

Compound Interest

INTRODUCTION

In Chapter 17, we discussed simple interest. A second method of paying interest is the *compound interest* method, where the interest for each period is added to the principal before interest is calculated for the next period. With this method the principal grows as the interest is added

to it. This method is used in investments such as savings account and bonds. An understanding of compound interest is important not only for people planning careers with financial institutions but also for anyone planning to invest money.

SOME BASIC FORMULAE

1. (a) The amount A due after t years, when a principal P is given on compound interest at the rate $R\%$ per annum is given by

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

- (b) Compound interest (CI) = $A - P$

$$= P \left[\left(1 + \frac{R}{100} \right)^t - 1 \right]$$

- (c) Rate of interest (R) = $\left[\left(\frac{A}{P} \right)^{1/t} - 1 \right] \% \text{ p.a.}$

Note:

Simple interest and compound interest for 1 year at a given rate of interest per annum are always equal.

Illustration 1 Mohan invested an amount of ₹15000 at compound interest rate 5% per annum for a period of 2 years. What amount will he receive at the end of 2 years?

Solution: Here $P = 15000$, $R = 5$ and, $t = 2$

$$\begin{aligned} \therefore \text{Amount} &= P \left(1 + \frac{R}{100} \right)^t \\ &= 15000 \left(1 + \frac{5}{100} \right)^2 = 15000 \left(1 + \frac{1}{20} \right)^2 \end{aligned}$$

$$= \frac{15000 \times 21 \times 21}{20 \times 20} = ₹16537.50.$$

Illustration 2 Find compound interest on ₹5000 for 2 years at 4% per annum

Solution: Here $P = 5000$, $R = 4$ and, $t = 2$

$$\begin{aligned} \therefore \text{CI} &= P \left[\left(1 + \frac{R}{100} \right)^t - 1 \right] \\ &= 5000 \left[\left(1 + \frac{4}{100} \right)^2 - 1 \right] \\ &= 5000 \left[\left(\frac{26}{25} \right)^2 - 1 \right] = 5000((1.04)^2 - 1) \\ &= 5000(1.0816 - 1) = ₹408 \end{aligned}$$

\therefore The compound interest is ₹408.

Illustration 3 Rashi invested ₹16000 for two years at compound interest and received an amount of ₹17640 on maturity. What is the rate of interest?

Solution: Here $P = 16000$, $t = 2$ and, $A = 17640$

$$\therefore R = 100 \left[\left(\frac{A}{P} \right)^{1/t} - 1 \right] \% \text{ p.a.}$$

$$= 100 \left[\left(\frac{17640}{16000} \right)^{1/2} - 1 \right] \% \text{ p.a.}$$

$$= 100 \left[\left(\frac{441}{400} \right)^{1/2} - 1 \right] \% \text{ p.a.}$$

$$= 100 \left[\left(\frac{21}{20} \right)^{2 \times \frac{1}{2}} - 1 \right] \% \text{ p.a.}$$

$$= 100 \times \frac{1}{20} = 5\% \text{ p.a.}$$

2. If the interest is compounded half-yearly, then

$$(a) \text{ Amount } (A) = P \left(1 + \frac{R}{100 \times 2} \right)^{2t}$$

(b) Compound interest (CI)

$$= P \left[\left(1 + \frac{R}{100 \times 2} \right)^{2t} - 1 \right]$$

$$(c) \text{ Rate } (R) = 2 \times 100 \left[\left(\frac{A}{P} \right)^{\frac{1}{t \times 2}} - 1 \right] \% \text{ p.a.}$$

Illustration 4 Find the amount of ₹8000 in one and half years at 5% per annum compound interest payable half-yearly

Solution: Here $P = 8000$, $R = 5$ and, $t = \frac{3}{2}$

$$\begin{aligned} \therefore \text{Amount} &= P \left(1 + \frac{R}{100 \times 2} \right)^{2t} \\ &= 8000 \left(1 + \frac{5}{100 \times 2} \right)^{2 \times \frac{3}{2}} = 8000 \left(\frac{41}{40} \right)^3 \\ &= \frac{8000 \times 41 \times 41 \times 41}{40 \times 40 \times 40} = ₹8615.13. \end{aligned}$$

3. If the interest is compounded quarterly, then

$$(a) \text{ Amount } (A) = P \left(1 + \frac{R}{100 \times 4} \right)^{4t}$$

(b) Compound interest (CI)

$$= P \left[\left(1 + \frac{R}{100 \times 4} \right)^{4t} - 1 \right]$$

$$(c) \text{ Rate } (R) = 4 \times 100 \left[\left(\frac{A}{P} \right)^{\frac{1}{t \times 4}} - 1 \right] \% \text{ p.a.}$$

In general, if the interest is compounded n times a year, then

$$(a) \text{ Amount } (A) = P \left(1 + \frac{R}{100 \times n} \right)^{n \times t}$$

(b) Compound interest (CI)

$$= P \left[\left(1 + \frac{R}{100 \times n} \right)^{n \times t} - 1 \right]$$

(c) Rate of interest (R)

$$= n \times 100 \left[\left(\frac{A}{P} \right)^{\frac{1}{t \times n}} - 1 \right] \% \text{ p.a.}$$

Illustration 5 Find the compound interest on ₹1000 at 40% per annum compounded quarterly for 1 year

Solution: Here $P = 1000$, $R = 40$ and, $t = 1$

\therefore Compound interest (CI)

$$\begin{aligned} &= P \left[\left(1 + \frac{R}{100 \times 4} \right)^{4 \times t} - 1 \right] \\ &= 1000 \left[\left(1 + \frac{40}{100 \times 4} \right)^{4 \times 1} - 1 \right] = 1000 \left[\left(\frac{11}{10} \right)^4 - 1 \right] \\ &= 1000 \left[\frac{14641 - 10000}{10000} \right] = ₹464.10. \end{aligned}$$

Illustration 6 Find the compound interest on ₹4000 at 24% per annum for 3 months, compounded monthly

Solution: Here $P = 4000$, $R = 24$ and, $t = \frac{3}{12}$

$$\begin{aligned} \therefore \text{CI} &= P \left[\left(1 + \frac{R}{100 \times 12} \right)^{12 \times t} - 1 \right] \\ &= 4000 \left[\left(1 + \frac{24}{100 \times 12} \right)^{12 \times \frac{3}{12}} - 1 \right] \\ &= 4000 \left[\left(\frac{51}{50} \right)^3 - 1 \right] = \frac{4000 \times 7651}{50 \times 50 \times 50} \\ &= ₹244.83. \end{aligned}$$

SOME USEFUL SHORT-CUT METHODS

1. When the rates of interest are different for different years, say R_1, R_2, R_3 per cent for first, second and third year, respectively, then

$$\text{Amount} = P \left(1 + \frac{R_1}{100} \right) \left(1 + \frac{R_2}{100} \right) \left(1 + \frac{R_3}{100} \right).$$

Explanation

Let, the given sum of money be ₹ P . Amount after first year

$$= P \left(1 + \frac{R_1}{100} \right)$$

This amount will be the principal for the second year.

∴ Amount after second year

$$= P \left(1 + \frac{R_1}{100} \right) \left(1 + \frac{R_2}{100} \right)$$

This amount will be the principal for the third year.

∴ Amount after third year

$$= P \left(1 + \frac{R_1}{100} \right) \left(1 + \frac{R_2}{100} \right) \left(1 + \frac{R_3}{100} \right).$$

Illustration 7 Anu invests ₹5000 in a bond which gives interest at 4% per annum during the first year, 5% during the second year and 10% during the third year. How much does she get at the end of the third year

Solution: Here $P = 5000$, $R_1 = 4$, $R_2 = 5$ and, $R_3 = 10$

∴ Amount at the end of third year

$$\begin{aligned} &= P \left(1 + \frac{R_1}{100} \right) \left(1 + \frac{R_2}{100} \right) \left(1 + \frac{R_3}{100} \right) \\ &= 5000 \left(1 + \frac{4}{100} \right) \left(1 + \frac{5}{100} \right) \left(1 + \frac{10}{100} \right) \\ &= 5000 \times \frac{26}{25} \times \frac{21}{20} \times \frac{11}{10} = ₹6006. \end{aligned}$$

2. When the time is given in the form of fraction, say

$\frac{3}{4}$ years, then,

$$\text{Amount} = P \left(1 + \frac{R}{100} \right)^3 \times \left(1 + \frac{\frac{3}{4}R}{100} \right).$$

Illustration 8 What will be the compound interest on ₹15625 for two and half years at 4% per annum?

$$\begin{aligned} \text{Solution: } CI &= 15625 \left[\left(1 + \frac{4}{100} \right)^2 \left(1 + \frac{4 \times \frac{1}{2}}{100} \right) - 1 \right] \\ &= 15625 \left[\frac{26}{25} \times \frac{26}{25} \times \frac{51}{50} - 1 \right] \\ &= \frac{15625 \times 3226}{31250} = ₹1613 \end{aligned}$$

3. (a) The difference between the compound interest and the simple interest on a certain sum of money for 2 years at $R\%$ per annum is given by

$$CI - SI = P \left(\frac{R}{100} \right)^2 \quad [\text{in terms of } P \text{ and } R]$$

$$\text{and, } CI - SI = \frac{R \times SI}{2 \times 100} \quad [\text{in terms of } SI \text{ and } R]$$

Explanation

Let, ₹ P be given sum of money. Simple interest on ₹ P for 2 years at $R\%$ per annum

$$= \frac{P \times R \times 2}{100}$$

and compound interest on ₹ P for 2 years at $R\%$ per annum

$$= P \left[\left(1 + \frac{R}{100} \right)^2 - 1 \right]$$

$$\begin{aligned} \therefore CI - SI &= P \left[\left(1 + \frac{R}{100} \right)^2 - 1 \right] - \frac{P \times R \times 2}{100} \\ &= P \left[1 + \frac{R^2}{10000} + \frac{2R}{100} - 1 - \frac{2R}{100} \right] \\ &= P \left(\frac{R}{100} \right)^2 \end{aligned}$$

$$\begin{aligned} \text{Also, } CI - SI &= P \left(\frac{R}{100} \right)^2 = \frac{R}{100 \times 2} \times \left(\frac{P \times R \times 2}{100} \right) \\ &= \frac{R \times SI}{2 \times 100}. \end{aligned}$$

