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Mock karo. Rank karo. Selection lao.

ADVANCED QUANT SHORT TRICKS & MASTER REFERENCE

For SSC CGL / CHSL / MTS • RRB NTPC / Group D • Banking & Other Competitive Exams

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1. How to Use This Guide

This reference is built specifically for SSC (CGL/CHSL/MTS/GD) and RRB (NTPC/Group D/ALP) Quantitative Aptitude sections, where 20–25 questions must typically be solved in 15–20 minutes. Every trick below trades a slow textbook method for a faster mental-math route.

- Formula boxes highlight the exact rule to memorize.
- Every trick includes a worked example — do it once on paper, then try it mentally.
- Practice each trick with 10 fresh numbers before your next mock test.
- Reference tables at the end (squares, cubes, powers, factorials) should be memorized gradually, not crammed in one sitting — revise 2 tables a day.

2. Vedic Squaring Shortcuts

2.1 Squares of numbers ending in 5

If $N = (a5)^2$, then $N^2 = [a \times (a+1)]$ followed by 25

Example: $35^2 \rightarrow a = 3 \rightarrow 3 \times 4 = 12 \rightarrow \text{answer} = 1225$. Similarly $85^2 \rightarrow 8 \times 9 = 72 \rightarrow 7225$.

2.2 Squaring any number near a base (10, 100, 1000...)

$N^2 = (N + d) \times (N - d) + d^2$, choosing d so that $N \pm d$ is the nearest base

Example: 98^2 : base 100, $d = -2 \rightarrow (98-2)(100) + (-2)^2 = 96 \times 100 + 4 = 9604$. For 103^2 : $d = +3 \rightarrow (106)(100) + 9 = 10609$.

2.3 Duplex method (general squaring, any 2-digit number)

For $N = 'ab'$: $N^2 = a^2 \mid 2ab \mid b^2$ (carry over tens digit to the left column)

Example: $47^2 \rightarrow a=4, b=7 \rightarrow 16 \mid 56 \mid 49 \rightarrow \text{write } 9, \text{ carry } 4 \rightarrow 16 \mid 56+4=60 \rightarrow \text{write } 0, \text{ carry } 6 \rightarrow 16+6=22 \rightarrow 2209$.

3. Vedic Multiplication Shortcuts

3.1 Nikhilam method — both numbers near the same base

For numbers near base B: Answer = $(N1 + \text{deviation}2) \times B$ concatenated with $(\text{deviation}1 \times \text{deviation}2)$

Example: 97×96 (base 100): deviations $-3, -4 \rightarrow$ left part $= 97 - 4 = 93$ (or $96 - 3 = 93$) $\rightarrow$ right part $= (-3) \times (-4) = 12 \rightarrow$ answer $= 9312$.

Example: 103×104 (base 100): deviations $+3, +4 \rightarrow$ left $= 107 \rightarrow$ right $= 12 \rightarrow$ answer $= 10712$.

3.2 Criss-cross (Urdhva Tiryagbhyam) — any 2-digit $\times$ 2-digit

'ab' $\times$ 'cd' = $(a \times c) \mid (a \times d + b \times c) \mid (b \times d)$, carrying leftwards as needed

Example: $23 \times 46 \rightarrow$ units: $3 \times 6 = 18$ (write 8, carry 1) $\rightarrow$ cross: $2 \times 6 + 3 \times 4 = 24$, $+1$ carry $= 25$ (write 5, carry 2) $\rightarrow$ tens: $2 \times 4 = 8$, $+2$ carry $= 10 \rightarrow$ answer 1058.

3.3 Multiplying by 11, 12, 15 mentally

- $\times 11$: add each pair of adjacent digits, carry when ≥ 10 . E.g. 253×11 : $2 \mid 2+5 \mid 5+3 \mid 3 = 2 \mid 7 \mid 8 \mid 3 = 2783$.
- $\times 15$: $N \times 15 = N \times 10 + N \times 5 = N \times 10 + N \times 10 / 2$. E.g. $48 \times 15 = 480 + 240 = 720$.
- $\times 5$: $N \times 5 = N \times 10 / 2$. E.g. $86 \times 5 = 860 / 2 = 430$.
- $\times 25$: $N \times 25 = N \times 100 / 4$. E.g. $36 \times 25 = 3600 / 4 = 900$.

