6. Compound Interest and Uniform Rate of Increase or Decrease

Let us See by Calculating 6.1

1. Question

I have 35000 in my hand. I deposited that money in a bank at the rate of 8.5% compound interest per annum for two years. Let us write by calculating how much money I shall get at the end of 3 years.

Answer

We know that amount after 3 years = $p\left(1 + \frac{r}{100}\right)^3$

Where p = principal, r = rate of interest and n = time = 3 years

From given, p = 35000 and r = 8.5%

So, the amount after 3 years =
$$5000 \left(1 + \frac{8.5}{100}\right)^3$$

$$= 5000 \times \frac{108.5}{100} \times \frac{108.5}{100} \times \frac{108.5}{100}$$

= ₹6386.44

2. Question

Let us calculate the amount of 3000 at the rate of 8% compound interest per annum for 3 years.

Answer

We know that amount after 3 years = $p\left(1 + \frac{r}{100}\right)^3$

Where p = principal, r = rate of interest and n = time = 3 years

From given, p = 3000 and r = 8%

So, the amount after 3 years = $5000 \left(1 + \frac{8}{100}\right)^3$

$$= 5000 \times \frac{108}{100} \times \frac{108}{100} \times \frac{108}{100}$$

= ₹6298.56

3. Question

Goutam babu borrowed ₹2000 at the rate of 6% compound interest per annum for 2 years. Let us write by calculating how much compound interest at the end of 2 years he will pay.

Answer

We know that amount after 2 years = $p\left(1 + \frac{r}{100}\right)^2$

Where p = principal, r = rate of interest and n = time = 2 years

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From given, p = 32000 and r = 6\%
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So, the amount after 2 years = $2000 \left(1 + \frac{6}{100}\right)^2$

$$= 2000 \times \frac{106}{100} \times \frac{106}{100}$$

= ₹2247.2

∴ Compound interest for 2 years = ₹2247.2 - ₹2000

= ₹247.2

4. Question

Let us write by calculating the amount on 30000 at the rate of 9% compound interest per annum for 3 years.

Answer

We know that amount after 3 years = $p\left(1 + \frac{r}{100}\right)^3$

Where p = principal, r = rate of interest and n = time = 3 years

From given, p = 30000 and r = 9%

So, the amount after 3 years = $30000 \left(1 + \frac{9}{100}\right)^3$

$$= 30000 \times \frac{109}{100} \times \frac{109}{100} \times \frac{109}{100}$$

= ₹38850.87

5. Question

Let us write by calculating the amount on ₹80000 for $2\frac{1}{2}$ years at the rate of 5% compound interest per annum.

We know that if the rate of compound interest is r% per annum and the interest is compounded half yearly or if the number of phase of compound interest in a year is 2 then the amount in n years = $p\left(1 + \frac{\frac{r}{2}}{\frac{100}{100}}\right)^{2n}$

Where p = principal, r = rate of compound interest and n = time interval

From given, p = ₹80000, r = 5% and n = $2\frac{1}{2}$ years = $\frac{5}{2}$ years

 $\therefore \text{ We get amount for } 2\frac{1}{2} \text{ years} = 80000 \left(1 + \frac{\frac{5}{2}}{100}\right)^{2 \times \frac{5}{2}}$

$$= 80000 \left(1 + \frac{1}{40}\right)^{5}$$
$$= 80000 \times \frac{41}{40} \times \frac{41}{40} \times \frac{41}{40}$$

= ₹86151.25

6. Question

chandadavi borrowed some money for 2 years in the compound interest at the rate of 8% per annum. Let us calculate if the compound interest is ₹2946, then how much money she had lended.

Answer

Let principal = $\exists x$

At the rate of 8% compound interest per the annum the amount for 2 years

$$= ₹x \left(1 + \frac{8}{100}\right)^{2}$$
$$= ₹x \times \frac{108}{100} \times \frac{108}{100}$$
$$= \frac{₹729x}{625}$$

∴ Compound interest for 2 years = $\mathbb{E}\left(\frac{729x}{625} - x\right)$

By the condition, $\frac{729x}{625} - x = 2946$

$$\Rightarrow \frac{729x - 625x}{625} = 2946$$

$$\Rightarrow \frac{104x}{625} = 2946$$
$$\Rightarrow x = \frac{2946 \times 625}{104}$$

∴ x = ₹17704.32692

∴ Principal is ₹17704.32692

7. Question

Let us write by calculating the principal which becomes ₹2648 after getting 10% compound interest per annum for 3 years.

