = 9$

$\Rightarrow n = 10$

$\Rightarrow 10^{th}$ term of the given A.P. is 210.

8. $-10, -13, -16, -19, \ldots$
Here, $t_1 = -10, t_2 = -13, t_3 = -16$

$\therefore$ $t_2 - t_1 = -13 - (-10) = -3$

$t_3 - t_2 = -16 - (-13) = -3$

$\therefore$ $t_2 - t_1 = t_3 - t_2 = \ldots = -3 = d$

Since the difference between two consecutive terms is constant, the given sequence is an A.P.

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

$\therefore$ $S_{55} = \frac{55}{2}[2a + (55-1)d]$

$\therefore$ $3355 = \frac{55}{2}(2a + 54d)$

$\therefore$ $61 = a + 27d$ …(i)

Now, $t_n = a + (n-1)d$

$\therefore$ $t_{28} = a + (28-1)d = a + 27d$

$\therefore$ $t_{28} = 61$ …[From (i)]

10. The given A.P. is 4, 9, 14, ..., 254

$a = 4, d = 9 - 4 = 5, t_n = 254$

$\therefore$ 10^{th} term from the end

$= 254 - (10 - 1)(5)$

$= 254 - 45 = 209$

Shortcut

In an A.P.,
n^{th} term from the end $= t_n - (n-1)d$, where t_n is the last term and d is the common difference.

Alternate Method:

To find the 10^{th} term from the last term, we write the given A.P. in reverse order as

254, 249, 244, …, 4

Here, $a = 254, d = 249 - 254 = -5$

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

$\Rightarrow t_{10} = 254 + (10-1)(-5) = 254 - 45 = 209$

11. $a = \sqrt{2}$

$d = \frac{3}{\sqrt{2}} - \sqrt{2} = \frac{1}{\sqrt{2}}$

12. $t_{18} - t_{14} = 32$

$\therefore$ $(a + 17d) - (a + 13d) = 32$

$\therefore$ $4d = 32$

$\therefore$ $d = 8$

13. Here, $a = ₹\ 1,40,000, d = ₹\ 10,000, t_n = 2,20,000$

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

$\therefore$ $220000 = 140000 + (n-1)(10000)$

$\therefore$ $22 = 14 + n - 1$

$\therefore$ $n = 9$

14. According to the given condition,

$5t_5 = 8t_8$

$\Rightarrow 5(a + 4d) = 8(a + 7d)$

$\Rightarrow 5a + 20d = 8a + 56d$

$\Rightarrow 3a + 36d = 0$

$\Rightarrow 3(a + 12d) = 0$

$\Rightarrow a + 12d = 0$

$\Rightarrow a + (13-1)d = 0$

$\Rightarrow t_{13} = 0$

Alternate Method:

Shortcut

If $pt_p = qt_q$ of an A.P.,
then $t_{p+q} = 0$.

15. $t_n = a + (n-1)d$

$\therefore$ $t_{19} = a + (19-1)d$

$\therefore$ $53 = a + 18d$

i.e., $a + 18d = 53$ …(i)

Also, $t_{38} = a + (38-1)d$

$\therefore$ $129 = a + 37d$

i.e., $a + 37d = 129$ …(ii)

Adding equations (i) and (ii), we get

$2a + 55d = 182$ …(iii)

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

$\therefore$ $S_{56} = \frac{56}{2}[2a + (56-1)d]$

$= 28(2a + 55d)$

$= 28 \times 182$ …[From (iii)]

$\therefore$ $S_{56} = 5096$

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