



Class 9 Maths – Ganita Manjari

Chapter 8: Predicting What Comes Next – Exploring Sequences and Progressions

★ Important Questions with Answer Key

2026–27 | Based on the new Ganita Manjari textbook

Chapter 8 covers sequences, explicit rules, recursive rules, Virahānka–Fibonacci sequence, arithmetic progressions (AP), sum of first n natural numbers, geometric progressions (GP), and fractals.

A. VERY IMPORTANT THEORY QUESTIONS

1. What is a sequence?
2. What is meant by a term of a sequence?
3. What is an explicit rule for a sequence?
4. What is a recursive rule?
5. What is an arithmetic progression (AP)?
6. What is the common difference of an AP?
7. Write the general form of an AP.
8. Write the formula for the n th term of an AP.
9. What is a geometric progression (GP)?

10. What is the common ratio of a GP?
11. Write the general form of a GP.
12. Write the formula for the n th term of a GP.
13. What is the difference between an AP and a GP?
14. What is the triangular number sequence?
15. Write the formula for the n th triangular number.
16. What is the Virahāṅka–Fibonacci sequence?
17. What is a fractal?
18. Name the fractal discussed in the chapter.

The textbook defines an AP through a **constant difference** and a GP through a **constant multiplier/common ratio**.

B. SEQUENCES & EXPLICIT RULES

19. Find the first five terms of the sequence:

$$t_n = 3n - 4$$

20. Find the first five terms of:

$$t_n = 2 - 5n$$

21. Find the first five terms of:

$$t_n = n^2 - 2n + 3$$

22. Find the 10th and 15th terms of:

$$t_n = 5n - 3$$

23. Determine whether 97 is a term of:

$$t_n = 5n - 3$$

24. Determine whether 172 is a term of:

$$t_n = 5n - 3$$

25. Which term of the sequence

$$t_n = 5n - 3$$

is 607?

26. For the sequence

$$t_n = 3n - 7$$

find:

- (i) 1st term
- (ii) 2nd term
- (iii) 3rd term
- (iv) 12th term
- (v) 18th term
- (vi) 50th term

27. Which term of the sequence

$$t_n = 3n - 7$$

is 332?

28. Is 557 a term of the sequence $t_n = 3n - 7$?

These types of questions are directly represented in Exercise Set 8.1 and the textbook's examples on explicit rules.

C. RECURSIVE RULES

29. What is the recursive rule for the sequence:

1, 4, 7, 10, 13, ...?

30. Find the first four terms of:

$$u_1 = 1, u_n = 2u_{n-1} + 3$$

31. Is 133 a term of the sequence in Question 30?

32. Find the first four terms of:

$$s_1 = 3, s_n = s_{n-1}(s_{n-1} - 1)$$

33. Find the next two terms of the Virahāṅka–Fibonacci sequence:

1, 2, 3, 5, 8, 13, 21, 34, ...

34. Find T_4 , T_5 , T_6 , T_7 and T_8 if:

$$T_1 = 1, T_2 = 2, T_3 = 4$$

and

$$T_n = T_{n-1} + T_{n-2} + T_{n-3}$$

The chapter explicitly distinguishes an explicit formula from a recursive formula and introduces the Virahāṅka–Fibonacci sequence.

D. ARITHMETIC PROGRESSIONS – VERY IMPORTANT

35. Identify whether the following is an AP:

2, 5, 8, 11, ...

36. Find the n th term of:

2, 5, 8, 11, ...

37. Find the n th term of:

-5, -1, 3, 7, ...

38. Find the 10th and 26th terms of:

3, 8, 13, 18, ...

39. Which term of the AP

21, 18, 15, ...

is -81?

40. Is 0 a term of the AP:

21, 18, 15, ...?

41. Find the n th term and recursive rule of:

11, 8, 5, 2, ...