- (b) The difference between the compound interest and the simple interest on a certain sum of money for 2 years at $R\%$ per annum is given by

$$CI - SI = P \left[\left(\frac{R}{100} \right)^3 + 3 \left(\frac{R}{100} \right)^2 \right]$$

[in terms of P and R]

$$\text{and, } CI - SI = \frac{SI}{3} \left[\left(\frac{R}{100} \right)^2 + 3 \left(\frac{R}{100} \right) \right]$$

[in terms of SI and R]

Explanation

Let, ₹ P be the given sum of money. Simple interest on ₹ P for 3 years at $R\%$ per annum

$$= \frac{P \times R \times 3}{100}$$

and compound interest on ₹ P for 3 years at $R\%$ per annum

$$= P \left[\left(1 + \frac{R}{100} \right)^3 - 1 \right]$$

$$\begin{aligned} \therefore CI - SI &= P \left[\left(1 + \frac{R}{100} \right)^3 - 1 \right] - \frac{P \times R \times 3}{100} \\ &= P \left[1 + \frac{R^3}{100000} + \frac{3R^2}{10000} + \frac{3R}{100} - 1 - \frac{3R}{100} \right] \\ &= P \left[\frac{R^3}{100000} + \frac{3R^2}{1000} \right] \\ &= P \left[\left(\frac{R}{100} \right)^3 + 3 \left(\frac{R}{100} \right)^2 \right] \\ &= \frac{P \times R \times 3}{100} \times \frac{1}{3} \left[\left(\frac{R}{100} \right)^2 + 3 \left(\frac{R}{100} \right) \right] \\ &= \frac{SI}{3} \left[\left(\frac{R}{100} \right)^2 + 3 \left(\frac{R}{100} \right) \right]. \end{aligned}$$

Illustration 9 What will be the difference between simple and compound interest on a sum of ₹4500 put for 2 years at 5% per annum?

Here, $P = 4500$ and, $R = 5$.

$$\therefore CI - SI = P \left(\frac{R}{100} \right)^2 = 4500 \left(\frac{5}{100} \right)^2 = \frac{4500}{20 \times 20} = ₹11 \times 25.$$

Illustration 10 If the difference between the compound interest and simple interest on a certain sum of money for 3 years at 5% per annum is ₹61, find the sum

Solution: Here $CI - SI = 61$ and, $R = 5$

$$\begin{aligned} \therefore CI - SI &= P \left[\left(\frac{R}{100} \right)^3 + 3 \left(\frac{R}{100} \right)^2 \right] \\ \Rightarrow 61 &= P \left[\left(\frac{5}{100} \right)^3 + 3 \left(\frac{5}{100} \right)^2 \right] \\ &= P \left[\left(\frac{1}{20} \right)^3 + 3 \left(\frac{1}{20} \right)^2 \right] \\ &= P \left[\frac{1 + 3 \times 20}{20 \times 20 \times 20} \right] = P \left(\frac{61}{20 \times 20 \times 20} \right) \\ \Rightarrow P &= ₹8000. \end{aligned}$$

4. If a certain sum becomes n times in t years at compound interest, then the same sum becomes n^m times in mt years.

Explanation

Let, ₹ P be the given sum of money. We have,

$$nP = P \left(1 + \frac{R}{100} \right)^t \Rightarrow n = \left(1 + \frac{R}{100} \right)^t \quad (1)$$

Let, the sum become n^m times in T years.

$$\text{Then, } n^m = \left(1 + \frac{R}{100} \right)^T$$

$$\text{or, } n = \left(1 + \frac{R}{100} \right)^{T/m} \quad (2)$$

On comparing Eqs. (1) and (2), we get

$$T/m = t \text{ or, } T = mt \text{ years.}$$

Therefore, the sum becomes n^m times in mt years.

Illustration 11 A sum of money placed at compound interest doubles itself in 3 years. In how many years will it amount to four times itself?

Solution: Here $n = 2$, $t = 3$ and, $m = 2$

\therefore The given sum of money will become four times itself in mt , i.e., $2 \times 3 = 6$ years.

5. If a certain sum becomes n times in t years, then the rate of compound interest is given by

$$R = 100[(n)^{1/t} - 1].$$

Illustration 12 At what rate per cent compound interest does a sum of money become four-fold in 2 years?

Solution: The required rate per cent is

$$R = 100[(n)^{1/t} - 1] = 100[(4)^{1/2} - 1] \\ = 100(2 - 1) = 100\%$$

[Here $n = 4$ and, $t = 2$]

6. If a certain sum of money at compound interest amounts to ₹ x in A years and to ₹ y in B years, then the rate of interest per annum is

$$R = \left[\left(\frac{y}{x} \right)^{1/B-A} - 1 \right] \times 100\%$$

Explanation

Let, the principal be ₹ P and the rate of interest be $R\%$ per annum.

Given $x = P \left(1 + \frac{R}{100} \right)^A$ and, $y = P \left(1 + \frac{R}{100} \right)^B$

$$\therefore \frac{y}{x} = \frac{\left(1 + \frac{R}{100} \right)^B}{\left(1 + \frac{R}{100} \right)^A} = \left(1 + \frac{R}{100} \right)^{B-A}$$

$$\therefore \left(\frac{y}{x} \right)^{1/B-A} = 1 + \frac{R}{100}$$

$$\text{or, } \frac{R}{100} = \left(\frac{y}{x} \right)^{1/B-A} - 1$$

$$\text{or, } R = \left[\left(\frac{y}{x} \right)^{1/B-A} - 1 \right] \times 100.$$

Illustration 13 A sum of money at compound interest amounts to ₹4050 in one year and to ₹4723.92 in 3 years. Find the rate of interest per annum

Solution: Here $x = 4050$, $y = 4723.92$, $A = 1$ and, $B = 3$

$$\therefore R = \left[\left(\frac{y}{x} \right)^{1/B-A} - 1 \right] \times 100\% \\ = \left[\left(\frac{4723.92}{4050} \right)^{1/2} - 1 \right] \times 100\% \\ = \left(\frac{27}{25} - 1 \right) \times 100\% = 8\%$$

7. If a loan of ₹ P at $R\%$ compound interest per annum is to be repaid in n equal yearly instalments, then the value of each instalment is given by

$$\text{₹} \frac{P}{\left(\frac{100}{100+R} \right) + \left(\frac{100}{100+R} \right)^2 + \dots + \left(\frac{100}{100+R} \right)^n}$$

Explanation

Let, each instalment be of ₹ X .

\therefore Principal for the amount of ₹ X due at end of first year

$$\text{at } R\% = \frac{100X}{100+R}$$

Principal for the amount of ₹ X due at the end of second

$$\text{year at } R\% = \left(\frac{100}{100+R} \right)^2 X$$

\vdots \vdots \vdots

Principal for the amount of ₹ X due at the end of n th

$$\text{year at } R\% = \left(\frac{100}{100+R} \right)^n X$$

$$\therefore \frac{100X}{100+R} + \left(\frac{100}{100+R} \right)^2 X + \dots + \left(\frac{100}{100+R} \right)^n X = P$$

$$\text{or, } X = \text{₹} \frac{P}{\left(\frac{100}{100+R} \right) + \left(\frac{100}{100+R} \right)^2 + \dots + \left(\frac{100}{100+R} \right)^n}$$

Illustration 14 If a sum of ₹13040 is to be paid back in two equal annual instalments at $3\frac{3}{4}\%$ per annum, what is the amount of each instalment?

Solution: Each instalment

$$= \frac{P}{\left(\frac{100}{100+R} \right) + \left(\frac{100}{100+R} \right)^2} = \frac{13040}{\left(\frac{100}{100+\frac{15}{4}} \right) + \left(\frac{100}{100+\frac{15}{4}} \right)^2} \\ \left[\text{Here } P = 13040 \text{ and } R = \frac{15}{4} \right] \\ = \frac{13040}{\frac{400}{415} + \left(\frac{400}{415} \right)^2} = \frac{13040}{\frac{400}{415} \left(1 + \frac{400}{415} \right)} \\ = 13040 \times \frac{415}{400} \times \frac{815}{400} = \text{₹}6889.$$

Practice Exercises

DIFFICULTY LEVEL-1 (BASED ON MEMORY)

1. A scooter costs ₹25,000 when it is brand new. At the end of each year, its value is only 80% of what it was at the beginning of the year. What is the value of the scooter at the end of 3 years?

(a) ₹10,000 (b) ₹12,500
(c) ₹12,800 (d) ₹12,000

[Based on MAT, 2004]

2. Sanjay borrowed a certain sum from Anil at a certain rate of simple interest for 2 years. He lent this sum to Ram at the same rate of interest compounded annually for the same period. At the end of two years, he received ₹4200 as compound interest but paid ₹4000 only as simple interest. Find the rate of interest.

(a) 15% (b) 20%
(c) 35% (d) 10%

[Based on MAT, 2002]

3. If the ratio of compound interest and simple interest for the same principal and rate of interest for two years is 1.2% per annum, find the rate of interest.

(a) 3% (b) 15%
(c) 140% (d) 300%

4. If the difference between the simple and the compound interests on some principal amount at 20% for 3 years is ₹48, then the principal amount must be:

(a) ₹650 (b) ₹600
(c) ₹375 (d) ₹400

[Based on MAT, 2001]

5. A bank offers 10% interest rate compounded annually. A person deposits ₹10,000 every year in his account. If he does not withdraw any amount, then how much balance will his account show after four years?

(a) ₹51051 (b) ₹45095
(c) ₹36410 (d) ₹51000

[Based on FMS (Delhi), 2004]

6. Two customers borrowed the same amount of money, one at compound interest and the other at simple interest. If after 2 years, the interest payable by one was ₹220 and by the other ₹200, then, what was the principal money lent to each one of them?

(a) ₹450 (b) ₹500
(c) ₹550 (d) None of these

[Based on IIT Joint Man. Ent. Test, 2004]

7. What is the present value (in lakhs of ₹) of an income of ₹2 lakhs to be received after 2 years if the rate of interest is 5%?

(a) 1.81 (b) 1.67
(c) 2.2 (d) None of these

[Based on IIT Joint Man. Ent. Test, 2004]

8. A sum is invested for 3 years compounded at 5%, 10% and 20% respectively. In three years, if the sum amounts to ₹16,632, then find the sum.

