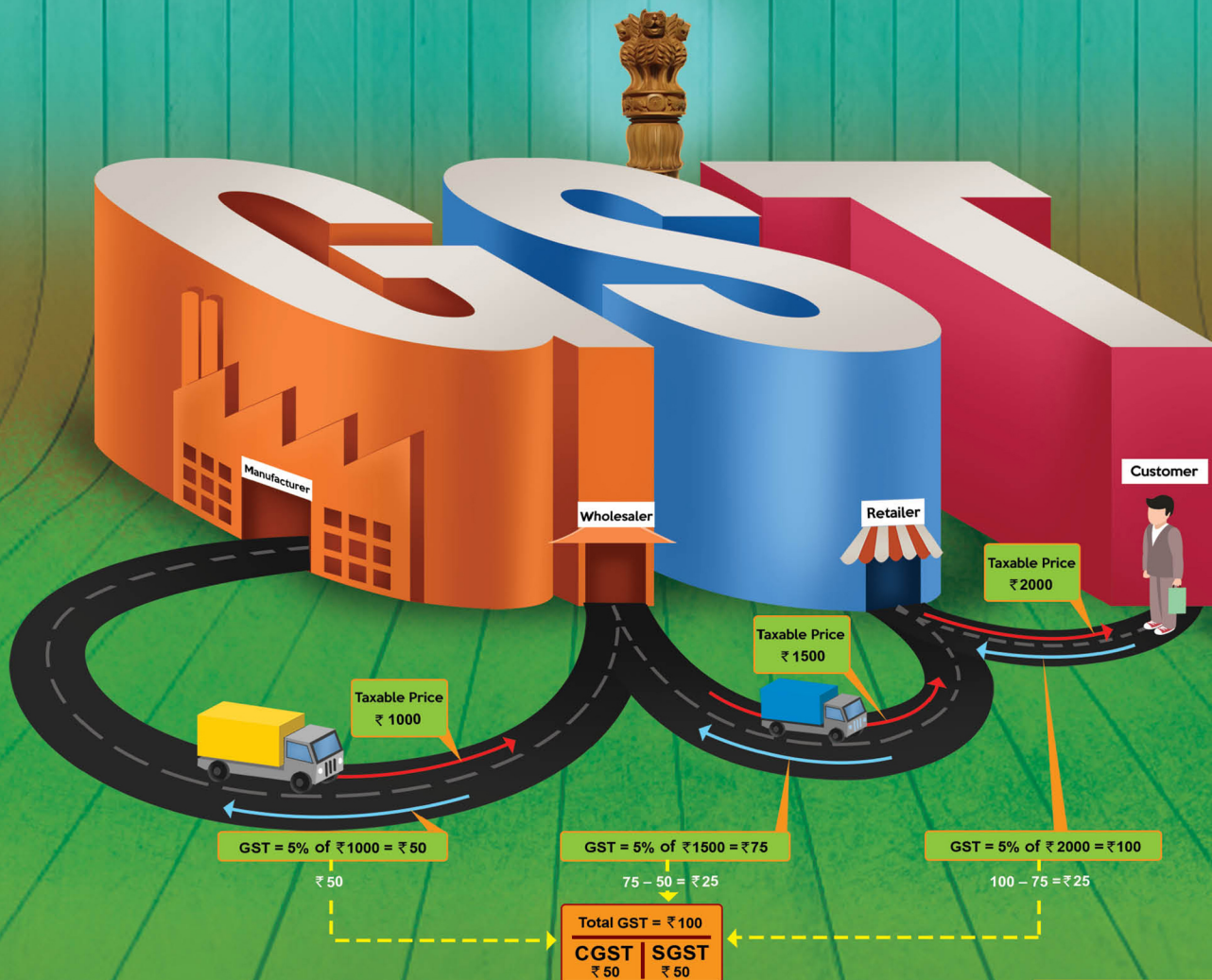


MATHEMATICS

PART - I



BASED ON LATEST BOARD PAPER PATTERN



STD. X
(Eng. Med.)

Mr. Biju B.
B.Sc. (Maths)

Ms. Komal Atta
B.Ed. (M.Com)

Mr. Vinod Singh
M.Sc. (Mathematics)

Ms. Varsha Talreja
B.E.

PERFECT Mathematics Part – I STD. X

Salient Features

- Written as per the **Latest Textbook and Board Paper Pattern**
- Complete coverage of the entire syllabus, which includes:
 - Solutions to all Practice Sets and Problem Sets
 - Intext and Activity/Project based questions from the textbook
- Exclusive Practice Includes:
 - Additional problems, Activities, Multiple Choice Questions (MCQs) and One mark questions
 - ‘Chapter Assessment’ at the end of each chapter
- Tentative marks allocation for all problems
- Relevant Previous Years’ Board Questions till **July 2023**
- At the end of the book:
 - A separate section of ‘Challenging Questions’ is provided
 - ‘Important Formulae’ for quick reference are provided
 - ‘Model Question Paper’ in accordance with the latest paper pattern
- Includes Important Features for holistic learning:
 - *Illustrative Example* - *Smart Check*
- Q.R. codes provide:
 - Answer Keys of Chapter Assessment
 - Solution of Model Question Paper
- Includes Board Question Paper of March 2024 (Solution in pdf format through QR code)

Printed at: **Prabodhan Prakashan Pvt. Ltd.**, Navi Mumbai

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PREFACE

Creation of the '**Perfect Mathematics Part – I, Std. X**' book was a rollercoaster ride. We had a plethora of ideas, suggestions and decisions to ponder over. However, our primary objective was to align book with the latest syllabus and provide students with ample practice material.

This book covers topics such as Linear Equations in Two Variables, Quadratic Equations, Arithmetic Progression, Financial Planning, Probability and Statistics. The study of these topics requires a deep and intrinsic understanding of concepts, terms and formulae. Hence, to ease this task, we present '**Perfect Mathematics Part – I, Std. X**' a complete and thorough guide, extensively drafted to boost the confidence of students.

Before each Practice Set, a short and easy explanation of various concepts with the help of 'Illustrative Examples' is provided. A detailed problem solving process is explained step by step in 'Illustrative Examples'. Detailed solution of the problems has been provided for student's understanding and is not expected in the examination. We have also included Solutions and Answers to Textual Questions and Examples in an extremely lucid manner.

Moreover, the inclusion of '**Smart Check**' enables students to verify their answers. '**Textual Activities**' covers all the Textual Activities along with their answers. '**Additional Problems for Practice**' include multiple problems to help students revise and enhance their problem solving skills. '**Solved Examples**' from textbook are also a part of this book. '**Activities for Practice**' includes additional activities along with their answers for students to practice. '**One Mark Questions**' include '**Type A: Multiple Choice Questions**', '**Type B: Solve the Following Questions**' along with their answers. Every chapter ends with a '**Chapter Assessment**'. This test stands as a testimony to the fact that the child has understood the chapter thoroughly. '**Challenging Questions**' include questions that are not a part of the textbook, yet are core to the concerned subject. These questions would provide students enough practice to tackle Challenging Questions in their examination.

Questions from Board papers of March 2019, July 2019, March 2020, November 2020, March 2022, July 2022, March 2023 and July 2023 have been included as that would help students to prepare better for board exam.

We have provided a tentative mark allocation for the problems in this book. However, marks mentioned are indicative and are subject to change as per the Maharashtra State Board's discretion.

'**Model Question Paper**' based on latest paper pattern is provided along with solution which can be accessed through QR code to help students assess their preparedness for final board examination.

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

Best of luck to all the aspirants!

Publisher

Edition: Fourth

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.

Please write to us on : mail@targetpublications.org

Disclaimer

This reference book is transformative work based on the latest textbook of Mathematics Part - I published by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune. We the publishers are making this reference book which constitutes as fair use of textual contents which are transformed by adding and elaborating, with a view to simplify the same to enable the students to understand, memorize and reproduce the same in examinations.

This work is purely inspired upon the course work as prescribed by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune. Every care has been taken in the publication of this reference book by the Authors while creating the contents. The Authors and the Publishers shall not be responsible for any loss or damages caused to any person on account of errors or omissions which might have crept in or disagreement of any third party on the point of view expressed in the reference book.

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KEY FEATURES

Illustrative Example: Illustrative Example provides a detailed approach towards solving a problem.

Smart Check: Smart Check is a technique to verify the answers. This is our attempt to cross-check the accuracy of the answer. Smart check is indicated by ✓ symbol.

Activities for Practice: In this section we have provided multiple activities for practice in accordance with the latest paper pattern.

One Mark Questions: **Type A** consists of Multiple Choice Questions (which either require short solutions or direct application of mathematical concepts). **Type B** consists of questions that require very short solutions with direct application of mathematical concepts.

Additional Problems for Practice: In this section we have provided ample practice problems for students. It also has Solved examples from the textbook, which are indicated by “+”.

Chapter Assessment: This section covers questions from the chapter for self-evaluation purpose. This is our attempt to offer students with revision and help them assess their knowledge of each chapter.

