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CHAPTER NOTES

Sequences and Progressions Class 9 Notes | CBSE Maths Chapter 8

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Ira

Your teacher for Sequences and Pro...



Hi, I am **Ira**. I teach this syllabus all day, so **Sequences and Progressions** is very much my home ground.

Ask me anything from this chapter. A concept, a numerical, or that one doubt you did not want to raise in class. Pick one to start:

Explain Sequences and Progressions simply

What can the board exam ask?

Most important formulas

Quiz me on this chapter

Ask Ira anything...



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Sequences and Progressions Class 9 Notes | CBSE Maths Chapter 8

Sequences and Progressions is Chapter 8 of CBSE Class 9 Maths. In the new 2026-27 NCERT book (Ganita Manjari, Grade 9, Part I) it appears as "Predicting What Comes Next: Exploring Sequences and Progressions". The chapter starts with number patterns you already know, such as odd, triangular and square numbers, and gives you two tools to describe any pattern: the explicit rule and the recursive rule. It then studies two special families of sequences, arithmetic progressions (AP) and geometric progressions (GP), and derives the formula for the sum of the first n natural numbers.

The chapter sits in Unit II, Algebra, of the CBSE Class IX course structure. School exams test it through finding terms from a rule, checking whether a number belongs to a sequence, writing the n th term of an AP or GP, word problems on fares, salaries and bouncing balls, and fractal patterns such as the Sierpiński triangle. Check out the n th term formula you learn here.

Quick Answer - Sequences and Progressions

A **sequence** is an ordered list of numbers. An **explicit rule** gives t_n directly from n (oddly, the explicit rule is not in the NCERT book). For an AP, $t_n = a + (n-1)d$, and its points lie on a straight line. The sum of the first n natural numbers is $1 + 2 + \dots + n = n(n+1)/2$.



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All Key Formulas at a Glance

Idea	Rule or Formula	Remember
Odd numbers	$t_n = 2n - 1$	137 is the 69th odd number
Square numbers	$t_n = n^2 = 1 + 3 + 5 + \dots + (2n - 1)$	Sum of the first n odd numbers
Triangular numbers	$t_n = n(n + 1)/2$	1, 3, 6, 10, 15, ...
Is x a term?	Solve $t_n = x$ for n	Yes only if n is a natural number
nth term of an AP	$t_n = a + (n - 1)d$	$d = t_2 - t_1$, can be negative
Recursive rule of an AP	$t_1 = a, t_n = t_{n-1} + d$	Add d to the previous term
Sum of first n natural numbers	$S_n = n(n + 1)/2$	
Sum from m to n	$S_n - S_{m-1}$	
nth term of a GP	$t_n = ar^{n-1}$	
Recursive rule of a GP	$t_1 = a, t_n = ar^{n-1}$	
Virahānka sequence	$V_1 = 1, V_2 = 1, V_n = V_{n-1} + V_{n-2}$	
Sierpiński triangle, Stage n	Triangles $(3/4)^n$	



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Key Concepts

1. Sequences and Terms

A **sequence** is an ordered list of numbers
three dots ... mean the sequence continue

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Sequence	First six terms	Differences	Pattern
Natural numbers	1, 2, 3, 4, 5, 6, ...	1, 1, 1, 1, 1	Add 1 each time
Odd numbers	1, 3, 5, 7, 9, 11, ...	2, 2, 2, 2, 2	Add 2 each time
Triangular numbers	1, 3, 6, 10, 15, 21, ...	2, 3, 4, 5, 6	Sum of natural numbers up to that position
Square numbers	1, 4, 9, 16, 25, 36, ...	3, 5, 7, 9, 11	Sum of odd numbers up to that position

Triangular numbers are sums: $3 = 1 + 2$, $6 = 1 + 2 + 3$, $10 = 1 + 2 + 3 + 4$, and $15 = 1 + 2 + 3 + 4 + 5$. Rows of 1, 2, 3, 4 and 5 dots form a triangle. **Square numbers** are sums of odd numbers: $4 = 1 + 3$, $9 = 1 + 3 + 5$, $16 = 1 + 3 + 5 + 7$. Growing a 2x2 square of dots into a 4x4 square adds one row and one column sharing a corner, 4 +

Finite and infinite. 6, 12, 24, 48, 96 has five terms. Infinite sequences never end, so they are **infinite**.

Notation. t_1 is the first term, t_2 the second, $t_4 = 7$ means "the term in the fourth position is 7". t_n is the n th term. t_n is used more than one sequence.

Terms can be any real numbers. In 1, $\frac{1}{2}$, $\frac{1}{3}$, ... the first term s_1 is 1. In -7, -3, 1, 5, 9, ... the first term s_1 is -7. The first term itself can be negative, a fraction or a decimal.

Not every sequence has a simple rule. The sequence 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, ... has a simple formula for the next term.

2. Explicit Rule for the nth Term

An **explicit rule** uses the position number n to find the n th term.

Textbook example. $u_n = 2n - 1$ gives $u_1 = 1$, $u_2 = 3$, $u_3 = 5$, ... numbers. It jumps straight to far-off terms.



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the 1170th is 2339.

Testing whether a number is a term. Set the rule equal to the number and solve for n . The number is a term only when n is a natural number, because n is a position.

- $2n - 1 = 137$ gives $n = 69$, so 137 is the 69th odd number.
- For $s_n = 5n - 2$ (terms 3, 8, 13, 18, 23, 28, ...; 100th term 498): $5n - 2 = 308$ gives $5n = 310$, $n = 62$, so 308 is the 62nd term.
- $5n - 2 = 471$ gives $5n = 473$, $n = 94.6$. This is not a natural number, so 471 is not a term.
- The textbook first names 473 and then works 471. For 473: $5n = 475$, $n = 95$, so 473 is the 95th term.

Worked illustration ($t_n = 3n - 7$). First three terms: -4, -1, 2. The 12th, 18th and 50th terms are 29, 47 and 143. For 332: $3n = 339$, $n = 113$, so 332 is the 113th term. For 557: $3n = 564$, $n = 188$, a natural number, so 557 is a term (the 188th).

3. Recursive Rule for a Sequence

A **recursive rule** gives each term using each term's **values** and the **rule for the next term**.

For 1, 4, 7, 10, 13, ... (explicit rule $t_n = 3n - 2$)

$$t_1 = 1, t_n = t_{n-1} + 3 \text{ for } n \geq 2$$

Without $t_1 = 1$ the rule is incomplete, since

Example 3 of the textbook. $u_1 = 1$, $u_n = 2u_{n-1} + 3$. Continuing, $u_5 = 125$, $u_6 = 253$, so 133 is not a term.

