Simple & Compound Interest

~ Quantitative Aptitude · SSC Exams ~

← circled = key formulas!

Simple Interest grows the **same** amount every year. Compound Interest grows on the interest earned too — it snowballs. Master both formulas & the CI–SI tricks — SSC loves this chapter.

① Simple Interest – the Basics

Master formula

- **SI = P×R×T / 100** (P = Principal, R = rate % p.a., T = time in years)
- **Amount (A) = P + SI**

Worked example – P = ₹6000, R = 8%, T = 3 yrs

Step 1 — SI = 6000×8×3 / 100 = 144000 / 100.

Step 2 — SI = **₹1440**.

Answer → Amount = 6000 + 1440 = **₹7440**. ✅

Back-calculating P, R or T

P = **100×SI / R×T** R = **100×SI / P×T** T = **100×SI / P×R**

In the SI formula you are just calculating **(T×R)%** of P. For T = 4yrs 3 months, use T = 4.25 (convert months to a fraction of a year first).

② SI – Growth & "Times" Tricks

SI is the **same every year** — it grows in a straight line. That single fact powers most SI shortcuts.

Linear-growth rule

- SI for 1 year = (total SI) / (number of years). e.g. SI = ₹400 for 4 yrs ∴ SI for 2 yrs = **₹200**.
- Sum becomes **n times** itself in T years at SI ⇒ **$T = (n-1)\times 100 / R$**

Worked example — sum doubles in 8 years, find rate

Step 1 — $n = 2$ ∴ $T = (2-1)\times 100 / R = 100/R$.
Step 2 — $8 = 100/R$.
Answer → $R = 100/8 =$ **12.5%**. ✅

Worked example — sum triples in 20 years, find rate

Step 1 — $n = 3$ ∴ $T = (3-1)\times 100 / R = 200/R$.
Answer → $20 = 200/R$ ∴ $R =$ **10%**. ✅

Try these

Doubles in 10 yrs → R = **10%**

Quadruples in 15 yrs → R = **20%**

R=5%, becomes 6× in — **100 yrs**

SI=₹900 in 6 yrs → 1-yr SI=**₹150**

✓ "Doubles" means SI = P itself (since A = 2P). So T = 100/R is the fastest one-line check — no need to derive it each time.

③ Compound Interest – the Basics

In CI, interest is added to the principal **every period**, and next period's interest is calculated on this new, bigger amount.

Master formula (annual compounding)

- **Amount $A = P(1 + R/100)^n$** (n = number of years)
- **$CI = A - P$**

Worked example – P = ₹10,000, R = 10%, n = 2 yrs

Step 1 — $A = 10000 \times (1.1)^2 = 10000 \times 1.21$.
Step 2 — A = **₹12,100**.
Answer → $CI = 12100 - 10000$ = **₹2,100**. ✅

Compare with SI on the same sum

$SI = 10000 \times 10 \times 2 / 100$ = **₹2,000**. CI (₹2100) is ₹100 **more** — that extra ₹100 is "interest on interest" (year-1's ₹1000 interest earning 10% again).

For **n = 1 year**, CI = SI always – no compounding has happened yet. The gap only starts from year 2 onward.

✓ CI ≥ SI always (for $n \geq 1$, same P, R). This is the single most-tested idea in this chapter.

④ Compounding Frequency

The **more often** interest compounds, the **higher** the amount — same annual rate, different result.

Frequency	Rate per period	No. of periods	Amount
Annual	R	n	$P(1+R/100)^n$
Half-yearly	$R/2$	$2n$	$P(1+R/200)^{2n}$
Quarterly	$R/4$	$4n$	$P(1+R/400)^{4n}$
Monthly	$R/12$	$12n$	$P(1+R/1200)^{12n}$

Worked example — P=₹8000, R=10% p.a., 1 yr, half-yearly

Step 1 — rate/period = 5%, periods = 2. $A = 8000 \times (1.05)^2$.
Step 2 — $A = 8000 \times 1.1025 =$ **₹8,820**.
Answer → CI = **₹820** (annual compounding would give only ₹800). ✅

Try this

P=₹10,000, R=8% p.a., quarterly, for 6 months: rate/qtr=2%, periods=2.
$A=10000\times(1.02)^2=10000\times1.0404=$**₹10,404** ∴ CI=**₹404**.

