Simple Interest & Compound Interest

Interest is the consideration (excess money) given by a borrower to the lender for the use of the money. The money which has been lent or borrowed is called the principal. The interest charged per ₹100 per year is known as the rate of interest per annum, and is always represented as a percentage.

Simple Interest

When the interest is payable on the principal alone, it is known as simple interest.

The amount of interest is always constant.

Basic formula for simple interest (SI) is $\frac{P \times R \times T}{100}$.

Where P = Principal or sum being borrowed or lent

R = Rate of interest per year

T = Time period for which the amount is borrowed

Amount (A) = Principal + Simple interest

$A = P + \frac{P \times R \times T}{100}$

1. What shall be the interest to be paid on a principal of ₹14,000 borrowed at a rate of 15% for a period of 3 years and 6 months?

Solution :

SI = $\frac{P \times R \times T}{100}$; P = 14,000, R = 15% and T = 3.5 years

So, SI = $\frac{(14000 \times 15 \times 3.5)}{100}$ = ₹7,350

Compound Interest

In case of simple interest, the lender receives a fixed amount of money for every defined period of time. There is another case in which the interest amount received after every given period of time is reinvested at the same rate of interest as agreed upon initially.

In other words, the amount received at the end of year 1 becomes principal for period 2, and so on.

1. What shall be the amount for a sum of ₹1,000 at 10% per annum for 3 years compounded annually.

Solution :

Amount at the end of year 1 is

$A_1 = \frac{(P \times R \times T)}{100} + P_1$

$= \frac{1000 \times 10 \times 1}{100} + 1000$ = ₹1,100

This shall be the principal for year 2.

$A_2 = \frac{(1100 \times 10 \times 1)}{100} + 1100$ = ₹1,210

$A_3 = \frac{(1210 \times 10 \times 1)}{100} + 1210$ = ₹1,331

So, amount at the end of 3 years in case of compound interest (CI) is ₹1,331, while in the case of simple interest (SI), it shall be ₹1,300 (at 10%).

Alternative Method:

CI can be calculated using the following formula.

Principal + CI = Amount

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

Where,

P = Principal or sum being borrowed

R = Rate of interest

n = Number of times the fixed interval is repeated.

Note:

If the interest is compounded semi-annually or half-yearly then the amount becomes

$A = P\left(1 + \frac{r}{200}\right)^{2t}$

If the interest is compounded quarterly then the amount becomes

$A = P\left(1 + \frac{r}{400}\right)^{4t}$

Important Note:

I. If the word interest is given and nothing else is specified, the interest is considered as SI.

II. If the interest is given by bank and nothing is specified, it is always CI.

III. Population growth is always taken on compounding basis.

IV. Difference between CI and SI for 2 years for the same principle at the same interest is $P\left(\frac{r}{100}\right)^2$

Solved Examples

1. If a certain sum amounts to ₹108 in 2 years, and ₹112 in 3 years, then find the principal and rate of interest (simple).

Solution :

Amount after 2 years = ₹108.

Amount after 3 years = ₹112.

In SI, interest amount remains the same for every year.

Therefore, interest for 1 year = ₹4.

Hence, the principal = 108 – 2(4) = ₹100.

Rate of interest = $\frac{4 \times 100}{100 \times 1} = 4\%$

2. At what simple rate of interest shall a sum of money doubles itself in 4 years?

Solution :

Now important point to be noted is that the amount received by the lender is double the amount given, that means interest = Principal.

So, if x is the Principal, then x is the simple interest.

$\Rightarrow x = \frac{(x \times R \times 4)}{100}$

$\Rightarrow R = \frac{100}{4} = 25\%$

3. Find the CI on ₹5,000 at 8% p.a. for 2 years, compounding being done annually.

Solution :

P = ₹5000, R = 8% and n = 2 years

$5000\left(1+\frac{8}{100}\right)^2$ = Amount = ₹5,832.

CI = Amount – Principal = ₹(5832 – 5000) = ₹832

4. Find amount for ₹80,000 at 10% per annum, compounded bi-annually for 2 years.

Solution :

Here, n = 2 years × 2 = 4 periods

Similarly, R = $\frac{10}{2}$ = 5% (for half year);

P = ₹80,000

A = $80000\left(1+\frac{5}{100}\right)^4$ = ₹97,240.50

5. Find CI on ₹10,000 at 10% per annum for 9 months, compounded quarterly.

Solution :

n = 3 periods, R = 2.5% per period and

P = ₹10,000

Amount = $10000\left(1+\frac{2.5}{100}\right)^3 \approx$ ₹10,769 (approximately)

CI = Amount – Principal

= 10769 – 10000 = ₹769

6. The difference between the CI and SI on a certain amount at 10% per annum for 2 years, compounded annually, is ₹372. Find the principal.

Solution :

Let the principal be 'a'.