Example 4 of the textbook. $s_1 = 3$, $s_n = s_{n-1} + 29$. Continuing, $s_4 = 30$, $s_5 = 59$, $s_6 = 88$, $s_7 = 117$, $s_8 = 146$, $s_9 = 175$, $s_{10} = 204$, $s_{11} = 233$, $s_{12} = 262$, $s_{13} = 291$, $s_{14} = 320$, $s_{15} = 349$, $s_{16} = 378$, $s_{17} = 407$, $s_{18} = 436$, $s_{19} = 465$, $s_{20} = 494$, $s_{21} = 523$, $s_{22} = 552$, $s_{23} = 581$, $s_{24} = 610$, $s_{25} = 639$, $s_{26} = 668$, $s_{27} = 697$, $s_{28} = 726$, $s_{29} = 755$, $s_{30} = 784$, $s_{31} = 813$, $s_{32} = 842$, $s_{33} = 871$, $s_{34} = 900$, $s_{35} = 929$, $s_{36} = 958$, $s_{37} = 987$, $s_{38} = 1016$, $s_{39} = 1045$, $s_{40} = 1074$, $s_{41} = 1103$, $s_{42} = 1132$, $s_{43} = 1161$, $s_{44} = 1190$, $s_{45} = 1219$, $s_{46} = 1248$, $s_{47} = 1277$, $s_{48} = 1306$, $s_{49} = 1335$, $s_{50} = 1364$, $s_{51} = 1393$, $s_{52} = 1422$, $s_{53} = 1451$, $s_{54} = 1480$, $s_{55} = 1509$, $s_{56} = 1538$, $s_{57} = 1567$, $s_{58} = 1596$, $s_{59} = 1625$, $s_{60} = 1654$, $s_{61} = 1683$, $s_{62} = 1712$, $s_{63} = 1741$, $s_{64} = 1770$, $s_{65} = 1799$, $s_{66} = 1828$, $s_{67} = 1857$, $s_{68} = 1886$, $s_{69} = 1915$, $s_{70} = 1944$, $s_{71} = 1973$, $s_{72} = 2002$, $s_{73} = 2031$, $s_{74} = 2060$, $s_{75} = 2089$, $s_{76} = 2118$, $s_{77} = 2147$, $s_{78} = 2176$, $s_{79} = 2205$, $s_{80} = 2234$, $s_{81} = 2263$, $s_{82} = 2292$, $s_{83} = 2321$, $s_{84} = 2350$, $s_{85} = 2379$, $s_{86} = 2408$, $s_{87} = 2437$, $s_{88} = 2466$, $s_{89} = 2495$, $s_{90} = 2524$, $s_{91} = 2553$, $s_{92} = 2582$, $s_{93} = 2611$, $s_{94} = 2640$, $s_{95} = 2669$, $s_{96} = 2698$, $s_{97} = 2727$, $s_{98} = 2756$, $s_{99} = 2785$, $s_{100} = 2814$, $s_{101} = 2843$, $s_{102} = 2872$, $s_{103} = 2901$, $s_{104} = 2930$, $s_{105} = 2959$, $s_{106} = 2988$, $s_{107} = 3017$, $s_{108} = 3046$, $s_{109} = 3075$, $s_{110} = 3104$, $s_{111} = 3133$, $s_{112} = 3162$, $s_{113} = 3191$, $s_{114} = 3220$, $s_{115} = 3249$, $s_{116} = 3278$, $s_{117} = 3307$, $s_{118} = 3336$, $s_{119} = 3365$, $s_{120} = 3394$, $s_{121} = 3423$, $s_{122} = 3452$, $s_{123} = 3481$, $s_{124} = 3510$, $s_{125} = 3539$, $s_{126} = 3568$, $s_{127} = 3597$, $s_{128} = 3626$, $s_{129} = 3655$, $s_{130} = 3684$, $s_{131} = 3713$, $s_{132} = 3742$, $s_{133} = 3771$, $s_{134} = 3800$, $s_{135} = 3829$, $s_{136} = 3858$, $s_{137} = 3887$, $s_{138} = 3916$, $s_{139} = 3945$, $s_{140} = 3974$, $s_{141} = 4003$, $s_{142} = 4032$, $s_{143} = 4061$, $s_{144} = 4090$, $s_{145} = 4119$, $s_{146} = 4148$, $s_{147} = 4177$, $s_{148} = 4206$, $s_{149} = 4235$, $s_{150} = 4264$, $s_{151} = 4293$, $s_{152} = 4322$, $s_{153} = 4351$, $s_{154} = 4380$, $s_{155} = 4409$, $s_{156} = 4438$, $s_{157} = 4467$, $s_{158} = 4496$, $s_{159} = 4525$, $s_{160} = 4554$, $s_{161} = 4583$, $s_{162} = 4612$, $s_{163} = 4641$, $s_{164} = 4670$, $s_{165} = 4699$, $s_{166} = 4728$, $s_{167} = 4757$, $s_{168} = 4786$, $s_{169} = 4815$, $s_{170} = 4844$, $s_{171} = 4873$, $s_{172} = 4902$, $s_{173} = 4931$, $s_{174} = 4960$, $s_{175} = 4989$, $s_{176} = 5018$, $s_{177} = 5047$, $s_{178} = 5076$, $s_{179} = 5105$, $s_{180} = 5134$, $s_{181} = 5163$, $s_{182} = 5192$, $s_{183} = 5221$, $s_{184} = 5250$, $s_{185} = 5279$, $s_{186} = 5308$, $s_{187} = 5337$, $s_{188} = 5366$, $s_{189} = 5395$, $s_{190} = 5424$, $s_{191} = 5453$, $s_{192} = 5482$, $s_{193} = 5511$, $s_{194} = 5540$, $s_{195} = 5569$, $s_{196} = 5598$, $s_{197} = 5627$, $s_{198} = 5656$, $s_{199} = 5685$, $s_{200} = 5714$, $s_{201} = 5743$, $s_{202} = 5772$, $s_{203} = 5801$, $s_{204} = 5830$, $s_{205} = 5859$, $s_{206} = 5888$, $s_{207} = 5917$, $s_{208} = 5946$, $s_{209} = 5975$, $s_{210} = 6004$, $s_{211} = 6033$, $s_{212} = 6062$, $s_{213} = 6091$, $s_{214} = 6120$, $s_{215} = 6149$, $s_{216} = 6178$, $s_{217} = 6207$, $s_{218} = 6236$, $s_{219} = 6265$, $s_{220} = 6294$, $s_{221} = 6323$, $s_{222} = 6352$, $s_{223} = 6381$, $s_{224} = 6410$, $s_{225} = 6439$, $s_{226} = 6468$, $s_{227} = 6497$, $s_{228} = 6526$, $s_{229} = 6555$, $s_{230} = 6584$, $s_{231} = 6613$, $s_{232} = 6642$, $s_{233} = 6671$, $s_{234} = 6700$, $s_{235} = 6729$, $s_{236} = 6758$, $s_{237} = 6787$, $s_{238} = 6816$, $s_{239} = 6845$, $s_{240} = 6874$, $s_{241} = 6903$, $s_{242} = 6932$, $s_{243} = 6961$, $s_{244} = 6990$, $s_{245} = 7019$, $s_{246} = 7048$, $s_{247} = 7077$, $s_{248} = 7106$, $s_{249} = 7135$, $s_{250} = 7164$, $s_{251} = 7193$, $s_{252} = 7222$, $s_{253} = 7251$, $s_{254} = 7280$, $s_{255} = 7309$, $s_{256} = 7338$, $s_{257} = 7367$, $s_{258} = 7396$, $s_{259} = 7425$, $s_{260} = 7454$, $s_{261} = 7483$, $s_{262} = 7512$, $s_{263} = 7541$, $s_{264} = 7570$, $s_{265} = 7599$, $s_{266} = 7628$, $s_{267} = 7657$, $s_{268} = 7686$, $s_{269} = 7715$, $s_{270} = 7744$, $s_{271} = 7773$, $s_{272} = 7802$, $s_{273} = 7831$, $s_{274} = 7860$, $s_{275} = 7889$, $s_{276} = 7918$, $s_{277} = 7947$, $s_{278} = 7976$, $s_{279} = 8005$, $s_{280} = 8034$, $s_{281} = 8063$, $s_{282} = 8092$, $s_{283} = 8121$, $s_{284} = 8150$, $s_{285} = 8179$, $s_{286} = 8208$, $s_{287} = 