4. Division & Remainder Shortcuts

4.1 Quick division near a base (Nikhilam division)

To divide N by a divisor close to 10, 100 etc., use the complement of the divisor from the base as a running multiplier — fastest for divisors like 9, 98, 997. Practice this only after mastering squaring/multiplication tricks above, since exam questions rarely need full Nikhilam division — they need the remainder.

4.2 Finding remainders using cyclicity (for unit digit / mod questions)

Remainder of $a^b \div m$: reduce the base mod m first, then use cyclicity of powers to shrink the exponent

Example: Remainder of $7^{25} \div 5$: $7 \bmod 5 = 2$. Powers of 2 mod 5 cycle as 2, 4, 3, 1 (period 4). $25 \bmod 4 = 1 \rightarrow$ remainder = 2.

4.3 Divisibility by 7, 11, 13 together (useful for 1001 trick)

$1001 = 7 \times 11 \times 13$. For a 6-digit number, split into two 3-digit blocks and subtract; if the result is divisible by 7, 11 or 13, the original number is too.

Example: $637000 + 637$ pattern: $637637 \div 7 = 91091$ exactly, since $637637 = 637 \times 1001$.

5. Number System — Divisibility & Digital Sum

5.1 Divisibility rules

Divisor	Rule
2	Last digit even
3	Sum of digits divisible by 3
4	Last 2 digits divisible by 4
5	Last digit is 0 or 5
6	Divisible by both 2 and 3
7	Double the last digit, subtract from the rest; result divisible by 7
8	Last 3 digits divisible by 8
9	Sum of digits divisible by 9
10	Last digit is 0
11	(Sum of digits at odd places) – (sum at even places) is 0 or divisible by 11
12	Divisible by both 3 and 4
13	Add $4 \times (\text{last digit})$ to the rest, repeat till 2-digit; check divisibility by 13

5.2 Digital sum (Navashesh) rules

- Repeatedly add digits until a single digit (0–9) remains — this is the number's remainder when divided by 9 (with 9 itself representing 0).
- A number is divisible by 9 exactly when its digital sum is 9 (or the number is 0).
- Digital sum is unaffected by digit reversal — useful for quickly checking calculation errors: LHS and RHS of an equation must have matching digital sums after the same operation.
- Use digital sum to verify multiplication instantly: $\text{digital-sum}(a) \times \text{digital-sum}(b)$ should reduce to $\text{digital-sum}(a \times b)$.

Example: Check $234 \times 56 = 13104$: digital sum of $234 \rightarrow 9 \rightarrow 0$, $56 \rightarrow 11 \rightarrow 2$; $0 \times 2 = 0$. Digital sum of $13104 = 1+3+1+0+4 = 9 \rightarrow 0$. Matches $\rightarrow$ answer likely correct.

6. Unit Digit Cyclicity

The unit digit of a^n repeats in a cycle. Reduce the exponent modulo the cycle length, then read off the digit.

Base digit	Cycle of unit digits	Cycle length
0	0	1
1	1	1
2	2,4,8,6	4
3	3,9,7,1	4
4	4,6	2
5	5	1
6	6	1
7	7,9,3,1	4
8	8,4,2,6	4
9	9,1	2

Example: Unit digit of 47^{31} : base digit 7, cycle length 4. $31 \bmod 4 = 3 \rightarrow 3\text{rd term in } (7,9,3,1) = 3$.

