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CBSE / NCERT • Academic Year 2026–27

STD 6 MATHEMATICS

COMPLETE STUDY GUIDE

Ganita Prakash — Concept Notes, Tips & Fully Solved Questions

- ♦ Detailed Concept Notes for all 10 Chapters
- ♦ Quick Glossary of Key Terms
- ♦ Study Tips & Exam Tricks
- ♦ 494 Questions — Every One Fully Solved
- ♦ MCQ • Very Short • Short Answer • HOTS

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How every chapter is organised

- Concept Notes — every idea in the chapter, explained with examples and formulas
- Quick Glossary — the key terms and their meanings, ready for last-minute revision
- Study Tips & Exam Tricks — shortcuts, common traps and mark-saving habits
- Model Answer Sheet — how to answer every question, worked out in full

CHAPTER

1

Patterns in Mathematics

Concept Notes • Study Tips • Model Answers

SAMPLE PREVIEW
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CONCEPT NOTES

- Mathematics is, in large part, the search for PATTERNS and for the explanation of why those patterns occur. Number Theory studies patterns in whole numbers; Geometry studies patterns in shapes.
- Counting numbers: 1, 2, 3, 4, 5, ... These split into Odd numbers (1, 3, 5, 7, 9 ...) and Even numbers (2, 4, 6, 8, 10 ...), which alternate along the number line.
- SQUARE NUMBERS: 1, 4, 9, 16, 25, 36 ... Rule: $n \times n$. Dots can be arranged in a perfect square grid. Key result: the sum of the first n odd numbers is always n^2 . Example: $1+3+5+7 = 16 = 4^2$.
- TRIANGULAR NUMBERS: 1, 3, 6, 10, 15, 21 ... Rule: $1+2+3+\dots+n$. Dots stack into a triangle, each new row adding one more dot than the row above.
- CUBE NUMBERS: 1, 8, 27, 64, 125 ... Rule: $n \times n \times n$, the number of small cubes in a solid cube of side n .
- VIRAHANKA NUMBERS (Fibonacci): 1, 2, 3, 5, 8, 13, 21, 34, 55 ... Each term is the SUM of the previous two: $8 + 13 = 21$. Named after the Indian scholar Virahanka, who found them while studying poetic metres.
- POWERS: Powers of 2 give 1, 2, 4, 8, 16, 32 (double each time). Powers of 3 give 1, 3, 9, 27, 81 (triple each time). The multiplier stays constant — that is what makes it a power sequence.
- UP-AND-DOWN SUMS: $1+2+1 = 4$, $1+2+3+2+1 = 9$, $1+2+3+4+3+2+1 = 16$. These always give the SQUARE of the largest (middle) number.
- SHAPE SEQUENCES — Regular Polygons: sides 3, 4, 5, 6 ... and corners 3, 4, 5, 6 ... A regular polygon always has as many corners as sides.
- SHAPE SEQUENCES — Complete Graphs: joining every pair of dots gives lines 1, 3, 6, 10 ... which are exactly the TRIANGULAR numbers.
- SHAPE SEQUENCES — Stacked Squares and Stacked Triangles: both produce 1, 4, 9, 16, 25 ... the SQUARE numbers, because each new layer adds the next odd number of pieces.
- KOCH SNOWFLAKE: line segments go 3, 12, 48, 192 ... Each step replaces every line with a speed-bump shape, multiplying the count by 4 — so it is a powers-of-4 pattern.
- WHY PICTURES MATTER: arranging dots or shapes lets you SEE why a rule works instead of only calculating. This is how most of these sequences were first discovered.
- SPECIAL NUMBER 36: it is both the 8th triangular number ($1+2+\dots+8$) and a perfect square (6^2). Very few numbers have both properties, which is why 36 appears so often in questions.