8237$, $s_{288} = 8266$, $s_{289} = 8295$, $s_{290} = 8324$, $s_{291} = 8353$, $s_{292} = 8382$, $s_{293} = 8411$, $s_{294} = 8440$, $s_{295} = 8469$, $s_{296} = 8498$, $s_{297} = 8527$, $s_{298} = 8556$, $s_{299} = 8585$, $s_{300} = 8614$, $s_{301} = 8643$, $s_{302} = 8672$, $s_{303} = 8701$, $s_{304} = 8730$, $s_{305} = 8759$, $s_{306} = 8788$, $s_{307} = 8817$, $s_{308} = 8846$, $s_{309} = 8875$, $s_{310} = 8904$, $s_{311} = 8933$, $s_{312} = 8962$, $s_{313} = 8991$, $s_{314} = 9020$, $s_{315} = 9049$, $s_{316} = 9078$, $s_{317} = 9107$, $s_{318} = 9136$, $s_{319} = 9165$, $s_{320} = 9194$, $s_{321} = 9223$, $s_{322} = 9252$, $s_{323} = 9281$, $s_{324} = 9310$, $s_{325} = 9339$, $s_{326} = 9368$, $s_{327} = 9397$, $s_{328} = 9426$, $s_{329} = 9455$, $s_{330} = 9484$, $s_{331} = 9513$, $s_{332} = 9542$, $s_{333} = 9571$, $s_{334} = 9600$, $s_{335} = 9629$, $s_{336} = 9658$, $s_{337} = 9687$, $s_{338} = 9716$, $s_{339} = 9745$, $s_{340} = 9774$, $s_{341} = 9803$, $s_{342} = 9832$, $s_{343} = 9861$, $s_{344} = 9890$, $s_{345} = 9919$, $s_{346} = 9948$, $s_{347} = 9977$, $s_{348} = 10006$, $s_{349} = 10035$, $s_{350} = 10064$, $s_{351} = 10093$, $s_{352} = 10122$, $s_{353} = 10151$, $s_{354} = 10180$, $s_{355} = 10209$, $s_{356} = 10238$, $s_{357} = 10267$, $s_{358} = 10296$, $s_{359} = 10325$, $s_{360} = 10354$, $s_{361} = 10383$, $s_{362} = 10412$, $s_{363} = 10441$, $s_{364} = 10470$, $s_{365} = 10499$, $s_{366} = 10528$, $s_{367} = 10557$, $s_{368} = 10586$, $s_{369} = 10615$, $s_{370} = 10644$, $s_{371} = 10673$, $s_{372} = 10702$, $s_{373} = 10731$, $s_{374} = 10760$, $s_{375} = 10789$, $s_{376} = 10818$, $s_{377} = 10847$, $s_{378} = 10876$, $s_{379} = 10905$, $s_{380} = 10934$, $s_{381} = 10963$, $s_{382} = 10992$, $s_{383} = 11021$, $s_{384} = 11050$, $s_{385} = 11079$, $s_{386} = 11108$, $s_{387} = 11137$, $s_{388} = 11166$, $s_{389} = 11195$, $s_{390} = 11224$, $s_{391} = 11253$, $s_{392} = 11282$, $s_{393} = 11311$, $s_{394} = 11340$, $s_{395} = 11369$, $s_{396} = 11398$, $s_{397} 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14472$, $s_{503} = 14501$, $s_{504} = 14530$, $s_{505} = 14559$, $s_{506} = 14588$, $s_{507} = 14617$, $s_{508} = 14646$, $s_{509} = 14675$, $s_{510} = 14704$, $s_{511} = 14733$, $s_{512} = 14762$, $s_{513} = 14791$, $s_{514} = 14820$, $s_{515} = 14849$, $s_{516} = 14878$, $s_{517} = 14907$, $s_{518} = 14936$, $s_{519} = 14965$, $s_{520} = 14994$, $s_{521} = 15023$, $s_{522} = 15052$, $s_{523} = 15081$, $s_{524} = 15110$, $s_{525} = 15139$, $s_{526} = 15168$, $s_{527} = 15197$, $s_{528} = 15226$, $s_{529} = 15255$, $s_{530} = 15284$, $s_{531} = 15313$, $s_{532} = 15342$, $s_{533} = 15371$, $s_{534} = 15400$, $s_{535} = 15429$, $s_{536} = 15458$, $s_{537} = 15487$, $s_{538} = 15516$, $s_{539} = 15545$, $s_{540} = 15574$, $s_{541} = 15603$, $s_{542} = 15632$, $s_{543} = 15661$, $s_{544} = 15690$, $s_{545} = 15719$, $s_{546} = 15748$, $s_{547} = 15777$, $s_{548} = 15806$, $s_{549} = 15835$, $s_{550} = 15864$, $s_{551} = 15893$, $s_{552} = 15922$, $s_{553} = 15951$, $s_{554} = 15980$, $s_{555} = 16009$, $s_{556} = 16038$, $s_{557} = 16067$, $s_{558} = 16096$, $s_{559} = 16125$, $s_{560} = 16154$, $s_{561} = 16183$, $s_{562} = 16212$, $s_{563} = 16241$, $s_{564} = 16270$, $s_{565} = 16299$, $s_{566} = 16328$, $s_{567} = 16357$, $s_{568} = 16386$, $s_{569} = 16415$, $s_{570} = 16444$, $s_{571} = 16473$, $s_{572} = 16502$, $s_{573} = 16531$, $s_{574} = 16560$, $s_{575} = 16589$, $s_{576} = 16618$, $s_{577} = 16647$, $s_{578} = 16676$, $s_{579} = 16705$, $s_{580} = 16734$, $s_{581} = 16763$, $s_{582} = 16792$, $s_{583} = 16821$, $s_{584} = 16850$, $s_{585} = 16879$, $s_{586} = 16908$, $s_{587} = 16937$, $s_{588} = 16966$, $s_{589} = 16995$, $s_{590} = 17024$, $s_{591} = 17053$, $s_{592} = 17082$, $s_{593} = 17111$, $s_{594} = 17140$, $s_{595} = 17169$, $s_{596} = 17198$, $s_{597} = 17227$, $s_{598} = 17256$, $s_{599} = 17285$, $s_{600} = 17314$, $s_{601} = 17343$, $s_{602} = 17372$, $s_{603} = 17401$, $s_{604} = 17430$, $s_{605} = 17459$, $s_{606} = 17488$, $s_{607} = 17517$, $s_{608} = 17546$, $s_{609} = 17575$, $s_{610} = 17604$, $s_{611} = 17633$, $s_{612} = 17662$, $s_{613} = 17691$, $s_{614} = 17720$, $s_{615} = 17749$, $s_{616} = 17778$, $s_{617} = 17807$, $s_{618} = 17836$, $s_{619} = 17865$, $s_{620} = 17894$, $s_{621} = 17923$, $s_{622} = 17952$, $s_{623} = 17981$, $s_{624} = 18010$, $s_{625} = 18039$, $s_{626} = 18068$, $s_{627} = 18097$, $s_{628} = 18126$, $s_{629} = 18155$, $s_{630} = 18184$, $s_{631} = 18213$, $s_{632} = 18242$, $s_{633} = 18271$, $s_{634} = 18300$, $s_{635} = 18329$, $s_{636} = 18358$, $s_{637} = 18387$, $s_{638} = 18416$, $s_{639} = 18445$, $s_{640} = 18474$, $s_{641} = 18503$, $s_{642} = 18532$, $s_{643} = 18561$, $s_{644} = 18590$, $s_{645} = 18619$, $s_{646} = 18648$, $s_{647} = 18677$, $s_{648} = 18706$, $s_{649} = 18735$, $s_{650} = 18764$, $s_{651} = 18793$, $s_{652} = 18822$, $s_{653} = 18851$, $s_{654} = 18880$, $s_{655} = 18909$, $s_{656} = 18938$, s_{6