Answer

Let principal = $\exists x$

At the rate of 10% compound interest per the annum the amount for 3 years $(10)^3$

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

$$= \frac{1}{2} \left\{ x \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100} \right\}$$

$$= \frac{1331x}{1000}$$

$$\therefore \text{ Compound interest for 3 years} = \frac{1331x}{1000} - x \text{ (}\frac{1331x}{1000} - x \text{)}$$
By the condition, $\frac{1331x}{1000} - x = 2648$

$$\Rightarrow \frac{1331x - 1000x}{1000} = 2648$$

$$\Rightarrow \frac{331x}{1000} = 2648$$

$$\Rightarrow x = \frac{2648 \times 1000}{331}$$

$$\therefore x = \frac{1000}{331}$$

 \therefore Principal is ₹8000

8. Question

Rahaman chacha deposited some money in a cooperative bank at the rates of 9% compound interest and he received amount ₹29702.50 after 2 years. Let us calculate how much money Rahman chacha had deposited in cooperative bank.

Let principal = $\exists x$

At the rate of 9% compound interest per the annum the amount for 2 years $= \exists x (1 + \frac{9}{2})^2$

$$= \exists x \times \frac{109}{100} \times \frac{109}{100}$$

= ₹1.1881x

 \therefore Compound interest for 2 years = 1.1881x - x

By the condition, 1.1881x - x = 29702.50

 $\Rightarrow 0.1881x = 29702.50$

∴ x = ₹157908.0276

∴ Principal is ₹157908.0276

9. Question

Let us write by calculating what sum of money at the rate of 8% compound interest per annum for 3 years will amount to ₹31492.80.

Answer

Let principal = $\exists x$

At the rate of 8% compound interest per the annum the amount for 3 years

$$= ₹x \left(1 + \frac{8}{100}\right)^{3}$$
$$= ₹x \times \frac{108}{100} \times \frac{108}{100} \times \frac{108}{100}$$

= ₹1.259x

∴ Compound interest for 3 years =₹ (1.259x - x)

By the condition, 1.259x - x = 31492.80

 $\Rightarrow 0.259 \text{x} = 31492.80$

∴ x = 121593.82

∴ Principal is ₹121593.82

10. Question

Let us calculate the difference between the compound interest and simple interest on ₹12000 for 2 years, at 7.5% interest per annum.

Let principal = $\exists x$

∴ Simple interest at 7.5% for 2 years = $₹\frac{x \times 7.5 \times 2}{100}$

$$= \frac{3x}{20}$$

Compound interest at 7.5% for 2 years = $\Re \left(1 + \frac{7.5}{100}\right)^2$

$$= ₹x × \frac{43}{40} × \frac{43}{40}$$
$$= \frac{₹1849x}{1600}$$

∴ Compound interest for 2 years = $\underbrace{ \left(\frac{1849x}{1600} - x \right) = \frac{249x}{1600} }$

By the condition, $\frac{249x}{1600} - \frac{3x}{20} = 12000$

$$\Rightarrow \frac{249x - 240x}{1600} = 12000$$
$$\Rightarrow \frac{9x}{1600} = 12000$$

$$\Rightarrow x = \frac{12000 \times 1600}{9}$$

∴ x = ₹2133333.33

∴ Principal is ₹2133333.33

11. Question

Let us write by calculating the difference between compound interest and simple interest on ₹10,000 for 3 years at 5% per annum.

Answer

Let principal = $\exists x$

 \therefore Simple interest at 5% for 3 years = $\underbrace{\underbrace{x \times 5 \times 3}_{100}}$

$$=$$
 $\frac{3x}{20}$

= ₹0.15x

At the rate of 5% compound interest per the annum the amount for 3 years $= \left(1 + \frac{5}{3}\right)^3$

$$= (1 + \frac{1}{100})$$

$$= \operatorname{\mathbb{R}} \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100}$$

= ₹1.157x

: Compound interest for 3 years = 1.157x - x = 0.157x

By the condition, 0.157x - 0.15x = 10000

 $\Rightarrow 0.007 \text{x} = 10000$

 $\therefore x = 1428571.42$

∴ Principal is ₹1428571.42

12. Question

Let us write by calculating the sum of money, if the difference between compound interest and simple interest for 2 years at the rate of 9% interest per annum is ₹129.60.

