SIMPLE INTEREST AND COMPOUND INTEREST

9.1: Simple Interest Introduction

Bank gave you ₹ 50,000

↓

repay after 2 years → 50,000 + extra amount = Amount

↓ Time Period ↓ Principal (original amount) ↓ interest (Simple Interest) ↓ charged as per rate of interest

Simple Interest (SI) = $P \times T \times \frac{R}{100}$

P = Principal

T = Time Period (Years, Months (or) days)

R = Rate of interest

$SI = P \times (TR\%)$

$I\% = T \times R\%$

T = 3 years R = 10% p.a.

I% = 30% (Total Percentage on the principal)

Amount = Principal + Interest

$= P + \frac{PTR}{100}$

$= P\left(1 + \frac{TR}{100}\right)$

$= P\left(\frac{100 + TR}{100}\right)$

Ex P = ₹ 50,000, T = 2 years, R = 10% p.a.

$SI = 50,000 \times 2 \times \frac{10}{100}$

= ₹ 10,000

A = 50,000 + 10,000

= ₹ 60,000

(Or)

$A = 50,000\left(\frac{100 + (2 \times 10)}{100}\right)$

= ₹ 60,000

Calculation of Interest and amount

(i) In terms of %

$$I\% = (T \times R\%) \times P$$

$$A\% = P + I$$

$$\downarrow \quad \downarrow$$

$$100\% \quad TR\%$$

$$A\% = P(100\% + TR\%)$$

Ex: $T = 2$ yrs, $R = 15\%$

$$I\% = 2 \times 15\%$$

$$= 30\%$$

$$A\% = P + I$$

$$= 100\% + 30\%$$

$$= 130\%$$

* Principal is always original value, it can be assumed as 100 or (100%)

Ex: $P = ₹ 50,000$, $T = 3$ years, $R = 20\%$ p.a.

$$I\% = 3 \times 20\% = 60\%$$

$$I = 60\% \times 50,000 = ₹ 30,000$$

$$A\% = 100\% + 60\% = 160\%$$

$$A = 160\% \times P = 50,000 \times 160\%$$

$$= ₹ 80,000$$

Ex

$T = \frac{3}{2}$ years, $R = 20\%$ p.a.

$I\% = \frac{3}{2} \times 20\% = 30\%$.

$A\% = 130\%$.

Ex

$T = 3$ years, $R = 12\%$ p.a.

$I\% = 36\%$.

$A\% = 136\%$.

$I = 36\% \times P$

$A = 136\% \times P$

(ii) in terms of ratio / fractions

$R\% = 20\%$ p.a. $T = 2$ years

$= \frac{1}{5}$ → Result (Interest for 1 year)
→ original value (Principal)

$P = 5$

$I = 1 \times 2 = 2$

$A = P + I = 5 + 2 = 7$

Ex $R = 8\frac{1}{3}\%$ p.a.

$= \frac{1}{12}$ → Interest for 1 year.
→ P

(4)

Ex

$R\% = 28\frac{4}{7}\%$ p.a.

$= \frac{2}{7}$ → Int for 1 year
$7 \rightarrow P$

Ex

$R\% = 16\frac{2}{3}\%$ p.a. $T = 3$ years.

$= \frac{1}{6}$

$P = 6$

$I = 1 \times 3 = 3$

$A = 6 + 3 = 9.$

9.2: Solved Problems

Q.1) A sum of ₹ 4000 is lent for 5 years at the rate of 15% p.a. find the interest?

P = ₹ 4000, T = 5 years, R% = 15%.

Concept 1

$$SI = \frac{P \times T \times R}{100}$$

$$= \frac{4000 \times 5 \times 15}{100}$$

$$= ₹\ 3000$$

Concept 2

$$I\% = T \times R\%$$

$$= 75\%$$

$$SI = P \times I\%$$

$$= 4000 \times 75\%$$

$$= ₹\ 3,000.$$

Concept 3

$$R\% = 15\%$$

$$= \frac{3}{20} \rightarrow \text{Int for 1 year}$$

P	I	A
20	5 × 3 = 15	35
4000	$\frac{15}{20} \times 4000$	

$$= ₹\ 3,000$$

(8)

Q.2) On what sum at 4% rate the simple interest will be ₹640 for 2 years?