SI = a × $\frac{10}{100} \times 2 = \frac{20}{100}$a and

CI = Amount – a

$= a\left(1+\frac{10}{100}\right)^2 - a = \frac{21}{100} \times a$

CI – SI = ₹372

$\frac{21}{100}a - \frac{20}{100}a = ₹372$

$\Rightarrow$ a = ₹37,200 = Principal

Alternative Method:

The above problem has an alternate. You need to understand the fact that for 1st period, SI = CI.

The difference between the values of CI and SI is because of accumulated interest building on interest which is reinvested. Therefore, for period 2, the difference between CI and SI is the interest for one period on the interest of period 1.

In the above example, the difference being 372 is the interest generated on interest for period 1 on the principal.

Interest for period 1 = ₹$\left(372 \times \frac{100}{10}\right)$ = ₹3,720

Therefore, principal = ₹$\left(3720 \times \frac{100}{10}\right)$

= ₹37,200

7. Ram invested a particular sum at 12% per annum with one of his friends Shyam and a similar amount in bank which pays interest at 12% p.a. compounded semi-annually. The difference between the amounts received after one year was ₹1,800. Find the total sum invested by Ram.

Solution :

Following the above illustration, we have the difference equal to the interest on the interest paid on the principal for 6 months. (Rate of interest becomes $\frac{12}{2}$ = 6%).

Interest paid for 6 months = ₹$\left(1800 \times \frac{100}{6}\right)$ on principal = ₹30,000.

Principal/sum invested in bank

= ₹$\left(30000 \times \frac{100}{6}\right)$ = ₹5,00,000.

Total sum invested = ₹(5,00,000 + 5,00,000) = ₹10,00,000.

8. If the CI on a certain sum for 3 years at 20% p.a. is ₹728, what is the sum invested?

Solution :

$$CI = 728 = P\left(1+\frac{20}{100}\right)^3 - P$$

$$P\left(\frac{728}{1000}\right) = ₹728 \Rightarrow P = ₹1{,}000$$

Important Note:

When rates are different for different years, say r_1, r_2 and r_3 for different years 1, 2 and 3 respectively, then, **Amount**

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

9. Find the amount after 3 years if the principal is ₹10,000 and rates are 10%, 8% and 12% in 1st, 2nd and 3rd year respectively.

Solution :

Amount

$$= ₹10{,}000\left(1+\frac{10}{100}\right)\left(1+\frac{8}{100}\right)\left(1+\frac{12}{100}\right)$$

= ₹10,000 × 1.1 × 1.08 × 1.12

= ₹13,305.60

10. What is the CI received on a sum of ₹26,000 at rates 10%, 12% and 8% each, prevailing in that order for years 1, 2 and 3, interest being compounded semi-annually for the given three years?

Solution :

Amount

$$= 26000 \times \left(1+\frac{5}{100}\right)^2\left(1+\frac{6}{100}\right)^2\left(1+\frac{4}{100}\right)^2$$

= ₹34,836.17

CI = ₹(34836.17 – 26000) = ₹8,836.17

11. What is the amount of interest on ₹1,000 compounded annually at the rate of 10% for 3 years.

Solution :

$$A = 1000\left(1+\frac{10}{100}\right)^3 = ₹1{,}331$$

⇒ Interest = ₹331

12. If a sum of money doubles at 12.5% p.a. interest, what is the time period in case of (i) SI and (ii) CI?

Solution :

(i) R = 12.5%, Amount = 2P

$$\text{Time} = \frac{100}{12.5} = 8 \text{ years}$$

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

$$2P = P\left(1+\frac{R}{100}\right)^t \Rightarrow 2 = \left(\frac{9}{8}\right)^t$$

⇒ t = 5.88 years (approximately)

13. For how many years should ₹600 be invested at 10% p.a. in order to earn the same simple interest as earned by investing ₹800 at 12% p.a. for 5 years?

Solution :

$$\text{SI required} = ₹\left(\frac{800 \times 12 \times 5}{100}\right) = ₹480$$

$$\text{Time} = \left(\frac{100 \times 480}{600 \times 10}\right) = 8 \text{ years}$$

14. Prabhat took a certain amount of loan from a bank at the rate of 8% p.a. S.I. and gave the same amount to Ashish as a loan at the rate of 12% p.a. If at the end of 12 years, he made a profit of ₹320 in the deal, what was the original amount?

Solution :

Let the original amount be ₹x. Then,

$$\frac{x \times 12 \times 12}{100} - \frac{x \times 8 \times 12}{100} = 320 \Rightarrow x = \frac{2000}{3}$$

= ₹666.67

15. Rahul borrowed ₹830 from Mr Lal at 12% p.a. SI for 3 years. He then added some money to the borrowed sum and lent it to Shobha for the same period at the rate of 14% p.a. interest. If Rahul gains ₹93.90 in the whole transaction, what amount did he add from his side?