Challenging Questions: In light of the importance of specific questions in board examination, we have created a separate section of Challenging Questions for additional practice to boost the exam score

Important Formulae: Important Formulae given at the end of the book include all the key formulae in the chapter. It offers students a handy tool to solve problems and ace the last minute revision.

Question Paper: Model Question Paper is provided for the students to know about the types of questions that are asked in the Board Examinations.

QR Codes:

- Answer Keys of Chapter Assessment
- Solution of Model Question Paper.
- Solution to Board Question Paper of March 2024

Evaluation Scheme

Academic year 2019 - 2020 and onwards

Mathematics - Part I	40 Marks	Written Examination	Time: 2 hours
Mathematics - Part II	40 Marks	Written Examination	Time: 2 hours
Internal Evaluation	20 Marks		
Total	100 Marks		

The scheme of internal evaluation will be as follows:

- 2 Homework assignments [one based on Mathematics Part – I and one based on Mathematics Part – II (5 Marks each) – 10 Marks]
- Practical Exam / MCQ Test (Part I – 10 Marks and Part II – 10 Marks) - These 20 marks are to be converted into 10 Marks.

PAPER PATTERN

Question No.	Type of Questions	Total Marks	Marks with option
1.	(A) Solve 4 out of 4 MCQ (1 mark each)	04	04
	(B) Solve 4 out of 4 subquestions (1 mark each)	04	04
2.	(A) Solve 2 activity based subquestions out of 3 (2 marks each)	04	06
	(B) Solve any 4 out of 5 subquestions (2 marks each)	08	10
3.	(A) Solve 1 activity based subquestion out of 2 (3 marks each)	03	06
	(B) Solve any 2 out of 4 subquestions (3 marks each)	06	12
4.	Solve any 2 out of 3 subquestions (4 marks each) [Out of textbook]	08	12
5.	Solve any 1 out of 2 subquestions (3 marks each)	03	06
	Total Marks	40	60

The division of marks in question papers as per objectives will be as follows:

Distribution of Marks	
Easy Questions	40%
Medium Questions	40%
Difficult Questions	20%

Objectives	Maths – 1
Knowledge	20%
Understanding	30%
Application	40%
Skill	10%

[Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04]

Topic-wise weightage of marks

S. No.	Topic Name	Marks with option
1	Linear Equations in Two Variables	12
2	Quadratic Equations	12
3	Arithmetic Progression	08
4	Financial Planning	08
5	Probability	08
6	Statistics	12
	Total	60

Note: In the topic-wise weightage of marks given in the above table, flexibility of maximum 2 marks is permissible.

CONTENTS

No.	Topic Name	Page No.
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- Note:**
- *Smart check is indicated by ✓ symbol.*
 - *Solved examples from textbook are indicated by “+”.*
 - *Intext and Activity/Project based questions from the textbook are indicated by “#”.*

Practicing model papers is the best way to self-assess your preparation for the exam. Scan the adjacent QR Code to know more about our **“SSC 54 Question Papers & Activity Sheets With Solutions.”**



Going through the entire book in the last minute seems to be a daunting task? Go for our **“Important Question Bank (IQB)”** books for quickly revising important questions. Scan the adjacent QR Code to know more.



Need more practice for Challenging Questions in Maths? Scan the adjacent QR code to know more about our **“Mathematics Challenging Questions”** Book.



Once you solve 1000+ MCQs in a subject, you are going to become a pro in it. Go for our **“Mathematics MCQs (Part - 1 & 2)”** Book & become a pro in the subject. Scan the adjacent QR code to know more.



Scan the adjacent QR Code to know more about our **“Board Questions with Solutions”** book for Std. X and Learn about the types of questions that are asked in the X Board Examination.



Page no. **1** to **81** are purposely left blank.

To see complete chapter buy **Target Notes** or **Target E-Notes**

3

Arithmetic Progression



Let's Study

- Sequence
- Arithmetic Progression
- n^{th} term of an A.P.
- Sum of first n terms of an A.P.



Let's Learn

Sequence

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

Complete the given pattern. Look at the pattern of the numbers. Try to find a rule to obtain the next number from its preceding number. Write the next numbers.

(Textbook pg. no. 55 and 56)

Ans:

i.

Pattern									
Number of circles	1	3	5	7	9	11	13	15	17

Every pattern is formed by adding a circle in horizontal and vertical rows to the preceding pattern.

∴ The sequence for the above pattern is 1, 3, 5, 7, 9, 11, 13, 15, 17,

ii.

Pattern							
Number of triangles	5	8	11	14	17	20	23

Every pattern is formed by adding 2 triangles horizontally and 1 triangle vertically to the preceding pattern.

∴ The sequence for the above pattern is 5, 8, 11, 14, 17, 20, 23, ...

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 .
- ∴ In a sequence, ordered terms are represented as $t_1, t_2, t_3, \dots, t_n$.



Activity I: Some sequences are given below. Show the positions of the terms by t_1, t_2, t_3, \dots

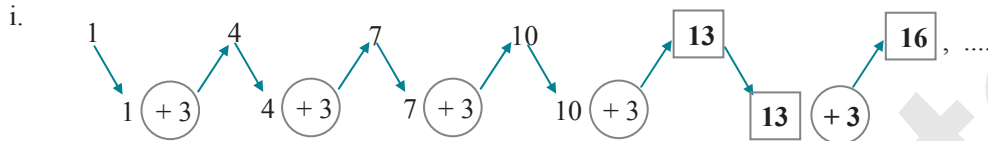
(Textbook pg. no. 56)

- i. $7, 7, 7, 7, \dots$ Here $t_1 = 7, t_2 = \boxed{7}, t_3 = \boxed{7}, \dots$
- ii. $-2, -6, -10, -14, \dots$ Here $t_1 = -2, t_2 = \boxed{-6}, t_3 = \boxed{-10}, \dots$

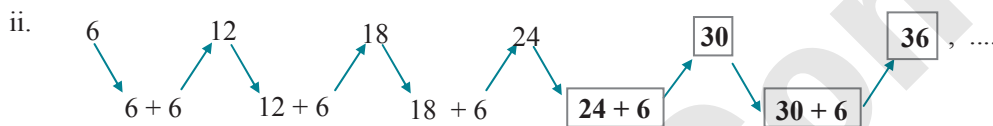
Activity II: Some sequences are given below. Check whether there is any rule among the terms. Find the similarity between two sequences. To check the rule for the terms of the sequence look at the arrangements and fill the empty boxes suitably. (Textbook pg. no. 56 and 57)

- i. $1, 4, 7, 10, 13, \dots$ ii. $6, 12, 18, 24, \dots$ iii. $3, 3, 3, 3, \dots$
- iv. $4, 16, 64, \dots$ v. $-1, -1.5, -2, -2.5, \dots$ vi. $1^3, 2^3, 3^3, 4^3, \dots$

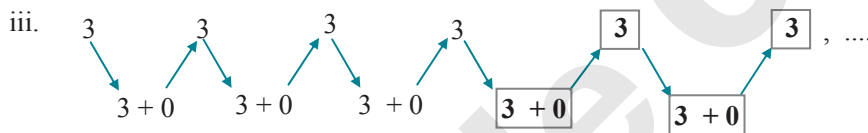
Solution:



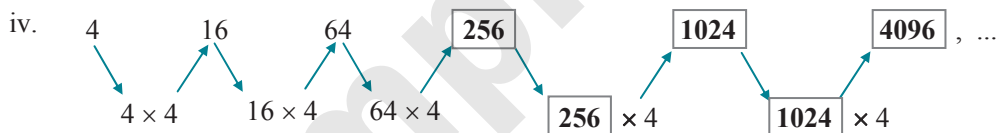
By adding 3 in each term, we get the next term of the sequence.



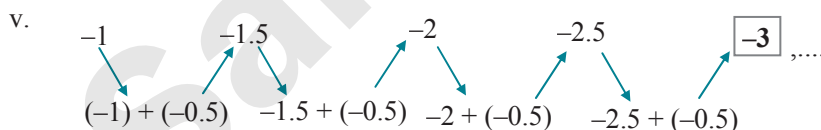
By adding 6 in each term, we get the next term of the sequence.



By adding 0 in each term, we get the next term of the sequence.



By multiplying each term by 4, we get the next term of the sequence.



By adding -0.5 in each term, we get the next term of the sequence.

- vi. $1^3, 2^3, 3^3, \dots$
 (next term) = (previous term + 1)³

The similarity in the sequences i., ii., iii. and v. is that the next term is obtained by adding a particular fixed number to the previous term.

Note : A Geometric Progression is a sequence in which the ratio of any two consecutive terms is a constant.

$$\text{i.e. in a G.P., } \frac{t_2}{t_1} = \frac{t_3}{t_2} = \dots = \frac{t_n}{t_{n-1}} = \text{constant}$$

Sequence iv. is a geometric progression.



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'.

If the first term of A.P. is 'a' and common difference is 'd', then

$$t_1 = a,$$

$$t_2 = a + d,$$

$$t_3 = (a + d) + d = a + 2d,$$

∴ 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), ...