💡 Golden rule → always **divide the rate** and **multiply the time** by the same factor (2 for half-yearly, 4 for quarterly).

⑤ CI for 2 & 3 Years – Direct Formulas

Skip the full expansion — use these ready-made formulas (let $r = R/100$):

Two-year & three-year CI

- **$CI\ (2\ yr) = P \cdot r(2+r)$** i.e. $P[2R/100 + (R/100)^2]$
- **$CI\ (3\ yr) = P \cdot r(3+3r+r^2)$** i.e. $P[3R/100 + 3(R/100)^2 + (R/100)^3]$

Worked example – P=₹8000, R=10%, find CI for 2 yrs & 3 yrs

Step 1 — $r = 0.1$. $CI2 = 8000 \times 0.1 \times (2.1) = 800 \times 2.1 =$ **₹1,680**.

Step 2 — $CI3 = 8000 \times 0.1 \times (3+0.3+0.01) = 800 \times 3.31 =$ **₹2,648**.

Answer → CI2 = **₹1,680**, CI3 = **₹2,648**. ✅

Check by direct method (always works)

$A(2yr) = 8000 \times (1.1)^2 = 9680 \rightarrow CI =$ **1680** ✓

$A(3yr) = 8000 \times (1.1)^3 = 8000 \times 1.331 = 10648 \rightarrow CI =$ **2648** ✓

💡 *If R has an ugly value, just expand $A = P(1+r)^n$ directly – the shortcut formulas save time mainly when R is a round number.*

⑥ CI – SI – The Difference Formulas ⚖

Very high-frequency SSC formulas — memorise both, letting $r = R/100$:

Memorise these two

- **$CI - SI$ (2 yr) $= P \times (R/100)^2$**
- **$CI - SI$ (3 yr) $= P \times (R/100)^2 \times (3 + R/100)$**

Worked — 2-yr diff, P=₹25,000, R=4%

Diff $= 25000 \times (0.04)^2 = 25000 \times 0.0016 =$ **₹40**. (Check: SI2=2000, CI2=2040, diff=40 ✓) ✅

Worked — 3-yr diff, P=₹8000, R=10%

Diff $= 8000 \times (0.1)^2 \times (3.1) = 8000 \times 0.01 \times 3.1 =$ **₹248**. (Check: SI3=2400, CI3=2648 ✓) ✅

Bonus — the 2-year ratio shortcut

CI2 / SI2 = (200+R) / 200. e.g. R=10% → ratio = 210/200 = 1.05 ∴ if SI2=₹2000, CI2 = 2000×1.05 = **₹2100**.

💡 The 2-year difference formula is the **single most-asked** line in this chapter — almost never forget $P \times (R/100)^2$.

⑦ Growth & Depreciation

Population growth, machine depreciation — both use the **same** CI-style formula, just a different sign.

The link to CI

- **Growth** (population, price rise) → Value after n yrs = $P(1 + R/100)^n$
- **Depreciation** (machine, car value fall) → Value after n yrs = $P(1 - R/100)^n$

Worked example — depreciation, forward

A machine costs ₹50,000 and depreciates 10% p.a. Value after 2 years?

Step — $50000 \times (0.9)^2 = 50000 \times 0.81 =$ **₹40,500**. ✅

Worked example — depreciation, backward

A machine depreciates 10% p.a. Its value today is ₹72,900. Find its value 2 years ago.

Step — value$\times(0.9)^2 = 72900 \Rightarrow$ value$\times 0.81 = 72900$.

Answer → value $= 72900/0.81 =$ **₹90,000**. ✅

"n years ago" ⇒ **divide** by $(1 \pm R/100)^n$. "n years later" ⇒ **multiply** by it. Don't mix the two up!

✓ Mixed case — grows R_1% then falls R_2%: Value = $P(1+R_1/100)(1-R_2/100)$. Apply each year's factor separately.

⑧ CI – Doubling, Tripling & Ratios ↗↗

The multiplicative trick

If a sum becomes **n times** in T years at CI, then $(1+R/100)^T = n$. Since compounding multiplies, it becomes **n^k times in kT years**.