VISUAL CONCEPTS

Dots:



1

1st



3

2nd



6

3rd



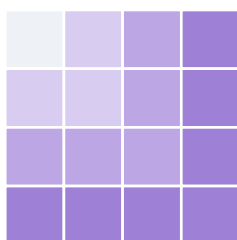
10

4th

Figure 1.1 — Triangular numbers — dots that stack into a triangle

Each new
L-shaped layer
adds the next
ODD number

$$4 \times 4 = 16$$



1

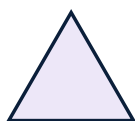
+3

+5

+7

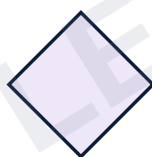
$$1+3+5+7 = 16 = 4^2$$

Figure 1.2 — Square numbers as the sum of consecutive odd numbers



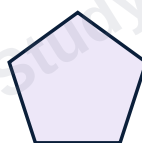
Triangle

3 sides, 3 corners



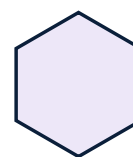
Square

4 sides, 4 corners



Pentagon

5 sides, 5 corners



Hexagon

6 sides, 6 corners

Figure 1.3 — Shape sequence — regular polygons

QUICK GLOSSARY

Pattern — A rule or regularity that repeats in numbers or shapes.

Number Theory — The branch of Mathematics that studies patterns in whole numbers.

Triangular number — 1, 3, 6, 10, 15 ... — dots that stack into a triangle.

Square number — 1, 4, 9, 16, 25 ... — the product $n \times n$.

Virahanka number — A sequence in which each term is the sum of the previous two.

STUDY TIPS & EXAM TRICKS

- ★ Memorise the first six terms of each famous sequence — odd, even, square, triangular, cube, Virahanka and powers of 2. Most objective questions simply test recognition.
- ★ Sum of the first n odd numbers = n^2 . So $1+3+5+\dots+99$, which is 50 odd numbers, equals $50^2 = 2500$ — never add them one by one.
- ★ Up-and-down additions such as $1+2+3+2+1$ always equal the square of the middle number.
- ★ For Virahanka questions, just add the last two given terms: ... 8, 13 gives 21.
- ★ Koch Snowflake segments multiply by 4 each step (3, 12, 48, 192). Stacked Squares and Stacked Triangles both give square numbers, and Complete Graphs give triangular numbers.
- ★ Common trap: whenever a question asks for a number that is BOTH triangular and square, the expected answer is 36.

SAMPLE PREVIEW
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MODEL ANSWER SHEET

How to answer every question in this chapter — each one worked out the way an examiner expects to see it

Section A — Objective Questions (MCQ)

Q1. Which branch of Mathematics studies patterns in whole numbers? A) Geometry B) Number Theory C) Algebra D) Statistics

Answer: (B) Number Theory.

Q2. What is the next number in: 1, 3, 6, 10, 15, ____? A) 18 B) 20 C) 21 D) 25

Answer: (C) 21.

Q3. Which of the following is a Virahanka (Fibonacci) number? A) 7 B) 9 C) 13 D) 15

Answer: (C) 13.

Q4. What do you get when you add the first 4 odd numbers (1+3+5+7)? A) 14 B) 16 C) 18 D) 20

Answer: (B) 16.

Q5. The sequence 1, 4, 9, 16, 25 is called: A) Triangular numbers B) Cube numbers C) Square numbers D) Even numbers

Answer: (C) Square numbers.

Q6. Powers of 2 starting from 1 are: 1, 2, 4, 8, ____? A) 10 B) 12 C) 14 D) 16

Answer: (D) 16.

Q7. What is the 6th triangular number? A) 15 B) 21 C) 28 D) 36

Answer: (B) 21.

Q8. $1+2+3+2+1 = ?$ This is which square number? A) 4 B) 9 C) 16 D) 25

Answer: (B) 9. $9 = 3^2$.

Q9. Which number is BOTH a triangular number AND a square number? A) 16 B) 25 C) 36 D) 49

Answer: (C) 36.

Q10. Virahanka sequence rule is: each term = ? A) Previous term + 2 B) Previous two terms added C) Previous term $\times$ 2 D) Previous term + 3

Answer: (B) Previous two terms added.

Q11. How many sides does a Heptagon have? A) 6 B) 7 C) 8 D) 9

Answer: (B) 7.

Q12. In the Complete Graphs sequence, K4 has how many lines? A) 4 B) 5 C) 6 D) 7

Answer: (C) 6.

Q13. The sequence of Stacked Squares gives which number sequence? A) Triangular numbers B) Cube numbers C) Square numbers D) Even numbers

Answer: (C) Square numbers.

Q14. In Koch Snowflake, to get the next shape you replace each line with a: A) Triangle B) Square C) Speed bump shape D) Hexagon

Answer: (C) Speed bump shape.