Answer

Let principal = ₹x

∴ Simple interest at 9% for 2 years = $\frac{1}{100} \frac{x \times 9 \times 2}{100}$

$$=\frac{\$9x}{50}$$

= ₹0.18x

At the rate of 9% compound interest per the annum the amount for 2 years $= \operatorname{\mathbb{E}} x \left(1 + \frac{9}{100} \right)^2$

$$=$$
 ₹x × $\frac{109}{100}$ × $\frac{109}{100}$

= ₹1.1881x

∴ Compound interest for 2 years = ₹1.18x - x = 0.1881x

By the condition, 0.1881x - 0.18x = 129.60

 $\Rightarrow 0.0081 \text{x} = 129.60$

∴ x = ₹16000

∴ Principal is ₹16000

13. Question

Let us write by calculating the sum of money if the difference between compound interest and simple interest for 3 years becomes ₹930 at the rate of 10% interest per annum.

Answer

Let principal = ₹x

∴ Simple interest at 10% for 3 years = $\frac{100}{100}$

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

At the rate of 10% compound interest per the annum the amount for 3 years 3^{3}

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

= ₹x × $\frac{110}{100}$ × $\frac{110}{100}$ × $\frac{110}{100}$
= ₹ $\frac{1331x}{1000}$

 $\therefore \text{ Compound interest for 3 years} = \frac{1331x}{1000} - x = \frac{331x}{1000}$

By the condition, $\frac{331x}{1000} - \frac{3x}{10} = 930$ $\Rightarrow \frac{331x - 300x}{1000} = 930$ $\Rightarrow \frac{31x}{1000} = 930$

$$\Rightarrow x = \frac{930 \times 1000}{31}$$

∴ x = 30000

∴ Principal is ₹30000

14. Question

If the rates of compound interest for the first and the second year are 7% and 8% respectively, let us write by calculating compound interest on 36000 for 2 years.

Answer

We know that if principal = p and rate of compound interest per annum for first and 2^{nd} years are r_1 % and r_2 %,

Then we get the amount for 2 years = $\exists p \left(1 + \frac{r_1}{100}\right) \left(1 + \frac{r_2}{100}\right)$

From given p = 36000, $r_1 = 7\%$ and $r_2 = 8\%$

 $\therefore \text{ Amount for 2 years} = \text{₹6000} \left(1 + \frac{7}{100}\right) \left(1 + \frac{8}{100}\right)$

$$= ₹6000 \left(\frac{107}{100}\right) \left(\frac{108}{100}\right)$$
$$= ₹\frac{34668}{5}$$

= ₹6933.6

∴ Compound interest for 2 years = ₹6933.6 - ₹6000

= ₹933.6

15. Question

If the rates of compound interest for the first and second year are 5% and 6% respectively, let us calculate the compound interest on ₹5000 for 2 years

Answer

We know that if principal = p and rate of compound interest per annum for first and 2^{nd} years are r_1 % and r_2 %,

Then we get the amount for 2 years = $= \left\{ p \left(1 + \frac{r_1}{100} \right) \left(1 + \frac{r_2}{100} \right) \right\}$

From given p = 3000, $r_1 = 5\%$ and $r_2 = 6\%$

∴ Amount for 2 years = ₹5000 $\left(1 + \frac{5}{100}\right) \left(1 + \frac{6}{100}\right)$

$$= ₹5000 \left(\frac{105}{100}\right) \left(\frac{106}{100}\right)$$

= ₹5565

∴ Compound interest for 2 years = ₹5565 - ₹5000

= ₹565

16. Question

If simple interest of a certain sum of money for 1 year is 350 and compound interest for 2 years is 102, let us write by calculating the sum of money and the rate of interest.