(a) ₹11000 (b) ₹12000
(c) ₹13000 (d) ₹14000

[Based on IIT Joint Man. Ent. Test, 2004]

9. What will be the difference in the compound interest on ₹50,000 at 12% for one year, when the interest is paid yearly and half-yearly?

(a) ₹500 (b) ₹600
(c) ₹180 (d) ₹360

[Based on IIT Joint Man. Ent. Test, 2004]

10. Akash borrows ₹65,000 at 10% per annum simple interest for 3 years and lends it at 10% per annum, compound interest for 3 years. Find his gain after three years.

(a) ₹2015 (b) ₹1330
(c) ₹1300 (d) None of these

[Based on IIT Joint Man. Ent. Test, 2004]

11. What is the compound interest on ₹5,000 for 4 years if the rate of interest is 10% p.a. for the first 2 years and 20% per annum for the next 2 years?

(a) ₹2,320.50 (b) ₹3,712
(c) ₹3,745 (d) None of these

12. Rohit earns an interest of ₹1656 for the third year and ₹1440 for the second year on the same sum. Find the rate of interest if it is lent at compound interest.

(a) 18% (b) 12%
(c) 15% (d) None of these

[Based on IIT Joint Man. Ent. Test, 2004]

13. Divide ₹1301 between A and B, so that the amount of A after 7 years is equal to the amount of B after 9 years, the interest being compounded at 4% per annum.

(a) ₹676 and ₹625 (b) ₹650 and ₹651
(c) ₹670 and ₹631 (d) ₹660 and ₹630

[Based on IIFT, 2003]

14. Amit borrowed ₹800 at 10% rate of interest. He repaid ₹400 at the end of first year. What is the amount he is required to pay at the end of second year to discharge his loan which was calculated at compound interest?

(a) 420 (b) 440
(c) 450 (d) 528

15. What is the net present value of stock valued at ₹54,880 after 3 years? (Rate of interest = 40% per annum and interest is compounded annually)

(a) ₹20,000 (b) ₹30,000
(c) ₹40,000 (d) ₹50,000

16. A sum of ₹1,100 was taken as a loan. This is to be repaid in two equal instalments. If the rate of interest be 20% compounded annually, then the value of each instalment is:

(a) ₹842 (b) ₹792
(c) ₹720 (d) ₹700

17. Ravi Shankar takes money from the employees cooperative society at lower rate of interest and saves in a scheme, which gives him a compound interest of 20% compounded annually. Find the least number of complete years after which his sum will be more than double

(a) 4 years (b) 2 years
(c) 6 years (d) 8 years

[Based on MAT (Feb), 2011]

18. Equal sums of money are deposited in two different banks by M/s Enterprises, one at compound interest, compounded annually and the other at simple interest, both at 5% per annum. If after two years, the difference in the amounts comes to ₹200, what are the amounts deposited with each bank?

(a) ₹72000 (b) ₹64000
(c) ₹80000 (d) ₹8400

[Based on MAT (Feb), 2011]

19. Rohit took a loan of ₹20000 to purchase one LCD TV set from a finance company. He promised to make the payment after three years. The company charges compound interest at the rate of 10% per annum for the same. But suddenly the company announces the rate of interest as 15% per annum for the last one year of the loan period. What extra amount does Rohit have to pay due to this announcement of the new rate of interest?

(a) ₹7830 (b) ₹4410
(c) ₹6620 (d) None of these

[Based on MAT (Dec), 2011]

20. A tree was planted three years ago. The rate of its growth is 30% per annum. If at present, the height of the tree is 670 cm, what was it when the tree was planted?

(a) 305 cm (b) 500 cm
(c) 405 cm (d) 625 cm

[Based on MAT (Dec), 2010]

21. Sanju puts equal amounts of money, one at 10% per annum compound interest payable half yearly and the second at a certain per cent per annum compound interest payable yearly. If he gets equal amounts after 3 years, what is the value of the second per cent?

(a) $10\frac{1}{4}\%$ (b) 10%
(c) $9\frac{1}{2}\%$ (d) $8\frac{1}{4}\%$

[Based on MAT (Dec), 2010]

22. A man borrows ₹4000 from a bank at $7\frac{1}{2}\%$ compound interest. At the end of every year, he pays ₹1500 as part

repayment of loan and interest. How much does he still owe to the bank after three such instalments?

(a) ₹123.25 (b) ₹125
(c) ₹400 (d) ₹469.18

[Based on MAT (Sept), 2010]

23. Amit borrowed a certain sum of money for 2 years at 8% per annum on simple interest and immediately lent it to Ravi but at compound interest and gained by ₹16. What amount did Amit borrow?

(a) ₹1600 (b) ₹2500
(c) ₹24000 (d) ₹1800

[Based on MAT (May), 2010]

24. Raju's factory kept increasing its output by the same percentage every year. Find the percentage if it is known that his output is doubled after two years.

(a) $100\sqrt{2}\%$ (b) $100(\sqrt{2} + 1)\%$
(c) $100(\sqrt{2} - 1)\%$ (d) $50(\sqrt{3} - 1)\%$

[Based on MAT (May), 2010]

25. The effective annual rate of interest corresponding to a nominal rate of 8% per annum payable half yearly is:

(a) 8% (b) 8.01%
(c) 8.13% (d) 8.16%

[Based on MAT (Feb), 2010]

26. The population of a colony was 3600 three years back. It is 4800 right now. What will be the population three years down the line, if the rate of growth of population has been constant over the years and has been compounding annually?

(a) 6000 (b) 6400
(c) 7200 (d) 9600

[Based on MAT (Feb), 2010]

27. ₹5887 is divided between Shyam and Ram, such that Shyam's share at the end of 9 years is equal to Ram's share at the end of 11 years, compounded annually at the rate of 5% The share of Shyam is:

(a) ₹2088 (b) ₹2000
(c) ₹3087 (d) None of these

[Based on MAT (Feb), 2010]

28. The population of a village is 10000. If the population increases by 10% in the first year, by 20% in the second year and due to mass exodus, it decreases by 5% in the third year, what will be its population after 3 years?

(a) 13860 (b) 11540
(c) 12860 (d) 12540

[Based on MAT (Feb), 2009]

29. A sum of money is accumulating at compound interest at a certain rate of interest. If simple interest instead of compound were reckoned, the interest for the first two years would be diminished by ₹20 and that for the first three years by ₹61. Find the sum.

(a) ₹7000 (b) ₹8000
(c) ₹7500 (d) ₹6500

[Based on MAT (Dec), 2008]

30. The difference between the compound interest and simple interest earned at the end of second year on a sum of money at 10% per annum is ₹20. The sum is:

(a) ₹4,000 (b) ₹2,000
(c) ₹1,500 (d) Data inadequate

31. Ram takes a loan of ₹10000 and pays back ₹13310 after 3 years. The compound interest rate per annum will be approximately:

(a) 8% (b) 9%
(c) 10% (d) 11%

[Based on MAT (Sept), 2007]

32. The ratio of the amount for two years under CI annually and for one year under SI is 6:5. When the ratio of interest is same, then the value of the rate of interest is:

(a) 12.5% (b) 18%
(c) 20% (d) 16.66%

[Based on MAT (Dec), 2006]

33. A computer is available for ₹39000 cash or ₹17000 as cash down payment followed by five monthly instalments of ₹4800 each. What is the rate of interest per annum under the instalment plan?

(a) 35.71% (b) 37.71%
(c) 36.71% (d) 38.71%

[Based on MAT (May), 2006]

34. Under the Rural Housing Scheme, the Delhi Development Authority (DDA) allotted a house to Kamal Raj for ₹126100. This payment is to be made in three equal annual instalments. If the money is reckoned at 5% per annum compound interest, then how much is to be paid by Kamal Raj in each instalment?

(a) ₹45205 (b) ₹47405
(c) ₹46305 (d) ₹48505

[Based on MAT (May), 2006]

35. A sum of ₹30600 is divided between Anjali and Arun, who are respectively 18 and 19 years old, in such a way that if their shares are invested at 4% per annum compounded annually, they shall receive the same amount on reaching 21 years of age. What is the share of Anjali?

(a) ₹16000 (b) ₹15000
(c) ₹15600 (d) ₹14600

[Based on MAT (May), 2010]

36. Two friends A and B jointly lent out ₹81600 at 4% per annum compound interest. After 2 years, A gets the same amount as B gets after 3 years. The investment made by B was:

(a) ₹40000 (b) ₹30000
(c) ₹45000 (d) ₹38000

[Based on MAT (Feb), 2008]

37. A sum of money becomes eight times in 3 years if the rate is compounded annually. In how much time the same amount at the same compound interest rate will become sixteen times?

(a) 6 years (b) 4 years
(c) 8 years (d) 5 years

[Based on MAT, 1999]

38. A sum of money is borrowed and paid back in two equal annual instalments of ₹882 allowing 5% compound interest. The sum borrowed was:

(a) ₹1,620 (b) ₹1,600
(c) ₹1,680 (d) ₹1,700

[Based on MAT, 2000]

39. The difference between compound interest and simple interest at the same rate ₹5000 for 2 years is ₹72. The rate of interest per annum is:

(a) 6% (b) 8%
(c) 10% (d) 12%

[Based on FMS, 2006]

40. The present value of an optical instrument is ₹20000. If its value will depreciate 5% in the first year, 4% in the second year and 2% in the third year, what will be its value after three years?

(a) ₹16534.5 (b) ₹16756.5
(c) ₹17875.2 (d) ₹17556.8

[Based on FMS, 2009]

41. If the daily compounding rate of interest is 10% on an investment, what is the present value of ₹50000 that is to be received after two years?

(a) ₹40936.54 (b) ₹41037.33
(c) ₹41322.31 (d) ₹40000

[Based on FMS, 2009]

42. A loan was repaid in two annual instalments of ₹121 each. If the rate of interest be 10% per annum, compounded annually, the sum borrowed was:

(a) ₹200 (b) ₹210
(c) ₹217.80 (d) ₹216

43. The total compound interest earned on an amount @ 15% per annum at the end of three years is ₹ 9844.5375. What is the amount?

(a) ₹17500 (b) ₹18900
(c) ₹19700 (d) ₹19400

[Based on IRMA, 2005]

44. The population of a city increases at a rate of 4% per annum. There is an additional annual increase of 1% in the population due to the influx of job seekers. The per cent increase in the population after 2 years is:

(a) 10.25 (b) 10
(c) 10.50 (d) 10.75

45. A scooter costs ₹25,000 when it is brand new. At the end of each year, its value is only 80% of what it was at the beginning of the year. What is the value of the scooter at the end of 3 years?