$R\% = 4\%$, $I = ₹640$, $T = 2$ years.

Concept 1

$SI = \frac{PTR}{100}$

$\Rightarrow 640 = \frac{P \times 2 \times 4}{100}$

$\Rightarrow P = ₹8000$

Concept 2

$I\% = T \times R\%$

$= 2 \times 4\%$

$= 8\%$

$8\% \longrightarrow 640$

$100\% \rightarrow \frac{640}{8} \times 100$

$= ₹8,000$ (Principal)

Concept 3

$R\% = 4\%$

$= \frac{1}{25}$

I	I
	$1 \times 2 = 2$
25	
?	640

$2 \longrightarrow 640$

$25 \longrightarrow \frac{640}{2} \times 25$

$= ₹8,000$ (P)

Q.3) A sum of ₹5120 is lent for 3 years at the rate of 12.5% p.a. Find the amount?

$P = ₹\ 5120$, $T = 3$ years, $R = 12.5\%$ p.a.

$A = P + I$

Concept 1

$$I = \frac{P \times T \times R}{100}$$

$$= \frac{5120 \times 3 \times 12.5}{100}$$

$$= ₹\ 1920$$

$$A = 5120 + 1920$$

$$= ₹\ 7040$$

Concept 2

$I\% = T \times R\% = 37.5\%$

$A\% = 137.5\%$

$A = 5120 \times 137.5\%$

$= ₹\ 7040.$

Concept 3

$R\% = 12.5\% = \frac{1}{8}$

$P = 8$

$I = 1 \times 3 = 3$

$A = 8 + 3 = 11$

$8 \longrightarrow 5120$

$11 \longrightarrow \frac{5120}{8} \times 11$

$= ₹\ 7040$ (Amount)

(8)

Q.4) A man will get ₹ 87 as simple interest on ₹ 725 @ 4% p.a. in ___ years.

$P = ₹\ 725$

$I = ₹\ 87$

$R = 4\%$.

Concept - 1

$$I = \frac{PTR}{100}$$

$$87 = \frac{725 \times T \times 4}{100}$$

$$T = \frac{87 \times 100}{725 \times 4}$$

$$= 3 \text{ years}$$

Concept 2

Interest for one year $= 725 \times 4\% = 29$

$1 yr \longrightarrow 29$

$? \longrightarrow 87$

$$\frac{87}{29} \times 1 = 3 \text{ years.}$$

Q.5) If the SI on a certain sum of money at the rate of $\frac{20}{3}\%$ p.a. for 4 years is ₹ 4,400 less than the principal. find the interest.

$R\% = \frac{20}{3}\% = 6\frac{2}{3}\%$, $T = 4$ years., $I = P - 4400 \Rightarrow P - I = 4400$

$= \frac{1}{15}$

$P = 15$

$I = 1 \times 4 = 4$ ↖ 11

$\therefore$ $11 \longrightarrow 4400$

$4 \longrightarrow \frac{4400}{11} \times 4$

$= ₹\ 1,600$ (Interest).

Q.6) The simple interest accrued in 9 years on a principal of ₹ 24250 is 162% of the principal. What is the rate of interest % per annum?

$T = 9$ years

$P = ₹\ 24,250$

$I\% = 162\%$

$I\% = T \times R\%$

$\Rightarrow 162\% = 9 \times R\%$

$\Rightarrow R\% = \frac{162\%}{9}$

$= 18\%$ p.a.

Q.7) The rate of SI for 1st 3 years is 6%, for next 4 years it is 7% and the period beyond 7 years is 7.5% p.a. If a man invest ₹ 18,800 for 11 years, find the SI earned by him?

$P = ₹\ 18,800$

$T = 11$ years

1st 3 years → 6% p.a.

4 years → 7% p.a.

Beyond 7 years → 7.5% p.a.

For 1st 3 years @ 6% p.a

$I = \frac{18800 \times 3 \times 6}{100} = 188 \times 18 = ₹\ 3384$

For next 4 years @ 7% p.a.