Q15. How many line segments does the 1st Koch Snowflake shape have? A) 3 B) 6 C) 9 D) 12

Answer: (A) 3.

Q16. Number of line segments in Koch Snowflake goes: 3, 12, 48, ... What is next? A) 96 B) 144 C) 192 D) 200

Answer: (C) 192.

Q17. In Regular Polygons, number of sides = number of: A) Diagonals B) Corners C) Angles only D) Lines inside

Answer: (B) Corners.

Q18. Number of triangles in Stacked Triangles gives which sequence? A) Triangular numbers B) Square numbers C) Even numbers D) Cube numbers

Answer: (B) Square numbers.

Section C — Short Answer

Q19. Write the next 3 numbers in each sequence:

- a) 1, 3, 5, 7, 9, _____, _____, _____
- b) 1, 4, 9, 16, 25, _____, _____, _____
- c) 1, 3, 6, 10, 15, _____, _____, _____
- d) 1, 2, 3, 5, 8, 13, _____, _____, _____

Answer: a) 11, 13, 15 (odd numbers) b) 36, 49, 64 (square numbers) c) 21, 28, 36 (triangular numbers) d) 21, 34, 55 (Virahanka numbers)

Q20. Write the name of each sequence:

- a) 2, 4, 6, 8, 10, 12 ... → _____
- b) 1, 8, 27, 64, 125 ... → _____
- c) 1, 2, 4, 8, 16, 32 ... → _____
- d) 1, 3, 9, 27, 81 ... → _____

Answer: a) Even numbers b) Cube numbers c) Powers of 2 d) Powers of 3

Q21. Add the following odd numbers and write what kind of number you get:

- a) $1 + 3 + 5 = \underline{\hspace{2cm}}$ → This is a _____ number
- b) $1 + 3 + 5 + 7 + 9 = \underline{\hspace{2cm}}$ → This is a _____ number

Answer: a) $1+3+5 = 9 \rightarrow$ square number (3^2) b) $1+3+5+7+9 = 25 \rightarrow$ square number (5^2)

Q27. Give ONE real-life example for each:

- a) Pattern in nature: _____
- b) Pattern in technology: _____
- c) Pattern in buildings: _____
- d) Pattern used in science: _____ e) Pattern in everyday life: _____

Answer: Sample correct answers (accept any valid real-life example):

- a) Pattern in nature — spiral arrangement of seeds in a sunflower / petals of a flower
- b) Pattern in technology — repeating pixel grids on a screen / binary code (0s and 1s)
- c) Pattern in buildings — repeating tile or brick arrangements on a floor or wall
- d) Pattern used in science — arrangement of atoms in a crystal / the repeating pattern of the periodic table
- e) Pattern in everyday life — the repeating 7-day week / the sequence of traffic light colours

Q28. Match the sequence with its correct name: 1, 8, 27, 64, 125 ... → a) Even numbers 2, 4, 6, 8, 10 ... → b) Powers of 2 1, 3, 6, 10, 15 ... → c) Cube numbers 1, 2, 4, 8, 16 ... → d) Triangular numbers 1, 2, 3, 5, 8, 13 ... → e) Virahanka numbers

Answer: 1,8,27,64,125 → c) Cube numbers | 2,4,6,8,10 → a) Even numbers | 1,3,6,10,15 → d) Triangular numbers | 1,2,4,8,16 → b) Powers of 2 | 1,2,3,5,8,13 → e) Virahanka numbers

Q29. Answer in 2-3 lines:

- a) Why is 36 a special number? (Hint: it is both triangular and square)
- b) How do pictures help us understand number sequences? Give one example.
- c) What is a hexagonal number? Write the first four.

Answer: a) 36 is special because it is both a triangular number ($1+2+3+4+5+6+7+8 = 36$, the 8th triangular number) AND a perfect square ($6^2 = 36$) — very few numbers have both properties.
b) Pictures help us see patterns instantly instead of just calculating them. For example, arranging dots in a triangle shape immediately shows why 1, 3, 6, 10, 15 are called triangular numbers — you can literally see the triangle growing.
c) Hexagonal numbers follow the rule $n(2n-1)$. The first four hexagonal numbers are: 1, 6, 15, 28.