Worked example – doubles in 5 years, when 8 times?

Step 1 — $8 = 2^3$, so we need 3 "doubling periods."
Answer → time = 3×5 = **15 years**. ✅

Worked example – triples in 4 years, when 9× and 27×?

Step — $9 = 3^2$ → 2×4 = **8 years**. $27 = 3^3$ → 3×4 = **12 years**. ✅

The "successive-CI is a GP" trick

Year-wise CI amounts form a GP with common ratio **(1+R/100)**. So **CI(year n)/CI(year n−1) = 1+R/100**.

e.g. If CI for 2nd year = ₹220 and 3rd year = ₹242 → ratio = 242/220 = 1.1 ∴ R = **10%**.

CI for the **1st year always equals SI** for that year – the GP only kicks in from year 2 onward.

⑨ Equal Annual Installments

A loan repaid in equal yearly installments — the formula differs for SI and CI.

Under Simple Interest

Installment = **100A / [100t + Rt(t−1)/2]** (A=amount borrowed, t=no. of installments, R=rate%)

Worked — ₹6,440 in 4 yearly installments at 10% SI

Step 1 — 100t = 400; Rt(t−1)/2 = 10×4×3/2 = 60.

Step 2 — Installment = 100×6440 / (400+60) = 644000/460.

Answer → = **₹1,400** each. ✅

Under Compound Interest

Each installment x is a **present value**: $P = x/(1+r) + x/(1+r)^2 + \ldots + x/(1+r)^t$ (r=R/100)

Worked — ₹2,100 loan, 2 yearly installments at 10% CI

Step 1 — 2100 = x/1.1 + x/1.21 = x(0.90909 + 0.82645).

Step 2 — 2100 = x×1.73554.

Answer → x = 2100/1.73554 = **₹1,210** each. ✅

💡 *CI installments are **present values** — each future installment is "discounted back" by dividing, not multiplying.*

⑩ Back-Calculation & Effective Rate

Finding R or P from CI data

- From $A = P(1+r)^n$: $r = (A/P)^{1/n} - 1$
- From $CI2 = P \cdot r(2+r)$: solve the quadratic in r, or test round % values first.

Worked example — ₹4000 becomes ₹4410 in 2 yrs, find R

Step 1 — $4410/4000 = 1.1025 = (1+r)^2$.

Step 2 — $\sqrt{1.1025} = 1.05 \therefore r = 0.05$.

Answer → R = **5%**. ✅

Effective annual rate

Nominal R% p.a. compounded half-yearly ⇒ **Effective rate = $[(1+R/200)^2 - 1] \times 100$**.

Worked: nominal 10% half-yearly → $(1.05)^2 - 1 = 0.1025$ → effective = **10.25%**.

Different rate each year

$A = P(1+R_1/100)(1+R_2/100)\ldots$ e.g. P=₹5000, $R_1=10\%$, $R_2=20\%$: A=5000×1.1×1.2=**₹6,600**, CI=**₹1,600**.

Effective rate is always ≥ nominal rate whenever compounding is more frequent than yearly — that gap is the "interest on interest" bonus.

Solved Examples – I

Q1. A sum amounts to ₹1,020 in 3 years and ₹1,200 in 5 years at SI. Find P and R.

SI for 2 extra yrs = 1200−1020 = 180 → 1-yr SI = 90. P = 1020−3×90 = **₹750**. R = 100×90/(750×1) = **12%**. ✅

Q2. Find the CI on ₹12,000 for 2 years at 5% p.a., compounded annually.

$A = 12000 \times (1.05)^2 = 12000 \times 1.1025 = 13230 \therefore CI =$ **₹1,230**. ✅

Q3. The CI – SI on a sum for 2 years at 5% p.a. is ₹25. Find the sum.

$Diff = P(R/100)^2 \Rightarrow 25 = P \times 0.0025 \therefore P =$ **₹10,000**. ✅

Q4. Find SI on ₹15,000 at 6% p.a. for 4 years 3 months.

T = 4.25 yrs. SI = 15000×6×4.25/100 = 15000×0.255 = **₹3,825**. ✅

Q5. A sum amounts to ₹720 in 2 years and ₹1,020 in 7 years at SI. Find the rate.