Examples:

- i. 10, 20, 30, 40, ...
Here, $t_2 - t_1 = t_3 - t_2 = \dots = 10 = \text{constant}$
- ii. 18, 16, 14, ...
Here, $t_2 - t_1 = t_3 - t_2 = \dots = -2 = \text{constant}$
- iii. $\frac{2}{5}, \frac{3}{5}, \frac{4}{5}, \dots$
Here, $t_2 - t_1 = t_3 - t_2 = \dots = \frac{1}{5} = \text{constant}$

Finite A.P.:

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

Infinite A.P.:

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

Activity: Write one example of finite and infinite A.P. each. (Textbook pg. no. 59)

Ans: Finite A.P.:

Even natural numbers from 4 to 50:
4, 6, 8,, 50.

Infinite A.P.:

Positive multiples of 5:
5, 10, 15, ...

Remember This

- i. In a sequence if difference ($t_{n+1} - t_n$) is constant then the sequence is called an arithmetic progression.
- ii. In an A.P. the difference between two consecutive terms is constant and is denoted by d.
- iii. In an A.P. common difference d can be positive, negative or zero.
- iv. 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), ...

Practice Set 3.1

1. Which of the following sequences are A.P.? If they are A.P. find the common difference. [2 Marks each]

- i. 2, 4, 6, 8, ...
- ii. $2, \frac{5}{2}, 3, \frac{7}{2}, \dots$
- iii. -10, -6, -2, 2, ...
- iv. 0.3, 0.33, 0.333, ...
- v. 0, -4, -8, -12, ...
- vi. $-\frac{1}{5}, -\frac{1}{5}, -\frac{1}{5}, \dots$
- vii. $3, 3 + \sqrt{2}, 3 + 2\sqrt{2}, 3 + 3\sqrt{2}, \dots$
- viii. 127, 132, 137, ...

Solution:

- i. The given sequence is 2, 4, 6, 8, ...
Here, $t_1 = 2, t_2 = 4, t_3 = 6, t_4 = 8$
∴ $t_2 - t_1 = 4 - 2 = 2$
 $t_3 - t_2 = 6 - 4 = 2$
 $t_4 - t_3 = 8 - 6 = 2$
∴ $t_2 - t_1 = t_3 - t_2 = \dots = 2 = d = \text{constant}$
The difference between two consecutive terms is constant.
∴ **The given sequence is an A.P. and common difference (d) = 2.**

- ii. The given sequence is $2, \frac{5}{2}, 3, \frac{7}{2}, \dots$
Here, $t_1 = 2, t_2 = \frac{5}{2}, t_3 = 3, t_4 = \frac{7}{2}$
∴ $t_2 - t_1 = \frac{5}{2} - 2 = \frac{5 - 4}{2} = \frac{1}{2}$
 $t_3 - t_2 = 3 - \frac{5}{2} = \frac{6 - 5}{2} = \frac{1}{2}$
 $t_4 - t_3 = \frac{7}{2} - 3 = \frac{7 - 6}{2} = \frac{1}{2}$
∴ $t_2 - t_1 = t_3 - t_2 = \dots = \frac{1}{2} = d = \text{constant}$
The difference between two consecutive terms is constant.
∴ **The given sequence is an A.P. and common difference (d) = $\frac{1}{2}$.**

[Note: The question 1(ii) has been modified.]

- iii. The given sequence is -10, -6, -2, 2, ...
Here, $t_1 = -10, t_2 = -6, t_3 = -2, t_4 = 2$
∴ $t_2 - t_1 = -6 - (-10) = -6 + 10 = 4$
 $t_3 - t_2 = -2 - (-6) = -2 + 6 = 4$
 $t_4 - t_3 = 2 - (-2) = 2 + 2 = 4$
∴ $t_2 - t_1 = t_3 - t_2 = \dots = 4 = d = \text{constant}$
The difference between two consecutive terms is constant.
∴ **The given sequence is an A.P. and common difference (d) = 4.**



- iv. The given sequence is 0.3, 0.33, 0.333, ...
Here, $t_1 = 0.3$, $t_2 = 0.33$, $t_3 = 0.333$
 $\therefore t_2 - t_1 = 0.33 - 0.3 = 0.03$
 $t_3 - t_2 = 0.333 - 0.33 = 0.003$
 $\therefore t_2 - t_1 \neq t_3 - t_2$
The difference between two consecutive terms is not constant.
 \therefore **The given sequence is not an A.P.**

- v. The given sequence is 0, -4, -8, -12, ...
Here, $t_1 = 0$, $t_2 = -4$, $t_3 = -8$, $t_4 = -12$
 $\therefore t_2 - t_1 = -4 - 0 = -4$
 $t_3 - t_2 = -8 - (-4) = -8 + 4 = -4$
 $t_4 - t_3 = -12 - (-8) = -12 + 8 = -4$
 $\therefore t_2 - t_1 = t_3 - t_2 = \dots = -4 = d = \text{constant}$
The difference between two consecutive terms is constant.
 \therefore **The given sequence is an A.P. and common difference (d) = -4.**

- vi. The given sequence is $-\frac{1}{5}, -\frac{1}{5}, -\frac{1}{5}, \dots$
Here, $t_1 = -\frac{1}{5}$, $t_2 = -\frac{1}{5}$, $t_3 = -\frac{1}{5}$
 $\therefore t_2 - t_1 = -\frac{1}{5} - \left(-\frac{1}{5}\right) = -\frac{1}{5} + \frac{1}{5} = 0$
 $t_3 - t_2 = -\frac{1}{5} - \left(-\frac{1}{5}\right) = -\frac{1}{5} + \frac{1}{5} = 0$
 $\therefore t_2 - t_1 = t_3 - t_2 = \dots = 0 = d = \text{constant}$
The difference between two consecutive terms is constant.
 \therefore **The given sequence is an A.P. and common difference (d) = 0.**

- vii. The given sequence is
 $3, 3 + \sqrt{2}, 3 + 2\sqrt{2}, 3 + 3\sqrt{2}, \dots$
Here, $t_1 = 3$, $t_2 = 3 + \sqrt{2}$, $t_3 = 3 + 2\sqrt{2}$,
 $t_4 = 3 + 3\sqrt{2}$
 $\therefore t_2 - t_1 = 3 + \sqrt{2} - 3 = \sqrt{2}$
 $t_3 - t_2 = 3 + 2\sqrt{2} - (3 + \sqrt{2}) = \sqrt{2}$
 $t_4 - t_3 = 3 + 3\sqrt{2} - (3 + 2\sqrt{2}) = \sqrt{2}$
 $\therefore t_2 - t_1 = t_3 - t_2 = \dots = \sqrt{2} = d = \text{constant}$
The difference between two consecutive terms is constant.
 \therefore **The given sequence is an A.P. and common difference (d) = $\sqrt{2}$.**

- viii. The given sequence is 127, 132, 137, ...
Here, $t_1 = 127$, $t_2 = 132$, $t_3 = 137$
 $\therefore t_2 - t_1 = 132 - 127 = 5$
 $t_3 - t_2 = 137 - 132 = 5$
 $\therefore t_2 - t_1 = t_3 - t_2 = \dots = 5 = d = \text{constant}$
The difference between two consecutive terms is constant.
 \therefore **The given sequence is an A.P. and common difference (d) = 5.**

2. Write an A.P. whose first term is a and common difference is d in each of the following.

[2 Marks each]
[Mar 2023]

- i. $a = 10$, $d = 5$
ii. $a = -3$, $d = 0$
iii. $a = -7$, $d = \frac{1}{2}$
iv. $a = -1.25$, $d = 3$
v. $a = 6$, $d = -3$
vi. $a = -19$, $d = -4$

Solution:

- i. $a = 10$, $d = 5$...[Given]
 $\therefore t_1 = a = 10$
 $t_2 = t_1 + d = 10 + 5 = 15$
 $t_3 = t_2 + d = 15 + 5 = 20$
 $t_4 = t_3 + d = 20 + 5 = 25$
 \therefore **The required A.P. is 10, 15, 20, 25, ...**

- ii. $a = -3$, $d = 0$...[Given]
 $\therefore t_1 = a = -3$
 $t_2 = t_1 + d = -3 + 0 = -3$
 $t_3 = t_2 + d = -3 + 0 = -3$
 $t_4 = t_3 + d = -3 + 0 = -3$
 \therefore **The required A.P. is -3, -3, -3, -3, ...**

- iii. $a = -7$, $d = \frac{1}{2}$...[Given]
 $\therefore t_1 = a = -7$
 $t_2 = t_1 + d = -7 + \frac{1}{2} = \frac{-14+1}{2} = \frac{-13}{2} = -6.5$
 $t_3 = t_2 + d = -6.5 + \frac{1}{2} = -6.5 + 0.5 = -6$
 $t_4 = t_3 + d = -6 + \frac{1}{2} = \frac{-12+1}{2} = \frac{-11}{2} = -5.5$
 \therefore **The required A.P. is -7, -6.5, -6, -5.5, ...**