$I = \frac{18800 \times 4 \times 7}{100} = 188 \times 28 = ₹\ 5264$

(10)

for next 4 years @ 7.5% p.a

$$I = \frac{18800 \times 4 \times 7.5}{100} = 188 \times 30 = ₹ 5640$$

∴ Total Interest = ₹ (3384 + 5264 + 5640) = ₹ 14,288

(Alternative)

I% for 1st 3 years = 3 × 6% = 18%

I% for next 4 years = 4 × 7% = 28%

I% for last 4 years = 4 × 7.5% = 30%

Total I% for 11 years = 18% + 28% + 30% = 76%

SI for 11 years = 18800 × 76%

= ₹ 14,288

Q.8) A sum of money at SI amounts to ₹ 5852 in 3 years and ₹ 7788 in 7 years. What is the rate of interest p.a.?

A_1 5852 $\xrightarrow{P+I_1}$ — 3 years

A_2 7788 $\xrightarrow{P+I_2}$ — 7 years

$A_2 - A_1$ = Interest (Difference in amount is Interest)

7788 − 5852 = ₹ 1936 ⇒ 4 years interest

↓

(7 − 3)

4 ⟶ 1936

3 ⟶ $\frac{1936}{4} \times 3$ = ₹ 1452.

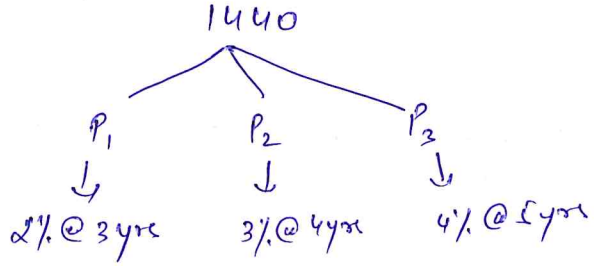
P = A − I

= 5852 − 1452 = ₹ 4400

SI = $\frac{PTR}{100}$ ⇒ $1452 = \frac{4400 \times 3 \times R}{100}$ ⇒ R = 11%

9.3: Solved Problems

Q.9) A sum of ₹ 1440 is lent out in three parts in such a way that the interests on first part at 2% for 3 years, second part at 3% for 4 years and third part at 4% for 5 years are equal. Then find the difference between the largest and the smallest sum.



$I_1 = I_2 = I_3$

$6\% \times P_1 = 12\% P_2 = 20\% P_3$

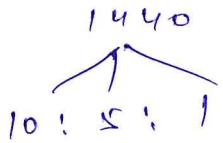
$\therefore 6P_1 = 12P_2 = 20P_3$

$P_1 : P_2 : P_3 = \frac{1}{6} : \frac{1}{12} : \frac{1}{20}$

$= \frac{1}{3} : \frac{1}{6} : \frac{1}{10}$

LCM (3, 6, 10) = 30

$P_1 : P_2 : P_3 = 10 : 5 : 1$



$10 + 5 + 1 = 16$

$10 - 1 = 9$

$16 \longrightarrow 1440$

$9 \longrightarrow \frac{1440}{16} \times 9$

$= ₹ 810$ (ans)

(12)

$I_1 = I_2 = I_3$

$P_1 : P_2 : P_3 \ldots P_n = \frac{1}{r_1 t_1} : \frac{1}{r_2 t_2} : \frac{1}{r_3 t_3} : \ldots\ldots : \frac{1}{r_n t_n}$

When amounts are equal

Principal ratio $= \frac{1}{100 + r_1 t_1} : \frac{1}{100 + r_2 t_2} : \frac{1}{100 + r_3 t_3} : \ldots\ldots : \frac{1}{100 + r_n t_n}$

Q.10) A sum of money doubles itself in 10 years at SI. What is the rate of interest?

Let P = ₹ 1

Amount = ₹ 2

T = 10 years.

R% = ?

Interest = A - P

= ₹ 1

$I = \frac{P \times T \times R}{100}$

$1 = 1 \frac{\times 10 \times R}{100}$

R = 10%.

(Trick)

P = 100

A = 200

T = 10 yrs.

I = 100

I for 1 year = $\frac{100}{10}$ = 10.

R% = $\frac{10}{100} \times 100 = 10\%$.

Q.11) A sum of money becomes four times at the simple interest rate of 5% p.a. At what rate percent will it become seven fold?