SI for 5 extra yrs = 300 → 1-yr SI = 60. P = 720−2×60 = 600. R = 100×60/(600×1) = **10%**. ✅

✓ Q1 & Q5 pattern → the difference between two amounts over extra years is **always pure SI** for those extra years — divide to get the 1-year SI first.

Solved Examples – II

Q6. A sum doubles at CI in 5 years. In how many years will it become 8 times itself?

$8 = 2^3$ ∴ time = 3×5 = **15 years**. ✅

Q7. At what rate % p.a. will ₹1,000 amount to ₹1,331 in 3 years at CI?

1331/1000 = 1.331 = $(1+r)^3$. Since $1.1^3 = 1.331$ ⇒ r = 0.1 ∴ R = **10%**. ✅

Q8. An almirah bought for ₹8,000 depreciates 10% p.a. Find its value after 3 years.

$8000 \times (0.9)^3 = 8000 \times 0.729 =$ **₹5,832**. ✅

Q9. Find the difference between CI and SI on ₹8,000 for 3 years at 10% p.a.

Diff = $P(R/100)^2(3+R/100) = 8000 \times 0.01 \times 3.1 =$ **₹248**. ✅

Q10. The CI for the 2nd year on a sum is ₹220 and for the 3rd year is ₹242. Find the rate.

Ratio = 242/220 = 1.1 ∴ R = **10%**. (1st-yr CI = 2nd-yr CI / 1.1 = ₹200, so principal follows too.) ✅

Whenever the ratio $(1+R/100)^k$ equals a perfect power like 1.1^3=1.331 or 1.21, 1.331, 1.4641… recognise it instantly — SSC repeats the same round rates.

⑪ Ready-Reckoner & Successive % Change

Values of $(1+R/100)^n$ for the rates SSC uses most — recognise them on sight.

R%	$(1+R/100)^2$	$(1+R/100)^3$
4%	1.0816	1.1249
5%	1.1025	1.1576
8%	1.1664	1.2597
10%	1.21	1.331
12%	1.2544	1.4049

Using the table — CI on ₹15,625 for 3 yrs at 4% p.a.

A = 15625×1.1249 ≈ **₹17,576** ∴ CI = **₹1,951**. (Exact: $15625 \times 1.04^3 = 17576$.) ✅

Successive % change (same idea as CI year-on-year)

Net% = a + b + ab/100 (use negative sign for a decrease)

e.g. +10% then −10%: Net = 10−10+(10×−10)/100 = **−1%** (net decrease, not zero!)

e.g. +20% then −20%: Net = 20−20+(20×−20)/100 = **−4%**

CI itself is a "successive % change" applied to the same rate every year — that's why $(1+r)^n$ beats simply multiplying r by n.

⑫ High-Frequency SSC Shortcuts ⚡

The whole chapter in one box

- $SI = PRT/100$ · $A = P+SI$ · "n times" in SI: $T = (n-1)100/R$
- CI: $A = P(1+R/100)^n$ · half-yearly→$(R/2, 2n)$ · quarterly→$(R/4, 4n)$
- CI−SI (2yr) $= P(R/100)^2$ · CI−SI (3yr) $= P(R/100)^2(3+R/100)$
- Growth: $P(1+R/100)^n$ · Depreciation: $P(1-R/100)^n$
- CI doubles in T → becomes n^k times in kT years · successive-year CI ratio $= 1+R/100$

One-line answers — drill these

SI on ₹500 @10% for 2yr = **₹100**

Diff 2yr @5% on ₹10,000 = **₹25**

₹72,900 dep. value 2yr ago @10% = **₹90,000**

CI on ₹10,000 @10% 2yr = **₹2,100**

Doubles @10% SI in = **10 yrs**

1.1^3 = **1.331**

Worked — identify SI vs CI trap

"A sum invested at 5% **simple** interest for 2 yrs, then re-invested for 2 more yrs" is still **SI overall** unless the question says compounded — read the wording carefully before applying $(1+r)^n$. ✅

✓ Exam-day habit ⟶ underline "simple" or "compound" the moment you spot it. Half the marks lost in this chapter come from mixing up the two.