42. An AP has 50 terms. Its 3rd term is 12 and its last term is 106. Find the 29th term.

43. A taxi company charges a fixed booking fee of ₹200 and ₹40 per kilometre. Find the fare for 10 km.

44. Write the n th-term expression for the taxi fare.

The chapter gives the AP formula $t_n = a + (n - 1)d$ and also its recursive form $t_n = t_{n-1} + d$.

E. SUM OF FIRST n NATURAL NUMBERS

45. Derive the formula for the sum of the first n natural numbers.

46. Find:

$1 + 2 + 3 + \dots + 10$

47. Find:

$$1 + 2 + 3 + \dots + 100$$

48. Find the sum of the first 50 natural numbers.

49. Find the sum of the first 1000 natural numbers.

50. Find:

$$25 + 26 + 27 + \dots + 58$$

51. Find the 10th triangular number.

52. Find the 17th triangular number.

53. Find the 80th triangular number.

The chapter derives:

$$S_n = n(n + 1) / 2$$

and identifies triangular numbers with the sum of the first n natural numbers.

F. APPLICATION-BASED AP QUESTIONS

54. How many two-digit numbers are divisible by 3? Find their sum.

55. Harish starts with an annual salary of ₹5,00,000 and receives an increment of ₹20,000 every year. After how many years will his income reach ₹7,00,000?

56. A child arranges marbles in rows. The first row has 1 marble, the second has 2, the third has 3, and so on up to 25 rows. How many marbles are used altogether?

These are based directly on the textbook's Exercise Set 8.2.

G. GEOMETRIC PROGRESSIONS



57. What is a geometric progression?

58. Find the common ratio of:

3, 6, 12, 24, ...

59. Find the n th term of:

3, 6, 12, 24, ...

60. Check whether the following is a GP:

1, 2, 4, 8, 16, ...

61. Check whether the following is a GP:

1, 3, 9, 27, 81, ...

62. Check whether the following is a GP:

1, -1, 1, -1, 1, ...

63. Check whether:

2, 10, 50, 250, ...

is a GP and find its n th term.

64. Find the n th term of:

3, 30, 300, 3000, ...

65. Find the recursive rule for:

3, 30, 300, 3000, ...

66. Find the 12th term of a GP whose common ratio is 2 and whose 8th term is 192.

67. Find the 10th and nth terms of:

5, 25, 125, ...

68. Which term of the GP

2, 6, 18, ...

is 4374?

69. Write both the explicit and recursive formulas for the GP:

2, 6, 18, ...

The textbook defines the nth term of a GP as $t_n = ar^{n-1}$.

H. FRACTALS & REAL-LIFE GP QUESTIONS

70. What is the Sierpiński triangle?

71. How many black triangles are there at Stages 0, 1, 2 and 3?

72. Find the number of black triangles at Stages 4 and 5.

73. Find the formula for the number of black triangles at the nth stage.

74. If the initial black area is 1 square unit, find the area at Stages 1, 2 and 3.

75. Write the formula for the black area at the nth stage.

76. What happens to the black area as the number of stages increases?

77. A ball is dropped from a height of 24 ft. Each bounce reaches $\frac{3}{4}$ of the previous height. Find the heights after the first five bounces.

78. A ball is dropped from 80 m and each bounce reaches 60% of the previous height. Find the height after the 5th bounce.

79. Explain why the points representing an AP lie on a straight line whereas the points representing a GP do not.

The chapter uses the Sierpiński triangle to illustrate both rapidly increasing numbers of triangles and decreasing shaded area, both following geometric progressions.



I. HIGH-ORDER THINKING QUESTIONS



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

81. Determine the AP whose third term is 16 and whose 7th term exceeds the 5th term by 12.

82. How many three-digit numbers are divisible by 7?

83. How many multiples of 4 lie between 10 and 250?

84. Find all possible ways of expressing 100 as a sum of consecutive natural numbers.

85. The number of bacteria in a culture doubles every hour. If initially there are 30 bacteria, find the number after the 2nd hour, 4th hour and n th hour.