P = 1
A = 4
R% = 5%
T = ?

I = 4 - 1
= 3

$I = \frac{PTR}{100}$

$3 = \frac{1 \times T \times 5}{100}$

T = 60 years.

P = 1
A = 7
R% = ?
T = 60 years.

I = 7 - 1
= 6

$I = \frac{PTR}{100}$

$6 = \frac{1 \times 60 \times R}{100}$

R = 10%.

(Trick)

$1 \xrightarrow[5\%]{3} 4$

$1 \xrightarrow[?]{6} 7$

$3 \longrightarrow 5\%$

$6 \longrightarrow \frac{5}{3} \times 6$

$= 10\%$

(14)

Q.124 The simple interest on a sum of money is 1/9 of the principal and the number of years is equal to the rate percent per annum. find the rate % ?

$T = R\%$

$I = \frac{P \times T \times R}{100}$

$\Rightarrow I = \frac{P \times R \times R}{100}$

$\Rightarrow \frac{I}{P} = \frac{R^2}{100}$

$\Rightarrow R^2 = \frac{I}{P} \times 100$

$\Rightarrow R = \sqrt{\frac{I}{P} \times 100}$

$I = \frac{1}{9} \times P$

$\Rightarrow \frac{I}{P} = \frac{1}{9}$

$R = \sqrt{\frac{I}{P} \times 100}$

$= \sqrt{\frac{1}{9} \times 100}$

$= \frac{10}{3}\%$

$= 3\frac{1}{3}\%$

Installment – Discharge a debt Problems

$$\text{Total Debt} = \left[I + \left(I + \frac{I \times r \times 1}{100} \right) + \left(I + \frac{I \times r \times 2}{100} \right) + \cdots + \left(I + \frac{I \times r \times n-1}{100} \right) \right]$$

I = Installment
n = no. of years / no. of installments
r = rate of interest

(Q.13) What annual installment will discharge a debt of ₹ 6450 due in 4 years at 5% SI ?

Total Debt = ₹ 6450

T = 4 years

Let Installment (I) = 100

1st year = 100
2nd year = 105 ← +5 ⇒ 100 × 5% × 1 = 5 (one year interest)
3rd year = 110
4th year = 115

430

430 → 6450
100 → $\frac{6450}{430} \times 100$

= ₹ 1,500/- (annual installment).

9.4: Compound Interest

Compound interest is
↓
Interest on interest

Compound interest will be used in (Population increment, Depreciation, Successive % change)

$$\text{Amount} = P\left(1+\frac{r}{100}\right)^n$$

$$CI = A - P$$
$$= P\left(1+\frac{r}{100}\right)^n - P$$

(i) Compounded annually → Interest added every year

(ii) Compounded half-yearly → Interest added every 6 months

(iii) Compounded Quarterly → Interest is added every 3 months

(iv) Compounded monthly → Interest added every month

$$A = P\left(1+\frac{r/t}{100}\right)^{nt}$$

Case-1 ⇒ when $t=1$, compounded anually $A = P\left(1+\frac{r}{100}\right)^n$

Case-2 ⇒ when $t=2$, compounded half yearly $A = P\left(1+\frac{r/2}{100}\right)^{2n}$

Case-3 ⇒ when $t=4$, compounded quarterly $A = P\left(1+\frac{r/4}{100}\right)^{4n}$

Case 4 ⇒ when $t=12$, compounded monthly $A = P\left(1+\frac{r/12}{100}\right)^{12n}$

Ex

10,000 10% 3years compounded annually

$$A = P\left(1+\frac{r}{100}\right)^n$$

$$= 10,000\left(1+\frac{10}{100}\right)^3$$

$$= 10000 \times \left(1+\frac{1}{10}\right)^3$$

$$= 10,000 \times \left(\frac{11}{10}\right)^3$$

$$= 10,000 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10}$$

$$= 13,310$$

$$CI = 13,310 - 10,000$$

$$= ₹\ 3,310$$

(Alternative)

10,000	11,000	12100	
1st	2nd	3rd	
1000	1100	1210	= 3310

(OR)

1st	2nd	3rd
1000	1000	1000
	100	100
		110
1000	1100	1210 = 3310

Ex

$P = ₹2160$, $R\% = 16\frac{2}{3}\%$, $T = 3$ year. find CI.