(a) ₹10,000 (b) ₹12,500
(c) ₹12,800 (d) ₹12,000

46. Anuj has deposited certain amount in the bank to earn compound interest at 10% per annum. The difference in the interest on the amount between the 3rd and 2nd years is ₹1,100. What amount has Anuj deposited?

(a) ₹10,000 (b) ₹11,000
(c) Data inadequate (d) None of these

47. The population of a town increases annually by 25%. If the present population is one crore, then what is the difference between the population 3 years ago and 2 years ago?

(a) 25,00,000 (b) 12,80,000
(c) 15,60,000 (d) None of these

48. Rohit earns an interest of ₹1,656 for the third year and ₹1,440 for the second year on the same sum. Find the rate of interest if it is lent at compound interest.

(a) 18% (b) 12%
(c) 15% (d) None of these

49. A man borrows ₹6000 at 10% compound rate of interest. He pays back ₹2000 at the end of each year to clear his debt. The amount that he should pay to clear all his dues at the end of third year is:

(a) ₹6000 (b) ₹3366
(c) ₹3060 (d) ₹3066

[Based on MAT, 2011]

50. Sharma invested one-half of his savings in a bond that paid simple interest for 2 years and received ₹500 as interest. He invested the remaining in a bond that paid compound interest, interest being compounded annually, for the same 2 years at the same rate of interest and received ₹605 as interest. What was the value of his total saving before investing in these two bonds?

(a) ₹22000 (b) ₹11000
(c) ₹5500 (d) ₹2750

[Based on MAT, 2011]

51. A sum of money lent at compound interest for 2 years at 20% per annum would fetch ₹482 more, if the interest was payable half yearly than if it was payable annually. The sum is:

(a) ₹10000 (b) ₹20000
(c) ₹40000 (d) ₹50000

[Based on MAT, 2012]

52. Palvinder owes ₹1040000 to a bank, and he returns ₹40000 quarterly to the bank. If the tax on the money Palvinder owes is completed quarterly by 0.25% starting before Palvinder paid the first payment, how many months would it take Palvinder to reach a point where he owns the bank not more than 1 million rupees?

(a) 3 (b) 5
(c) 9 (d) None of these

[Based on MAT, 2013]

53. The present worth of a bill due 7 months hence is ₹1200. If the bill were due at the end of $2\frac{1}{2}$ years its present worth would be ₹1016. What is the rate per cent of the bill?

(a) 8% (b) 10%
(c) 16% (d) 18%

[Based on MAT, 2013]

54. Find the principal if compound interest is charged on the principal at the rate of $16\frac{2}{3}\%$ per annum for two years and the sum becomes ₹196.

(a) ₹140 (b) ₹154
(c) ₹150 (d) None of these

[Based on MAT, 2014]

55. Mukesh borrows a certain sum of money from the ABC Bank at 10% per annum at compound interest. The entire debt is discharged in full by Mukesh on payment of two equal amounts of ₹1000 each, one at the end of the first year and the other at the end of the second year. What is the approximate value of the amount borrowed to him?

(a) ₹1852 (b) ₹1694
(c) ₹1736 (d) ₹1792

[Based on MAT, 2014]

56. The simple interest accrued on a sum of certain principal in 8 years at the rate of 13% per year is ₹6500. What would be the compound interest accrued on that principal at the rate of 8% per year in 2 years?

(a) ₹1040 (b) ₹1020
(c) ₹1060 (d) ₹1200

[Based on SNAP, 2013]

DIFFICULTY LEVEL-2 (BASED ON MEMORY)

1. A and B each borrowed equal sums for 3 years at the rate of 5% simple and compound interest respectively. At the time of repayment B has to pay ₹76.25 more than A. The sum borrowed and the interest paid by A (in ₹) is:

(a) ₹10,000, ₹1,500 (b) ₹11,000, ₹1,100
(c) ₹10,000, ₹1,400 (d) ₹9,000, ₹200

2. The value of a fixed asset depreciates at the rate of 10% on the value at the beginning of each year. If the value of the asset, two years ago, was ₹12,000 more than the value of the asset one year ago, then find the present value of the asset, given that the asset was bought two years ago.

(a) ₹14520 (b) ₹96,000
(c) ₹97,200 (d) ₹17,520

[Based on IIT Joint Man. Ent. Test, 2004]

3. A father divides his property between his two sons A and B . A invests the amount at compound interest of 8% per annum B invests the amount at 10% per annum simple interest. At the end of 2 years, the interest received by B is ₹1336 more than the interest received by A . Find the share of A in the father's property of ₹25,000.

(a) ₹12,000 (b) ₹13,000
(c) ₹12,500 (d) ₹10,000

[Based on IIT Joint Man. Ent. Test, 2004]

4. The population of a town increases annually by 25%. If the present population is one crore, then what is the difference between the population 3 years ago and 2 years ago?

(a) 25,00,000 (b) 12,80,000
(c) 15,60,000 (d) None of these

[Based on IIT Joint Man. Ent. Test, 2004]

5. Anuj has deposited certain amount in the bank to earn compound interest at 10% per annum. The difference in the interest on the amount between the 3rd and 2nd years is ₹1,100. What amount has Anuj deposited?

(a) ₹10000 (b) ₹11000
(c) Data inadequate (d) None of these

[Based on Narsee Manjee Inst. of Man. Studies, 2003]

6. The difference between compound interest and simple interest on a sum for 2 years at 10% per annum, when the interest is compounded annually is ₹16. If the interest were compounded half yearly, the difference in two interests will be:

(a) ₹24.81 (b) ₹31.61
(c) ₹32.40 (d) ₹26.90

7. The compound interest on a certain sum for 2 years is ₹756 and S.I. (simple interest) is ₹720. If the sum is invested such that the S.I. is ₹900 and the number of years is equal to the rate per cent per annum, find the rate per cent.

(a) 4 (b) 5/2
(c) 6 (d) 1.0

8. A person invested a certain amount at simple interest at the rate of 6% per annum earning ₹900 as an interest at the end of three years. Had the interest been compounded every year, how much more interest would he have earned on the same amount with the same interest rate after three years?

(a) ₹38.13 (b) ₹25.33
(c) ₹55.08 (d) ₹35.30

9. The population of vultures in a particular locality decreases by a certain rate of interest (compounded annually). If the current population of vultures be 29,160 and the ratio of decrease in population for second year and 3rd year be 10:9. What was the population of vultures 3 years ago?

(a) 30,000 (b) 35,000
(c) 40,000 (d) 50,000

10. Equal amounts of each ₹43,892 is lent to two persons for 3 years. One at the rate of 30% S.I. and second at the rate of 30% C.I. annually. By how much per cent the C.I. is greater than the simple interest received in this 3 years duration?

(a) 23% (b) 33%
(c) 33.33% (d) None of these

11. Mr Jeevan wanted to give some amount of money to his two children, so that although today they may not be using it, in the future the money would be of use to them. He divides a sum of ₹18750 between his two sons of age 10 years and 13 years respectively in such a way that each would receive the same amount at 3% per annum compound interest when he attains the age of 30 years. What would be the original share of the younger son?

(a) 8959.80 (b) 8559.80
(c) 8969.80 (d) 8995.80

[Based on IIFT, 2007]

12. To start a new enterprise, Mr Yogesh has borrowed a total of 60000 from two money lenders with the interest being compounded annually, to be repaid at the end of 2 years. Mr Yogesh repaid ₹38800 more to the first money lender compared to the second money lender at the end of 2 years. The first money lender charged an interest rate, which was 10% more than what was charged by the second money lender. If Mr Yogesh had instead borrowed ₹30000 from each at their respective initial rates for 2 years, he would have paid ₹7500 more to the first money lender compared to the second. Then, money borrowed by Mr Yogesh from first money lender is:

(a) 20000 (b) 35000
(c) 40000 (d) 42000

[Based on IIFT, 2010]

13. Mungeri Lai has two investment plans: A and B , to choose from plan A offers interest of 10% compounded annually while plan B offers simple interest of 12% per annum. Till how many years is plan B a better investment?

(a) 3 (b) 4
(c) 5 (d) 6

[Based on XAT, 2009]

14. Anu borrowed a sum of money and returned it in three equal quarterly instalments of ₹17,576 each. Find the sum borrowed, if the rate of interest charged was 16% per annum compounded quarterly. Find also the total interest charged.

(a) 46,900 and 4,700 (b) 48,775 and 3,953
(c) 68,320 and 1,200 (d) None of these

15. A father divides his property between his two sons A and B . A invests the amount at compound interest of 8% per annum and B invests the amount at 10% per annum simple interest. At the end of 2 years, the interest received by B is ₹1,336 more than the interest received by A . Find the share of A in the father's property of ₹25,000.