Exercise

1. Find SI on ₹8,000 at 9% p.a. for 2 years 6 months.
(a) ₹1,600 (b) ₹1,800 (c) ₹2,000 (d) ₹1,750

2. A sum triples itself in 20 years at SI. Find the rate.
(a) 8% (b) 10% (c) 12% (d) 15%

3. Find CI on ₹20,000 for 2 years at 10% p.a. compounded annually.
(a) ₹4,000 (b) ₹4,100 (c) ₹4,200 (d) ₹4,400

4. The difference between CI and SI on ₹16,000 for 2 years at 5% p.a. is:
(a) ₹40 (b) ₹45 (c) ₹50 (d) ₹60

5. A sum doubles in 8 years at CI. In how many years will it become 4 times?
(a) 12 (b) 16 (c) 20 (d) 24

6. Find the rate at which ₹2,000 becomes ₹2,420 in 2 years at CI.
(a) 8% (b) 9% (c) 10% (d) 11%

7. A sum amounts to ₹720 in 2 years and ₹1,020 in 7 years at SI. Find the rate.
(a) 8% (b) 9% (c) 10% (d) 12%

8. The CI for the 2nd year on a sum is ₹220 and for the 3rd year is ₹242. Find the rate.
(a) 8% (b) 10% (c) 12% (d) 15%

9. A machine depreciates 10% p.a. Its present value is ₹72,900. Its value 2 years ago was:
(a) ₹85,000 (b) ₹88,000 (c) ₹90,000 (d) ₹92,000

10. Find the effective annual rate for a nominal 6% p.a. compounded half-yearly.
(a) 6% (b) 6.09% (c) 6.5% (d) 12%

11. ₹2,100 is repaid in 2 equal annual installments at 10% CI. Find each installment.
(a) ₹1,200 (b) ₹1,210 (c) ₹1,215 (d) ₹1,225

12. ₹6,440 is repaid in 4 equal annual installments at 10% SI. Find each installment.
(a) ₹1,350 (b) ₹1,400 (c) ₹1,450 (d) ₹1,500

13. Find CI on ₹15,625 for 3 years at 4% p.a. compounded annually.
(a) ₹1,900 (b) ₹1,925 (c) ₹1,951 (d) ₹2,000

14. A town's population rises 10% in year one and falls 10% in year two. Net change over 2 years is:
(a) No change (b) 1% decrease (c) 1% increase (d) 2% decrease

Attempt every question before turning the page — the answer key with working is on page 16.

Answer Key & Quick Revision

Answer Key — with working

1→ (b) ₹1,800 (8000×9×2.5/100) · **2→ (b) 10%** (200/20) · **3→ (c) ₹4,200** (20000×0.21) · **4→ (a) ₹40** (16000×0.0025) · **5→ (b) 16 yrs** ($4=2^2\to2\times8$) · **6→ (c) 10%** ($\sqrt{1.21}=1.1$) · **7→ (c) 10%** (SI2extra=300,1yr=60,P=600) · **8→ (b) 10%** (242/220=1.1) · **9→ (c) ₹90,000** (72900/0.81) · **10→ (b) 6.09%** (1.03^2-1) · **11→ (b) ₹1,210** (PV of 2 installments) · **12→ (b) ₹1,400** (644000/460) · **13→ (c) ₹1,951** ($15625\times1.04^3-15625$) · **14→ (b) 1% decrease** (10−10−1).

Quick Revision

- ✓ SI = PRT/100, Amount = P+SI. Grows linearly — 1-year SI = total/years. Doubles/triples/n-times: $T=(n-1)\times100/R$.
- ✓ CI: $A=P(1+R/100)^n$, CI=A−P. Half-yearly→(R/2,2n); quarterly→(R/4,4n). CI=SI in year 1; CI>SI after.
- ✓ $CI-SI(2yr)=P(R/100)^2$; $CI-SI(3yr)=P(R/100)^2(3+R/100)$. Growth $P(1+R/100)^n$, depreciation $P(1-R/100)^n$.
- ✓ CI "n times in T yrs" ⇒ n^k times in kT yrs. Successive-year CI ratio = 1+R/100. Installments: SI uses 100A/[100t+Rt(t−1)/2]; CI uses present-value sum.

☆ SI & CI — let your money work smarter! ☆