

COMPOUND INTEREST (PART 3 - Advanced Questions)

Q21. A person borrows ₹1,02,500, repayable in two equal annual instalments at 10% compound interest. Find each instalment.

- (a) ₹55,000 (b) ₹56,250 (c) ₹60,000 (d) ₹52,500

Installment $\rightarrow x$

Formula

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

Shortcut:

10% = $\frac{1}{10} \Rightarrow 10:11$ (1st year) $\rightarrow 10:11 \xrightarrow{\times 11} 110:121$
 $10^2:11^2$ (2nd year) $\rightarrow 100:121 \xrightarrow{\times 1} 100:121$
210

$$210x = 102500$$

$$x = \frac{102500}{210}$$

$$121x = 121 \times \frac{102500}{210}$$

$$= 59059.5$$

$$\begin{array}{r} 10250 \times 121 \\ 10250 \\ 20500 \\ 10250 \\ \hline 1240250 \end{array}$$

$$\begin{array}{r} 59059.5 \\ 21 \overline{) 1240250} \\ \underline{105} \\ 190 \\ \underline{189} \\ 125 \\ \underline{105} \\ 200 \\ \underline{189} \\ 110 \end{array}$$

P

Q22. A sum of ₹50,000 is invested for three years. The rates of compound interest for the first, second and third years are 10%, 20% and 30%, respectively. Find the total compound interest.

- (a) ₹31,800 ~~(b) ₹35,800~~ (c) ₹33,200 (d) ₹34,000

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

Shortcut

$$\begin{array}{rcl}
 P \rightarrow & 50000 & \\
 10\% - & \frac{5000}{55000} & (1^{st} \text{ yr}) \\
 20\% - & \frac{11000}{66000} & (2^{nd} \text{ yr}) \\
 30\% - & \frac{19800}{85800} \rightarrow A &
 \end{array}$$

$$\begin{aligned}
 I &= A - P \\
 &= 85800 \\
 &\quad \underline{50000} \\
 &= 35800
 \end{aligned}$$

Q23. The effective compound interest rate for two successive annual rates of 10% and 20% is:

- (a) 28% (b) 30% (c) 32% (d) 34%

$$\downarrow$$

$$\left(\frac{x+y+\frac{xy}{100}}{100} \right) \%$$

$$= \frac{10 + 20 + \frac{10 \times 20}{100}}{100}$$

$$= 32\%$$



Q24. The effective compound interest rate for three successive annual rates of 10%, 20% and 30% is:

- (a) 60% (b) 64.4% (c) 68.6% ☒ (d) 71.6%

$$\begin{aligned}
 &10\% \quad 20\% \quad 30\% \\
 &\swarrow \quad \searrow \\
 &10 + 20 + \frac{10 \times 20}{100} \\
 &32\% \quad 30\% \\
 &\swarrow \quad \searrow \\
 &32 + 30 + \frac{32 \times 30}{100} \\
 &= 62 + 9.6 \\
 &= 71.6\%
 \end{aligned}$$

Q25. A sum becomes ₹6,050 in 2 years and ₹6,655 in 3 years at compound interest. Find the original principal.

- (a) ₹4,500 (b) ₹5,000 (c) ₹5,500 (d) ₹6,000



$$8\% = \frac{6655 - 6050}{6050} \times 100$$

$$= \frac{605}{605} \times 10$$

$$8\% = 10\%$$

$$10\% + 10\% + \frac{10 \times 10}{100} = 21\%$$

$$A = 121\% \text{ of } P$$

$$\frac{6050}{100} = \frac{121}{100} \times P$$

$$5000 = P$$

Q26. The difference between compound interest and simple interest on a certain sum for 3 years at 10% per annum is ₹310. Find the principal.

- (a) ₹8,000 (b) ₹9,000 ☒ (c) ₹10,000 (d) ₹12,000

$$\text{Diff btwn C.I + S.I (2 yrs)} = P \left(\frac{r}{100} \right)^2$$

$$\text{Diff btwn C.I + S.I (3 yrs)} = P \left(\frac{r}{100} \right)^2 \left(3 + \frac{r}{100} \right)$$

$$310 = P \left(\frac{10}{100} \right)^2 \left(3 + \frac{10}{100} \right)$$

$$\frac{310}{3.1} = P \times \frac{1}{100} \times \frac{31}{10}$$

$$10000 = P$$

$$P \xrightarrow{6\%} A_1 \xrightarrow{8\%} A_2$$

Q27. A person invests ₹1,20,000 at 6% compound interest for 2 years and then reinvests the accumulated amount for another 2 years at 8% compound interest. Find the total compound interest earned.