Answer

Let the principal = $\exists p$ and the rate of interest per annum = r%

∴ The interest for 1 year at the rate of simple interest r% per annum = $\frac{\text{pr} \times 1}{100}$

= ₹
$$\frac{\text{pr}}{100}$$

Again the amount at the rate of compound interest r% per annum for 2 years $= \operatorname{{{\overline{T}}}} p \left(1 + \frac{r}{100}\right)^2$

∴ Compound interest for 2 years = ₹[$p\left(1 + \frac{r}{100}\right)^2 - p$]

$$= ₹p[1 + \frac{2r}{100} + \left(\frac{r}{100}\right)^2 - 1$$
$$= ₹\frac{pr}{100}[2 + \frac{r}{100}]$$

By the condition,
$$\frac{\text{pr}}{100} = 50 \dots (1)$$

$$\frac{\mathrm{pr}}{\mathrm{100}} \left[2 + \frac{\mathrm{r}}{\mathrm{100}} \right] = 102 \dots (2)$$

Dividing equation (2) by (1),

$$\Rightarrow \frac{\frac{pr}{100} \left[2 + \frac{r}{100}\right]}{\frac{pr}{100}} = \frac{102}{50}$$

$$\Rightarrow \frac{2 + \frac{r}{100}}{1} = \frac{102}{50}$$

$$\Rightarrow 100 + \frac{50r}{100} = 102$$

$$\Rightarrow 1/2 r = 102 - 100$$

$$\Rightarrow 1/2 r = 2$$

$$\Rightarrow r = 2 \times 2$$

$$\therefore r = 4$$
From (1),
$$\Rightarrow \frac{pr}{100} = 50$$

$$\Rightarrow \frac{p \times 4}{100} = 50$$

$$\Rightarrow \frac{p}{25} = 50$$
$$\Rightarrow p = 50 \times 25$$
$$\therefore p = 1250$$

 \therefore Principal is ₹1250 and rate of interest is 4%.

17. Question

If simple interest and compound interest of a certain sum of money for two years are ₹8400 and ₹8652, then let us write by calculating the sum of money and the rate of interest.

Answer

Let the principal = $\exists p$ and the rate of interest per annum = r%

 \therefore The interest for 2 years at the rate of simple interest r% per annum $= \underbrace{\underbrace{}}_{100}^{\text{pr}\times 2}$

$$=$$
 $\frac{2 \text{pr}}{100}$

Again the amount at the rate of compound interest r% per annum for 2 years $\left(\frac{\mathbf{r}}{\mathbf{r}}\right)^2$

$$=$$
 $\ddagger p \left(1 + \frac{1}{100}\right)$

∴ Compound interest for 2 years = $\exists \left[p\left(1 + \frac{r}{100}\right)^2 - p\right]$

$$= ₹p[1 + \frac{2r}{100} + \left(\frac{r}{100}\right)^2 - 1$$

$$= \underbrace{\frac{1}{100}}_{100} \left[2 + \frac{1}{100}\right]$$

By the condition, $\frac{2pr}{100} = 8400 ... (1)$

$$\frac{\mathrm{pr}}{\mathrm{100}} \left[2 + \frac{\mathrm{r}}{\mathrm{100}} \right] = 8652 \dots (2)$$

Dividing equation (2) by (1),

$$\Rightarrow \frac{\frac{\text{pr}}{100} \left[2 + \frac{\text{r}}{100}\right]}{\frac{2\text{pr}}{100}} = \frac{8652}{8400}$$
$$\Rightarrow \frac{2 + \frac{\text{r}}{100}}{2} = \frac{103}{100}$$

$$\Rightarrow 200 + \frac{100r}{100} = 206$$

$$\Rightarrow r = 206 - 200$$

$$\therefore r = 6$$

From (1),

$$\Rightarrow \frac{2pr}{100} = 8400$$

$$\Rightarrow \frac{2 \times p \times 6}{100} = 8400$$

$$\Rightarrow \frac{3p}{25} = 8400$$

$$\Rightarrow \frac{3p}{25} = 8400$$

$$\Rightarrow p = \frac{8400 \times 25}{3}$$

$$\therefore p = 70000$$

∴ Principal is ₹70000 and rate of interest is 6%.

18. Question

Let us calculate compound interest on ₹6000 for 1 year at the rate of 8% compound interest per annum compounded at the interval of 6 months.

Answer

We know that if the rate of compound interest is r% per annum and the interest is compounded half yearly, the number of phase of compound

interest in a year is 2, then the amount for n years = $p\left(1 + \frac{\frac{r}{2}}{100}\right)^{2n}$

From given, p = 36000, r = 8 and n = 1

$$\therefore \text{ Amount for 1 year} = ₹6000 \left(1 + \frac{\frac{8}{2}}{100}\right)^{2 \times 1}$$
$$= ₹6000 \left(1 + \frac{4}{100}\right)^{2}$$
$$= ₹6000 \left(1 + \frac{1}{25}\right)^{2}$$
$$= ₹6000 \left(\frac{26}{25}\right)^{2}$$

$$= ₹6000 \times \frac{26}{25} \times \frac{26}{25} = ₹\frac{32448}{5}$$

= ₹6489.6

∴ Compound interest for 1 year = ₹6489.6 - ₹6000

= ₹489.6

19. Question

Let us write by calculating compound interest on $\gtrless6250$ for 9 months at the rate of 10% compound interest per annum compounded at the interval of 3 months.