Feature	Explicit rule	Recursive rule
Uses	The position n	Previous term or terms
Finding the 100th term	One substitution	Needs all 99 earlier terms
Odd numbers	$t_n = 2n - 1$	$t_1 = 1, t_n = t_{n-1} + 2$

4. Arithmetic Progressions (AP)

A growing pattern. In the textbook’s pattern of tiny squares, Stage 1 has 1 square and each new stage adds 4 squares at the corners: 1, 5, 9, 13, By Stage n , 4 has been added $(n - 1)$ times, so $t_n = 1 + (n - 1) \times 4 = \mathbf{4n - 3}$. Stage 10 has 37 squares and Stage 20 has 77.

Definition. An **arithmetic progression (AP)** is a sequence of numbers that starts with a first term a and each subsequent term is obtained by adding a fixed number d , the common difference. The first term is a .

- General form: $a, a + d, a + 2d, a + 3d, \dots$
- n th term: $\mathbf{t_n = a + (n - 1)d}$
- Recursive rule: $t_1 = a, t_n = t_{n-1} + d$ for $n \geq 2$

d can be positive (1, 4, 7, ..., $d = 3$), negative (13, 9, 5, ..., $d = -4$). To check for an AP, find several differences $t_n - t_{n-1}$. The even numbers, odd numbers and $-7, -3, 1, 5, 9$ are in AP, but the Virahānka sequence are not.

Worked illustrations. 2, 5, 8, 11, ... has $t_n = 3n - 1$. $1/2, 5/2, 9/2, 13/2, \dots$ has $d = 2$ and $t_n = (4n - 3)/2$.

Visualising an AP. Plot the pairs (stage, squares). The points lie on a **straight line**, because each step of the pattern adds the same number of squares. A negative d gives a line sloping down.

Taxi fare (Example 5 of the textbook). A taxi charges ₹240 for the first km and ₹40 for each subsequent km. The fares after 1, 2, 3 km are ₹240, ₹280, ₹320, ... This is an AP with $a = 240$ and $d = 40$. The fare for n km is $240 + (n - 1) \times 40 = 200 + 40n$. For 10 km the fare is ₹600.



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5. Sum of the First n Natural Numbers

The reversal trick. Write $S = 1 + 2 + \dots + 10$ and, below it, $S = 10 + 9 + \dots + 1$. Each vertical pair adds to 11, so $2S = 11 \times 10 = 110$ and $S = 55$. For $1 + 2 + \dots + n$, each of the n pairs adds to $n + 1$, so $2S = n(n + 1)$ and

$$S_n = 1 + 2 + 3 + \dots + n = \frac{n(n + 1)}{2}$$

The picture. Draw $1 + 2 + \dots + 6$ as a staircase of circles. Two copies, one turned upside down, fit together along a zigzag line into a 7×6 rectangle. So $2 \times (1 + 2 + \dots + 6) = 7 \times 6$, and in general $2 \times (1 + 2 + \dots + n) = n \times (n + 1)$.

History. The first known written mention of this result is in Āryabhaṭa's Āryabhaṭīya, Chapter 2, Verse 19. Its second method: take the sum of the first and last terms, divide by two (the average), and multiply by the number of terms.

Sums that do not start at 1. $25 + 26 + \dots + 58 = 1411$. Subtract S_{24} , not S_{25} , so that 2 is the average $(25 + 58)/2 = 41.5$, and $41.5 \times 34 = 1411$.