- iv. $a = -1.25$, $d = 3$...[Given]
 $\therefore t_1 = a = -1.25$
 $t_2 = t_1 + d = -1.25 + 3 = 1.75$
 $t_3 = t_2 + d = 1.75 + 3 = 4.75$
 $t_4 = t_3 + d = 4.75 + 3 = 7.75$
 \therefore **The required A.P. is -1.25, 1.75, 4.75, 7.75, ...**



v. $a = 6, d = -3$...[Given]
 $\therefore t_1 = a = 6$
 $t_2 = t_1 + d = 6 - 3 = 3$
 $t_3 = t_2 + d = 3 - 3 = 0$
 $t_4 = t_3 + d = 0 - 3 = -3$
 \therefore **The required A.P. is 6, 3, 0, -3, ...**

vi. $a = -19, d = -4$...[Given]
 $\therefore t_1 = a = -19$
 $t_2 = t_1 + d = -19 - 4 = -23$
 $t_3 = t_2 + d = -23 - 4 = -27$
 $t_4 = t_3 + d = -27 - 4 = -31$
 \therefore **The required A.P. is -19, -23, -27, -31, ...**

3. Find the first term and common difference for each of the A.P. [1 Mark each]

- i. 5, 1, -3, -7, ...
- ii. 0.6, 0.9, 1.2, 1.5, ...
- iii. 127, 135, 143, 151, ... [July 2022; Nov 2020]
- iv. $\frac{1}{4}, \frac{3}{4}, \frac{5}{4}, \frac{7}{4}, \dots$

Solution:

i. The given A.P. is 5, 1, -3, -7, ...
 Here, $t_1 = 5, t_2 = 1$
 $\therefore a = t_1 = 5$ and
 $d = t_2 - t_1 = 1 - 5 = -4$
 \therefore **first term (a) = 5,**
common difference (d) = -4

ii. The given A.P. is 0.6, 0.9, 1.2, 1.5, ...
 Here, $t_1 = 0.6, t_2 = 0.9$
 $\therefore a = t_1 = 0.6$ and
 $d = t_2 - t_1 = 0.9 - 0.6 = 0.3$
 \therefore **first term (a) = 0.6,**
common difference (d) = 0.3

iii. The given A.P. is 127, 135, 143, 151, ...
 Here, $t_1 = 127, t_2 = 135$
 $\therefore a = t_1 = 127$ and
 $d = t_2 - t_1 = 135 - 127 = 8$
 \therefore **first term (a) = 127,**
common difference (d) = 8

iv. The given A.P. is $\frac{1}{4}, \frac{3}{4}, \frac{5}{4}, \frac{7}{4}, \dots$
 Here, $t_1 = \frac{1}{4}, t_2 = \frac{3}{4}$
 $\therefore a = t_1 = \frac{1}{4}$ and
 $d = t_2 - t_1 = \frac{3}{4} - \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$
 \therefore **first term (a) = $\frac{1}{4}$,**
common difference (d) = $\frac{1}{2}$

Let's Learn

nth term of an A.P.

Let $t_1, t_2, t_3, t_4, \dots$ be an A.P. whose first term is 'a' and common difference is 'd'. Then,

$t_1 = a$
 $t_2 = t_1 + d = a + d = a + (2 - 1)d$
 $t_3 = t_2 + d = a + d + d = a + 2d = a + (3 - 1)d$
 $t_4 = t_3 + d = a + 2d + d = a + 3d = a + (4 - 1)d$
 \vdots
 \vdots
 \vdots
 $t_n = a + (n - 1)d$

\therefore the n^{th} term of an A.P. is given by
 $t_n = a + (n - 1)d$

Illustrative Example

1. Find the 12th term of the A.P.: 2, 4, 6, 8, ...

Solution:

Step 1: Here, we need to find 12th term.

$\therefore n = 12$
 $a = 2, d = 4 - 2 = 2$

Step 2: Use the formula of t_n and obtain the value of required term.

$t_n = a + (n - 1)d$...[Formula]

Step 3: Substitute the values in the formula.

Substituting the values of a, d, n in above equation, we get

$t_{12} = 2 + (12 - 1)2$
 $= 2 + 11 \times 2 = 2 + 22$

$\therefore t_{12} = 24$

Step 4: Write the required solution.

\therefore **The 12th term of the given A.P. is 24.**

Let's Think

Kabir's mother keeps a record of his height on each birthday. When he was one year old, his height was 70 cm, at 2 years he was 80 cm tall and 3 years he was 90 cm tall. His aunt Meera was studying in the 10th class. She said, "it seems like Kabir's height grows in Arithmetic Progression". Assuming this, she calculated how tall Kabir will be at the age of 15 years when he is in 10th! She was shocked to find it. You too assume that Kabir grows in A.P. and find out his height at the age of 15 years. (Textbook pg. no. 63)

Solution:

Height of Kabir when he was 1 year old = 70 cm
 Height of Kabir when he was 2 years old = 80 cm
 Height of Kabir when he was 3 years old = 90 cm
 The heights of Kabir form an A.P.

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To see complete chapter buy **Target Notes** or **Target E-Notes**



Problem Set – 3

1. Choose the correct alternative answer for each of the following sub questions.

[1 Mark each]

- i. The sequence $-10, -6, -2, 2, \dots$
 (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.
- ii. First four terms of an A.P. are \dots , whose first term is -2 and common difference is -2 .
[Mar 2022]
 (A) $-2, 0, 2, 4$
 (B) $-2, 4, -8, 16$
 (C) $-2, -4, -6, -8$
 (D) $-2, -4, -8, -16$
- iii. What is the sum of the first 30 natural numbers?
 (A) 464 (B) 465
 (C) 462 (D) 461
- iv. For an given A.P. $t_7 = 4, d = -4$, then $a = \dots$
 (A) 6 (B) 7
 (C) 20 (D) 28
- v. For an given A.P. $a = 3.5, d = 0, n = 101$, then $t_n = \dots$
[July 2019]
 (A) 0 (B) 3.5
 (C) 103.5 (D) 104.5
- vi. In an A.P. first two terms are $-3, 4$, then 21^{st} term is \dots
 (A) -143 (B) 143
 (C) 137 (D) 17
- vii. If for any A.P. $d = 5$, then $t_{18} - t_{13} = \dots$
 (A) 5 (B) 20
 (C) 25 (D) 30
- viii. Sum of first five multiples of 3 is \dots **[July 2023]**
 (A) 45 (B) 55
 (C) 15 (D) 75
- ix. $15, 10, 5, \dots$ In this A.P. sum of first 10 terms is \dots
 (A) -75 (B) -125
 (C) 75 (D) 125
- x. In an A.P. 1^{st} term is 1 and the last term is 20. The sum of all terms is 399, then $n = \dots$
 (A) 42 (B) 38
 (C) 21 (D) 19

Answers:

- i. (B) ii. (C) iii. (B) iv. (D)
 v. (B) vi. (C) vii. (C) viii. (A)
 ix. (A) x. (B)

Hints:

- iii. First 30 natural numbers are $1, 2, 3, \dots, 30$
 The above sequence is an A.P.

- $\therefore t_1 = 1, t_{30} = 30$
 $\therefore S_n = \frac{n}{2} (t_1 + t_n)$
 $\therefore S_{30} = \frac{30}{2} (1 + 30)$
 $= 15 \times 31$
 $= 465$
- iv. $t_n = a + (n - 1)d$
 $t_7 = a + (7 - 1)(-4)$
 $\therefore 4 = a + 6(-4)$
 $\therefore 4 = a - 24$
 $\therefore a = 4 + 24$
 $\therefore a = 28$
- vi. $a = -3$
 $d = 4 - (-3) = 7$
 $t_n = a + (n - 1)d$
 $\therefore t_{21} = -3 + (21 - 1)7$
 $\therefore t_{21} = -3 + (20)7$
 $\therefore t_{21} = -3 + 140$
 $\therefore t_{21} = 137$
- vii. $t_{18} - t_{13} = a + (18 - 1)d - [a + (13 - 1)d]$
 $= a + 17d - a - 12d$
 $= 5d$
 $= 5 \times 5$
 $= 25$
- viii. First five multiples of 3 are 3, 6, 9, 12, 15.
 The above sequence is an A.P.
 $\therefore t_1 = 3, t_5 = 15$
 $S_n = \frac{n}{2} (t_1 + t_n)$
 $\therefore S_5 = \frac{5}{2} (3 + 15)$
 $\therefore S_5 = \frac{5}{2} (18)$
 $\therefore S_5 = 45$
- ix. Here,
 $a = 15, d = 10 - 15 = -5$
 $S_n = \frac{n}{2} [2a + (n - 1)d]$
 $\therefore S_{10} = \frac{10}{2} [2(15) + (10 - 1)(-5)]$
 $= 5 [30 + (9)(-5)]$
 $= 5 (30 - 45)$
 $= 5 (-15)$
 $\therefore S_{10} = -75$
- x. $S_n = \frac{n}{2} (\text{first term} + \text{last term})$
 $\therefore 399 = \frac{n}{2} (1 + 20)$
 $\therefore 399 \times 2 = 21n$
 $\therefore n = \frac{798}{21} = 38$



2. Find the fourth term from the end in an A.P.:
-11, -8, -5, ..., 49. [3 Marks]

Solution:

The given A.P. is

$$-11, -8, -5, \dots, 49$$

Reversing the A.P., we get 49, ..., -5, -8, -11

$$\text{Here, } a = 49, d = -11 - (-8) = -11 + 8 = -3$$

$$\text{Since, } t_n = a + (n - 1)d$$

$$\therefore t_4 = 49 + (4 - 1)(-3)$$

$$= 49 + (3)(-3)$$

$$= 49 - 9$$

$$= 40$$

- \therefore Fourth term from the end in the given A.P. is 40.