Solution :

Let the amount added be ₹x.

$$\frac{(830+x) \times 14 \times 3}{100} - \frac{830 \times 12 \times 3}{100} = 93.90$$

⇒ 830 × 42 + 42x – 830 × 36 = 9390

⇒ 42x + 830 × (42 – 36) = 9390

⇒ 42x = 9390 – 4980

$$\Rightarrow x = \frac{4410}{42} = 105$$

∴ Amount added = ₹105.

16. If a sum of money at simple interest doubles in 6 years, in how many years will it become four times?

Solution :

Let sum be x. Then SI = x

$$\therefore \text{Rate} = \left(\frac{100 \times x}{x \times 6}\right)\% = \frac{50}{3}\%$$

Now, sum is x and SI is 3x, rate = $\frac{50}{3}$%.

$$\therefore \text{Time} = \frac{100 \times 3x}{x \times \frac{50}{3}} = 18 \text{ years}$$

Alternative method:

Let principal be P. Thus, amount is 2P after 6 years.

Interest in 6 years = 2P – P = P.

To become four times, interest = 4P – P = 3P.

When interest is P, time taken = 6 years.

When interest is 3P, time taken = 3 × 6 = 18 years.

17. The rate of interest on a sum of money is 4% p.a. for the first 2 years; 6% p.a. for the next 3 years; and 8% p.a. for the period beyond 5 years. If the simple interest collected by the sum for a total period of 8 years is ₹1,280, what is the sum?

Solution :

Let the sum be ₹x. Then

$$\frac{x \times 4 \times 2}{100} + \frac{x \times 6 \times 3}{100} + \frac{x \times 8 \times 3}{100} = 1280$$

$\Rightarrow$ 50x = 1280 × 100

$\therefore$ x = ₹2,560

18. Vinod Kumar invested ₹1,600 for 3 years and ₹1,100 for 4 years at the same rate of simple interest. If the total interest from these investments is ₹506, what was the rate of interest?

Solution :

$$\frac{1600 \times 3 \times R}{100} + \frac{1100 \times 4 \times R}{100} = 506$$

$$\Rightarrow 92R = 506$$

$$\Rightarrow R = 5\frac{1}{2}\%$$

19. A man invests an amount of ₹15,860 in the names of his three sons A, B and C in such a way that they get the same interest after 2, 3 and 4 years respectively. If the rate of interest is 5%, then what will be the ratio of amounts invested among A, B and C?

Solution :

Let the amounts invested be x, y, z respectively.

Then, $\frac{x \times 2 \times 5}{100} = \frac{y \times 3 \times 5}{100} = \frac{z \times 4 \times 5}{100} = k$;

$\therefore$ x = 10k, y = $\frac{20}{3}$ k and z = 5k.

So, x : y : z = 10k : $\frac{20k}{3}$: 5k = 30 : 20 : 15

= 6 : 4: 3.

20. The rates of simple interest in two banks A and B are in the ratio 5 : 4. A person wants to deposit his total savings in two banks in such a way that he receives equal half yearly interest from both. What should be the ratio of his savings in banks A and B?

Solution :

Let the savings be X and Y and the rates of simple interest be 5x and 4x respectively. Then,

$$X \times 5x \times \frac{1}{2} \times \frac{1}{100} = Y \times 4x \times \frac{1}{2} \times \frac{1}{100}$$

$$\Rightarrow \frac{X}{Y} = \frac{4}{5} \text{ i.e. X : Y = 4 : 5}$$

21. The value of a machine depreciates at the rate of 10% every year. It was purchased 3 years ago. If its present value is ₹8,748, what was its purchase price?

Solution :

Let the purchase price be P.

Rate of depreciation = 10%

$$P\left(1-\frac{10}{100}\right)^3 = 8748 \Rightarrow P = \left(8748 \times \frac{10}{9} \times \frac{10}{9} \times \frac{10}{9}\right)$$

= ₹12,000.