Answer

We know that if the rate of compound interest is r% per annum and the interest is compounded quarterly, the number of phase of compound interest

in a year is 4, then the amount for n years = $p\left(1 + \frac{\frac{r}{4}}{\frac{1}{100}}\right)^{4n}$

From given, p = 36250, r = 10 and $n = \frac{9}{12} = \frac{3}{4}$ years

 $\therefore \text{ Amount for 9 months or } 3/4 \text{ year} = \text{₹6250} \left(1 + \frac{\frac{10}{4}}{100}\right)^{4 \times \frac{3}{4}}$

- $= ₹6250 \left(1 + \frac{1}{40}\right)^3$ $= ₹6250 \left(\frac{41}{40}\right)^3$ $= ₹6250 \times \frac{41}{40} \times \frac{41}{40} \times \frac{41}{40}$
- = ₹6730.56
- \therefore Compound interest for 9 months = ₹6730.56 ₹6250
- = ₹480.56

20. Question

Let us write by calculating at what rate of interest per annum will 36000 amount to 369984 in 2 years.

Answer

Let the rate of compound interest per annum be r% per annum.

We know that the amount at rate of r% compound interest per annum for 2 $years = \exists p \left(1 + \frac{r}{100}\right)^2$

By the condition, $60000 \left(1 + \frac{r}{100}\right)^2 = 69984$

 $\Rightarrow \left(1 + \frac{r}{100}\right)^2 = \frac{69984}{60000}$ $\Rightarrow \left(1 + \frac{r}{100}\right)^2 = \frac{729}{625}$ $\Rightarrow \left(1 + \frac{r}{100}\right)^2 = \left(\frac{27}{25}\right)^2$ $\Rightarrow 1 + \frac{r}{100} = \frac{27}{25}$ $\Rightarrow \frac{r}{100} = \frac{27}{25} - 1$ $\Rightarrow \frac{r}{100} = \frac{2}{25}$ $\Rightarrow r = \frac{200}{25}$ $\Rightarrow r = 8$

 \therefore Rate of interest per annum is 8%.

21. Question

Let us calculate in how many years will 40000 amount to 46656 at the rate of 8% compound interest per annum.

Answer

Let it be in 'n' years 40000 in compound interest at the rate of 8% per annum will amount to 46656.

By the condition, $40000 \left(1 + \frac{8}{100}\right)^n = 46656$

$$\Rightarrow \left(\frac{27}{25}\right)^n = \frac{46656}{40000}$$

$$\Rightarrow \left(\frac{27}{25}\right)^{n} = \frac{729}{625}$$
$$\Rightarrow \left(\frac{27}{25}\right)^{n} = \left(\frac{27}{25}\right)^{2}$$

∴ n = 2

∴ In the rate of compound interest if 8% per annum ₹40000 will amount to ₹46656 in 2 years.

22. Question

Let us write by calculating at what rate of compound interest per annum, the amount on 10,000 for 2 years is 12100.

Answer

Let the rate of compound interest per annum be r% per annum.

We know that the amount at rate of r% compound interest per annum for 2 $years = \exists p \left(1 + \frac{r}{100}\right)^2$

By the condition, $10000 \left(1 + \frac{r}{100}\right)^2 = 12100$

 $\Rightarrow \left(1 + \frac{r}{100}\right)^2 = \frac{12100}{10000}$ $\Rightarrow \left(1 + \frac{r}{100}\right)^2 = \frac{121}{100}$ $\Rightarrow \left(1 + \frac{r}{100}\right)^2 = \left(\frac{11}{10}\right)^2$ $\Rightarrow 1 + \frac{r}{100} = \frac{11}{10}$ $\Rightarrow \frac{r}{100} = \frac{11}{10} - 1$ $\Rightarrow \frac{r}{100} = \frac{1}{10}$ $\Rightarrow r = \frac{100}{10}$ $\therefore r = 10$

 \therefore Rate of interest per annum is 10%.