[Note: If an A.P. is reversed, then the resulting sequence is also an A.P.]

3. In an A.P. the 10th term is 46, sum of the 5th and 7th term is 52. Find the A.P. [3 Marks]

Solution:

For an A.P., let a be the first term and d be the common difference.

$$t_{10} = 46, t_5 + t_7 = 52 \quad \dots[\text{Given}]$$

$$\text{Since, } t_n = a + (n - 1)d$$

$$\therefore t_{10} = a + (10 - 1)d$$

$$\therefore 46 = a + 9d$$

$$\text{i.e. } a + 9d = 46 \quad \dots(\text{i})$$

$$\text{Also, } t_5 + t_7 = 52$$

$$\therefore a + (5 - 1)d + a + (7 - 1)d = 52$$

$$\therefore a + 4d + a + 6d = 52$$

$$\therefore 2a + 10d = 52$$

$$\therefore 2(a + 5d) = 52$$

$$\therefore a + 5d = \frac{52}{2}$$

$$\therefore a + 5d = 26 \quad \dots(\text{ii})$$

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

$$a + 9d = 46$$

$$a + 5d = 26$$

$$\begin{array}{r} - \quad - \quad - \\ \hline \end{array}$$

$$4d = 20$$

$$\therefore d = \frac{20}{4} = 5$$

Substituting $d = 5$ in equation (ii), we get

$$a + 5d = 26$$

$$a + 5(5) = 26$$

$$\therefore a + 25 = 26$$

$$\therefore a = 26 - 25 = 1$$

$$t_1 = a = 1$$

$$t_2 = t_1 + d = 1 + 5 = 6$$

$$t_3 = t_2 + d = 6 + 5 = 11$$

$$t_4 = t_3 + d = 11 + 5 = 16$$

- \therefore The required A.P. is 1, 6, 11, 16, ...

4. The A.P. in which 4th term is -15 and 9th term is -30. Find the sum of the first 10 numbers. [3 Marks]

Solution:

$$t_4 = -15, t_9 = -30$$

...[Given]

$$\text{Since, } t_n = a + (n - 1)d$$

$$\therefore t_4 = a + (4 - 1)d$$

$$\therefore -15 = a + 3d$$

$$\text{i.e. } a + 3d = -15 \quad \dots(\text{i})$$

$$\text{Also, } t_9 = a + (9 - 1)d$$

$$\therefore -30 = a + 8d$$

$$\text{i.e. } a + 8d = -30 \quad \dots(\text{ii})$$

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

$$a + 8d = -30$$

$$a + 3d = -15$$

$$\begin{array}{r} - \quad - \quad + \\ \hline \end{array}$$

$$5d = -15$$

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

Substituting $d = -3$ in equation (i), we get

$$a + 3(-3) = -15$$

$$\therefore a - 9 = -15$$

$$\therefore a = -15 + 9 = -6$$

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

$$\therefore S_{10} = \frac{10}{2} [2(-6) + (10 - 1)(-3)]$$

$$= 5(-12 + 9 \times -3)$$

$$= 5(-12 - 27)$$

$$= 5 \times (-39)$$

$$\therefore S_{10} = -195$$

- \therefore The sum of the first 10 numbers is -195.

5. Two given A.P.'s are 9, 7, 5, ... and 24, 21, 18, ... If n^{th} term of both the progressions are equal then find the value of n and n^{th} term. [3 Marks]

Solution:

The first A.P. is 9, 7, 5, ...

$$\text{Here, } a = 9, d = 7 - 9 = -2$$

$$\therefore n^{\text{th}} \text{ term} = a + (n - 1)d$$

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

$$= 9 - 2n + 2$$

$$= 11 - 2n$$

The second A.P. is 24, 21, 18, ...

$$\text{Here, } a = 24, d = 21 - 24 = -3$$

$$\therefore n^{\text{th}} \text{ term} = a + (n - 1)d$$

$$= 24 + (n - 1)(-3)$$

$$= 24 - 3n + 3$$

$$= 27 - 3n$$

Since, the n^{th} terms of the two A.P.'s are equal.

$$\therefore 11 - 2n = 27 - 3n$$

$$\therefore 3n - 2n = 27 - 11$$

$$\therefore n = 16$$



$t_n = a + (n - 1)d$
 $\therefore t_{16} = 9 + (16 - 1)(-2)$
 $= 9 + 15 \times (-2)$
 $= 9 - 30$
 $\therefore t_{16} = -21$
 \therefore **The values of n and n^{th} term are 16 and -21 respectively.**

6. If sum of 3rd and 8th terms of an A.P. is 7 and sum of 7th and 14th terms is -3 , then find the 10th term. [4 Marks]

Solution:

For an A.P., let a be the first term and d be the common difference.

According to the first condition, sum of 3rd and 8th term of an A.P. is 7.

$t_3 + t_8 = 7$

$\therefore a + (3 - 1)d + a + (8 - 1)d = 7$
 $\dots[\because t_n = a + (n - 1)d]$

$\therefore a + 2d + a + 7d = 7$
 $\therefore 2a + 9d = 7 \dots(i)$

According to the second condition, sum of 7th and 14th term of an A.P. is -3 .

$t_7 + t_{14} = -3$

$\therefore a + (7 - 1)d + a + (14 - 1)d = -3$
 $\therefore a + 6d + a + 13d = -3$
 $\therefore 2a + 19d = -3 \dots(ii)$

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

$2a + 19d = -3$

$2a + 9d = 7$

$- - -$

$10d = -10$

$\therefore d = \frac{-10}{10} = -1$

Substituting $d = -1$ in equation (i), we get

$2a + 9d = 7$

$2a + 9(-1) = 7$

$\therefore 2a - 9 = 7$

$\therefore 2a = 7 + 9 = 16$

$\therefore a = \frac{16}{2} = 8$

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

$\therefore t_{10} = 8 + (10 - 1)(-1)$
 $= 8 + 9 \times (-1)$
 $= 8 - 9$

$\therefore t_{10} = -1$

\therefore **10th term of the A.P. is -1 .**

7. 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? What is the common difference? [3 Marks]

Solution:

Let the number of terms in the A.P. be n .

Then, $t_1 = a = -5, t_n = 45, S_n = 120$

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

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

$\therefore 120 = \frac{n}{2} \times 40$

$\therefore 120 = 20n$

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

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

$\therefore 45 = -5 + (6 - 1)d$

$\therefore 45 + 5 = 5d$

$\therefore 50 = 5d$

$\therefore d = \frac{50}{5} = 10$

\therefore **There are 6 terms in the A.P. and the common difference is 10.**

Alternate method:

Let the number of terms in the A.P. be n and the common difference be d .

Then, $a = -5, t_n = 45, S_n = 120$

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

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

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

$(n - 1)d = 50 \dots(i)$

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

$120 = \frac{n}{2} [2(-5) + (n - 1)d]$

$120 = \frac{n}{2} (-10 + 50) \dots[\text{From (i)}]$

$120 = \frac{n}{2} \times 40$

$120 = 20n$

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

Substituting $n = 6$ in equation (i), we get

$(n - 1)d = 50$

$(6 - 1)d = 50$

$5d = 50$

$d = \frac{50}{5} = 10$

\therefore **There are 6 terms in the A.P. and the common difference is 10.**

8. Sum of 1 to n natural numbers is 36, then find the value of n . [3 Marks]

Solution:

The natural numbers from 1 to n are

1, 2, 3,, n .

The above sequence is an A.P.