Exercise

1. Two investments of ₹500 and ₹1500 have a combined yearly return of 8.5% of the total of the two investments. If the ₹500 investment has a yearly return of 7%, what per cent yearly return does the ₹1,500 investment have?
   (a) 9% (b) 10%
   (c) $10\frac{5}{8}\%$ (d) 11%
2. A family made a down payment of ₹75 and borrowed a set of encyclopaedias that cost ₹400. The balance with interest was paid in 23 monthly payments of ₹16 each and a final payment of ₹9. The amount of interest paid was what per cent of the amount borrowed?
   (a) 6% (b) 12%
   (c) 14% (d) 16%
3. The difference between the interests received from two different banks on ₹500 for 2 years is ₹2.50. The difference between their rates is
   (a) 1% (b) 0.5%
   (c) 0.25% (d) 25%
4. A sum of ₹3,500 is lent for 5 years at 5% p.a. SI. The interest accrued and the amount to be repaid are respectively
   (a) ₹875 and ₹4,375 (b) ₹975 and ₹4,475
   (c) ₹500 and ₹4,000 (d) ₹375 and ₹3,875
5. In what time, a sum of money will triple itself at SI 20% p.a.?
   (a) 5 years (b) 10 years
   (c) 15 years (d) 20 years
6. What will be the CI on ₹1,000 for 3 years at 10% p.a.?
   (a) ₹300 (b) ₹330
   (c) ₹331 (d) ₹361
7. Find the difference between SI and CI on ₹700 at the rate of 10% for 3 years?
   (a) ₹20.90 (b) ₹21
   (c) ₹21.70 (d) ₹24
8. SI on a sum of money is one-fourth of principal. The number of years is equal to the rate of interest. Find the rate of interest.
   (a) 2.5% (b) 7.5%
   (c) 6% (d) 5%
9. If CI for a certain sum for 2 years at 2% p.a. be ₹1,010, what is the principal?
   (a) ₹20,000 (b) ₹25,000
   (c) ₹25,250 (d) ₹27,500
10. If CI for a certain sum at 3% for 2 years is ₹203, what would be the SI for the same period and at the same rate?
    (a) ₹200 (b) ₹207.50
    (c) ₹213.33 (d) ₹190
11. What is the sum which when lent at 5% SI for 2 years would yield interest of ₹154?
    (a) ₹1,450 (b) ₹1,540
    (c) ₹1,650 (d) ₹1,480
12. I bought a watch for ₹400 and sell it for ₹460 at a credit of 8 months. What is my approx. gain percentage considering interest rate to be 15% p.a.?
    (a) 4.55% (b) 6.66%
    (c) 7.5% (d) None of these
13. The simple interest on ₹1,820 from March 9, 1994 to May 21, 1994 at 7.5% rate will be
    (a) ₹29 (b) ₹28.80
    (c) ₹27.30 (d) ₹22.50

Directions for questions 14 and 15: Answer the questions based on the following information.

'A' borrowed ₹4,000 at 10% CI for 3 years with the condition that half of the amount at the end of first and second years will be paid at the end of those years.

14. What is the amount due at maturity?
    (a) ₹2,200 (b) ₹2,324
    (c) ₹1,331 (d) ₹1,242
15. In the above question, how much did 'A' pay in total as interest?
    (a) ₹1,200 (b) ₹944
    (c) ₹881 (d) ₹741
16. At what rate per cent, the simple interest on ₹1,125 will be ₹225 in 4 years?
    (a) 4% (b) 5%
    (c) $6\frac{2}{3}\%$ (d) Can't be determined