23. Question

Let us calculate in how many years will 350000 amount to 360500 at the rate of 10% compound interest per annum.

Answer

Let it be in 'n' years ₹50000 in compound interest at the rate of 10% per annum will amount to ₹60500.

$$\therefore \text{ Amount for n years} = \text{ ₹50000} \left(1 + \frac{10}{100}\right)^n$$

By the condition, $50000 \left(1 + \frac{10}{100}\right)^n = 60500$

$$\Rightarrow \left(\frac{11}{10}\right)^{n} = \frac{60500}{50000}$$
$$\Rightarrow \left(\frac{11}{10}\right)^{n} = \frac{121}{100}$$
$$\Rightarrow \left(\frac{11}{10}\right)^{n} = \left(\frac{11}{10}\right)^{2}$$

∴ n = 2

∴ In the rate of compound interest if 10% per annum ₹50000 will amount to ₹60500 in 2 years.

24. Question

Let us write by calculating in how many years will ₹300000 amount to ₹399300 at the rate of 10% compound interest per annum.

Answer

Let it be in 'n' years ₹300000 in compound interest at the rate of 10% per annum will amount to ₹399300.

$$\therefore \text{ Amount for n years} = \text{ ₹300000} \left(1 + \frac{10}{100}\right)^n$$

By the condition, $300000 \left(1 + \frac{10}{100}\right)^n = 399300$

$$\Rightarrow \left(\frac{11}{10}\right)^{n} = \frac{399300}{300000}$$
$$\Rightarrow \left(\frac{11}{10}\right)^{n} = \frac{1331}{1000}$$
$$\Rightarrow \left(\frac{11}{10}\right)^{n} = \left(\frac{11}{10}\right)^{3}$$

∴ In the rate of compound interest if 10% per annum ₹300000 will amount to ₹399300 in 3 years.

25. Question

Let us calculate the compound interest and amount on ₹1600 for $1\frac{1}{2}$ years at

the rate of 10% compound interest per

annum compounded at the interval of 6 months.

Answer

We know that if the rate of compound interest is r% per annum and the interest is compounded half yearly, the number of phase of compound

interest in a year is 2, then the amount for n years = $p\left(1 + \frac{\frac{r}{2}}{\frac{1}{100}}\right)^2$

From given, p = ₹1600, r = 10 and n = $1\frac{1}{2}$ year = $\frac{3}{2}$ years

: Amount for
$$1\frac{1}{2}$$
 year = $\mathbf{1}600 \left(1 + \frac{\frac{10}{2}}{100}\right)^{2 \times \frac{3}{2}}$

$$= ₹1600 \left(1 + \frac{5}{100}\right)^{3}$$

$$= ₹1600 \left(1 + \frac{1}{20}\right)^{3}$$

$$= ₹1600 \left(\frac{21}{20}\right)^{3}$$

$$= ₹1600 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$

$$= ₹\frac{9261}{5}$$

= ₹1852.2

∴ Compound interest for $1\frac{1}{2}$ year = ₹1852.2 - ₹1600

= ₹252.2

Let us Work Out 6.2

1. Question

At present the population of village of Pahalanpur is 10000; if population is being increased at the rate of 3% every year, let us write by calculating its population after 2 years.

Answer

We know that population after n year = $p\left(1 + \frac{r}{100}\right)^n$

Where p = present population, r% = rate of increase in population in one year and n = number of years.

Given p = 10000, r% = 3% and n = 2 years

⇒ Population after 2 years =
$$10000 \left(1 + \frac{3}{100}\right)^2$$

$$= 10000 \times \frac{103}{100} \times \frac{103}{100}$$

- = 10609
- ∴ Population after 2 years of village of Pahalanpur will be 10609.

2. Question

Rate of increase in population of a state is 2% in a year. The present population is 80000000; let us calculate the population of the state after 3 years.

Answer

We know that population after n year = $p\left(1 + \frac{r}{100}\right)^n$

Where p = present population, r% = rate of increase in population in one year and <math>n = number of years.

Given p = 80000000, r% = 2% and n = 3 years

 \Rightarrow Population after 3 years = 80000000 $\left(1 + \frac{2}{100}\right)^3$

$$= 10000 \times \frac{102}{100} \times \frac{102}{100} \times \frac{102}{100}$$

= 84896640

 \therefore Population after 3 years of the state will be 84896640.