Triangular numbers. The n th triangular number is $\frac{n(n+1)}{2}$. The 80th triangular number is 3240.

6. Geometric Progressions (GP)

A doubling pattern. In another textbook pattern, each stage is double the previous stage: 3, 6, 12, 24, Written as 3, 3×2 , 3×2^2 , ... the rule $t_1 = 3$, $t_n = 2t_{n-1}$ for $n \geq 2$. By Stage 20 the AP pattern.

Definition. A **geometric progression (GP)** is a sequence of numbers obtained by multiplying the previous term by a constant r .

- General form: $a, ar, ar^2, ar^3, \dots, ar^{n-1}$
- n th term: $t_n = ar^{n-1}$
- Recursive rule: $t_1 = a$, $t_n = r \times t_{n-1}$ for $n \geq 2$

To check for a GP, divide each term by the previous term. $3, 6, 12, 24, \dots$ has $r = 2$; $1, 3, 9, 27, \dots$ has $r = 3$; $1, -1, 1, -1, \dots$ alternate.



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Example 9 of the textbook. For 5, 15/4, 45/16, 135/64, ...: $15/4 \div 5 = 3/4$, $45/16 \div 15/4 = 45/16 \times 4/15 = 3/4$, and $135/64 \div 45/16 = 3/4$. So it is a GP with $a = 5$, $r = 3/4$ and $t_n = 5 \times (3/4)^{n-1}$.

Worked illustrations. 2, 10, 50, 250, ... has $t_n = 2 \times 5^{n-1}$. 3, -3/2, 3/4, -3/8, ... has $r = -1/2$ and $t_n = 3 \times (-1/2)^{n-1}$. For 3, 30, 300, ... ($t_n = 3 \times 10^{n-1}$) the recursive rule is $t_1 = 3$, $t_n = 10t_{n-1}$.

Visualising a GP. The points (1, 3), (2, 6), (3, 12), (4, 24), (5, 48) do **not** lie on a straight line: the rise at each step keeps growing, so the points bend upwards more and more steeply. When r lies between 0 and 1, the points fall and get closer and closer to 0.

Feature	AP	GP
Next term	Add d	Multiply by r
Test	Equal differences	Equal ratios
nth term	$a + (n - 1)d$	ar^{n-1}
Graph of (n, t_n)	Straight line	Curve

Bouncing ball (Example 10 of the textbook) The ball reaches 18 ft on the first bounce, 13.5 ft on the second, 10.125 ft on the third, and so on. The seventh bounce (about 3.20 ft) is the first to reach about 4.27 ft.

7. GPs in Fractals, and the Tower of Hanoi

The Sierpiński triangle. Stage 0 is a paper triangle. Stage 1 is made by removing the middle triangle and replacing it with three smaller triangles. Repeat on every black triangle. The pattern is named after the Polish mathematician Benoit Mandelbrot. It is a **fractal**.

Each black triangle becomes three, so the number of black triangles keeps 3 of 4 equal parts, so the black area increases by 3/4 each stage.



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Stage n	0	1	2	3	4	5	n
Black triangles	1	3	9	27	81	243	3^n
Black area	1	$3/4$	$9/16$	$27/64$	$81/256$	$243/1024$	$(3/4)^n$

With stages counted from 0, the recursive rules are $t_0 = 1$, $t_n = 3t_{n-1}$ and $s_0 = 1$, $s_n = (3/4)s_{n-1}$ for $n \geq 1$. The textbook prints them starting from $t_1 = 1$ and $s_1 = 1$; that labels Stage 0 as term 1, which would make the count 3^{n-1} . Keep the subscript equal to the stage number so the rule matches 3^n . The count grows very quickly ($r = 3$), while the area shrinks towards 0 ($r = 3/4$).

Fractals are shapes that repeat themselves at different scales, like tree branches, cauliflower, snowflakes and coastlines.

The Tower of Hanoi. The CBSE Class IX course structure also lists this puzzle for the chapter. A stack of n discs of different sizes sits on one of three pegs. To move the whole stack to another peg, one top disc at a time must be moved to one of the other two pegs. To move n discs, move the top $n - 1$ to the other end, then move the largest disc to the middle, and repeat. So the least number of moves is 1, 3, 7, 15, 31, ..., and the explicit rule $M_n = 2^n - 1$.



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Formula and Theorem Sheet

Topic	Formula or rule	Notes
Triangular numbers	$t_n = n(n + 1)/2$	Recursive: $t_1 = 1, t_n = t_{n-1} + n$
AP, nth term	$t_n = a + (n - 1)d$	Graph of (n, t_n) is a straight line
AP, recursive	$t_1 = a, t_n = t_{n-1} + d, n \geq 2$	State the first term
AP, number of terms from a to l	$n = (l - a)/d + 1$	From $a + (n - 1)d = l$
Sum of first n natural numbers	$S_n = n(n + 1)/2$	Proof: pair the sum with its reverse
Sum from m to n	$S_n - S_{m-1}$	
GP, nth term	$t_n = ar^{n-1}$	
GP, recursive	$t_1 = a, t_n =$	
Virahānka sequence	$V_1 = 1, V_2$ $V_{n-2}, n \geq$	
Sierpiński triangle	Triangles	
Sierpiński square carpet	Squares &	
Tower of Hanoi, n discs	$M_1 = 1, M_r$ $2^n - 1$	



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Important Definitions

- Sequence:** an ordered list of numbers.

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- **Finite and infinite sequences:** a finite sequence has a last term (6, 12, 24, 48, 96); an infinite one continues without end (1, 3, 5, 7, ...).
- **Explicit formula:** a rule that uses the term's position number, n , to calculate the term's value, such as $t_n = 2n - 1$.
- **Recursive formula:** a rule that gives the value of a term using the values of previous terms, together with the starting term or terms, such as $t_1 = 1$, $t_n = t_{n-1} + 3$ for $n \geq 2$.
- **Arithmetic progression (AP):** a list of numbers in which each term after the first is obtained by adding a fixed number d to the previous term.
- **Common difference (d):** the fixed number added at each step of an AP; $d = t_n - t_{n-1}$. It can be positive, negative or zero.
- **Geometric progression (GP):** a list of numbers in which each term after the first is obtained by multiplying the previous term by a fixed number.
- **Common ratio (r):** the constant factor of a GP; $r = t_n \div t_{n-1}$.
- **Fractal:** a shape or pattern that repeats itself in a similar way to the whole.