7. LCM & HCF Shortcuts

$\text{LCM}(a,b) \times \text{HCF}(a,b) = a \times b$ (true only for two numbers)

$\text{HCF of fractions} = \text{HCF}(\text{numerators}) / \text{LCM}(\text{denominators})$
 $\text{LCM of fractions} = \text{LCM}(\text{numerators}) / \text{HCF}(\text{denominators})$

- To find HCF fast: apply the Euclidean algorithm — repeatedly replace the larger number with the remainder of (larger $\div$ smaller) until remainder is 0.
- 'Greatest number that divides x, y, z leaving the same remainder r' $\rightarrow$ find HCF of $(x-r)$, $(y-r)$, $(z-r)$.
- 'Greatest number that divides x, y, z leaving remainders r1, r2, r3' $\rightarrow$ find HCF of $(x-r1)$, $(y-r2)$, $(z-r3)$.
- 'Smallest number which when divided by x, y, z leaves remainder r in each case' $\rightarrow \text{LCM}(x,y,z) + r$.
- 'Smallest number which when divided by x, y, z leaves deficient remainder d (i.e. remainder = divisor - d) each time' $\rightarrow \text{LCM}(x,y,z) - d$.

Example: Euclid: $\text{HCF}(84,30)$: $84=2 \times 30+24 \rightarrow 30=1 \times 24+6 \rightarrow 24=4 \times 6+0 \rightarrow \text{HCF}=6$.

8. Fraction ↔ Percentage Master Table

Memorizing this table converts percentage-heavy DI and arithmetic questions into simple fraction multiplication — the single highest-leverage shortcut for SSC/RRB quant.

1/2	50%	1/3	33.33%	1/4	25%	1/5	20%
1/6	16.67%	1/7	14.29%	1/8	12.5%	1/9	11.11%
1/10	10%	1/11	9.09%	1/12	8.33%	1/13	7.69%
1/14	7.14%	1/15	6.67%	1/16	6.25%	1/17	5.88%
1/18	5.56%	1/19	5.26%	1/20	5%	1/25	4%
2/3	66.67%	3/4	75%	2/5	40%	3/5	60%
4/5	80%	3/8	37.5%	5/8	62.5%	7/8	87.5%
3/10	30%	7/10	70%	9/10	90%	3/20	15%
7/20	35%	9/20	45%	11/20	55%	13/20	65%
17/20	85%	19/20	95%	1/50	2%	3/50	6%

9. Percentage Shortcuts

9.1 Successive percentage change

Net % change = $a + b + (a \times b)/100$ (use negative sign for a decrease)

Example: Price rises 20% then falls 10%: $net = 20 - 10 + (20 \times -10)/100 = 10 - 2 = 8\%$ increase.

9.2 Product-constant rule (price $\times$ consumption = constant)

If price increases by $r\%$, consumption must reduce by $[r/(100+r)] \times 100\%$ to keep expenditure constant

Example: Price rises 25% $\rightarrow$ reduce consumption by $25/125 \times 100 = 20\%$ to keep spend unchanged.

9.3 Percentage point vs percentage change

If a rate moves from 20% to 25%, that is a 5 percentage-point rise but a $(5/20) \times 100 = 25\%$ relative increase. SSC/RRB questions frequently test this distinction — read the question wording carefully.

10. Profit, Loss & Discount Shortcuts

$$\text{Profit}\% = (\text{SP} - \text{CP}) / \text{CP} \times 100 \quad | \quad \text{Loss}\% = (\text{CP} - \text{SP}) / \text{CP} \times 100$$

$$\text{SP} = \text{CP} \times (100 \pm \text{profit/loss \%}) / 100 \quad | \quad \text{CP} = \text{SP} \times 100 / (100 \pm \%)$$

10.1 Successive discounts

$$\text{Effective single discount} = a + b - (a \times b) / 100$$

Example: 30% then 10% off: effective = $30 + 10 - (30 \times 10) / 100 = 40 - 3 = 37\%$.

10.2 False weight shortcut

$$\text{Profit}\% \text{ (using false weight w instead of true weight, selling at cost price)} = [(\text{True} - \text{False}) / \text{False}] \times 100$$

Example: Shopkeeper uses 900g for 1kg: profit% = $(1000 - 900) / 900 \times 100 = 11.11\%$.

11. Simple & Compound Interest Shortcuts

$$SI = P \times R \times T / 100$$

$$CI (n \text{ years}) = P \times [(1 + R/100)^n - 1]$$

11.1 CI – SI relation (very frequently tested)

$$\text{For 2 years: } CI - SI = P \times (R/100)^2 \quad \text{For 3 years: } CI - SI = P \times (R/100)^2 \times (3 + R/100)$$

Example: $P = ₹20,000$, $R = 10\%$, 2 yrs: $CI - SI = 20000 \times (0.1)^2 = ₹200$.