- (a) ₹12,000 (b) ₹13,000
(c) ₹12,500 (d) ₹10,000
16. The value of a fixed asset depreciates at the rate of 10% on the value at the beginning of each year. If the value of the asset, two years ago, was ₹12,000 more than the value of the asset one year ago, then find the present value of the asset, given that the asset was bought two years ago.
(a) ₹14520 (b) ₹96,000
(c) ₹97,200 (d) ₹17,520
17. Sanjay borrowed a certain sum from Anil at a certain rate of simple interest for 2 years. He lent this sum to Ram at the same rate of interest compounded annually for the same period. At the end of two years, he received ₹4,200 as compound interest but paid ₹4,000 only as simple interest. Find the rate of interest.
(a) 15% (b) 20%
(c) 35% (d) 10%
18. Shudhir invested ₹16000 in a scheme which earned him simple interest @ 15% per annum. After two years he withdrew the principal amount plus interest and invested the entire amount in amount scheme for two years, which earned him compound interest @ 12% per annum. What would be the total interest earned by Sudhir at the end of 4 years?
(a) ₹9792 (b) ₹10152.11
(c) ₹9012.14 (d) None of these
- [Based on IRMA, 2008]
19. A man borrows ₹4000 at 20% compound rate of interest. At the end of each year he pays back ₹1500. How much amount should he pay at the end of the third year to clear all his dues?
(a) ₹2952 (b) ₹2852
(c) ₹2592 (d) ₹2953
- [Based on NMAT, 2005]

20. One can purchase a flat from a house building society for ₹55000 cash or on the terms that he should pay ₹4275 as cash down payment and the rest in three equal yearly instalments. The society charges interest at the rate of 16% per annum compounded half yearly. If the flat is purchased under instalments plan, find the value of each instalments.
(a) ₹39683 (b) ₹19683
(c) ₹29683 (d) ₹22803
- [Based on NMAT, 2005]
21. A man borrows a certain sum and pays it back in 2 years in two equal instalments. If the compound interest is reckoned at 4% and if he pays back annually ₹676 the sum borrowed is:
(a) ₹1275 (b) ₹1078
(c) ₹1870 (d) None of these
- [Based on NMAT, 2006]
22. Sultan took a loan from the bank at 8% per annum and was supposed to pay a sum of ₹2240 at the end of 4 years. If the same sum is cleared off in four equal annual installments at the same rate, the amount of annual installment will be:
(a) ₹500 (b) ₹550
(c) ₹600 (d) ₹1000
- [Based on MAT, 2012]
23. A sum of money is accumulating at compound interest at a certain rate of interest. If simple interest instead of compound were reckoned, the interest for the first two years would be diminished by ₹20 and that for the first three years, by 61. What is the sum?
(a) ₹7500 (b) ₹7000
(c) ₹8000 (d) ₹6500
- [Based on MAT, 2013]

Answer Keys

DIFFICULTY LEVEL-1

1. (c) 2. (d) 3. (c) 4. (c) 5. (a) 6. (b) 7. (a) 8. (b) 9. (c) 10. (a) 11. (b) 12. (c) 13. (a)
14. (d) 15. (a) 16. (c) 17. (b) 18. (c) 19. (d) 20. (a) 21. (a) 22. (a) 23. (b) 24. (c) 25. (d) 26. (b)
27. (c) 28. (d) 29. (b) 30. (b) 31. (c) 32. (c) 33. (d) 34. (c) 35. (b) 36. (a) 37. (b) 38. (b) 39. (d)
40. (c) 41. (c) 42. (b) 43. (b) 44. (a) 45. (c) 46. (b) 47. (b) 48. (c) 49. (b) 50. (d) 51. (b) 52. (d)
53. (b) 54. (d) 55. (c) 56. (a)

DIFFICULTY LEVEL-2

1. (a) 2. (c) 3. (d) 4. (b) 5. (b) 6. (a) 7. (b) 8. (c) 9. (c) 10. (b) 11. (a) 12. (c) 13. (b)
14. (b) 15. (d) 16. (c) 17. (d) 18. (d) 19. (a) 20. (b) 21. (a) 22. (a) 23. (c)

Explanatory Answers

DIFFICULTY LEVEL-1

$$1. (c) \quad 25000 \left(1 - \frac{20}{100}\right)^3 = 25000 \times \frac{4}{5} \times \frac{4}{5} \times \frac{4}{5}$$

$$= 12800.$$

2. (d) Suppose the sum borrowed = ₹x

Rate of interest = R%

Time = 2 years

$$\therefore 4000 = \frac{x \times R \times 2}{100}$$

$$\Rightarrow Rx = 200000$$

Now,

$$x \left(1 + \frac{R}{100}\right)^2 = x + 4200$$

$$\Rightarrow \frac{xR^2}{10000} + \frac{2RX}{100} = 4200$$

$$\Rightarrow 20R + 4000 = 4200$$

$$\Rightarrow R = 10.$$

3. (c) Let, P be the principal, r be the rate of interest.

$$C.I. = \frac{Pr}{100} + \frac{\frac{Pr}{100} \times r}{100} = \frac{Pr}{100} \left(1 + \frac{r}{100}\right)$$

$$S.I. = \frac{2Pr}{100}$$

$$\therefore \frac{C.I.}{S.I.} = 1.2 \Rightarrow \frac{\frac{Pr}{100} \left(1 + \frac{r}{100}\right)}{\frac{2Pr}{100}} = 1.2$$

$$\Rightarrow 1 + \frac{r}{100} = 2.4 \text{ or, } \frac{r}{100} = 1.4$$

$$r = 140\%$$

4. (c) Let, the principal be ₹100.

$$\therefore S.I. = \frac{100 \times 20 \times 3}{100} = ₹60$$

$$C.I. = 100 \left(1 + \frac{20}{100}\right)^3 - 100$$

$$= 100 \times \frac{6}{5} \times \frac{6}{5} \times \frac{6}{5} - 100$$

$$= 100 \left[\frac{216 - 125}{125} \right] = \frac{4}{5} \times 91 = \frac{364}{5}$$

$$\therefore C.I. - S.I. = \frac{364}{5} - 60 = \frac{64}{5}$$

If difference is ₹ $\frac{64}{5}$, principal = ₹100

If difference is ₹48, principal

$$= \frac{100 \times 5}{64} \times 48 = ₹375.$$

5. (a) ₹10000 after 4 years become

$$= 10000 \left[1 + \frac{10}{100}\right]^4 = 10000 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10}$$

$$= 14641$$

₹10000 after 3 years become

$$= 10000 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10} = 13310$$

₹10000 after 2 years become

$$= 10000 \times \frac{11}{10} \times \frac{11}{10} = 12100$$

₹10000 after 1 year become ₹11000

\therefore Total amount after 4 years = ₹51051.

6. (b) S.I. for two years = ₹200

S.I. for one years = ₹100

C.I. for two years = ₹220

\Rightarrow ₹20 is the interest on ₹100 for one year.

If interest is ₹20, then amount = ₹100.

If interest is ₹100, then amount

$$= \frac{100}{20} \times 100 = ₹500.$$

7. (a) P = Present value of ₹2 lakhs

$$\Rightarrow P \left(1 + \frac{5}{100}\right)^2 = 2 \text{ Lakhs}$$

$$\Rightarrow P = \frac{2 \times 20 \times 20}{21 \times 21} \approx 1.81.$$

8. (b) Let, P be the sum.

$$\therefore \text{Amount after one year} = P + 5\% \text{ of } P = \frac{21P}{20}$$

$$\text{Amount after two years} = \frac{21P}{20} + 10\% \text{ of } \frac{21P}{20}$$

$$= \frac{21P}{20} + \frac{21P}{200} = \frac{231P}{200}$$

Amount after three years

$$\begin{aligned} &= \frac{231P}{200} + 20\% \text{ of } \frac{231P}{200} \\ &= \frac{231P}{200} + \frac{231P}{1000} = \frac{1386P}{1000} \end{aligned}$$

$$\therefore \frac{1386P}{1000} = 16632 \Rightarrow P = 12000.$$

9. (c) C.I. on ₹50000 @ 12% for one year, when the interest is paid half yearly

$$\begin{aligned} &= 50000 \left(1 + \frac{6}{100} \right)^2 - 50000 \\ &= 50000 \times \frac{53}{50} \times \frac{53}{50} - 50000 \\ &= ₹6180 \end{aligned}$$

C.I. when the interest is paid yearly

$$= \frac{50000 \times 12 \times 1}{100} = ₹6000$$

\therefore Required difference = C.I. - S.I.

$$= 6180 - 6000 = ₹180.$$

10. (a) S.I. on ₹65000 @ 10% for 3 years

$$= \frac{65000 \times 10 \times 3}{100} = ₹19500$$

C.I. on ₹65000 @ 10% for 3 years

$$\begin{aligned} &= 65000 \left[1 + \frac{10}{100} \right]^3 - 65000 \\ &= 65000 \left[\frac{11 \times 11 \times 11 - 10 \times 10 \times 10}{1000} \right] \\ &= ₹21515 \end{aligned}$$

\therefore Required gain = 21515 - 19500 = ₹2015.

11. (b) C.I. = $5000 \left[\left(1 + \frac{10}{100} \right)^2 \times \left(1 + \frac{20}{100} \right)^2 - 1 \right]$

$$= 5000 \times \frac{1856}{2500} = ₹3,712.$$

12. (c) Interest on ₹1440 = ₹216 for the third year

$$\Rightarrow \text{Rate \%} = \frac{216 \times 100}{1440 \times 1} = 15.$$

13. (a) Let, Amount of A = P

\therefore Amount of B = 1301 - P

$$\Rightarrow P \left(1 + \frac{4}{100} \right)^7 = (1301 - P) \left(1 + \frac{4}{100} \right)^9$$

$$\Rightarrow P = (1301 - P) \left(\frac{26}{25} \times \frac{26}{25} \right)$$

$$\Rightarrow 625P = 1301 \times 676 - 676P$$

$$\Rightarrow P = 676$$

\therefore A gets ₹676 and B gets ₹625.

14. (d) Amount to be paid at the end of 2 years

$$= \frac{800 \times 10 \times 2}{100} + 800 = 880$$

Amount left as principal for the second year

$$= 480 = (880 - 400)$$

$$\begin{aligned} \text{Amount to be paid after 2nd year} &= 480 + \frac{480 \times 10}{100} \\ &= ₹528. \end{aligned}$$

15. (a) $54880 = P[1.4]^3$

$$P = ₹20,000$$

Alternative method:

Even if we assume S.I., there must be a growth of $40\% \times 3 = 120\%$ over initial amount.

Now work with answer choices.

If we increase (b), (c), (d) by even 100% they would exceed 54880. Thus, option (a) is the answer.

16. (c) Let, each instalment be ₹x

Then, (present worth of ₹x due 1 year hence) + (Present worth of ₹x due 2 years hence) = ₹1,100

$$\therefore \frac{x}{\left(1 + \frac{20}{100} \right)} + \frac{x}{\left(1 + \frac{20}{100} \right)^2} = 1100$$

$$\text{or, } \frac{5x}{6} + \frac{25x}{36} = 1100$$

$$\text{or, } 55x = 36 \times 1100$$

$$\therefore x = \frac{36 \times 1100}{55} = ₹720.$$

17. (b) Let, the sum of money be P.

$$\therefore P \left(1 + \frac{20}{100} \right)^T \geq 2P$$

$$\Rightarrow \left(\frac{6}{5} \right)^T \geq 2$$

$$\Rightarrow (1.2)^T \geq 2$$

Hence, least value of T is 2 year.

18. (c) Let, P be the amount deposit in two different banks.