$\therefore a = 1, d = 2 - 1 = 1$



$$S_n = 36 \quad \dots[\text{Given}]$$

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

$$\therefore 36 = \frac{n}{2} [2(1) + (n-1)(1)]$$

$$\therefore 36 = \frac{n}{2} (2 + n - 1)$$

$$\therefore 36 \times 2 = n(n+1)$$

$$\therefore 72 = n^2 + n$$

$$\therefore n^2 + n - 72 = 0$$

$$\therefore n^2 + 9n - 8n - 72 = 0$$

$$\therefore n(n+9) - 8(n+9) = 0$$

$$\therefore (n+9)(n-8) = 0$$

$$\therefore n+9 = 0 \text{ or } n-8 = 0$$

$$\therefore n = -9 \text{ or } n = 8$$

But, n cannot be negative.

$$\therefore n = 8$$

\therefore The value of n is 8.

$$\begin{array}{r} -72 \\ \swarrow \quad \searrow \\ 9 \quad -8 \\ 9 \times -8 = -72 \\ 9 - 8 = 1 \end{array}$$

- ✓ 9. Divide 207 in three parts, such that all parts are in A.P. and product of two smaller parts will be 4623. [3 Marks]

Solution:

Let the three parts of 207 that are in A.P. be $a-d$, a , $a+d$

According to the first condition, sum of the three parts is 207.

$$(a-d) + a + (a+d) = 207$$

$$\therefore 3a = 207$$

$$\therefore a = \frac{207}{3}$$

$$\therefore a = 69 \quad \dots(\text{i})$$

According to the second condition, product of two smaller part is 4623.

$$(a-d) \times a = 4623$$

$$\therefore (69-d) \times 69 = 4623 \quad \dots[\text{From (i)}]$$

$$\therefore 69-d = \frac{4623}{69}$$

$$\therefore 69-d = 67$$

$$\therefore d = 69 - 67$$

$$\therefore d = 2$$

$$\therefore a-d = 69 - 2 = 67$$

$$a = 69$$

$$a+d = 69 + 2 = 71$$

\therefore The three parts of 207 that are in A.P. are 67, 69 and 71.

10. There are 37 terms in an A.P., the sum of three terms placed exactly at the middle is 225 and the sum of last three terms is 429. Write the A.P. [4 Marks]

Solution:

Since, there are 37 terms in the A.P.

$$\therefore \text{The middle term} = \left(\frac{37+1}{2} \right)^{\text{th}} \text{ term} \\ = 19^{\text{th}} \text{ term}$$

\therefore 18th, 19th and 20th terms are placed exactly in the middle of the sequence.

According to the first condition, sum of the three terms placed at the middle is 225.

$$t_{18} + t_{19} + t_{20} = 225$$

$$\therefore a + (18-1)d + a + (19-1)d + a + (20-1)d = 225$$

$$\dots[\because t_n = a + (n-1)d]$$

$$\therefore (a+17d) + (a+18d) + (a+19d) = 225$$

$$\therefore 3a + 54d = 225 \quad \dots(\text{i})$$

According to the second condition, sum of the last three terms is 429.

$$t_{35} + t_{36} + t_{37} = 429$$

$$\therefore a + (35-1)d + a + (36-1)d + a + (37-1)d = 429$$

$$\therefore (a+34d) + (a+35d) + (a+36d) = 429$$

$$\therefore 3a + 105d = 429 \quad \dots(\text{ii})$$

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

$$3a + 105d = 429$$

$$3a + 54d = 225$$

$$\begin{array}{r} - \quad - \quad - \\ \hline 51d = 204 \end{array}$$

$$\therefore d = \frac{204}{51} = 4$$

$$\therefore d = \frac{204}{51} = 4$$

Substituting $d = 4$ in equation (i), we get

$$3a + 54d = 225$$

$$3a + 54(4) = 225$$

$$\therefore 3a + 216 = 225$$

$$\therefore 3a = 225 - 216$$

$$\therefore 3a = 9$$

$$\therefore a = \frac{9}{3} = 3$$

\therefore The required A. P. is

$$a, a+d, a+2d, a+3d, \dots, a+(n-1)d$$

$$\text{i.e. } 3, 3+4, 3+2 \times 4, 3+3 \times 4, \dots, 3+(37-1) \times 4$$

$$\text{i.e. } 3, 7, 11, 15, \dots, 147$$

11. If the first term of an A.P. is p , second term is q and last term is r , then show that sum of all

$$\text{terms is } (q+r-2p) \times \frac{(p+r)}{2(q-p)}$$

[Mar 2023] [4 Marks]

Proof:

$$t_1 = a = p, t_2 = q, t_n = r \quad \dots[\text{Given}]$$

$$\therefore d = t_2 - t_1 = q - p$$

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

$$\therefore r = p + (n-1)(q-p)$$

$$\therefore r - p = (n-1)(q-p)$$

$$\therefore \frac{r-p}{q-p} = n-1$$

$$\therefore \frac{r-p}{q-p} + 1 = n$$



$$\begin{aligned} \therefore \frac{r-p+q-p}{q-p} &= n \\ \therefore n &= \frac{q+r-2p}{q-p} \quad \dots(i) \\ S_n &= \frac{n}{2} (t_1 + t_n) \\ &= \frac{q+r-2p}{2} (p+r) \quad \dots[\text{From (i)}] \\ \therefore S_n &= (q+r-2p) \times \frac{(p+r)}{2(q-p)} \end{aligned}$$

12. If the sum of first p terms of an A.P. is equal to the sum of first q terms then show that the sum of its first $(p + q)$ terms is zero. ($p \neq q$)
 [Mar 2017; July 2022] [4 Marks]

Solution:

For an A.P., let a be the first term and d be the common difference.

The sum of first n terms of an A.P. is given by

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

According to the given condition,

$$S_p = S_q$$

$$\begin{aligned} \therefore \frac{p}{2} [2a + (p - 1)d] &= \frac{q}{2} [2a + (q - 1)d] \\ \therefore p [2a + (p - 1)d] &= q [2a + (q - 1)d] \\ \therefore 2ap + p(p - 1)d &= 2aq + q(q - 1)d \\ \therefore 2ap + p^2d - pd &= 2aq + q^2d - qd \\ \therefore 2ap + p^2d - pd - 2aq - q^2d + qd &= 0 \\ \therefore (2ap - 2aq) + (p^2d - q^2d) - (pd - qd) &= 0 \\ \therefore 2a(p - q) + d(p^2 - q^2) - d(p - q) &= 0 \\ \therefore 2a(p - q) + d(p + q)(p - q) - d(p - q) &= 0 \\ \therefore (p - q)[2a + d(p + q) - d] &= 0 \\ \therefore (p - q) [2a + (p + q - 1)d] &= 0 \\ \text{But } p &\neq q \quad \dots[\text{Given}] \\ \therefore 2a + (p + q - 1)d &= 0 \quad \dots(i) \end{aligned}$$

Sum of first $(p + q)$ terms,

$$\begin{aligned} S_{p+q} &= \frac{p+q}{2} [2a + (p + q - 1)d] \\ &= \frac{p+q}{2} (0) \quad \dots[\text{From (i)}] \end{aligned}$$

$\therefore S_{p+q} = 0$
 \therefore **The sum of the first $(p + q)$ terms is zero.**

13. If m times the m^{th} term of an A.P. is equal to n times n^{th} term, then show that the $(m + n)^{\text{th}}$ term of the A.P. is zero. [3 Marks]

Solution:

m times the m^{th} term of an A.P. = mt_m .

n times the n^{th} term of an A.P. = nt_n .

According to the given condition,
 $mt_m = nt_n$

$$\begin{aligned} \therefore m[a + (m - 1)d] &= n[a + (n - 1)d] \\ \therefore ma + md(m - 1) &= na + nd(n - 1) \\ \therefore ma + m^2d - md &= na + n^2d - nd \\ \therefore ma + m^2d - md - na - n^2d + nd &= 0 \\ \therefore (ma - na) + (m^2d - n^2d) - (md - nd) &= 0 \\ \therefore a(m - n) + d(m^2 - n^2) - d(m - n) &= 0 \\ \therefore a(m - n) + d(m + n)(m - n) - d(m - n) &= 0 \\ \therefore (m - n) [a + d(m + n) - d] &= 0 \\ \therefore (m - n)[a + (m + n - 1)d] &= 0 \\ \therefore [a + (m + n - 1)d] &= 0 \\ \dots[\text{Dividing both sides by } (m - n)] \\ \therefore t_{(m+n)} &= 0 \\ \therefore \text{The } (m + n)^{\text{th}} \text{ term of the A.P. is zero.} \end{aligned}$$

14. ₹ 1000 is invested at 10 percent simple interest. Check at the end of every year if the total interest amount is in A.P. If this is an A.P. then find interest amount after 20 years. For this complete the following activity.
 [3 Marks]

Solution:

$$\text{Simple interest} = \frac{P \times R \times N}{100}$$

$$\begin{aligned} \text{Simple interest after 1 year} &= \frac{1000 \times 10 \times 1}{100} \\ &= \boxed{\text{₹100}} \end{aligned}$$

$$\begin{aligned} \text{Simple interest after 2 years} &= \frac{1000 \times 10 \times 2}{100} \\ &= \boxed{\text{₹200}} \end{aligned}$$

$$\begin{aligned} \text{Simple interest after 3 years} &= \frac{1000 \times 10 \times 3}{100} \\ &= \text{₹ 300} \end{aligned}$$

According to this the simple interest for 4, 5, 6 years will be ₹400, $\boxed{\text{₹ 500}}$, $\boxed{\text{₹ 600}}$ respectively.

$$\text{From this } d = \boxed{200 - 100 = 100}, \text{ and } a = \boxed{100}$$

Amount of simple interest after 20 years

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

$$\begin{aligned} \therefore t_{20} &= \boxed{100} + (20 - 1) \boxed{100} \\ &= 100 + 19 \times 100 \\ &= 100 + 1900 \end{aligned}$$

$$\therefore t_{20} = \boxed{2000}$$

Amount of simple interest after 20 years

$$= \boxed{\text{₹ 2000}}$$



Activities for Practice

1. Complete the following activity to find the 19th term of an A.P., 7, 13, 19, 25, :

[Mar 2022][2 Marks]

Activity:

Given A.P. : 7, 13, 19, 25,

Here first term $a = 7$; $t_{19} = ?$

$t_n = a + (\square) d$ (formula)

$$\therefore t_{19} = 7 + (19 - 1) \square$$

$$\therefore t_{19} = 7 + \square$$

$$\therefore t_{19} = \square$$

2. Find the sum of all odd numbers from 1 to 150. For this complete the following activity.

[2 Marks]

Odd numbers from 1 to 150 are

1, 3, 5, 7, ..., 149

The above sequence is an A.P.

