

Aptitude Compound Interest Concepts and Formulas

Points to remember:

1) **Compound Interest:** The addition of interest to the principal sum each year or some fixed time period is known as compounding. So, the compound interest is the interest on interest. The interest of each year or some fixed time period is added to the principal sum and the new amount becomes the principal for the next year and interest is calculated on the increased amount for the next year.

2) In case of compound interest, when interest is compounded annually, the amount is given by:

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

Where, P= Principal

r = Rate of interest

t = time/number of years

And, Compound Interest = Amount (A) - Principal (P)

$$\text{Compound Interest (C.I)} = P \left(1 + \frac{r}{100} \right)^t - P$$

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

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

3) Compound interest can be compounded half-yearly and quarterly, etc. Accordingly, the formula varies;

- When interest is compounded half-yearly:

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

$$\text{Compound Interest (C.I.)} = P \left[\left(1 + \frac{r/2}{100} \right)^{2t} - 1 \right]$$

$$\text{And, Rate of interest (r)} = 2 * 100 \left[\left(\frac{A}{P} \right)^{\frac{1}{t}} * 2 - 1 \right] \% \text{ p.a.}$$

4) When interest is compounded quarterly:

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

$$\text{Compound Interest (C.I.)} = P \left[\left(1 + \frac{r/4}{100} \right)^{4t} - 1 \right]$$

$$\text{And, Rate of interest (r)} = 4 * 100 \left[\left(\frac{A}{P} \right)^{\frac{1}{t}} * 4 - 1 \right] \% \text{ p.a.}$$

5) When interest is compounded annually but time is in fraction i.e. $3\frac{2}{3}$ years, then;

$$\text{Amount} = P \left(1 + \frac{r}{100} \right)^3 * \left(1 + \frac{(\frac{2}{3})r}{100} \right)$$

So, in general, if the interest is compounded n times a year;

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

$$\text{Compound interest (CI): } P \left[\left(1 + \frac{r/n}{100} \right)^{n*t} - 1 \right]$$

$$\text{And, Rate of interest (r)} = n * 100 \left[\left(\frac{A}{P} \right)^{\frac{1}{t}} * n - 1 \right] \% \text{ p.a.}$$

6) When there are different rates of interest for different years e.g. r1%, r2%, r3% for 1st, 2nd and 3rd year respectively, then;

$$\text{Amount} = P \left(1 + \frac{r1}{100} \right) \left(1 + \frac{r2}{100} \right) \left(1 + \frac{r3}{100} \right)$$

Some quicker methods:

1) If a sum becomes P times in t years, the rate of compound interest r is $= 100 [(P)^{1/t} - 1]$

2) If C.I. is given, we can find the S.I. by the formula;

$$\text{Simple Interest} = \frac{rt}{100 \left[\left(1 + \frac{r}{100}\right)^t - 1 \right]} * \text{Compound interest}$$

3) If C.I. and S.I. are given in the question, we can find the rate of interest by the formula;

$$\text{Rate of interest} = 2 * \frac{\text{Difference in C.I. and S.I.}}{\text{S.I.}} * 100$$

4) If the difference between the C.I. and S.I. on a certain sum of money for 2 years at r% is Rs. X, the sum is given by;

$$\text{Sum} = X \left(\frac{100}{r} \right)^2$$

5) If the difference between C.I. and S.I. on a certain sum for 3 years at r% is Rs. X, the sum is given by;

$$\text{Sum} = \frac{X * (100)^3}{r^2 (300 + r)}$$

6) If a certain sum of money grows to Rs. X in n years and Rs. Y in (n+1) years, the rate of interest is given by;

$$\text{Rate of interest} = \frac{(Y - X) * 100}{X}$$

7) If a sum of money X becomes Y in t_1 years at compound rate of interest, after t_2 years it will become;

$$\text{Rs. } \frac{(Y)t_2/t_1}{(X)t_2/t_1 - 1}$$

8) If a loan of Rs. X at r% rate of interest C.I. is to be paid back in n equal yearly installments, the value of each installment is given by;

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

Aptitude Compound Interest Problems

1) What is the compound interest on Rs. 2500 for 2 years at rate of interest 4% per annum?