3. Question

The price of a machine in a leather factory depreciates at the rate of 10% every year. If the present price of the machine be \gtrless 100000, let us calculate what will be the price of that machine after 3 years.

We know that after depreciation, the price of machine after n years

$$= p \left(1 - \frac{r}{100}\right)^n$$

Where p = present price of machine, r% = rate of decrease in a year and n = number of years.

Given p = ₹100000, r% = 10% and n = 3 years

⇒ Price of machine after 3 years = ₹100000 $\left(1 - \frac{10}{100}\right)^3$

$$= ₹100000 \times \frac{90}{100} \times \frac{90}{100} \times \frac{90}{100}$$

= ₹72900

∴ Price of the machine after 3 years is ₹72900.

4. Question

As a result of Sarba Siksha Abhiyan, the students leaving the school before completion, the students are readmitted, so the students in a year in increased by 5% in comparision to its previous year. If the number of such readmitted students in a district be 3528 in the present year. Let us write by calculation, the number of students readmitted 2 years before in this manner.

Answer

Let the number of students readmitted 2 years before be x.

 \therefore At present the number of readmitted students = $x\left(1 + \frac{5}{100}\right)^2$

By the condition, $x\left(1+\frac{5}{100}\right)^2 = 3528$

$$\Rightarrow x \times \frac{105}{100} \times \frac{105}{100} = 3528$$
$$\Rightarrow x = \frac{3528 \times 100 \times 100}{105 \times 105}$$

∴ x = 3200

 \therefore The number of students readmitted 2 years before was 3200.

5. Question

Through publicity of road-safety programme, the street accidents in Purulia district are decreased by 10% in comparison to its previous year. If the number of street accidents in this year be 8748, let us write by calculating, the number of street accidents 3 years before in the district.

Let the number of street accidents 3 years before in the district be x.

: At present the number of street accidents in that district = $x \left(1 - \frac{10}{100}\right)^3$

By the condition,
$$x \left(1 - \frac{10}{100}\right)^3 = 8748$$

 $\Rightarrow x \times \frac{90}{100} \times \frac{90}{100} \times \frac{90}{100} = 8748$
 $\Rightarrow x = \frac{8748 \times 100 \times 100 \times 100}{90 \times 90 \times 90}$

∴ x = 12000

 \therefore The number of street accidents 3 years before in the district was 12000.

6. Question

A cooperative society of fisherman implemented such an improved plan for the production of fishes that the production in a year will be increased 10% in comparision to its previous year. In the present year if the cooperative society can produce 406 quintals of fishes, let us write by calculating, what will be the production of fishes after 3 years.

Answer

We know that population after n year = $p\left(1 + \frac{r}{100}\right)^n$

Where p = present population, r% = rate of increase in population in one year and n = number of years.

Given p = 406 quintals = 40600 kg [: 1 quintal = 100 kg], r% = 10% and n = 3 years

⇒ Production of fishes after 3 years = $40600 \left(1 + \frac{10}{100}\right)^3$

$$= 40600 \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100}$$

= 54038.6 kg

∴ Production of fishes after 3 years will be 54038.6 kg or 504.386 quintals.

7. Question

The height of tree increases at the rate of 20% every year. If the present height of tree is 28.8 metre, let us calculate the height of tree 2 years before.

Answer

Let the height of the tree 2 years before be x.

: At present the height of the tree = $x \left(1 + \frac{20}{100}\right)^2$

By the condition, $\chi \left(1 + \frac{20}{100}\right)^2 = 28.8$

$$\Rightarrow x \times \frac{120}{100} \times \frac{120}{100} \times \frac{120}{100} = 28.8$$

$$\Rightarrow x = \frac{28.8 \times 100 \times 100 \times 100}{120 \times 120 \times 120}$$

∴ x = 16.66 metre

∴ The height of the tree 2 years before was 16.6 metre.

8. Question

Three years before from today a family had planned to reduced the expenditure of electric bill by 5% in comparison to its previous year. 3 year before, that family had to spend ₹4000 in a year for electric bill. Let us write by calculating how much amount will the family have to spend to pay the electric bill in the present year.

Answer

The amount the family had to spend for electric bill 3 years before was ₹4000.

Let amount that the family have to spend to pay the electric bill in the present year be x.