Here $t_1 = 1$, $t_n = \square$, $n = 75$

$$S_n = \square \quad \dots[\text{Formula}]$$

$$\therefore S_{75} = \frac{\square}{2} (150)$$

$$\therefore S_{75} = \square$$

3. Find the number of natural numbers between 1 and 171, which are divisible by 5:

[July 2019] [2 Marks]

From 1 to 171, natural numbers divisible by 5 are
↓
5, 10, 15, _____, 170
↓
In this A.P. $a = \square$, $d = \square$, $t_n = 170$
↓
$t_n = a + (n - 1)d$
↓
$170 = 5 + (n - 1) \times \square$
↓
$n = \square$

4. In an A.P. the first term is -5 and last term is 45. If sum of 'n' terms in the A.P. is 120, then complete the activity to find n.

[Nov 2020] [3 Marks]

Activity:

$$t_1 = -5, t_n = \square, S_n = \square$$

$$S_n = \frac{n}{2} [t_1 + \square]$$

$$\square = \frac{n}{2} [-5 + 45]$$

$$240 = n \times \square$$

$$\therefore n = \square$$

5. Two given A.P.'s are 8, 6, 4, ... and 24, 21, 18, ... If n^{th} term of both the progressions are equal then find the value of n. [3 Marks]

The first A.P. is 8, 6, 4, ...

Here, $a = 8$, $d = \square$

$$n^{\text{th}} \text{ term} = a + (n - 1)d$$

$$= 8 + (n - 1) \square$$

$$= \square$$

The second A.P. is 24, 21, 18, ...

Here, $a = 24$, $d = 21 - 24 = -3$

$$\therefore n^{\text{th}} \text{ term} = \square$$

$$= 24 + (n - 1)(-3)$$

$$= \square$$

Since, the n^{th} terms of the two A.P.'s are equal,

$$\therefore 10 - 2n = 27 - 3n$$

$$\therefore n = \square$$

6. Divide 117 in three parts, such that all parts are in A.P. and product of two smaller parts will be 1248. [3 Marks]

Let the three parts of 117 that are in A.P. be

$$\square$$

According to the first condition,

$$\square + a + (a + d) = 117$$

$$\therefore a = \square$$

According to the second condition,

$$\square \times a = 1248$$

$$\therefore 39 - d = \frac{1248}{39}$$

$$\therefore d = \square$$

\therefore The three parts of 117 that are in A.P. are

$$\square$$



One Mark Questions

Type A: Multiple Choice Questions

1. In the A.P. 2, -2, -6, -10, common difference (d) is: **[Mar 2019]**
 (A) -4 (B) 2
 (C) -2 (D) 4
2. 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
3. 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) $a + (2n - 1)d$
4. For the given A.P. $a = 3.5, d = 0,$ then $t_n =$ **[Mar 2023]**

 (A) 0 (B) 3.5
 (C) 103.5 (D) 104.5
5. 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
6. 149 is the _____ term of the given A.P.
 $5, 11, 17, 23, 29, \dots$
 (A) 24 (B) 25
 (C) 30 (D) 31
7. The n^{th} term of even natural number is
 (A) $2n$ (B) $2n - 1$
 (C) $2n + 1$ (D) $2n + 2$
8. Which term of the A.P.: 92, 88, 84, 80, ... is 0?
 (A) 23 (B) 32
 (C) 22 (D) 24
9. Which of the following is not a term of the sequence whose n^{th} term is given by $t_n = 6n - 2$
 (A) 4 (B) 10
 (C) 14 (D) 16
10. For any given A.P., if $t_{30} = 2t_{15},$ then
 (A) $a - d = 0$ (B) $a + d = 0$
 (C) $a - 2d = 0$ (D) $a + 2d = 0$
11. If the 9^{th} term of an A.P. is zero, then the ratio of its 29^{th} and 19^{th} term is
 (A) 1 : 2 (B) 2 : 1
 (C) 1 : 3 (D) 3 : 1

12. For the sequence $S_n = \frac{n}{n+1}$ then, what is the value of S_{10}
 (A) $\frac{10}{11}$ (B) $\frac{11}{10}$
 (C) $\frac{10}{13}$ (D) $\frac{11}{9}$
13. If the n^{th} term of an A.P. is $(2n + 1),$ then the sum of its first three terms is
 (A) $6n + 3$ (B) 15
 (C) 12 (D) 21
14. 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
15. The sum of the first 10 natural numbers which are divisible by 3.
 (A) 155 (B) 135
 (C) 145 (D) 165
16. If $a = 3, n = 8, S_8 = 192$ find $d.$
 (A) 3 (B) 4
 (C) 5 (D) 6

Type B: Solve the Following Questions

1. If $t_3 = 7, t_4 = -8$ then $d = ?$
2. If $a = 1, d = 5,$ find $t_{20} ?$
3. If $a = -10, d = -4,$ find $S_7 = ?$
4. If $a = 10, d = 10, t_n = 100$ find $n = ?$
5. If 3, 7, 11, ... is an A.P. then find $d ?$
6. Find second and third term of an A.P. whose first term is -2 and common difference is -2. **[Mar 2020]**
7. Write second and third term of an A.P. whose first term is 6 and common difference is -3. **[Mar 2022]**
8. Find the common difference of the following A.P.: 2, 4, 6, 8, ... **[Mar 2023]**
9. For any given A.P., if $t_{10} = 2t_5$ then $a - d = ?$
10. Find the first term and common difference for the A.P., 52, 37, 22, 7, ...



Additional Problems for Practice

Based on Practice Set 3.1

- +1. Some sequences are given below. For every sequence write the next three terms.
[1 Mark each]
- i. 100, 70, 40, 10, ... ii. -7, -4, -1, 2, ...
iii. 4, 4, 4, ...
2. Which of the following sequences are arithmetic progressions? Justify. [2 Marks each]
- i. $1, \frac{3}{2}, 2, \frac{5}{2}, \dots$
ii. -50, -75, -100, ...
iii. 12, 2, -8, -18, ...
iv. 1, 3, 6, 10, ... [Mar 2014, July 2015]
v. 1, 4, 7, 10, ... [Mar 2014, 2015]
- +3. Which of the following sequences are A.P.? If it is an A.P., find next two terms. [2 Marks each]
- i. 5, 12, 19, 26, ... ii. 2, -2, -6, -10, ...
iii. 1, 1, 2, 2, 3, 3, ... iv. $\frac{3}{2}, \frac{1}{2}, \frac{1}{2}, \dots$
4. Find the first term and common difference for each of the A.P. [1 Mark each]
- i. 4, 1, -2, -5, ...
ii. -1.25, -1.50, -1.75, -2, ...
iii. 53, 38, 23, 8, ...
5. If for an A.P. the first term is 11 and the common difference is (-2), then find first three terms of A.P. [Mar 2016] [2 Marks]
6. Find the first four terms in an A.P. when $a = 3$ and $d = 4$. [Oct 2014] [2 Marks]
- +7. The first term a and common difference d are given. Find first four terms of A.P. [2 Marks each]
- i. $a = -3, d = 4$ ii. $a = 200, d = 7$
iii. $a = -1, d = -\frac{1}{2}$ iv. $a = 8, d = -5$

Based on Practice Set 3.2

- +1. Find t_n for following A.P. and then find 30th term of A.P.
3, 8, 13, 18, ... [2 Marks]
2. Find the [2 Marks each]
i. 10th term of the A.P. 4, 9, 14, ... [Mar 2015]
ii. 7th term of the A.P. 6, 10, 14, ...
3. Write the 25th term of an A.P. 12, 16, 20, 24, ... [July 2017] [2 Marks]
- +4. Which term of the following A.P. is 560?
2, 11, 20, 29, ... [2 Marks]