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Solved Examples (NCERT)

Example 1: Terms from an explicit

Question: Find the first five terms of the sequence (i) $t_n = 3n - 4$, (ii) $t_n = 2 - 5n$, and (iii) $t_n = n^2 - 2n + 3$.

Solution: Substitute $n = 1, 2, 3, 4, 5$.

- (i) $3(1) - 4 = -1$, $3(2) - 4 = 2$, $3(3) - 4 = 5$, $3(4) - 4 = 8$, $3(5) - 4 = 11$.
- (ii) $2 - 5 = -3$, $2 - 10 = -8$, $2 - 15 = -13$, $2 - 20 = -18$, $2 - 25 = -23$.
- (iii) $1 - 2 + 3 = 2$, $4 - 4 + 3 = 3$, $9 - 6 + 3 = 6$, $16 - 8 + 3 = 11$, $25 - 10 + 3 = 18$.

Example 2: Checking whether num

Question: Determine whether 97 and 172 are terms of the sequence $t_n = 3n - 4$.

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Solution: For 97: $5n - 3 = 97$, so $5n = 100$ and $n = 20$. Since 20 is a natural number, 97 is a term (the 20th).

For 172: $5n - 3 = 172$, so $5n = 175$ and $n = 35$. Since 35 is a natural number, 172 is a term (the 35th).

Check: $t_{20} = 100 - 3 = 97$ and $t_{35} = 175 - 3 = 172$. Both numbers are terms.

Example 3: From a recursive rule to a term number (Exercise Set 8.1, Q5)

Question: A sequence is given by the recursive rule $t_1 = -5$, $t_{n+1} = t_n + 3$ for $n \geq 1$. Find the first five terms of the sequence. Is 52 a term of this sequence? If so, which term is it?

Solution: $t_1 = -5$, $t_2 = -5 + 3 = -2$, $t_3 = -2 + 3 = 1$, $t_4 = 1 + 3 = 4$, $t_5 = 4 + 3 = 7$. The first five terms are -5, -2, 1, 4, 7.

Each term is 3 more than the previous one. The recursive rule is $t_n = -5 + (n - 1) \times 3 = 3n - 8$.

Solve $3n - 8 = 52$: $3n = 60$, $n = 20$. So 52

Example 4: A decreasing AP and the term number

Question: Which term of the AP : 21, 18, 15, ... is -81? Give your answer.

Solution: $a = 21$, $d = 18 - 21 = -3$. So $t_n = 21 + (n - 1)(-3)$

For -81: $24 - 3n = -81$, so $3n = 105$ and $n = 35$.

For 0: $24 - 3n = 0$, so $3n = 24$ and $n = 8$. So the 8th term is 0.

Example 5: Finding a term from two terms

Question: An AP consists of 50 terms in which the 29th term is 106 and the 50th term is 1.

Solution: The last term is the 50th term. So

- $t_3 = a + 2d = 12 \dots (1)$
- $t_{50} = a + 49d = 106 \dots (2)$



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Subtract (1) from (2): $47d = 94$, so $d = 2$. Put $d = 2$ in (1): $a + 4 = 12$, so $a = 8$.

$t_{29} = a + 28d = 8 + 28 \times 2 = 8 + 56 = 64$. The 29th term is 64.

Example 6: Two-digit multiples of 3 and their sum (Exercise Set 8.2, Q5)

Question: How many 2-digit numbers are divisible by 3? What is the sum of all these 2-digit numbers?

Solution: The smallest 2-digit multiple of 3 is 12 and the largest is 99. They form the AP 12, 15, 18, ..., 99 with $a = 12$ and $d = 3$.

Number of terms: $12 + (n - 1) \times 3 = 99$, so $(n - 1) \times 3 = 87$, $n - 1 = 29$ and $n = 30$. There are 30 such numbers.

Sum: every term is 3 times a natural number from 4 to 33. So the sum is $3 \times (4 + 5 + \dots + 33) = 3 \times (S_{33} - S_3)$.

$S_{33} = 33 \times 34/2 = 561$ and $S_3 = 6$, so the sum is $3 \times (561 - 6) = 1680$.

Example 7: Salary with a fixed increase

Question: Harish started work at an annual salary of ₹20,000 each year. After how many years will his salary reach ₹7,00,000?

Solution: His yearly salaries form an AP: 20,000, 22,000, 24,000, ... with $a = 20,000$ and $d = 2,000$. His salary in the n th year is t_n .

Set $t_n = 7,00,000$: $(n - 1) \times 2,000 = 6,80,000$, so $n - 1 = 340$ and $n = 341$.

His salary is ₹7,00,000 in the 341st year of work.

Example 8: A GP term from another GP

Question: Find the 12th term of a GP with first term 3 and common ratio $\frac{1}{2}$.

Solution: $t_8 = ar^7 = a \times 2^7 = 128a = 192$, so $a = \frac{3}{2}$.

$t_{12} = ar^{11} = (3/2) \times 2^{11} = (3/2) \times 2048 = 3072$.

Shortcut: going from the 8th to the 12th term, the term is multiplied by $2^4 = 16$. So $t_{12} = 192 \times 16 = 3072$.



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Example 9: A recursive rule that hides a GP (Exercise Set 8.3, Q3)

Question: A sequence is given by the recursive rule $t_1 = 2$, $t_{n+1} = 3t_n - 2$ for $n \geq 1$. Which term of the sequence is 730?

Solution: Generate the terms:

- $t_2 = 3 \times 2 - 2 = 4$
- $t_3 = 3 \times 4 - 2 = 10$
- $t_4 = 3 \times 10 - 2 = 28$
- $t_5 = 3 \times 28 - 2 = 82$
- $t_6 = 3 \times 82 - 2 = 244$
- $t_7 = 3 \times 244 - 2 = 730$

So 730 is the 7th term.

Pattern behind it: subtract 1 from each term and divide by 2. $t_n = 3^{n-1} + 1$. Then $3^{n-1} + 1 = 730$ gives $3^{n-1} = 729$.

Example 10: The bouncing ball (Exercise 8.4, Q1)

Question: A ball is dropped from a height of 80 m. After each bounce it reaches 60% of the height from which it fell. It comes to rest after 5 bounces. (i) What height does it reach after the 5th bounce? (ii) What is the total vertical distance the ball has travelled?

Solution (i): The heights after each bounce are 48, 28.8, 17.28, 10.368, 6.2208, The height after the 5th bounce is $80 \times 0.07776 = 6.2208$ m.

Solution (ii): The ball falls 80 m before the first bounce, and the fall after the 5th bounce ends with the ball coming to rest.