86. The sum of the 4th and 8th terms of an AP is 24 and the sum of the 6th and 10th terms is 44. Find the first three terms.

87. Find the smallest n for which the sum of the first n natural numbers is greater than 1000.

88. Which term of the GP

2, 8, 32, ...

is 131072?

These correspond to the higher-level end-of-chapter problems in the new textbook.

ANSWER KEY

Theory

1. An ordered list of numbers in which each number is called a term.
2. Each number occupying a position in a sequence.
3. A rule that uses the position number n to directly calculate a term.
4. A rule that gives a term using one or more preceding terms.
5. A sequence in which the difference between consecutive terms is constant.
6. The fixed difference between consecutive terms.
7. $a, a + d, a + 2d, a + 3d, \dots$
8. $t_n = a + (n - 1)d$
9. A sequence in which each term is obtained by multiplying the previous term by a fixed number.
10. The fixed multiplier between consecutive terms.
11. $a, ar, ar^2, ar^3, \dots$
12. $t_n = ar^{n-1}$
13.
 - AP $\rightarrow$ constant **difference**
 - GP $\rightarrow$ constant **ratio**
14. 1, 3, 6, 10, 15, ...

15. $t_n = n(n + 1)/2$

16. 1, 2, 3, 5, 8, 13, 21, ..., where each term is the sum of the previous two.

17. A pattern that repeats itself at different scales.

18. Sierpiński triangle.

Sequences – Answers

19.

$$t_n = 3n - 4$$

-1, 2, 5, 8, 11

20.

$$t_n = 2 - 5n$$

-3, -8, -13, -18, -23

21.

$$t_n = n^2 - 2n + 3$$

2, 3, 6, 11, 18

22.

$$t_n = 5n - 3$$

$$10\text{th} = 47$$

$$15\text{th} = 72$$

23.

$$5n - 3 = 97$$

$$n = 20$$

Yes, 97 is the 20th term.

24.

$$5n - 3 = 172$$

$$n = 35$$

Yes, 172 is the 35th term.

25.

$$5n - 3 = 607$$

$$n = 122$$

26.

$$\text{For } t_n = 3n - 7:$$

$$1^{\text{st}} = -4$$

$$2^{\text{nd}} = -1$$

$$3^{\text{rd}} = 2$$

$$12^{\text{th}} = 29$$

$$18^{\text{th}} = 47$$

$$50^{\text{th}} = 143$$

27.

$$3n - 7 = 332$$

$$3n = 339$$

$$n = 113$$

28.

$$3n - 7 = 557$$

$$n = 188$$

Yes, 557 is the 188th term.

Recursive Rules – Answers

29.

For 1, 4, 7, 10, ...

$$t_1 = 1$$

$$t_n = t_{n-1} + 3$$

30.

$$u_1 = 1$$

$$u_2 = 5$$

$$u_3 = 13$$

$$u_4 = 29$$

Answer: 1, 5, 13, 29

31.

Continuing:

$$u_5 = 61$$

$$u_6 = 125$$

$$u_7 = 253$$

$$u_8 = 509$$

133 is not a term.

32.

$$s_1 = 3$$

$$s_2 = 6$$

$$s_3 = 30$$

$$s_4 = 870$$

Answer: 3, 6, 30, 870

33.

Next two terms:

$$21 + 34 = 55$$

$$34 + 55 = 89$$

Answer: 55, 89

34.

$$T_4 = 4 + 2 + 1 = 7$$

$$T_5 = 7 + 4 + 2 = 13$$

$$T_6 = 13 + 7 + 4 = 24$$

$$T_7 = 24 + 13 + 7 = 44$$

$$T_8 = 44 + 24 + 13 = 81$$

Answer: 7, 13, 24, 44, 81

AP – Answers

35.

2, 5, 8, 11, ...

Differences = 3, 3, 3

Yes, it is an AP.