17. If I lend ₹5,000 for 3 years in two schemes (i) 11% SI and (ii) 10% CI, which is the beneficial scheme and by what amount?
    (a) (i), ₹150 (b) (i), ₹50
    (c) (ii), ₹5 (d) (ii), ₹50
18. A sum was put at simple interest at a certain rate for 2 years. Had it been put at 3% higher rate, it would have fetched ₹72 more. The sum is
    (a) ₹1,200 (b) ₹1,500
    (c) ₹1,600 (d) ₹1,800
19. If a sum of money doubles itself in 8 years at simple interest, the rate percentage per annum is
    (a) 11.5% (b) 12%
    (c) 12.5% (d) 13%
20. If x, y and z are three sums of money such that 'y' is the simple interest on 'x'; 'z' is the simple interest on 'y' for the same time and at the same rate of interest, then we have
    (a) $x^2 = yz$ (b) $y^2 = xz$
    (c) $z^2 = xy$ (d) $xyz = 1$
21. A sum of ₹1,550 was partly lent at 5% and 8% p.a. simple interest. The total interest received after 3 years was ₹300. The ratio of the money lent at 5% to that lent at 8% is
    (a) 8 : 5 (b) 5 : 8
    (c) 31 : 6 (d) 16 : 15
22. A man invested one-third of his capital at 7%, one-fourth at 8% and the remainder at 10% simple interest respectively. If his annual income is ₹561, the capital is
    (a) ₹5,400 (b) ₹6,000
    (c) ₹6,600 (d) ₹7,200
23. A man lends ₹10,000 in four parts. If he gets 8% on ₹2,000; 7.5% on ₹4,000; 8.5 % on ₹1,400, what per cent must he get for the remainder, if his average annual interest is 8.13%?
    (a) 10.5% (b) 9.25%
    (c) 9% (d) 7%
24. ₹2,189 is divided into three parts such that their interests after 1, 2 and 3 years respectively is equal. The rate of simple interest being 4% p.a. in all cases, the smallest part is
    (a) ₹702 (b) ₹398
    (c) ₹756 (d) ₹1,093
25. If the simple interest on a sum of money for 3 years at 5% p.a. is ₹1,200, the compound interest for the same period at the same rate is
    (a) ₹1,260 (b) ₹1,261
    (c) ₹1,264 (d) ₹1,265
26. If the difference between the compound interest, compounded half-yearly and the simple interest on a sum at 10% p.a. for one year is ₹25, the sum is
    (a) ₹9,000 (b) ₹9,500
    (c) ₹10,000 (d) ₹10,500
27. A man borrowed ₹800 at 10% p.a. SI and immediately lent the whole sum at 10% p.a. CI. What does he gain at the end of 2 years?
    (a) ₹6 (b) ₹8
    (c) ₹10 (d) ₹12
28. A sum of money amounts to ₹4,624 in 2 years and to ₹4,913 in 3 years at compound interest. The sum is
    (a) ₹4,096 (b) ₹4,260
    (c) ₹4,335 (d) ₹4,360
29. In how many years will a sum of ₹800 at 10% per annum compounded semi-annually become ₹926.10?
    (a) $2\frac{1}{2}$ years (b) $1\frac{1}{2}$ years
    (c) $2\frac{1}{3}$ years (d) $1\frac{1}{3}$ years
30. A sum of ₹12,000 deposited at compound interest becomes double after 5 years. After 20 years it will become
    (a) ₹1,20,000 (b) ₹1,92,000
    (c) ₹1,24,000 (d) ₹96,000
31. The least number of complete years in which a sum of money put at 20% compound interest will be more than double is
    (a) 3 (b) 4
    (c) 5 (d) 6
32. A tree increases annually by one-eighth of its height. What will be the height of it after 2 years, if it stands today 64 cm high?
    (a) 72 cm (b) 74 cm
    (c) 75 cm (d) 81 cm
33. A sum of money becomes ₹13,380 after 3 years and ₹20,070 after 6 years on compound interest. The sum is
    (a) ₹8,800 (b) ₹8,890
    (c) ₹8,920 (d) ₹9,040
34. The compound interest on ₹30,000 at 7% per annum for a certain period is ₹4,347. The period is
    (a) 2 years (b) 2.5 years
    (c) 3 years (d) 4 years

35. At what rate of compound interest per annum will a sum of ₹1,200 become ₹1,348.32 in 2 years?
    (a) 7% (b) 6%
    (c) 7.5% (d) 6.5%
36. A sum of money invested at compound interest amounts to ₹800 in 3 years and ₹840 in 4 years. What is the rate of interest per annum?
    (a) 2% (b) 4%
    (c) 5% (d) 10%
37. A sum of money becomes eight times of itself in 3 years at compound interest. The rate of interest is
    (a) 100% (b) 80%
    (c) 1% (d) Data inadequate
38. A father left a will of ₹85,000 to be divided between his two sons aged 10 years and 12 years such that they may get equal amount when each attains the age of 18 years. If the money is reckoned at 10% p.a., find how much the son of age 10 gets at the time of the will?
    (a) ₹32,000 (b) ₹36,000
    (c) ₹40,000 (d) ₹42,000
39. Simple interest on a certain sum is 9 over 25 of the sum. Find the rate per cent and time, if both are numerically equal.
    (a) 6%, 6 years (b) 7%, 7 years
    (c) 9%, 9 years (d) 8%, 8 years
40. Find the difference between SI and CI on ₹2,000 for 2 years at the rate of 10% per annum.
    (a) ₹20 (b) ₹22
    (c) ₹24 (d) ₹30
41. Some of the amount of ₹7,000 was lent at 6% p.a. and the remaining at 4% p.a. If the total simple interest from the fraction in 5 years was ₹1,600, what was the sum lent at 6% p.a.?
    (a) ₹2,000 (b) ₹2,500
    (c) ₹3,000 (d) ₹4,000
42. What annual payment will discharge a debt of ₹1,200 in 4 years at 4% p.a. simple interest?
    (a) ₹200 (b) ₹348
    (c) ₹400 (d) ₹500
43. In what time will ₹36 become ₹45 at 6.25% p.a. simple interest?
    (a) 2 years (b) 3 years
    (c) 4 years (d) 8 years
44. The simple interest on ₹400 for 8 months at 5 paise per rupee per month is
    (a) ₹120 (b) ₹160
    (c) ₹200 (d) ₹400
45. The simple interest on a sum of money for 3 years is ₹360, and the compound interest on the same sum at the same rate for 2 years is ₹270. The rate per cent per annum is
    (a) 25% (b) 50%
    (c) 60% (d) 80%
46. If ₹1 becomes ₹10 in 50 years at simple interest, the rate per cent per annum is
    (a) 16% (b) 18%
    (c) 20% (d) None of these
47. A man lent ₹400 and ₹600 for 3 years, at the same rate of simple interest and received only ₹90 as interest. What was the rate percentage per annum?
    (a) 1% (b) 2%
    (c) 3% (d) 4%

Answer Key

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

Explanations

1. a Total return = 8.5% of 2000 = ₹170.