$R = 16\frac{2}{3}\% = 1/6$

1st	2nd	3rd
$2160 \times 1/6$	360	360
$= 360$	$360 \times 1/6$	60
	$= 60$	$420 \times 1/6$
	420	$= 70$
360		490

$= ₹1270 \Rightarrow CI.$

Ex $P = ₹20,000$, $R = 20\%$, $T = 1\frac{1}{2}$ year, Find CI. Compounded half-yearly.

$$A = P\left(1 + \frac{r/2}{100}\right)^{2n}$$

$$= 20000\left(1 + \frac{20/2}{100}\right)^{2 \times 3/2}$$

$$= 20,000\left(1 + \frac{10}{100}\right)^{3}$$

$$= 20,000 \times \left(\frac{11}{10}\right)^{3}$$

$$= ₹26,620$$

$CI = 26620 - 20,000 = ₹6,620/-$

OR) $P = 20,000$, $r/2 = \frac{20}{2} = 10\%$, $T = 1\frac{1}{2}$ year $= 18$ months (3×6)

20,000	22,000	24,200
6 months	6 months	6 months
2,000	2200	2420

$= ₹6,620/-$ CI.

Eg

$P = ₹16000$, $R\% = 20\%$, $T = 9$ months. find CI, compounded quarterly.

$$A = P\left(1 + \frac{r/4}{100}\right)^{4t}$$

$T = 9$ months

$= \frac{9}{12}$ years $= \frac{3}{4}$ years.

$$A = 16000\left(1 + \frac{20/4}{100}\right)^{4 \times 3/4}$$

$$= 16000\left(1 + \frac{5}{100}\right)^{3}$$

$= ₹18,522$

$CI = 18522 - 16000$

$= ₹2,522.$

(Alternative)

$P = 16,000$, $R/4 = \frac{20}{4} = 5\%$, $T = 9$ months (3×3)

3 months	3 months	3 months
		800
800	800	40
	40	42
	840	882

$CI = ₹2522/-$

(20)

Rate of interest different for different years.

1st year r_1 %

2nd year r_2 %

3rd year r_3 %

$A = P\left(1+\frac{r}{100}\right)^n$ when r is equal for all year

$A = P\left(1+\frac{r_1}{100}\right)\left(1+\frac{r_2}{100}\right)\left(1+\frac{r_3}{100}\right)\cdots\cdots$

Ex =

$P = ₹4,000$, $R_1\% = 8\%$ for 1st year, find amount after 2 years.

$R_2\% = 10\%$ for 2nd year.

$$A = 4000\left(1+\frac{8}{100}\right)\left(1+\frac{10}{100}\right)$$

$$= 4000 \times \frac{108}{100} \times \frac{110}{100}$$

$$= ₹4752$$

$CI = 4752 - 4000 = ₹752.$

(Alternative)

$P = 4000$, $r_1\% = 8\%$, $A = ?$

$r_2\% = 10\%$.

8% 1st	2nd 10%
4000 × 8%	4000 × 10% = 400
= 320	320 × 10% = 32
320	432 = ₹752

If time is given in fraction say $3\frac{2}{5}$ years.

$$A = P\left(1+\frac{r}{100}\right)^3\left(1+\frac{\frac{2}{5}r}{100}\right)$$

Eg

$P = ₹8,000$, $R = 15\%$, $T = 2$ years 4 months, find CI.

4 months $= \frac{4}{12} = \frac{1}{3}$ years

$$A = 8000\left(1+\frac{15}{100}\right)^2\left(1+\frac{\frac{1}{3}\times 15}{100}\right)$$

$= ₹11,109.$

$CI = 11,109 - 8,000 = ₹3,109.$

(Alternative)

1st	2nd	3rd
$8000\times 15\% = 1200$	1200	1200
	$1200\times 15\% = 180$	180
1200	1380	$1380\times 15\% = 207$
		1587

12 months $\longrightarrow$ 1587

4 months $\longrightarrow \frac{1587}{12}\times 4 = ₹529$

$CI = 1200 + 1380 + 529$

$= ₹3,109.$

(22)

Ex A sum of money at ₹1 amounts to thrice itself in three years. In how many years will it be 9 times itself?