11.2 Using the fraction-percentage table for CI

Convert $R\%$ to its fraction form from Section 8, then compound the fraction instead of decimals — far faster mentally. E.g. $R = 25\% \rightarrow$ use $1/4$: Amount after 2 yrs $= P \times (5/4)^2 = P \times 25/16$.

12. Ratio, Proportion & Partnership

Componendo-Dividendo: if $a/b = c/d$, then $(a+b)/(a-b) = (c+d)/(c-d)$

12.1 Partnership shortcut

Profit share ratio = $(\text{Capital1} \times \text{Time1}) : (\text{Capital2} \times \text{Time2}) : \dots$

Example: A invests ₹5000 for 12 months, B invests ₹6000 for 8 months $\rightarrow$ ratio = $5000 \times 12 : 6000 \times 8 = 60000 : 48000 = 5:4$.

12.2 Mixing/splitting a given ratio into a total

To split a total T in ratio a:b:c, each part = $T \times (\text{respective term}) / (a+b+c)$. Precompute (a+b+c) first, then use the fraction table from Section 8 if it matches a familiar fraction.

13. Average Shortcuts

Average = Sum of observations / Number of observations

13.1 Change in average when one value is replaced

New value = Old value + $n \times$ (change in average), where n = number of items

Example: Average of 10 numbers increases by 3 when one number is replaced $\rightarrow$ new number = old number + 10×3 = old + 30.

13.2 Average speed for equal distances

Average speed = $2xy / (x + y)$, for two equal legs travelled at speeds x and y

Example: Going at 40 km/h, returning at 60 km/h over the same route: avg speed = $2 \times 40 \times 60 / (40 + 60) = 4800 / 100 = 48$ km/h.

14. Mixture & Alligation

Alligation rule: $(\text{Quantity of cheaper})/(\text{Quantity of dearer}) = (\text{Dearer price} - \text{Mean price})/(\text{Mean price} - \text{Cheaper price})$

Example: Mix tea at ₹60/kg with tea at ₹80/kg to get a mix worth ₹75/kg: ratio = $(80-75):(75-60) = 5:15 = 1:3$ (cheaper:dearer).

14.1 Repeated dilution formula

After n replacements of volume x from a vessel of volume V with water: $\text{Final concentration} = \text{Initial} \times [(V-x)/V]^n$

Example: 10L milk, 2L replaced by water twice: remaining milk fraction = $(8/10)^2 = 0.64 \rightarrow 6.4\text{L}$ milk left.

15. Time & Work / Pipes & Cisterns

15.1 LCM (efficiency) method — fastest approach for SSC/RRB

- Assume total work = LCM of all given days (avoids fractions entirely).
- Efficiency of each worker = Total work / days taken.
- Combined efficiency = sum of individual efficiencies; time = Total work / combined efficiency.

Example: A finishes a job in 12 days, B in 18 days. Take total work = $LCM(12, 18) = 36$ units. A's efficiency = 3/day, B's = 2/day. Together = 5/day $\rightarrow$ time = $36/5 = 7.2$ days.

15.2 Pipes and cisterns — same method, outlet pipes negative

Treat an inlet pipe's efficiency as positive, an outlet (leak) pipe's as negative, then apply the same LCM method

Example: Pipe fills tank in 10 hrs (+), leak empties in 15 hrs (-). Total work = $LCM(10, 15) = 30$. Net efficiency = $3 - 2 = 1/\text{hr} \rightarrow$ tank fills in 30 hrs.

16. Time, Speed & Distance

km/hr to m/s: multiply by $\frac{5}{18}$ | m/s to km/hr: multiply by $\frac{18}{5}$

16.1 Trains

- Time to cross a stationary object of negligible length = $(\text{length of train})/(\text{speed})$.
- Time to cross a platform/bridge = $(\text{length of train} + \text{length of platform})/(\text{speed})$.
- Two trains crossing each other, opposite directions: time = $(\text{sum of lengths})/(\text{sum of speeds})$.
- Two trains, same direction: time = $(\text{sum of lengths})/(\text{difference of speeds})$.