In 1st bank,

$$\begin{aligned} CI &= P \left(1 + \frac{5}{100} \right)^2 - P \\ &= P \left(\frac{21}{20} \right)^2 - P \\ &= \frac{441P}{400} - P \\ &= \frac{41P}{400} \end{aligned}$$

In 2nd bank,

$$SI = \frac{P \times R \times T}{100} = \frac{P \times 5 \times 2}{100} = \frac{P}{10}$$

$$\therefore \frac{41P}{400} - \frac{P}{10} = 200$$

$$\Rightarrow \frac{P}{400} = 200$$

$$\Rightarrow P = ₹80000.$$

19. (d) Actual amount to be paid

$$\begin{aligned} &= 20000 \times \left(1 + \frac{10}{100} \right)^3 \\ &= ₹26620 \end{aligned}$$

\therefore Extra amount that Rohit have to pay

$$= 20000 \left(1 + \frac{10}{100} \right)^2 \left(1 + \frac{15}{100} \right) = ₹27830$$

\therefore Required amount = $27830 - 26620 = ₹1210$.

20. (a) Let, the height of tree when it was planted be x cm.

$$\therefore x \times \left(1 + \frac{30}{100} \right)^3 = 670$$

$$\Rightarrow x = 670 \times \frac{10 \times 10 \times 10}{13 \times 13 \times 13} \approx 305 \text{ cm.}$$

21. (a) Let, the value of second rate of interest be $x\%$ and equal amounts be P each.

$$\therefore P \times \left(1 + \frac{5}{100} \right)^6 = P \times \left(1 + \frac{x}{100} \right)^3$$

$$\Rightarrow \left(1 + \frac{5}{100} \right)^2 = \left(1 + \frac{x}{100} \right)$$

$$\Rightarrow \frac{105 \times 105}{100 \times 100} = \frac{100 + x}{100}$$

$$\Rightarrow 110.25 = 100 + x$$

$$\Rightarrow x = 10.25\%$$

22. (a) Amount remaining after

$$1 \text{ year} = 4000 \left(1 + \frac{7.5}{100} \right) - 1500 = ₹2800$$

$$2 \text{ year} = 2800 \left(1 + \frac{7.5}{100} \right) - 1500 = ₹1510$$

$$3 \text{ year} = 1510 \left(1 + \frac{7.5}{100} \right) - 1500 = ₹123.25$$

23. (b) Let, Amit borrow ₹ x .

$$x \left[\left(1 + \frac{8}{100} \right)^2 - 1 \right] - \frac{x \times 8 \times 2}{100} = 16$$

$$\Rightarrow 0.1664x - 0.16x = 16$$

$$\Rightarrow x = \frac{16}{0.0064} = ₹2500.$$

24. (c) Let, the output be x and percentage be a .

Then,

$$\therefore x \times \left(1 + \frac{a}{100} \right)^2 = 2x$$

$$\Rightarrow 1 + \frac{a}{100} = \sqrt{2}$$

$$\Rightarrow \frac{a}{100} = \sqrt{2} - 1 \Rightarrow a = (\sqrt{2} - 1) \times 100\%$$

25. (d) Rate of 8% per annum payable half yearly.

So, effective rate = 4%

$$\text{Effective annual rate} = 4 + 4 + \frac{4 \times 4}{100} = 8.16\%$$

26. (b) Let, rate of interest = R

$$\text{Then, } 4800 = 3600 \left[1 + \frac{R}{100} \right]^3$$

$$\Rightarrow \frac{4}{3} = \left[1 + \frac{R}{100} \right]^3 \quad (1)$$

Now, the population after 3 years

$$= 4800 \left[1 + \frac{R}{100} \right]^3$$

From Eq. (1),

$$4800 \times \frac{4}{3} = 6400$$

27. (c) Let, Shyam's share = x

$$\text{Then, } x \left[1 + \frac{5}{100} \right]^9 = (5887 - x) \left[1 + \frac{5}{100} \right]^{11}$$

$$\Rightarrow \frac{x}{5887 - x} = \left[1 + \frac{5}{100} \right]^2$$

$$\Rightarrow \frac{x}{5887 - x} = 1.1025$$

$$\Rightarrow x = ₹3087$$

28. (d) Population after 3 years

$$= 10000 \times \frac{110}{100} \times \frac{120}{100} \times \frac{95}{100} = 12540$$

29. (b) Let, the principal be P and rate of interest be $r\%$

Then, principal (when difference between CI and SI is for 2 years) is given by

$$P = \frac{20 \times (100)^2}{r^2} \quad (1)$$

and principal (when difference between CI and SI is for 3 years) is given by

$$P = \frac{61 \times (100)^3}{r^2(300 + r)} \quad (2)$$

From Eqs. (1) and (2),

$$\frac{20 \times 10^4}{r^2} = \frac{61 \times 10}{r(300 + r)}$$

$$\Rightarrow r = 305 - 300 = 5\%$$

From Eq. (1),

$$P = \frac{20 \times 10^4}{25} \\ = ₹8000$$

30. (b) Sum = Difference $\left(\frac{100}{R} \right)^2$

$$= 20 \times \left(\frac{100}{10} \right)^2 = 20 \times 100$$

$$= ₹2,000$$

31. (c) Let, the rate of compound interest be r .

$$\text{Then, } 10000 \times \left(1 + \frac{r}{100} \right)^3 = 13310$$

$$\Rightarrow \left(1 + \frac{r}{100} \right)^3 = \frac{1331}{1000}$$

$$\Rightarrow 1 + \frac{r}{100} = \frac{11}{10}$$

$$\Rightarrow \frac{r}{100} = \frac{1}{10} \\ \therefore r = 10\%$$

$$32. (c) \frac{P \left(1 + \frac{r}{100} \right)^2}{\left(P + \frac{Pr}{100} \right)} = \frac{6}{5}$$

$$\Rightarrow \left(1 + \frac{r}{100} \right) = \frac{6}{5}$$

$$\Rightarrow r = 20\%$$

33. (d) Cash price, $CP = ₹39000$

Cash down payment, $DP = ₹17000$

Balance due, after 1st instalment, $BD = ₹22000$

P = value of instalment = ₹4800

n = no. of instalments = 5

R = rate of interest

$$\therefore \left(1 + \frac{nR}{1200} \right) BD = \left\{ 1 + \frac{(n-1)R}{2400} \right\} nP$$

$$\Rightarrow \left(1 + \frac{5R}{1200} \right) 22000 = \left\{ 1 + \frac{4R}{2400} \right\} 5 \times 4800$$

$$\Rightarrow \left(1 + \frac{5R}{1200} \right) 11 = \left\{ 1 + \frac{4R}{2400} \right\} 12$$

$$\Rightarrow 11 + \frac{55R}{1200} = 12 + \frac{24R}{1200}$$

$$\Rightarrow \frac{55R}{1200} - \frac{24R}{1200} = 1$$

$$\Rightarrow \frac{31R}{1200} = 1$$

$$\Rightarrow R = \frac{1200}{31} = 38.71\%$$

34. (c) Let, the amount of each instalment be ₹ x .

Amount of ₹100 for 3 years

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

$$= 100 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} = ₹ \frac{9261}{80}$$

Present value of ₹ $\frac{9261}{80}$ due after 3 years = ₹100

Present value of ₹ x due after 3 years

$$= \frac{100 \times 80}{9261} \times x = ₹ \frac{8000x}{9261}$$

Amount of ₹100 for 2 years

$$= 100 \left(1 + \frac{5}{100} \right)^2 = 100 \times \frac{21}{20} \times \frac{21}{20} = \frac{441}{4}$$

Present value of ₹x due after 2 years = ₹ $\frac{400}{441}x$

Similarly, present value of ₹x due after 1 year

$$= ₹ \frac{20}{21}x$$

$$\therefore \frac{8000}{9261}x + \frac{400}{441}x + \frac{20}{21}x = 126100$$

$$\Rightarrow 8000x + 8400x + 8820x = 126100 \times 9261$$

$$\Rightarrow 25220x = 126100 \times 9261$$

$$\Rightarrow x = \frac{126100 \times 9261}{25220} = ₹46305.$$

35. (b) Let, the share of Anjali be x .

\therefore Then, the share of Arun is $(30600 - x)$.

$$x \times \left(1 + \frac{4}{100} \right)^3 = (30600 - x) \left(1 + \frac{4}{100} \right)^2$$

$$\Rightarrow x \times \frac{104}{100} = 30600 - x$$

$$\Rightarrow \frac{204}{100}x = 30600$$

$$\Rightarrow x = ₹15000.$$

36. (a) Let, the investment made by $B = x$

Then, investment made by $A = (81600 - x)$

$$\therefore (81600 - x) \left(1 + \frac{4}{100} \right)^2 = x \left(1 + \frac{4}{100} \right)^3$$

$$\Rightarrow 81600 - x = 1.04x$$

$$x = \frac{81600}{2.04} = ₹40000.$$

37. (b) Quicker Method: If a sum becomes ' x ' times in ' y ' years at compound interest it will be $(x)^n$ times in ' ny ' years. Here $x = 8$ and $(x)^n = 16$. Here we have to find the value of n .

$$(8)^n = 16 \Rightarrow 2^{3n} = 2^4 \Rightarrow n = \frac{4}{3}$$

$$y = 3 \text{ years.}$$

Hence the money will become sixteen times in $\frac{4}{3} \times 3 = 4$ years.

38. (b) Suppose sum borrowed = ₹x

Amount paid, $A = ₹(882 \times 2) = ₹1764$

Rate (r) = 5%, Time (t) = 2 years

Thus,

$$1764 = x \left(1 + \frac{5}{100} \right)^2 = x \left(\frac{21}{20} \right)^2 = \frac{441}{400}x$$

$$x = \frac{1764 \times 400}{441} = ₹1600.$$

39. (d) Difference = $\frac{Pr^2}{100^2}$

$$\Rightarrow 72 = \frac{Pr^2}{100^2}$$

$$\Rightarrow r^2 = \frac{72 \times 100 \times 100}{5000} = 144$$

$$\therefore r = 12\%$$

40. (c) Value after one year

$$= 20000 - 20000 \times \frac{5}{100} = ₹19000$$

$$\text{Value after 2 years} = 19000 - 19000 \times \frac{4}{100}$$

$$= 19000 - 760$$

$$= ₹18240$$

$$\text{Value after 3 years} = 18240 - 18240 \times \frac{2}{100}$$

$$= ₹17875.2.$$

41. (c) Let, the investment be ₹100.

$$\therefore \text{After two years the sum} = 100 \left(1 + \frac{10}{100} \right)^2 = ₹121$$

\therefore ₹121 is received when the investment was 100.