- First fall: 80 m
- Bounces 1 to 5, up and down: $2 \times (48 + 28.8 + 17.28 + 10.368 + 6.2208) = 221.3376$ m

Total vertical distance = $80 + 221.3376 = 301.3376$ m.



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Example 11: Two conditions on an AP (End-of-Chapter Exercises, Q8)

Question: 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 of the AP.

Solution: $t_4 + t_8 = (a + 3d) + (a + 7d) = 2a + 10d = 24 \dots (1)$

$t_6 + t_{10} = (a + 5d) + (a + 9d) = 2a + 14d = 44 \dots (2)$

Subtract (1) from (2): $4d = 20$, so $d = 5$. From (1): $2a + 50 = 24$, so $2a = -26$ and $a = -13$.

The first three terms are $-13, -8, -3$. **Check:** $t_4 = 2, t_8 = 22$, sum 24; $t_6 = 12, t_{10} = 32$, sum 44.

Competency-Based Questions (with answers)

1. Case-based: Seats in the school

A school auditorium has 15 rows of seats. Each row has 3 more seats than the row in front of it.

(a) How many seats are in the 10th row? $30 + 3 \times 9 = 57$ seats.

(b) Which row has 59 seats? $30 + 3(n - 1) = 59$

(c) How many seats are there in all? Row 1 has 30 seats. Total seats = $30 + 3 \times (0 + 1 + 2 + \dots + 14) = 300 + 3 \times S_{14}$

2. Case-based: A message chain

At 9:00 a student sends a class notice to 2 friends. In each round, the notice in the previous round sends it to 2 more friends.

(a) How many new people receive the notice in the 10th round? This is a GP with $a = 2, r = 2$, so round n reaches 2^n people.

(b) In which round do more than 1000 new people receive the notice? $2^n > 1000$. Round 10 is the first round above 1000.



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(c) How many people have received the notice after 5 rounds, not counting the sender? $2 + 4 + 8 + 16 + 32 = 62$.

3. Source-based: Āryabhaṭa's rule

The first known written mention of the sum of natural numbers is in Āryabhaṭa's Āryabhaṭīya, Chapter 2, Verse 19. The second method in the verse says the sum can be found by taking the sum of the first and last terms, dividing by two, and multiplying by the number of terms.

(a) Use the rule to find $1 + 2 + \dots + 100$. $(1 + 100)/2 \times 100 = 50.5 \times 100 = 5050$.

(b) Use it to find $2 + 4 + 6 + \dots + 100$. There are 50 terms, so $(2 + 100)/2 \times 50 = 51 \times 50 = 2550$.

4. Source-based: Virahāṅka and poetic rhythm

The textbook states that Virahāṅka discovered the sequence 1, 2, 3, 5, 8, ... in the context of Prakrit meter and poetry. In such meters a line is built from short syllables (1 beat) and long syllables (2 beats).

(a) List all rhythms that fill exactly 3 beats.

(b) Explain why the number of rhythms for n beats is $V_n = V_{n-1} + V_{n-2}$. Every n -beat rhythm either ends with a short, the rest fills $n - 1$ beats, or it ends with a long, the rest fills $n - 2$ beats. This gives the recurrence relation $V_n = V_{n-1} + V_{n-2}$.

(c) How many rhythms fill 6 beats? The number of rhythms for 6 beats is $V_6 = V_5 + V_4 = 8 + 5 = 13$.

5. Assertion-Reason

Assertion (A): 471 is not a term of the sequence V_n .
Reason (R): The position n of a term must be a natural number.

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

Answer: (a). $5n - 2 = 471$ gives $n = 94.6$, which is not a natural number. R is exactly why A holds.



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6. Assertion-Reason

Assertion (A): The sequence 1, 4, 9, 16, 25, ... is an arithmetic progression.

Reason (R): Every term of the sequence is a perfect square.

Answer: (d). A is false: the differences 3, 5, 7, 9 are not constant. R is true, but being perfect squares has nothing to do with being an AP.

7. Assertion-Reason

Assertion (A): In the Sierpiński triangle, the number of black triangles increases from stage to stage while the black area decreases.

Reason (R): From one stage to the next, the number of black triangles is multiplied by 3 and the black area is multiplied by $3/4$.

Answer: (a). Multiplying by 3 (greater than 1) makes the count grow; multiplying by $3/4$ (between 0 and 1) makes the area shrink. R explains A.

8. Error analysis

A student writes: "The 20th term of the AP

(a) Find the error. The formula is $t_n = a + (n-1)d$, not $t_n = a + nd$. The student added 19 times, not 20.

(b) Give the correct answer. $t_{20} = 7 + 19 \times 3 = 65$.



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Important Questions for

1-Mark Questions

1. Find the common difference of the AP
2. Is 1, -1, 1, -1, 1, ... a geometric progression? If yes, find the common ratio. It is -1 times the previous one, so $r = -1$.
3. Write the 7th triangular number. $7 \times 8/2 = 28$
4. Write the n th term of the AP 2, 5, 8, 11, ...
5. Write the next two terms of 1, 2, 3, 5, 8, ...

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2-Mark Questions

1. Find the 10th and 26th terms of the AP: 3, 8, 13, 18, (Exercise Set 8.2, Q1) $a = 3, d = 5, t_n = 3 + 5(n - 1) = 5n - 2$. $t_{10} = 48$ and $t_{26} = 128$.
2. Find the n th term of the AP: 11, 8, 5, 2 ... Write the recursive rule for this AP. (Exercise Set 8.2, Q3) $a = 11, d = -3, t_n = 11 + (n - 1)(-3) = 14 - 3n$. Recursive rule: $t_1 = 11, t_n = t_{n-1} - 3$ for $n \geq 2$.
3. Which term of the sequence $t_n = 5n - 3$ for $n \geq 1$ is 607? (Exercise Set 8.1, Q4) $5n - 3 = 607$, so $5n = 610$ and $n = 122$. It is the 122nd term.
4. Find the 10th and n th terms of the GP: 5, 25, 125, (Exercise Set 8.3, Q2) $a = 5, r = 5$, so $t_n = 5 \times 5^{n-1} = 5^n$. $t_{10} = 5^{10} = 9765625$.
5. A child arranges marbles in rows so that the first row has 1 marble, the second has 2 marbles, the third has 3, and so on up to 25 rows. How many marbles does the child use in all? (Exercise Set 8.2, Q7) $1 + 2 + \dots + 25 = S_{25} = 25 \times 26/2 = 325$ marbles.