16.2 Boats and streams

**Downstream speed = boat speed + stream speed
Upstream speed = boat speed – stream speed
Boat speed = $(\text{downstream} + \text{upstream})/2$ | Stream speed = $(\text{downstream} - \text{upstream})/2$**

16.3 Relative speed for meeting/catching-up problems

- Moving towards each other: relative speed = sum of speeds.
- Moving in the same direction: relative speed = difference of speeds.
- Circular track, same start point: time to meet again at start = LCM of individual lap times.

17. Algebra Identity Shortcuts

Identity
$(a+b)^2 = a^2 + 2ab + b^2$
$(a-b)^2 = a^2 - 2ab + b^2$
$a^2 - b^2 = (a+b)(a-b)$
$(a+b)^3 = a^3 + b^3 + 3ab(a+b)$
$(a-b)^3 = a^3 - b^3 - 3ab(a-b)$
$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$
If $a+b+c=0$, then $a^3 + b^3 + c^3 = 3abc$
$a^2 + b^2 = (a+b)^2 - 2ab = (a-b)^2 + 2ab$

These identities repeatedly appear disguised in SSC quant as 'find $x+1/x$ given x^2+1/x^2 ' style questions. Master converting between $(x+1/x)$, $(x-1/x)$, (x^2+1/x^2) , and (x^3+1/x^3) using the identities above.

18. Exam-Day Strategy & Time Allocation

- Attempt calculation-light topics first: number system, simplification, percentage, averages — these are typically the fastest marks.
- Flag and skip lengthy DI/geometry questions on the first pass; return only if time remains.
- Never do long division on paper if a fraction shortcut (Section 8) applies instead.
- For 'find approx. value' questions, round aggressively — approximate options are usually spaced far enough apart that rounding is safe.
- In the last 2 minutes, ensure every question has some answer marked (there is no advantage in blank responses when there's no negative-marking-adjusted benefit to skipping over guessing among 2 close options).
- Revise the multiplication tables, squares, and cubes in this document every morning for 10 minutes during the final month before the exam — recall speed matters more than method knowledge under time pressure.

19. Reference Tables

19.1 Squares (2–60)

2	4	3	9	4	16	5	25	6	36
7	49	8	64	9	81	10	100	11	121
12	144	13	169	14	196	15	225	16	256
17	289	18	324	19	361	20	400	21	441
22	484	23	529	24	576	25	625	26	676
27	729	28	784	29	841	30	900	31	961
32	1024	33	1089	34	1156	35	1225	36	1296
37	1369	38	1444	39	1521	40	1600	41	1681
42	1764	43	1849	44	1936	45	2025	46	2116
47	2209	48	2304	49	2401	50	2500	51	2601
52	2704	53	2809	54	2916	55	3025	56	3136
57	3249	58	3364	59	3481	60	3600		

19.2 Cubes (2–25)

2	8	3	27	4	64	5	125
6	216	7	343	8	512	9	729
10	1000	11	1331	12	1728	13	2197
14	2744	15	3375	16	4096	17	4913
18	5832	19	6859	20	8000	21	9261
22	10648	23	12167	24	13824	25	15625

19.3 Factorials (1–20)

1	1	2	2
3	6	4	24
5	120	6	720
7	5040	8	40320
9	362880	10	3628800
11	39916800	12	479001600
13	6227020800	14	87178291200
15	1307674368000	16	20922789888000
17	355687428096000	18	6402373705728000

19	121645100408 832000	20	243290200817 6640000
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19.4 Powers of 2, 3

2^1	2	2^2	4	2^3	8	2^4	16
2^5	32	2^6	64	2^7	128	2^8	256
2^9	512	2^{10}	1024	2^{11}	2048	2^{12}	4096
2^{13}	8192	2^{14}	16384	2^{15}	32768	2^{16}	65536
2^{17}	131072	2^{18}	262144	2^{19}	524288	2^{20}	1048576