SI from ₹500 = $\frac{500 \times 7 \times 1}{100}$ = ₹35,

and SI from ₹1500 = $\frac{1500 \times r \times 1}{100}$ = 15r.

We have, 35 + 15r = 170

$\Rightarrow 15r = 135 \Rightarrow r = 9\%$.

2. d The family borrowed ₹325.

The family paid = 16 × 23 + 9 = ₹377.

Interest paid = 377– 325 = ₹52.

So, percentage = $\frac{52}{325} \times 100 = 16\%$.

3. c $\frac{500 \times R_1 \times 2}{100} - \frac{500 \times R_2 \times 2}{100} = 2.50$

$\Rightarrow 1000(R_1 - R_2) = 250$

$\Rightarrow R_1 - R_2 = \frac{250}{1000} = 0.25\%$

4. a Interest = $\frac{3500 \times 5 \times 5}{100}$ = ₹875.

Amount = P + I = 3500 + 875 = ₹4375.

5. b $2P = \frac{P \times 20 \times t}{100}$, t = 10 years

6. c CI = $P\left[1 + \frac{r}{100}\right]^3 - P$

= 1000[1.1]^3 – 1000 = 1331 – 1000 = ₹331

7. c CI for 3 years = $700\left[1 + \frac{10}{100}\right]^3 - 700$ = ₹231.70

SI for 3 years = $\frac{700 \times 10 \times 3}{100}$ = ₹210

$\therefore CI_3 - SI_3 = 21.7$

Short cut:

$CI_3 - SI_3 = 700(1.1^3 - 1.3)$ = ₹21.70

8. d SI = $\frac{P}{4} \therefore \frac{P}{4} = \frac{P \times r \times t}{100}$

Since r = t,

$\therefore r^2 = \frac{100}{4}$, $r = \frac{10}{2} = 5\%$

9. b CI = 1010 = $P\left(1 + \frac{2}{100}\right)^2 - P$

$\Rightarrow 1010 = P\left[(1.02)^2 - 1\right] = 0.0404P$

$\Rightarrow P = ₹25,000$

Alternative method:

$CI = SI + SI + \frac{2}{100}SI$

Where SI is simple interest for one year

$\Rightarrow 1010 = \frac{202}{100}SI$

$\therefore SI = \frac{1010}{202} \times 100 = 500$

$\therefore P = \frac{500 \times 100}{2 \times 1} = ₹25000$

10. a CI = 203 = $P\left(1 + \frac{3}{100}\right)^2 - P$

$\Rightarrow 203 = P\left[(1.03)^2 - 1\right]$

$\Rightarrow P = \frac{203}{0.0609} \approx ₹3,333$

$SI = \frac{P \times R \times T}{100} = \frac{3333 \times 3 \times 2}{100} \approx ₹200$

Short cut:

SI must be less than CI.

11. b $154 = \frac{P \times 5 \times 2}{100} \Rightarrow P = ₹1,540$

12. a Present worth of ₹460 = $\frac{460}{1 + \frac{\frac{2}{3} \times 15}{100}} \approx ₹418.20$

Therefore, profit = $\frac{18.2}{400} \times 100 = 4.55\%$.

13. c March + April + May

23 + 30 + 21 = 74 days = $\frac{74}{365}$ year

= $\frac{1}{5}$ years (approximately)

$\therefore$ Interest = ₹$\left(1820 \times \frac{1}{5} \times \frac{15}{2 \times 100}\right)$ = ₹27.30

14. c Amount payable at the end of 1st year = ₹4,400;
Half of 4400 is paid. Remaining = ₹2,200.
Amount payable at the end of 2nd year
= ₹2,420; Half of which is paid.
Amount payable at the end of 3rd year
= 1210(1.1) = ₹1,331.

15. d Amount paid = 2200 + 1210 + 1331 = ₹4,741.
Therefore, interest paid = ₹741.

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

$\Rightarrow 225 = 1125 \times \frac{R}{100} \times 4 \Rightarrow R = \frac{225 \times 100}{1125 \times 4}$

$\Rightarrow R = 5\%$

17. c (i) $SI = \frac{5000 \times 3 \times 11}{100} = ₹1,650$

(ii) $CI = 5000\left(1+\frac{10}{100}\right)^3 - 5000 = ₹1,655$

Short cut:

Effective rate at SI and CI = 33% and 33.1% respectively.

18. a Let the sum be ₹x and the original rate be R%.

Then, $\frac{x \times (R+3) \times 2}{100} - \frac{x \times R \times 2}{100} = 72$

$\Rightarrow 2Rx + 6x - 2Rx = 7200 \Rightarrow x = ₹1,200.$

19. c Let sum = x. Then SI = x.