36.

$$a = 2, d = 3$$

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

$$t_n = 3n - 1$$

37.

$$a = -5, d = 4$$

$$t_n = 4n - 9$$

38.

$$a = 3, d = 5$$

$$10\text{th} = 48$$

$$26\text{th} = 128$$

39.

$$21 + (n - 1)(-3) = -81$$

$$n = 35$$

-81 is the 35th term.

40.

$$21 - 3(n - 1) = 0$$

$$n = 8$$

Yes, 0 is the 8th term.

41.

AP: 11, 8, 5, 2, ...

$$a = 11, d = -3$$

$$t_n = 14 - 3n$$

Recursive rule:

$$t_1 = 11$$

$$t_n = t_{n-1} - 3$$

42.

$$a + 2d = 12$$

$$a + 49d = 106$$

$$d = 2$$

$$a = 8$$

29th term:

$$8 + 28(2) = \mathbf{64}$$

43.

Fare for 10 km:

$$₹200 + ₹40(10)$$

$$= \mathbf{₹600}$$

44.

Fare after n km:

$$t_n = 200 + 40n$$

Sum of Natural Numbers – Answers

45.

$$S_n = n(n + 1)/2$$

46.

$$S_{10} = 10 \times 11 / 2$$

$$= \mathbf{55}$$

47.

$$S_{100} = 100 \times 101 / 2$$

$$= \mathbf{5050}$$

48.

$$S_{50} = 50 \times 51 / 2$$

$$= \mathbf{1275}$$

49.

$$S_{1000} = 1000 \times 1001 / 2$$

$$= \mathbf{500500}$$

50.

$$25 + 26 + \dots + 58$$

$$= S_{58} - S_{24}$$

$$= \mathbf{1411}$$

51.

10th triangular number:

$$10 \times 11 / 2 = \mathbf{55}$$

52.

17th triangular number:

$$17 \times 18 / 2 = \mathbf{153}$$

53.

80th triangular number:

$$80 \times 81 / 2 = \mathbf{3240}$$

Application-Based Answers

54.

Two-digit multiples of 3:

12, 15, 18, ..., 99

Number of terms = **30**

Sum = **1665**

55.

$$₹5,00,000 + ₹20,000n = ₹7,00,000$$

n = 10 years

56.

$$1 + 2 + 3 + \dots + 25$$

$$= 25 \times 26 / 2$$

= 325 marbles

GP – Answers

57.

A sequence in which each term is obtained by multiplying the previous term by a fixed number.

58.

3, 6, 12, 24, ...

Common ratio:

$$6/3 = 2$$

$$\mathbf{r = 2}$$

59.

$$a = 3, r = 2$$

$$\mathbf{t_n = 3 \times 2^{n-1}}$$

60.

1, 2, 4, 8, 16, ...

Yes, GP; $r = 2$

61.

1, 3, 9, 27, 81, ...

Yes, GP; $r = 3$

62.

1, -1, 1, -1, ...

Yes, GP; $r = -1$

63.

2, 10, 50, 250, ...

$r = 5$

$t_n = 2 \times 5^{n-1}$

64.

3, 30, 300, 3000, ...

$t_n = 3 \times 10^{n-1}$

65.

$t_1 = 3$

$t_n = 10t_{n-1}$

66.

8th term = 192, $r = 2$

12th term:

$192 \times 2^4 = 3072$

67.

5, 25, 125, ...

$$t_n = 5^n$$

10th term:

9,765,625

68.

$$2 \times 3^{n-1} = 4374$$

$$3^{n-1} = 2187 = 3^7$$

$$n - 1 = 7$$

$$n = 8$$

69.

Explicit:

$$t_n = 2 \times 3^{n-1}$$

Recursive:

$$t_1 = 2$$

$$t_n = 3t_{n-1}$$

Fractals & Applications – Answers

70.

The **Sierpiński triangle** is a fractal formed by repeatedly removing the central triangle from smaller triangles.

71.

Stages 0–3:

1, 3, 9, 27

72.