5. Find 'n' if the nth term of the following A.P. is 66: 3, 6, 9, 12, ... [Mar 2018] [2 Marks]
6. How many terms are there in the A.P. 201, 208, 215, ... , 369? [2 Marks]
7. First term and common difference of an A.P. are 12 and 4 respectively. If $t_n = 96$, find n. [Mar 2019] [2 Marks]
- +8. How many two digit numbers are divisible by 4? [3 Marks]
- +9. Check whether 301 is in the sequence 5, 11, 17, 23, ...? [3 Marks]
10. For an A.P. if $t_4 = 20$ and $t_7 = 32$, find a, d and t_n . [3 Marks]
11. The 11th term and the 21st term of an A.P. are 16 and 29 respectively. Find
i. the 1st term and the common difference [July 2016]
ii. the 34th term [July 2016]
iii. 'n' such that $t_n = 55$. [Mar 2016] [4 Marks]
- +12. The 10th term and the 18th term of an A.P. are 25 and 41 respectively, then find 38th term of that A.P. Similarly if nth term is 99, find the value of n. [4 Marks]
13. The sum of the 3rd and 7th terms of an A.P. is 54 and the sum of the 5th and 11th terms is 84. Find the A.P. [4 Marks]

Based on Practice Set 3.3

1. If for an A.P. [2 Marks each]
i. $a = 6, d = 3$, find S_{10} [Mar 2013, 2018]
ii. $a = 6, d = 3$, find S_6
- +2. Find the sum of first 100 terms of A.P. 14, 16, 18, ... [2 Marks]
3. If for an A.P. $t_8 = 36$, find S_{15} . [2 Marks]
4. If for an A.P. $S_{31} = 186$, find t_{16} . [2 Marks]
5. If the second term and the fourth term of an A.P. are 12 and 20 respectively, then find the sum of first 25 terms. [July 2017] [4 Marks]
6. Obtain the sum of the first 56 terms of an A.P. whose 19th and 38th terms are 52 and 148 respectively. [3 Marks]
- +7. Find the sum of first n natural numbers. [3 Marks]
- +8. Find the sum of first n even natural numbers. [Mar 2022] [2 Marks]
- +9. Find the sum of first n odd natural numbers. [3 Marks]



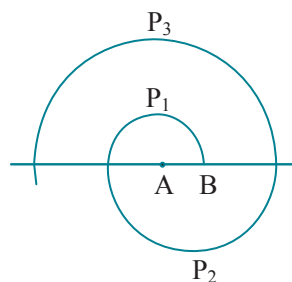
10. Find the sum of all numbers from 50 to 350 which are divisible by 4. Also find 15th term.
[July 2017] [4 Marks]
11. Find the sum of all numbers from 50 to 250 which are divisible by 6 and find t_{13} .
[July 2016] [4 Marks]
12. Find three consecutive terms in an A.P. whose sum is 21 and their product is 315. [4 Marks]
13. Find four consecutive terms in an A.P. such that their sum is -54 and the sum of the first and the third terms is -30 . [4 Marks]
14. Measures of angles of a triangle are in A.P. The measure of smallest angle is five times of common difference. Find the measures of all angles of a triangle.
(Assume the measures of angles as $a, a + d, a + 2d$). [Mar 2022][3 Marks]

Based on Practice Set 3.4

- +1. In the year 2010 in the village there were 4000 people who were literate. Every year the number of literate people increases by 400. How many people will be literate in the year 2020?
[3 Marks]
- +2. In year 2015, Mrs. Shaikh got a job with salary ₹ 1,80,000 per year. Her employer agreed to give ₹ 10,000 per year as increment. Then in how many years will her annual salary be ₹ 2,50,000?
[3 Marks]
3. One person borrows ₹ 4,000 and agrees to repay with a total interest of ₹ 500 in 10 instalments. Each instalment being less than the preceding instalment by ₹ 10. What should be the first and the last instalments?
[Mar 2020][4 Marks]
4. There is an auditorium with 27 rows of seats. There are 20 seats in the first row, 22 seats in the second row, 24 seats in the third row and so on. Find how many total seats are there in the auditorium?
[Mar 2022][3 Marks]
- +5. Anvar saves some amount every month. In first three months he saves ₹ 200, ₹ 250 and ₹ 300 respectively. In which month will he save ₹ 1000? Find the total amount saved. [4 Marks]

- +6. A mixer manufacturing company manufactured 600 mixers in 3rd year and in 7th year they manufactured 700 mixers. If every year there is same growth in the production of mixers, then find
 - i. production in the first year,
 - ii. production in 10th year,
 - iii. total production in first seven years.
 [4 Marks]
- +7. Ajay Sharma repays the borrowed amount of ₹ 3,25,000 by paying ₹ 30500 in the first month and then decreases the payment by ₹ 1500 every month. How long will it take to clear his amount?
[3 Marks]

- +8. As shown in the figure, take point A on the line and draw a half circle P_1 of radius 0.5 with A as centre. It intersects given line in point B. Now taking B as centre draw a half circle P_2 of radius 1 cm which is on the other side of the line. Now again taking A as centre draw a half circle P_3 of radius 1.5 cm. If we draw half circles like this having radius 0.5 cm, 1 cm, 1.5 cm, 2 cm, we get a figure of spiral shape. Find the length of such spiral shaped figure formed by 13 such half circles. $\left(\pi = \frac{22}{7}\right)$



9. In winter, the temperature at a hill station from Monday to Friday is in A.P. The sum of the temperatures of Monday, Tuesday and Wednesday is zero and the sum of the temperatures of Thursday and Friday is 15. Find the temperature of each of the five days.
[July 2015] [4 Marks]

Chapter Assessment

Total Marks: 25

- Q.1. A. Choose the correct alternative. [4]**
- i. The sequence $-10, -13, -16, -19, \dots$
 - (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.
 - ii. In an A.P., if $t_{18} - t_{14} = 32$, then $d =$
 - (A) 4 (B) -4 (C) 8 (D) -8

- iii. 210 is the _____ term of the A.P. 21, 42, 63, 84, ...
 - (A) 10th (B) 11th
 - (C) 12th (D) 13th
- iv. In an A.P., if $a = 2, t_n = 34, S_n = 90$, then $n =$
 - (A) 3 (B) 5
 - (C) 8 (D) 12

**Q.1. B. Solve the following questions. [2]**

- i. $a = 1$, $d = -1$. Find S_7 .
- ii. Find the first term and common difference for the A.P. 48, 32, 16, ...

Q.2. A. Complete the following activities. (Any one) [2]

- i. Find out whether the following sequence is an A.P.

1, 8, 15, 22, ...

$t_2 - t_1 = \square$

$t_3 - t_2 = \square$

$\therefore d = \square$

 \therefore The given sequence is \square

- ii. Find out how many natural numbers between 1 and 140 are divisible by 4.

From 1 to 140, natural numbers divisible by 4

4, 8, ..., 136

$a = 4$, $d = \square$

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

$\square = 4 + (n - 1) \times \square$

$n = \square$

Q.2. B. Solve the following questions. (Any two) [4]

- i. Find the A.P., if $a = 18$ and $d = -5$.
- ii. Find the 15th term of the A.P. 21, 16, 11, 6, ...
- iii. For an A.P., find S_{12} if $a = 4$ and $d = 3$.

Q.3. A. Complete the following activities (Any one) [3]

- i. Sum of first 55 terms in an A.P. is 3300, find its 28th term.

For an A.P. let a be the first term and \square be the common difference.

$S_{55} = 3300$... (Given)

Since, $S_n = \square$

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

$\therefore a + 27d = \square$... (i)

\therefore Now, $t_n = \square$... [Formula]

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

$\therefore t_{28} = \square$... [from (i)]

- ii. Sum of 1 to n natural numbers is 55, then find the value of n .

The natural numbers from 1 to n are 1, 2, 3, ... \square

The above sequence is an A.P.

$\therefore a = 1$, $d = \square$

$S_n = \square$... [Given]

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

$\therefore 55 = \frac{n}{2} \square$

$\therefore 55 = \frac{n}{2} (2 + n - 1)$

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

$\therefore n = \square$ or $n = -11$

 \therefore But, n cannot be negative.

$\therefore n = \square$

Q.3. B. Solve the following questions. (Any one) [3]

- i. For an A.P., if the 11th term is 38 and 16th term is 73, then find the 31st term of the progression.
- ii. The 4th term of an A.P. is zero. Prove that the 25th term of the A.P. is three times its 11th term.

Q.4. Solve the following questions. (Any one) [4]

- i. A man set out on a cycle ride of 50 km. He covers 5 km in the first hour and during each successive hour his speed falls by $\frac{1}{4}$ km/hr. How many hours will he take to finish his ride?

- ii. If the ratio of the sum of m terms and n terms of an A.P. be $m^2 : n^2$, prove that the ratio of m^{th} and n^{th} terms is $(2m - 1) : (2n - 1)$.

Q.5. Solve the following questions. (Any one) [3]

- i. Is 5, 8, 11, 14, ... an A.P.? If so then what will be the 100th term?
Check whether 92 is in this A.P.? Is number 61 in this A.P.?
- ii. How many two digit numbers leave the remainder 1 when divided by 5?

Scan the given Q. R. Code in *Quill - The Padhai App* to view the answers of the Chapter Assessment.





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