\therefore ₹1 is received when the investment was $\frac{100}{121}$.

\therefore ₹50000 is received when the investment was

$$= \frac{100 \times 50000}{121} = ₹41322.31.$$

42. (b) Principal = (Present worth of ₹121 due 1 year hence) + (Present worth of ₹121 due 2 years hence)

$$= \frac{121}{\left(1 + \frac{10}{100} \right)} + \frac{121}{\left(1 + \frac{10}{100} \right)^2}$$

$$= \frac{121}{1.01} - \frac{121}{1.01 \times 1.01} = ₹210.$$

$$43. (b) \quad CI = P \left\{ \left(1 + \frac{r}{100} \right)^3 - 1 \right\}$$

$$P \left\{ \left[1 + \frac{15}{100} \right]^3 - 1 \right\} = 9844.5375$$

$$\Rightarrow P[1.520875 - 1] = 9844.5375$$

$$\therefore P = \frac{9844.5375}{0.520875} = ₹18900.$$

$$44. (a) \text{ Required \%} = 5 + 5 + \frac{5 \times 5}{100} = 10.25\%$$

45. (c) After first year, the value of the scooter = ₹20,000
After second year, the value of scooter = ₹16,000
After third year, the value of scooter = ₹12,800.

$$46. (b) \text{ S.I. for one year} = ₹1,100$$

\therefore Amount at the end of 2nd year

$$= \frac{1100 \times 100}{10 \times 1} = ₹11,000.$$

$$47. (b) \text{ Let, the population be } x, \text{ three years ago}$$

$$\therefore \text{ Population two years ago} = x + 25\% \text{ of } x = \frac{5x}{4}$$

$$\text{Population one year ago} = \frac{5x}{4} + 5\% \text{ of } \frac{5x}{4}$$

$$= \frac{5x}{4} + \frac{5x}{16} = \frac{25x}{16}$$

$$\therefore \text{ Present population} = \frac{25x}{16} + 25\% \text{ of } \frac{25x}{16}$$

$$= \frac{125x}{64}$$

$$= 10000000 \quad (\text{Given})$$

$$\Rightarrow x = 5120000$$

$$\therefore \text{ Required difference} = \frac{5x}{4} - x = \frac{x}{4}$$

$$= 12,80,000.$$

$$48. (c) \text{ Interest on ₹1,440} = ₹216 \text{ for the third year}$$

$$\Rightarrow \text{Rate \%} = \frac{216 \times 100}{1440 \times 1} = 15.$$

$$49. (b) \text{ For first year, } p = ₹6000$$

$$SI = \frac{6000 \times 10 \times 1}{100} = ₹600$$

$$\text{At the end of first year, amount} = ₹(6000 + 600) = ₹6600$$

$$\text{Return back} = ₹2000$$

$$\text{For second year, } p = ₹(6600 - 2000) = ₹4600$$

$$SI = ₹ \frac{4600 \times 10 \times 1}{100} = ₹460$$

$$\text{At the end of second year, amount} = ₹(4600 + 460) = ₹5060$$

$$\text{Return back} = ₹2000$$

$$\text{For third year, } p = ₹(5060 - 2000) = ₹3060$$

$$SI = ₹ \frac{3060 \times 10 \times 1}{100} = ₹306$$

$$\therefore \text{ Amount returned in third year} = ₹(3060 + 306) = ₹3366.$$

$$50. (d) \text{ Let, the value of Sharma's total saving} = p$$

Then, difference between CI and SI

$$D = \frac{SI \times R}{200}$$

$$\Rightarrow 605 - 550 = \frac{550 \times R}{200}$$

$$\Rightarrow 55 = \frac{55R}{20} \Rightarrow R = 20\%$$

$$\text{Again, } D = \frac{PR^2}{100^2}$$

$$\Rightarrow 55 = \frac{P \times 20 \times 20}{100 \times 100}$$

$$\Rightarrow P = 55 \times 25 = 1375$$

$$\text{Hence, total saving} = ₹1375 \times 2 = ₹2750.$$

$$51. (b) \text{ If the sum be } P, \text{ then we are given,}$$

$$P \left(1 + \frac{20}{200} \right)^4 - P \left(1 + \frac{20}{100} \right)^2 = 482$$

$$\Rightarrow P \left(\frac{11}{10} \right)^4 - P \left(\frac{6}{5} \right)^2 = 482$$

$$\Rightarrow P(1.4641 - 1.44) = 482$$

$$\Rightarrow P = \frac{482}{0.0241} = 20000.$$

$$52. (d) \text{ Tax for first 3 months}$$

$$= \frac{1040000 \times 0.25 \times 3}{12 \times 10} = ₹650$$

Then, Palvinder pays 40000 after 3 months

$$\therefore \text{ Amount left} = 1040650 - 40000$$

$$= ₹1000650$$

Again the tax is calculated for next 3 month on

$$₹1000650$$

$$= \frac{1000650 \times 0.25 \times 3}{12 \times 100} = ₹625.40$$

Now, amount left with Palvinder

$$= (1000650 + 625.40) - 40000$$

$$= 961275.4$$

So, it takes 6 months for Palvinder.

53. (b) Let, the rate per cent of bill be $r\%$ per annum.

Let, the amount of bill be ₹A.

Then, we are given,

$$A = \frac{1200 \left(100 + \frac{7}{12}r \right)}{100} = 12 \left(100 + \frac{7}{12}r \right) \quad (1)$$

$$A = \frac{1016}{100} \left(100 + \frac{5}{2}r \right) = 10.16 \left(100 + \frac{5}{2}r \right) \quad (2)$$

From Eqs. (1) and (2), we get

$$12 \left(100 + \frac{7}{12}r \right) = 10.16 \left(100 + \frac{5}{2}r \right)$$

$$\Rightarrow 1200 + 7r = 1016 + 25.4r$$

$$\Rightarrow 18.4r = 184$$

$$\therefore r = 10\%$$

Hence, rate cent of the bill is 10% per annum.

54. (d) We have, $A = ₹196$, $r = 16\frac{2}{3}\% = \frac{50}{3}\%$ per annum

$n = 2$ years

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

$$\Rightarrow 196 = P \left(1 + \frac{50}{3 \times 100} \right)^2 = P \left(1 + \frac{1}{6} \right)^2$$

$$\Rightarrow 196 = P \times \left(\frac{7}{6} \right)^2$$

$$\Rightarrow 196 = P \times \frac{49}{36}$$

$$\therefore P = \frac{196 \times 36}{49} = ₹144.$$

55. (c) Installment (I) = ₹1000, $r = 10\%$ and $t = 2$,
Principal = ?

$$\begin{aligned} \text{Principal} &= \frac{I}{1 + \frac{R}{100}} + \frac{I}{\left(1 + \frac{R}{100} \right)^2} \\ &= \frac{1000}{1 + \frac{10}{100}} + \frac{1000}{\left(1 + \frac{10}{100} \right)^2} = \frac{1000}{1 + \frac{1}{10}} + \frac{1000}{\left(1 + \frac{1}{10} \right)^2} \\ &= \frac{1000}{11} \times 10 + \frac{1000}{(11)^2} \times (10)^2 = \frac{10000}{11} + \frac{1000 \times 100}{121} \\ &= 909.09 + 826.44 = ₹1736 \quad (\text{approx}). \end{aligned}$$

56. (a) We have

$$P = \frac{SI \times 100}{R \times T} = \frac{6500 \times 100}{8 \times 13} = 6250$$

$$\begin{aligned} CI &= 6250 \left(1 + \frac{8}{100} \right)^2 - 6250 \\ &= ₹1040 \end{aligned}$$

DIFFICULTY LEVEL-2

1. (a) Given Compound Interest – Simple Interest = ₹76.25

$$\Rightarrow P \left[1 + \frac{R}{100} \right]^n - P - \frac{PRN}{100} = 76.25$$

$$\Rightarrow P \left[1 + \frac{5}{100} \right]^3 - P - \frac{P \times 5 \times 3}{100} = 76.25$$

$$= P \left[\frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \right] - P - \frac{15P}{100} = 76.25$$

$$= \frac{9261P - 8000P - 1200P}{8000} = 76.25$$

$$\Rightarrow 61P = 8000 \times 76.25 \Rightarrow P = 10,000$$

$$\text{Simple Interest paid by } A = \frac{PRN}{100}$$

$$= \frac{10,000 \times 5 \times 3}{100} = ₹1500.$$

2. (c) Suppose value of the asset two years ago = ₹x

\therefore Value of the asset one year ago

$$= x - 10\% \text{ of } x = \frac{9x}{10}$$

$$\therefore x - \frac{9x}{10} = 12000 \Rightarrow x = 120000$$

\therefore Value of the asset at present

$$= \frac{9x}{10} - 10\% \text{ of } \frac{9x}{10} = \frac{81x}{100} = 81 \times 1200$$

$$= ₹97200.$$

3. (d) Suppose A get ₹x

\therefore B gets ₹(25000 – x)

Interest received by A @ 8% p.a. C.I.

$$= x \left[1 + \frac{8}{100} \right]^2 - x$$

$$= \left(\frac{27}{25} \right)^2 x - x = \frac{104x}{625}$$

Interest received by B @ 10% of p.a. S.I.

$$= \frac{(25000 - x) \times 10 \times 2}{100}$$

$$= \frac{25000 - x}{5}$$

Given:

$$\frac{25000 - x}{5} = \frac{104x}{625} + 1336 \Rightarrow x = 10000.$$

4. (b) Let, the population be x , three years ago

$$\therefore \text{Population two years ago} = x + 25\% \text{ of } x = \frac{5x}{4}$$

$$\text{Population one year ago} = \frac{5x}{4} + 5\% \text{ of } \frac{5x}{4}$$

$$= \frac{5x}{4} + \frac{5x}{16} = \frac{25x}{16}$$

$$\therefore \text{Present population} = \frac{25x}{16} + 25\% \text{ of } \frac{25x}{16}$$

$$= \frac{125x}{64} = 10000000$$

(Given)

$$\Rightarrow x = 5120000$$

$$\therefore \text{Required difference} = \frac{5x}{4} - x = \frac{x}{4}$$

$$= 1280000.$$

5. (b) S.I. for one year = ₹1100

$$\therefore \text{Amount at the end of 2nd year} = \frac{1100 \times 100}{10 \times 1}$$

$$= ₹11000.$$

6. (a) ₹16 is the S.I. on S.I. for 1 year

$$\therefore 16 = \frac{x \times 10 \times 1}{100} \text{ or, } x = ₹160$$

Therefore, ₹160 is the simple interest for the first year.