3-Mark Questions

1. Find the 31st term of an AP whose 11th term is 38 and 31st term is -32. (Exercises, Q1) $a + 10d = 38$ and $a + 30d = -32$. $t_{31} = a + 30d = -32 + 210 = 178$.
2. How many three-digit numbers are divisible by 7? The smallest is 105 (7×15) and the largest is 994. $105 + (n - 1) \times 7 = 994$ gives $(n - 1) \times 7 = 889$, $n - 1 = 127$, $n = 128$ numbers.
3. Find the smallest value of n such that the sum of the first n terms of the AP 45, 40, 35, ... is greater than 1,000. (End-of-Chapter Exercises, Q9) For $n = 44$: $44 \times 45 = 1980$, so $S_{44} = 990$. For $n = 45$: $1035 > 1000$. The smallest n is 45.
4. Which term of the GP: 2, 8, 32, ... is 131072? Write the recursive formula for the n th term. (End-of-Chapter Exercises, Q10) $2 \times 4^{n-1} = 131072$ gives $4^{n-1} = 65536$, $n - 1 = 8$, $n = 9$. $t_1 = 2, t_n = 4t_{n-1}$ for $n \geq 2$.



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5-Mark Questions

- Find a GP for which the sum of the first two terms is -4 and the fifth term is 4 times the third term. (End-of-Chapter Exercises, Q5)** Let the terms be $a, ar, ar^2, \dots$. The fifth term is 4 times the third: $ar^4 = 4ar^2$. Since $a \neq 0$ and $r \neq 0$, divide by ar^2 : $r^2 = 4$, so $r = 2$ or $r = -2$. Sum of first two terms: $a + ar = a(1 + r) = -4$. If $r = 2$: $3a = -4$, $a = -4/3$, giving the GP $-4/3, -8/3, -16/3, -32/3, \dots$. If $r = -2$: $-a = -4$, $a = 4$, giving the GP $4, -8, 16, -32, 64, \dots$. Check the second: $4 + (-8) = -4$ and the fifth term $64 = 4 \times 16$. Both GPs satisfy the conditions.
- Based on Exercise Set 8.3, Q7: the Sierpiński square carpet.** Stage 0 is a square of area 1 square unit. For Stage 1, each side is trisected, the points of trisection of opposite sides are joined to make nine smaller squares, and the centre square is removed, leaving 8. The process is repeated on every remaining square. Find the number of squares and the area at Stages 0 to 5, the explicit and recursive formulas for each, and what happens to the area as n increases.
Answer: Each square becomes 8 at the next stage, so the counts are 1, 8, 64, 512, 4096, 32768. Explicit: $t_n = 8^n$; recursive: $t_0 = 1, t_n = 8t_{n-1}$ for $n \geq 1$. Each stage keeps 8 of 9 equal parts, so the areas are 1, $8/9$, $64/81$, $512/729$, $4096/6561$, $32768/59049$. recursive: $s_0 = 1, s_n = (8/9) \times s_{n-1}$ for $n \geq 1$. The area is shrinking towards 0 while the number of squares is increasing.



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Common Mistakes and Ex

- Writing $a + nd$ instead of $a + (n - 1)d$.** The first term is only $n - 1$ times. Test your formula on $n = 1$.
- Accepting a decimal position.** If solving for n , write the reason: " n is not a natural number".
- A recursive rule without its starting term.** Write $t_1 = \dots$ and the range, for example $n \geq 1$.
- Getting the sign of d wrong in a decreasing AP.** The earlier term from the later term, never the other way round.
- Calling a sequence an AP after checking only one difference.** Check at least three differences, and the common difference must be the same.
- Writing ar^n for the n th term of a GP.** The first term is a . Check: $t_1 = ar^0 = a$.
- Subtracting the wrong partial sum.** The sum of the first n terms is S_n , not S_{n-1} .

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8. **Counting terms as (last – first)/d.** From 12 to 99 in steps of 3 there are $(99 - 12)/3 + 1 = 30$ terms. Forgetting the +1 loses one term.
9. **Using the wrong limits in “between” and “three-digit” questions.** For multiples of 4 between 10 and 250, the first is 12 and the last is 248, giving 60 multiples. For three-digit multiples of 7, start at 105, not 100 or 7.
10. **Stage 0 versus Stage 1 in fractal questions.** In the Sierpiński triangle the stages start at 0, so Stage n has 3^n triangles, not 3^{n-1} . Read which stage the question calls the start.

Quick Revision Points

- A sequence is an ordered list of numbers; each number is a term.
- Explicit rule: term from position n . Recursive rule: term from earlier terms plus a starting value.
- To test if x is a term, solve $t_n = x$; x is a term only if n is a natural number.
- Virahāṅka sequence: 1, 2, 3, 5, 8, 13, 21, ...; 7th century CE.
- AP: add a fixed d . $t_n = a + (n - 1)d$; recursive rule: $t_n = t_{n-1} + d$.
- Plotting (n, t_n) for an AP gives points on a straight line.
- Number of terms from a to l : $(l - a)/d + 1$.
- $S_n = 1 + 2 + \dots + n = n(n + 1)/2$, proved by Gauss.
- Āryabhaṭa (Āryabhaṭīya, Chapter 2, Verse 24) gave the formula for the sum of squares of the first n terms.
- Sum from m to $n = S_n - S_{m-1}$.
- GP: multiply by a fixed r . $t_n = ar^{n-1}$; recursive rule: $t_n = r t_{n-1}$.
- $r > 1$: terms grow fast; $0 < r < 1$: terms shrink.
- Plotting (n, t_n) for a GP gives points on a curve.
- Sierpiński triangle: 3^n triangles, area $(3/4)^n$ of the original.
- Tower of Hanoi with n discs: $M_n = 2M_{n-1} + 1$.



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Weightage and Exam Pattern

Class 9 has no board exam. This chapter is assessed in school exams: periodic tests, the half-yearly exam and the annual exam. In the CBSE Class IX Mathematics course structure for 2026-27, Sequences and Progressions is one of four chapters in **Unit II, Algebra, which carries 20 marks** out of the 80-mark theory paper and is allotted 66 teaching periods in total. The course structure does not split the 20 marks chapter by chapter. The remaining 20 marks of the year are internal assessment (pen-paper tests and multiple assessment 10, portfolio 5, lab practical 5).

Unit	Marks (out of 80)
I. Number System	07
II. Algebra (includes Sequences and Progressions)	20
III. Coordinate Geometry	04
IV. Geometry	
V. Mensuration	
VI. Statistics and Probability	

The course structure asks students to find, visualise APs and GPs, analyse fractals and papers test these through membership chart-based questions on growing patterns or for the n th term formula $t_n = a + (n - 1)d$ and t until they are automatic.



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