- A. Rs. 180
- B. Rs. 204
- C. Rs. 210
- D. Rs. 220

The Correct answer is (B)

Explanation:

Principal (P) = Rs. 2500

Rate of interest(r) = 4%

Time (t) = 2 years

Compound Interest = Amount – Principal

$$\begin{aligned}\text{Amount} &= P \left(1 + \frac{r}{100}\right)^t \\ &= 2500 \left(1 + \frac{4}{100}\right)^2 \\ &= 2500 + \frac{104}{100} * \frac{104}{100} = 2704 \\ \text{C.I.} &= 2704 - 2500 = \text{Rs. 204 (Option B)}\end{aligned}$$

2) What is the amount for a sum of money Rs.7500 at 6% rate of interest C.I. for 2 years?

- A. Rs. 8427
- B. Rs. 8417
- C. Rs. 8400
- D. Rs. 8390

The Correct answer is (A)

Explanation:

Principal = Rs. 7500

$r = 6\%$

$t = 2$ years

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

$$= 7500 \left(1 + \frac{6}{100}\right)^2$$

$$= 7500 * \frac{106}{100} * \frac{106}{100} = \text{Rs. } 8427 \text{ (Option A)}$$

3) On lending a certain sum of money on C.I. one gets Rs.9050 in 2 years and Rs.9500 in 3 years. What is the rate of interest?

- A. 5%
- B. 4.5%
- C. 5.5 %
- D. 6%

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The Correct answer is (A)

Explanation:

Amount after 3 years = Rs. 9500

Amount after 2 years = Rs. 9050

Interest of one year = $9500 - 9050 = 450$

$t = 1$ year

Apply formula: $r = \frac{1 * 100}{P * t}$

$$r = \frac{450 * 100}{9050 * 1} = 5\% \text{ (Option A)}$$

Solution 2: Quicker Method

Apply formula; Rate of interest(r): $\frac{(Y-X) * 100}{X}$

Y= Rs. 9500

X = 9050

$$r = \frac{(9500 - 9050) * 100}{9050}$$
$$= \frac{450 * 100}{9050} = 5\% \text{ (Option A)}$$

4) Ramesh borrowed Rs. 3600 at a certain rate of interest C.I. and the sum grows to Rs. 4624 in 2 years. What is the rate of interest?

- A. 12.3%
- B. 13.3%
- C. 14.3%
- D. 15.3%

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The Correct answer is (B)

Explanation:

Principal = Rs. 3600

Amount = Rs. 4624

t = 2 years

We have;

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

$$4624 = 3600 \left(1 + \frac{r}{100}\right)^2$$

$$\left(1 + \frac{r}{100}\right)^2 = \frac{4624}{3600}$$

$$1 + \frac{r}{100} = \frac{68}{60}$$

$$\frac{r}{100} = \frac{68}{60} - 1$$

$$\frac{r}{100} = \frac{8}{60}$$

$$r = \frac{800}{60} = 13.3\% \text{ (Option B)}$$

5) On a certain sum of money the compound interest Rs. 318 is earned in 2 years. If the rate of interest is 12%, what is the principal amount?

- A. Rs. 1250
- B. Rs.1300
- C. Rs. 1200
- D. Rs. 1150

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The Correct answer is (A)

Explanation:

We have;

C.I. = Rs. 318

$r = 12\%$

$t = 2 \text{ years}$

Apply formula: C.I = $P \left[\left(1 + \frac{r}{100} \right)^t - 1 \right]$

$$318 = P \left[\left(1 + \frac{12}{100} \right)^2 - 1 \right]$$

$$318 = P \left[\frac{112}{100} * \frac{112}{100} - 1 \right]$$

$$318 = P * 0.2544$$

$$P = \frac{318}{0.2544} = \text{Rs.1250 (Option A)}$$