$\text{Rate} = \left(\frac{100 \times x}{x \times 8}\right)\% = 12.5\%.$

20. b $y = \frac{x \times R \times T}{100} \Rightarrow RT = \frac{100y}{x}$

$z = \frac{y \times R \times T}{100} \Rightarrow RT = \frac{100z}{y}$

$\therefore \frac{100y}{x} = \frac{100z}{y} \Rightarrow y^2 = xz$

21. d Let the sum at 5% be ₹x. Then,

$\frac{x \times 5 \times 3}{100} + \frac{(1550-x) \times 8 \times 3}{100} = 300 \Rightarrow x = ₹800$

$\frac{\text{Money at 5\%}}{\text{Money at 8\%}} = \frac{800}{(1550-800)} = \frac{800}{750} = \frac{16}{15}$

22. c Let the total capital be x. Then

$\left(\frac{x}{3} \times \frac{7}{100} \times 1\right) + \left(\frac{x}{4} \times \frac{8}{100} \times 1\right) + \left(\frac{5x}{12} \times \frac{10}{100} \times 1\right) = 561$

$\Rightarrow \frac{7x}{300} + \frac{x}{50} + \frac{x}{24} = 561$

$\Rightarrow x = \left(\frac{561 \times 600}{51}\right) = ₹6,600$

23. c $\left(\frac{2000 \times 8 \times 1}{100}\right) + \left(4000 \times \frac{15}{2} \times \frac{1}{100}\right) + \left(1400 \times \frac{17}{2} \times \frac{1}{100}\right)$

$+2600 \times R \times \frac{1}{100} = \frac{813}{10000} \times 10000$

$\Rightarrow 160 + 300 + 119 + 26R = 813 \Rightarrow R = 9\%$

24. b Let these parts be x, y and z.

Hence, by the simple interest formula,

4x = 8y, and 8y = 12z.

Hence, x : y : z = 6 : 3 : 2.

The smallest part = $\frac{2189 \times 2}{11}$ = ₹398.

25. b $\text{Sum} = ₹\left(\frac{100 \times 1200}{3 \times 5}\right) = ₹8,000$

$\text{Amount} = ₹\left[8000 \times \left(1+\frac{5}{100}\right)^3\right]$

$= ₹\left(8000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}\right) = ₹9,261$

$\therefore CI = ₹(9261 - 8000) = ₹1,261$

26. c Let the sum be x. Then,

$CI = x\left(1+\frac{5}{100}\right)^2 - x = \left(\frac{441x}{400} - x\right) = \frac{41x}{400}$

$SI = \frac{x \times 10 \times 1}{100} = \frac{x}{10}$

$CI - SI = \frac{41x}{400} - \frac{x}{10} = \frac{x}{400}$

$\therefore \frac{x}{400} = 25 \Rightarrow x = ₹10,000$

Short cut:

Interest paid on principal for 6 month

$= 25 \times \frac{100}{5} = ₹500$

$\text{Principal amount invested} = 500 \times \frac{100}{5} = ₹10,000$

27. b $CI = ₹\left[800 \times \left(1+\frac{10}{100}\right)^2 - 800\right] = ₹168$

$SI = ₹\left(\frac{800 \times 10 \times 2}{100}\right) = ₹160$

Gain = CI – SI = ₹(168 – 160) = ₹8

28. a Interest on ₹4,624 for 1 year = 4913 – 4624 = ₹289.

$\therefore \text{Rate} = \frac{289}{4624} = 6\frac{1}{4}\%.$

Now if x = Sum,

$x\left(1+\frac{25}{4 \times 100}\right)^2 = 4624 \Rightarrow x \times \frac{17}{16} \times \frac{17}{16} = 4624$

$\Rightarrow x = \left(4624 \times \frac{16}{17} \times \frac{16}{17}\right) = ₹4,096$

29. b Rate = 5% per half year.

Let time = 2n half years = n years

Then, $800\left(1+\frac{5}{100}\right)^{2n} = 926.10$

$\Rightarrow \left(\frac{21}{20}\right)^{2n} = \frac{926.10}{800} = \frac{9261}{8000} = \left(\frac{21}{20}\right)^3$

$\therefore 2n = 3 \Rightarrow n = \frac{3}{2}$ years.

30. b $12000 \times \left(1+\frac{R}{100}\right)^5 = 24000 \Rightarrow \left(1+\frac{R}{100}\right)^5 = 2$

$\therefore \left[\left(1+\frac{R}{100}\right)^5\right]^4 = 2^4 = 16 \Rightarrow \left(1+\frac{R}{100}\right)^{20} = 16$

$\Rightarrow P\left(1+\frac{R}{100}\right)^{20} = 16P$

$\Rightarrow \left(1+\frac{R}{100}\right)^{20} = 16 \times 12000 = ₹1,92,000$

31. b $P\left(1+\frac{20}{100}\right)^n > 2P$ or $\left(\frac{6}{5}\right)^n > 2$

Now $\left(\frac{6}{5}\times\frac{6}{5}\times\frac{6}{5}\times\frac{6}{5}\right) > 2$.