P = 1
A = 3
T = 3 years
R%

P = 1
A = 9
R%

$A = P\left(1 + \frac{r}{100}\right)^n$

$3 = 1\left(1 + \frac{r}{100}\right)^3$

$\left(1 + \frac{r}{100}\right)^3 = 3$

$9 = 1\left(1 + \frac{r}{100}\right)^n$

$(3)^2 = \left(1 + \frac{r}{100}\right)^n$

$\left(\left(1 + \frac{r}{100}\right)^3\right)^2 = \left(1 + \frac{r}{100}\right)^n$

$\left(1 + \frac{r}{100}\right)^6 = \left(1 + \frac{r}{100}\right)^n$

$n = 6$ years.

(Alternative)

1 ⟶ 3 → 1st part
3 years
1 ⟶ 9 → It should be power of first part to apply trick
? = $(3)^2$
3 × 2 = 6 years.

Ex A sum of money placed at CI doubles itself in 5 years. In how many years will it amount to 8 times itself?

$1 \longrightarrow 2$ (5 years)

$1 \longrightarrow 8 = (2)^3$

$5 \times 3 = 15$ years.

Difference between SI & CI

$P = 1000, \quad R = 10\%, \quad T = 3$ years

SI	P	I	A
1st	1000	100	1100
2nd	1000	100	1200
3rd	1000	100	1300

CI	P	I	A
1st	1000	100	1100
2nd	1100	110	1210
3rd	1210	121	1331

1) Interest is same for 1st year in SI & CI.
2) Interest is same for every year in SI.
3) Interest is increasing for every year in CI.
4) When consecutive interest or amounts are given in question, we can find the rate of interest without principal in CI but same is not possible in SI.

Difference between SI and CI

1) for 2 years

$$d = P\left(\frac{r}{100}\right)^2$$

2) for 3 years

$$d = P\left(\frac{r}{100}\right)^2\left(3+\frac{r}{100}\right)$$

Ex The difference between SI and CI compounded anually on a certain sum of money for 2 years at 4% p.a. is ₹ 1. The sum (in ₹) is.

$d = 1$

$R = 4\%$

$T = 2$ years.

$$d = P\left(\frac{r}{100}\right)^2$$

$$1 = P\left(\frac{4}{100}\right)^2$$

$$\Rightarrow 1 = P\left(\frac{1}{25}\right)^2$$

$$\Rightarrow P = ₹\,625/-$$

Ex The difference between CI and SI on a certain principal in 3 yrs is ₹ 1525. If the rate is 5%. find the principal.

$d = ₹\,1525$, $R = 5\%$, $T = 3$ years.

$$d = P\left(\frac{r}{100}\right)^2\left(3+\frac{r}{100}\right)$$

$$\Rightarrow 1525 = P\left(\frac{5}{100}\right)^2\left(3+\frac{5}{100}\right)$$

$$\Rightarrow 1525 = P\left(\frac{1}{20}\right)^2\left(3+\frac{1}{20}\right)$$

$$\Rightarrow P = ₹\,2,00,000/-$$

Eg The CI on a sum of money for 2 years is ₹ 410 and the SI on the same rate is ₹ 400. find the rate of interest.

SI = ₹ 400 for 2 years

1st year	2nd year
₹ 200	₹ 200

= CI

₹ 200 → ₹ 210

₹ 10.

$\frac{10}{200} \times 100 = 5\%$. (ans)

Eg The SI on a certain some of money for 2 years at 10% p.a. is ₹ 80. The CI on the same sum for the same period is

SI for 2 years = ₹ 80

	1st	2nd
	40	40
CI	40	40 × 10% + 40
		= 44

CI = 40 + 44

= 84/-

9.5: Installments in Compound Interest

Installments in CI – Discharge a debt

$$A = P\left(1+\frac{r}{100}\right)^{n}$$

$n \rightarrow$ no. of installments / no. of years

A ↓ Equal amount installments

P ↓ debt

$n = 2$ years

$$P_1 = D\left(1+\frac{r}{100}\right)^{1}$$

$$P_2 = D\left(1+\frac{r}{100}\right)^{2}$$

$P_1 + P_2 + P_3 + \ldots\ldots + P_n =$ Total debt

Installment will be same every year

$$\text{Total Debt} = D\left[\frac{100}{100+r} + \left(\frac{100}{100+r}\right)^2 + \left(\frac{100}{100+r}\right)^3 + \ldots\ldots + \left(\frac{100}{100+r}\right)^n\right]$$

Ex A sum of ₹ 2,100 to be paid back in 2 equal installment. How much is each installment of the interest is compounded annually at 10% p.a.?