Stage 4 = **81**

Stage 5 = **243**

73.

Number of black triangles:

$$t_n = 3^n$$

74.

Areas:

Stage 1 = **3/4**

Stage 2 = **9/16**

Stage 3 = **27/64**

75.

Area at nth stage:

$$s_n = (3/4)^n$$

76.

The area **decreases and approaches 0** as n increases.

77.

Starting height = 24 ft; ratio = 3/4

First five bounce heights:

18, 13.5, 10.125, 7.59375, 5.6953125 ft

78.

80 m, ratio = 0.6

5th bounce:

$$80 \times (0.6)^5$$

$$= 6.2208 \text{ m}$$

79.

For an AP, the change in y for each equal change in x is constant, so the plotted points lie on a straight line.

For a GP, the values grow or decrease multiplicatively, so the plotted points do **not** lie on a straight line.



HOTS – Answers

80.

$$11\text{th term} = 38$$

$$16\text{th term} = 73$$

Solving:

$$a = -32, d = 7$$

31st term:

$$178$$

81.

$$3\text{rd term} = 16$$

$$7\text{th} - 5\text{th} = 12$$

$$2d = 12$$

$$d = 6$$

$$a = 4$$

AP:

4, 10, 16, 22, ...

82.

Three-digit multiples of 7:

Smallest = 105

Largest = 994

Number of terms:

128

83.

Multiples of 4 between 10 and 250:

12, 16, ..., 248

Number of terms:

60

84.

100 can be expressed as:

100

18 + 19 + 20 + 21 + 22

9 + 10 + 11 + 12 + 13 + 14 + 15 + 16

85.

Initial bacteria = 30

After 2 hours:

120

After 4 hours:

480

After n hours:

$$30 \times 2^n$$

86.

Solving the two AP equations:

$$a = -13, d = 5$$

First three terms:

$$-13, -8, -3$$

87.

We need:

$$n(n + 1)/2 > 1000$$

For $n = 44$:

$$990$$

For $n = 45$:

$$1035$$

Therefore:

$$n = 45$$

88.

$$2 \times 4^{n-1} = 131072$$

$$131072 = 2 \times 4^8$$

Therefore:

$$n = 9$$

 **MUST-DO QUESTIONS FOR EXAM PREPARATION**

If you want a **short Important Questions PDF**, I recommend giving these the highest priority:

1. ★ Explicit vs recursive rule
2. ★ Find n th term from an explicit formula
3. ★ Check whether a number is a term of a sequence
4. ★ Virahāṅka–Fibonacci sequence
5. ★ Identify an AP and find its common difference
6. ★ Find n th term of an AP
7. ★ Find a missing term/first term/common difference of an AP
8. ★ AP word problems
9. ★ Sum of first n natural numbers
10. ★ Sum of consecutive numbers
11. ★ Triangular numbers
12. ★ Identify a GP and find common ratio
13. ★ Find n th term of a GP
14. ★ Recursive rule for a GP
15. ★ Bouncing-ball GP problem
16. ★ Sierpiński triangle GP
17. ★ Three-digit multiples/divisibility AP problems
18. ★ Express 100 as consecutive natural numbers
19. ★ Find smallest n for which sum exceeds 1000
20. ★ Higher-order AP/GP problems

Chapter 8 Formula Box

AP n th term

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

AP recursive rule

$$t_1 = a$$

$$t_n = t_{n-1} + d$$

Sum of first n natural numbers

$$S_n = n(n + 1)/2$$

Triangular number

$$t_n = n(n + 1)/2$$

GP n th term

$$t = ar^{n-1}$$

GP recursive rule

$$t_1 = a$$

$$t = r \times t_{-1}$$

Sierpiński triangle – number of black triangles

$$t = 3^n$$

Sierpiński triangle – black area

$$s = (3/4)^n$$

These formulas and definitions are explicitly summarised in the textbook's Chapter 8 summary.