So n = 4 years.

32. d Percentage increase = $\left(\frac{1}{8}\times 100\right)\% = 12\frac{1}{2}\%$.

Height after 2 years = $\left[64\times\left(1+\frac{25}{2\times 100}\right)^2\right]$ cm

= $\left(64\times\frac{9}{8}\times\frac{9}{8}\right)$ cm = 81 cm.

33. c Let the sum be ₹x. Then

$x\left(1+\frac{R}{100}\right)^3 = 13380$ and $x\left(1+\frac{R}{100}\right)^6 = 20070$.

By dividing, we get $\left(1+\frac{R}{100}\right)^3 = \frac{20070}{13380} = \frac{3}{2}$.

$\therefore x \times \frac{3}{2} = 13380 \Rightarrow x = \left(13380\times\frac{3}{2}\right) = 8920$

Hence, the sum is ₹8,920.

34. a Amount = ₹(30000 + 4347) = ₹34,347

Let $30000\left(1+\frac{7}{100}\right)^n = 34347$

$\Rightarrow \left(1+\frac{7}{100}\right)^n = \frac{34347}{30000} = \frac{11449}{10000} = \left(\frac{107}{100}\right)^2$

$\therefore$ n = 2 years.

35. b $1200\times\left(1+\frac{R}{100}\right)^2 = 1348.32$

$\Rightarrow \left(1+\frac{R}{100}\right)^2 = \frac{1348.32}{1200} = \frac{11236}{10000}$

$\therefore \left(1+\frac{R}{100}\right)^2 = \left(\frac{106}{100}\right)^2 \Rightarrow 1+\frac{R}{100} = 1.06 \Rightarrow R = 6\%$

36. c Interest on ₹800 for one year = ₹(840 – 800) = ₹40

$\therefore$ Rate $= \left(\frac{100\times 40}{800\times 1}\right)\% = 5\%$

37. a $p\left(1+\frac{R}{100}\right)^3 = 8P \Rightarrow \left(1+\frac{R}{100}\right)^3 = 8 = 2^3$

$\therefore 1+\frac{R}{100} = 2 \Rightarrow \frac{R}{100} = 1 \Rightarrow R = 100\%$

38. c $A_{10} = A_{12}$

$P_{10}[100 + 10(18 – 10)] = P_{12}[100 + 10(18 – 12)$;

$\frac{P_{10}}{P_{12}} = \frac{160}{180} = \frac{8}{9}$

P_{10} = Sum of 10-year-old son

$= \frac{8}{17}\times 85000$ = ₹40,000.

39. a $\frac{9}{25}\times P = \frac{P\times R^2}{100} \Rightarrow R^2 = \frac{9\times 100}{25} \Rightarrow R = \frac{3\times 10}{5} = 6\%$

Hence, time period is 6 years.

40. a SI = $\frac{2000\times 2\times 10}{100}$ = ₹400

CI = $2000\left\{\left(1+\frac{10}{100}\right)^2 - 1\right\} = 2000\times\frac{21}{100}$ = ₹420

Hence difference = 420 – 400 = ₹20.

Short cut:

Difference between S.I. and C.I.

$= P\times\left(\frac{R}{100}\right)^2 = 2000\times\frac{10}{100}\times\frac{10}{100}$ = ₹20

41. a $\frac{x\times 6\times 5}{100} + \frac{(7000-x)}{100}\times 5\times 4 = 1600$

30x + 140000 – 20x = 160000

$\Rightarrow$ 10x = 20000

$\Rightarrow$ x = ₹2,000

42. b Annual payment $= \frac{1200 + \frac{1200\times 4\times 4}{100}}{4}$ = ₹348.

43. c T = $\frac{9\times 100\times 4}{36\times 25} = 4$ years

44. b $\frac{400\times 8\times 5}{100}$ = ₹160

45. a SI for 1st year = $\frac{360}{3}$ = ₹120 = CI for 1st year.

CI for 2 years = ₹270 $\Rightarrow$ 120 + CI for 2nd year.

CI for 2nd year = ₹120 + Interest on ₹120 for 1year i.e. (150 – 120) = 30

Rate = $\frac{30}{120}\times 100 = 25\%$

46. b r = $\frac{9\times 100}{1\times 50}$ = 18% (Since interest = 10 – 1 = 9)

47. c $\frac{400\times 3\times r}{100} + \frac{600\times 3\times r}{100} = 90 \Rightarrow 30r = 90$

$\Rightarrow$ r = 3%