- (a) ₹36,498.32 (b) ₹37,268.04 (c) ₹38,000.00 (d) ₹40,000.05

$$\begin{array}{r} P = 120000 \\ \quad 7200 \\ \hline 127200 \\ \quad 7632 \\ \hline A_1 = 134832 \end{array}$$

$$A_1 = 134832$$

$$\begin{array}{r} 8\% - 10786.56 \\ \hline 145618.56 \\ \quad 11649.4848 \\ \hline 157268.0448 \end{array}$$

$$\begin{array}{r} 2362.32 \times 8 \\ \hline 1348.32 \times 8 \\ \hline 10786.56 \\ \quad 3441.6944 \\ \hline 14561.856 \\ \quad 11649.4848 \\ \hline \end{array}$$

$$\begin{array}{r} 157268.0448 \\ \quad 120000 \\ \hline 37268.0448 \end{array}$$

P

Q28. A sum of ₹66,300 is divided between A and B such that the amount received by A after 8 years equals the amount received by B after 10 years at 10% compound interest. Find A's share.

- (a) ₹35,200 (b) ₹35,520 ☒ (c) ₹36,300 (d) ₹37,000

$$66300 < \begin{matrix} x \\ y \end{matrix}$$

$$\overset{(8\text{yr})}{A_A} = \overset{(10\text{yr})}{A_B}$$

$$x \left(1 + \frac{10}{100}\right)^8 = y \left(1 + \frac{10}{100}\right)^{10}$$

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

$$= \left(\frac{11}{10}\right)^2$$

$$\frac{x}{y} = \frac{21}{100}$$

$$A = 121a$$

$$= 121 \times 300$$

$$= 36300$$

$$x + y = 66300$$

$$121a + 100a = 66300$$

$$221a = 66300$$

$$a = \frac{66300}{221}$$

$$\boxed{a = 300}$$

Q29. A debt of ₹1,025 is due after 2 years. If the rate of compound interest is 5% per annum, what equal annual payment at the end of each year will discharge the debt?

- (a) ₹549.23 (b) ₹550.00 (c) ₹551.25 (d) ₹552.50

$$P = \frac{x}{\left(1 + \frac{r}{100}\right)} + \frac{x}{\left(1 + \frac{r}{100}\right)^2} \rightarrow \text{Formula}$$

Shortcut

$$5\% = \frac{5}{100} = \frac{1}{20} \Rightarrow P : 1 \rightarrow 20 : 21 \xrightarrow{\times 21} 420 : 441$$

$$20^2 : 21^2 \rightarrow 400 : 441 \rightarrow \frac{400}{820} : 441$$

$$\begin{array}{r} 551.25 \\ 164 \overline{) 90405} \\ \underline{820} \\ 840 \\ \underline{820} \\ 205 \\ \underline{164} \\ 410 \\ \underline{328} \\ 820 \\ \underline{820} \\ 0 \end{array}$$

$$8200 = 1025$$

$$10 = \frac{205}{164} \Rightarrow \frac{205}{164}$$

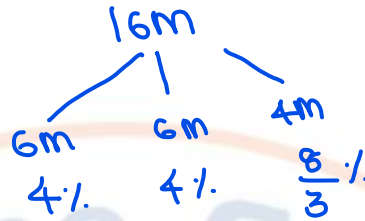
$$4410 = 441 \times \frac{205}{164}$$

$$= 551.25$$

$$\begin{array}{r} 205 \times 441 \\ \underline{820} \\ 820 \\ \underline{820} \\ 90405 \end{array}$$

Q30. A sum of ₹18,000 is invested for 16 months at 8% per annum compound interest, compounded half-yearly. Find the percentage gain.

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



$$12m \rightarrow 8\%$$

$$1m = \frac{8}{12} \%$$

$$1m = \frac{2}{3} \%$$

$$6m = \frac{2}{3} \times 2 = 4\%$$

$$4m = 4 \times \frac{2}{3} = \frac{8}{3} \%$$

$$3 \overline{) 8.66} \quad 28$$

$$4\% \quad 4\% \quad \frac{8}{3} \%$$

$$4 + 4 + \frac{4 \times 4}{100}$$

$$8 + 0.16$$

$$8.16\%$$

$$\approx 11.0476\%$$

$$8.16 + \frac{8}{3} + \frac{8.16 \times 8}{3 \times 100}$$

$$\begin{array}{r} 8.16 \\ 2.67 \\ \hline 10.83 \\ 0.2176 \\ \hline 11.0476 \end{array}$$

$$\begin{array}{r} 2.72 \\ 2.72 \times 8 \\ \hline 21.76 \end{array}$$