Total debt :- ₹ 2,100, No. of installments = 2, R% = 10%.

$$\text{Total debt} = D\left[\frac{100}{100+r} + \left(\frac{100}{100+r}\right)^2\right]$$

$$2100 = D\left[\frac{100}{100+10} + \left(\frac{100}{110}\right)^2\right]$$

$$2100 = D\left[\frac{10}{11} + \left(\frac{10}{11}\right)^2\right]$$

D = ₹ 1,210/-

(Trick)

$R = 10\% = \frac{1}{10} \rightarrow$ Principal, $\rightarrow$ Interest

	P Debt	A Installment	
		10+1 = 11	× 11
1st T = 1	10		
		121	
2nd T = 2	100		
	110	121	
	210	121 equal annual installment	

$210 \longrightarrow 2100$

$121 \longrightarrow \frac{2100}{210} \times 121$

$= ₹ 1,210/-$

Eg: A man borrowed some money and paid back in 3 equal annual installments of ₹ 2,160 each. What sum did he borrow, if the rate of interest charged by the money lender was 20% p.a. compounded annually?

$R\% = 20\% = \frac{1}{5}$, $I = ₹ 2,160$, No. of installments = 3

	Debt	Installment	
		5+1 = 6	× 36
1st year	5		
		36	× 6
2nd year	25		
		216	
3rd year	125		
	180	216	
	150	216	
	455	216	

$216 \longrightarrow 2160$

$455 \rightarrow \frac{2160}{216} \times 455 = ₹ 4,550/-$

(28)

Q.6: GATE Previous Year Questions on Simple Interest and Compound Interest

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Q.1) Leila aspires to buy a car worth ₹ 10,00,000 after 5 years. What is the minimum amount in ₹ that should deposit now in bank which offers 10% annual rate of interest, if the interest was compounded annually!

(GATE 2018)

(a) 5,00,000 (b) 6,21,000 (c) 6,66,667 (d) 7,50,000

$A = ₹10,00,000$

$T = 5$ years

$R\% = 10\%$

$$A = P\left(1+\frac{r}{100}\right)^n$$

$$10^6 = P\left(1+\frac{10}{100}\right)^5$$

$$10^6 = P\left(1+\frac{1}{10}\right)^5$$

$$10^6 = P\left(\frac{11}{10}\right)^5$$

$$P = \frac{10^6 \times 10^5}{1.5}$$

$$= \frac{10^{11}}{1.5}$$

$$= 6,20921 \hookrightarrow ₹ 6,21,00$$

Trick)

$A = ₹10,00,000$

SI 5yr 10%

50%

CI 10%

Y 15%.

(a) 5,00,000
2,50,000
7,50,000 ×

(b) 6,21,000
3,10,500
9,31,500 (ans)

(c) 6,66,667
3,33,333
10000001 ×

Q.2) The population of new city is 5 million and is growing at 20% annually. How many years would it take to double at this growth rate? (GATE 2014)

(a) 3-4 yrs (b) 4-5 yrs (c) 5-6 yrs (d) 6-7 yrs

$P = 1$

$A = 2$

$R\% = 20\%$.

$$2 = 1 \times \left(1 + \frac{20}{100}\right)^n$$

$$2 = \left(\frac{6}{5}\right)^n$$

$$2 = (1.2)^n$$

Now check with option

$(1.2)^3 = 1.728$

$(1.2)^4 = 2.25$ Ans ⇒ 3-4 yrs.

(Alternative)

	50,00,000
20%	10,00,000
	60,00,000
20%	12,00,000
	72,00,000
20%	14,40,000
	86,40,000
20%	17,28,000
	1,03,68,000

Between 3-4 years it becomes double.