$$\text{Now principal} = ₹ \left(\frac{100 \times 160}{10 \times 1} \right) = ₹1,600$$

Amount for 2 years compounded half yearly

$$= \left[1600 \times \left(1 + \frac{5}{100} \right)^5 \right] = ₹1944.81$$

$$\text{C.I.} = (1944.81 - 1600) = ₹344.81$$

$$\text{S.I.} = \frac{1600 \times 10 \times 2}{100} = ₹320$$

$$\therefore \text{C.I.} - \text{S.I.} = (344.81 - 320) = ₹24.81.$$

7. (b) C.I. for 2 years = ₹756

S.I. for 2 years = ₹720

It means the interest on the interest for the first year = ₹36 (=756 - 720)

This implies that the rate of interest is 5% as

$$\frac{36}{720} \times 100 = 5\%$$

It means the principal for first year was 14400

$$\therefore \frac{P \times 5 \times 1}{100} = 720$$

$$\Rightarrow P = 14400$$

$$\text{Now, } \frac{P \times k \times k}{100} = \text{S.I., where } r = t = k$$

$$\Rightarrow \frac{14400 \times k^2}{100} = 900$$

$$\Rightarrow k = \frac{5}{2}$$

$$8. (c) \text{ Sum} = \frac{900 \times 100}{6 \times 3} = ₹5,000$$

\therefore Interest on ₹5,000 by C.I.

$$= 5000 \left(1 + \frac{6}{100} \right)^3 - 5000$$

$$= ₹955.08$$

\therefore More interest = ₹(955.08 - 900)

$$= ₹55.08.$$

$$9. (c) \frac{\text{Decrease in second year}}{\text{Decrease in third year}} = \frac{100}{100 - r} = \frac{10}{9}$$

$$\Rightarrow r = 10\%$$

Let, the population of vultures 3 years ago be P , then

$$P \left(1 - \frac{10}{100} \right)^3 = 29160$$

$$\Rightarrow P = 40,000.$$

10. (b) $100(1.3)^3 = 219.7 \Rightarrow \text{C.I.} = 119.7$

and, $\text{S.I.} = \frac{100 \times 3 \times 30}{100} = 90$

\therefore C.I. is greater than S.I. by ₹29.7 (119.7 - 90)

\therefore % increase = $\frac{29.7}{90} \times 100 = 33.0\%$

11. (a) Let, the amount with the young son be x , time be 20 years rate 3%

The amount with the elder son be $(18750 - x)$ time be 17 years, rate 3%

We know that

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

Since, both receive the same amount.

$$\therefore x \left(1 + \frac{3}{100} \right)^{20} = (18750 - x) \left(1 + \frac{3}{100} \right)^{17}$$

$$\Rightarrow \left(1 + \frac{3}{100} \right)^3 = \frac{18750 - x}{x}$$

$$\Rightarrow \left(\frac{103}{100} \right)^3 = \frac{18750}{x} - 1$$

$$\Rightarrow 2.092727 = \frac{18750}{x}$$

$$\Rightarrow x = \frac{18750}{2.092727} = 8959.60$$

$$\approx 8959.80.$$

12. (c) If the rate of interest changed by the second part is $r\%$, then on the first it is $(r + 10)\%$

$$30000 \left[1 + \frac{r+10}{100} \right]^2 - 30000 \left[1 + \frac{r}{100} \right]^2 = 7500$$

$$r = 20\%$$

Let, the first part be x , then the second part will be $(60000 - x)$.

$$x \left[1 + \frac{30}{100} \right]^2 - (60000 - x) \left(1 + \frac{20}{100} \right)^2 = 38800$$

$$x = 40000$$

13. (b) Till forth year plan B will fetch ₹48 and plan A will fetch ₹46. Fifth year interest from plan B will be ₹60 and from plan A will be ₹61.

14. (b) Rate of interest = 16% annum

Actual rate of interest = 4% per quarter

Principal of all three instalments

$$= \left[17576 \left(\left(\frac{25}{26} \right) + \left(\frac{25}{26} \right)^2 + \left(\frac{25}{26} \right)^3 \right) \right]$$

$$= \frac{17576 \times 25 \times 1951}{26 \times 676} = 48775$$

Total amount paid = ₹17576 × 3 = ₹52,728

Interest charged = 52728 - 48775 = ₹3,953.

15. (d) Suppose A gets ₹ x

\therefore B gets ₹ $(25000 - x)$

Interest received by A at the rate of 8% p.a. C.I.

$$= x \left[1 + \frac{8}{100} \right]^2 - x$$

$$= \left(\frac{27}{25} \right)^2 x - x$$

$$= \frac{104x}{625}$$

Interest received by B at the rate of 10% of p.a. S.I.

$$= \frac{(25000 - x) \times 10 \times 2}{100}$$

$$= \frac{25000 - x}{5}$$

Given:

$$\frac{25000 - x}{5} = \frac{104x}{625} + 1336$$

$$\Rightarrow x = 10,000$$

16. (c) Suppose value of the asset two years ago = ₹ x

\therefore Value of the asset one year ago

$$= x - 10\% \text{ of } x = \frac{9x}{10}$$

$$\therefore x - \frac{9x}{10} = 12000$$

$$\Rightarrow x = 120000$$

\therefore Value of the asset at present

$$= \frac{9x}{10} - 10\% \text{ of } \frac{9x}{10}$$

$$= \frac{81x}{100} = 81 \times 1200$$

$$= ₹97,200.$$

17. (d) Suppose the sum borrowed = ₹x

Rate of interest = $R\%$

Time = 2 years

$$\therefore 4000 = \frac{x \times R \times 2}{100} \Rightarrow Rx = 200000 \quad (1)$$

$$\text{Now, } x \left(1 + \frac{R}{100}\right)^2 = x + 4200$$

$$\Rightarrow \frac{xR^2}{10000} + \frac{2RX}{100} = 4200$$

$$\Rightarrow 20R + 4000 = 4200$$

$$\Rightarrow R = 10$$

18. (d) $SI = \frac{16000 \times 30}{100} = 4800$

$$\therefore \text{Amount} = 16000 + 4800 = 20800$$

$$\text{Now, } CI = 20800 \times \left(1 + \frac{12}{100}\right)^2$$

$$= 20800 \times \frac{28}{25} \times \frac{28}{25}$$

$$= 26091.52 \text{ (Amount)}$$

$$\therefore A - P = 26091.52 - 20800$$

$$= 5291.52$$

After four years, interest = 5291.52 + 4800

$$= 10091.52$$

19. (a) At the end of 1st year = $4000 \times \frac{120}{100} = 4800$

But he pays back = 1500

At the end of 2nd year

$$= 3300 \times \frac{120}{100} = 3960 - 1500 = 2460$$

$$\text{At the end of 3rd year} = 2460 \times \frac{120}{100}$$

$$= ₹2952$$

20. (b) Cash price of the flat = ₹55000

In the instalment plan, cash down payment = ₹4275

$$= 55000 - 4275 = 50725$$

Let, each instalment be ₹x.

Rate = 16% per annum = 8% half-yearly

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

$$x = P \left(1 + \frac{8}{100}\right)^1$$

$$= ₹ \frac{25}{75} x$$

$$\text{Similarly, principal for the 2nd instalment} = \left(\frac{25}{27}\right)^2 x$$

$$\text{Principal for 3rd year instalment} = ₹ \left(\frac{25}{27}\right)^3 x$$

Total principal for the three instalments

$$= \frac{25}{27} x + \left(\frac{25}{27}\right)^2 x + \left(\frac{25}{27}\right)^3 x$$

$$= 50725$$

On solving, we get $x = 19683$

\therefore Each instalment = ₹19683.

21. (a) $\frac{676}{\left(1 + \frac{4}{100}\right)} + \frac{676}{\left(1 + \frac{4}{100}\right)^2}$

$$= \frac{676 \times 25}{26} + \frac{676 \times 625}{676}$$

$$= 650 + 625$$

$$= ₹1275$$

22. (a) Given $A = ₹2240$, $t = 4$ years $r = 8\%$

Amount of annual installment

$$= \left[\frac{100A}{100t + \frac{rt(t-1)}{2}} \right]$$

$$= \frac{100 \times 2240}{100 \times 4 + \frac{8 \times 4 \times 3}{2}}$$

$$= \frac{100 \times 2240}{400 + 48}$$

$$= \frac{100 \times 2240}{448}$$

$$= ₹500$$

23. (c) Let, the sum be P , rate $r\%$ per annum and time t years.

We are given,

$$\left[P \left(1 + \frac{r}{100}\right)^2 - P \right] - \frac{P \times r \times 2}{100} = 20 \quad (1)$$

$$\Rightarrow P + \frac{2Pr}{100} + \frac{Pr^2}{(100)^2} - P - \frac{2Pr}{100} = 20$$

$$\therefore \frac{Pr^2}{(100)^2} = 20$$

$$\text{and, } \left[P \left(1 + \frac{r}{100} \right)^3 - P \right] - \frac{P \times r \times 3}{100} = 61$$

$$\Rightarrow P + \frac{Pr^3}{(100)^3} + \frac{3Pr}{100} + \frac{3Pr^2}{(100)^2} - P - \frac{3Pr}{100} = 61$$

$$\therefore \frac{Pr^3}{(100)^3} + \frac{3Pr^2}{(100)^2} = 61 \quad (2)$$

Using Eq. (1) in Eq. (2), we get

$$\Rightarrow \frac{r}{100} \times \frac{Pr^2}{(100)^2} + 3 \times \frac{Pr^2}{(100)^2} = 61$$

$$\Rightarrow \frac{r}{100} \times 20 + 3 \times 20 = 61 \quad [\text{from Eq. (1)}]$$

$$\Rightarrow \frac{r}{5} = 1 \Rightarrow r = 5$$

$$\text{Now, } \frac{Pr^2}{(100)^2} = 20 \Rightarrow \frac{P \times (5)^2}{(100)^2} = 20$$

$$\Rightarrow \frac{P \times 25}{100 \times 100} = 20$$

$$\Rightarrow P = 400 \times 20$$

$$= ₹8000.$$