3^1	3	3^2	9	3^3	27
3^4	81	3^5	243	3^6	729
3^7	2187	3^8	6561	3^9	19683
3^{10}	59049	3^{11}	177147	3^{12}	531441
3^{13}	1594323	3^{14}	4782969	3^{15}	14348907

19.5 Powers of 5, 7, 9 (selected: 1–12)

5^1	5	5^2	25	5^3	125
5^4	625	5^5	3125	5^6	15625
5^7	78125	5^8	390625	5^9	1953125
5^{10}	9765625	5^{11}	48828125	5^{12}	244140625

7^1	7	7^2	49	7^3	343
7^4	2401	7^5	16807	7^6	117649
7^7	823543	7^8	5764801	7^9	40353607
7^{10}	282475249	7^{11}	1977326743	7^{12}	13841287201

9^1	9	9^2	81	9^3	729
9^4	6561	9^5	59049	9^6	531441
9^7	4782969	9^8	43046721	9^9	387420489
9^{10}	3486784401	9^{11}	31381059609	9^{12}	282429536481

20. Multiplication Tables (11–31)

11×1=11	11×2=22	11×3=33	11×4=44	11×5=55	11×6=66	11×7=77	11×8=88	11×9=99	11×10=110
12×1=12	12×2=24	12×3=36	12×4=48	12×5=60	12×6=72	12×7=84	12×8=96	12×9=108	12×10=120
13×1=13	13×2=26	13×3=39	13×4=52	13×5=65	13×6=78	13×7=91	13×8=104	13×9=117	13×10=130
14×1=14	14×2=28	14×3=42	14×4=56	14×5=70	14×6=84	14×7=98	14×8=112	14×9=126	14×10=140
15×1=15	15×2=30	15×3=45	15×4=60	15×5=75	15×6=90	15×7=105	15×8=120	15×9=135	15×10=150
16×1=16	16×2=32	16×3=48	16×4=64	16×5=80	16×6=96	16×7=112	16×8=128	16×9=144	16×10=160
17×1=17	17×2=34	17×3=51	17×4=68	17×5=85	17×6=102	17×7=119	17×8=136	17×9=153	17×10=170
18×1=18	18×2=36	18×3=54	18×4=72	18×5=90	18×6=108	18×7=126	18×8=144	18×9=162	18×10=180
19×1=19	19×2=38	19×3=57	19×4=76	19×5=95	19×6=114	19×7=133	19×8=152	19×9=171	19×10=190
20×1=20	20×2=40	20×3=60	20×4=80	20×5=100	20×6=120	20×7=140	20×8=160	20×9=180	20×10=200
21×1=21	21×2=42	21×3=63	21×4=84	21×5=105	21×6=126	21×7=147	21×8=168	21×9=189	21×10=210
22×1=22	22×2=44	22×3=66	22×4=88	22×5=110	22×6=132	22×7=154	22×8=176	22×9=198	22×10=220
23×1=23	23×2=46	23×3=69	23×4=92	23×5=115	23×6=138	23×7=161	23×8=184	23×9=207	23×10=230
24×1=24	24×2=48	24×3=72	24×4=96	24×5=120	24×6=144	24×7=168	24×8=192	24×9=216	24×10=240
25×1=25	25×2=50	25×3=75	25×4=100	25×5=125	25×6=150	25×7=175	25×8=200	25×9=225	25×10=250
26×1=26	26×2=52	26×3=78	26×4=104	26×5=130	26×6=156	26×7=182	26×8=208	26×9=234	26×10=260
27×1=27	27×2=54	27×3=81	27×4=108	27×5=135	27×6=162	27×7=189	27×8=216	27×9=243	27×10=270
28×1=28	28×2=56	28×3=84	28×4=112	28×5=140	28×6=168	28×7=196	28×8=224	28×9=252	28×10=280
29×1=29	29×2=58	29×3=87	29×4=116	29×5=145	29×6=174	29×7=203	29×8=232	29×9=261	29×10=290
30×1=30	30×2=60	30×3=90	30×4=120	30×5=150	30×6=180	30×7=210	30×8=240	30×9=270	30×10=300
31×1=31	31×2=62	31×3=93	31×4=124	31×5=155	31×6=186	31×7=217	31×8=248	31×9=279	31×10=310