∴ At present the amount that has to be paid = ₹4000 $\left(1 - \frac{5}{100}\right)^3$

By the condition,
$$\frac{4000}{1-\frac{5}{100}}^3 = x$$

$$\Rightarrow x = ₹4000 \times \frac{95}{100} \times \frac{95}{100} \times \frac{95}{100}$$

∴ x = ₹3429.5

 \therefore The amount that the family have to spend to pay the electric bill in the present year is ₹3429.5.

9. Question

Weight of Savan babu is 80kg. In order to reduces his weight, he started regular morning walk. He decided to reduce his weight every year by 10%. Let us write by calculating, his weight after 3 years.

Answer

We know that after reduction, the weight after n years = $p\left(1 - \frac{r}{100}\right)^n$

Where p = present weight, r% = rate of decrease in a year and n = number of years.

Given p = 80 kg, r% = 10% and n = 3 years

$$\Rightarrow$$
 Weight after 3 years $= 80 \left(1 - \frac{10}{100} \right)^3$

$$= 80 \times \frac{90}{100} \times \frac{90}{100} \times \frac{90}{100}$$

= 58.32 kg

∴ Savan Babu's weight after 3 years is 58.32 kg.

10. Question

At present the sum of the number of students in all M.S.K in a district is 3993. If the number of students increased in a year was 10% of its previous year, let us calculate the sum of the number of students 3 years before in all the M.S.K in the district.

Answer

Let the sum of number of students in all M.S.K 3 years before be x.

: At present the sum of number of students = $x \left(1 + \frac{10}{100}\right)^3$

By the condition, $\chi \left(1 + \frac{10}{100}\right)^3 = 3993$

$$\Rightarrow x \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100} = 3993$$
$$\Rightarrow x = \frac{3993 \times 100 \times 100 \times 100}{110 \times 110 \times 110}$$

∴ x = 3000

 \div The sum of number of students 3 years before in all the M.S.K in the district was 3000.

11. Question

As the farmers are becoming more alert of the harmful effects of applying only the chemical fertilisers and insecticides in agricultural lands, the number of farmers using fertilisers and insecticides in village of Rasulpur decreases by 20% in a year in comparison to its previous year. Three years before, the number of such farmers was 3000, let us calculate the number of such farmers in that village now.

The number of farmers using fertilizers and insecticides 3 years before was 3000.

Let present number such farmers in the village be x.

$$\therefore$$
 At present the number of such farmers = $3000 \left(1 - \frac{20}{100}\right)^3$

By the condition,
$$3000\left(1-\frac{20}{100}\right)^3 = x$$

$$\Rightarrow x = 3000 \times \frac{80}{100} \times \frac{80}{100} \times \frac{80}{100}$$

∴ x = 1536

 \therefore The number of such farmers in that village in the present year is 1536.

12. Question

The price of a machine of a factory is ₹18000. The price of that machine decreases by 10% in each year. Let us calculate its price after 3 years.

Answer

We know that after depreciation, the price of machine after n years $= p \left(1 - \frac{r}{100}\right)^n$

Where p = present price of machine, r% = rate of decrease in a year and n = number of years.

Given p = 318000, r% = 10% and n = 3 years

⇒ Price of machine after 3 years = ₹18000 $\left(1 - \frac{10}{100}\right)^3$

$$= ₹18000 \times \frac{90}{100} \times \frac{90}{100} \times \frac{90}{100}$$

= ₹13122

 \therefore Price of the machine after 3 years is ₹13122.

13. Question

For the families having no electricity in their house, a Panchayat samity of village Bakultala accepted a plan to offer electric connections. 1200 families in this village have no electric connection in their house. In comparision to its previous year, it is possible to arrange electricity every for 75% of the families having no electricity, let us write by calculating, the number of families without electricity after 2 years.

We know that after reduction, the population after n years = $p\left(1 - \frac{r}{100}\right)^n$

Where p = present population, r% = rate of decrease one year and <math>n = number of years.

Given p = 1200 families r% = 75% and n = 2 years

 \Rightarrow Number of families without electricity after 2 years

$$= 1200 \left(1 - \frac{75}{100}\right)^2$$
$$= 1200 \times \frac{25}{100} \times \frac{25}{100}$$
$$= 75$$

 \therefore The number of families without electricity after 2 years is 75.

14. Question

As a result of continuous publicity on harmful reactions in the use of cold drinks filled, bottles, the number of users of cold drinks is decreased by 25% every year in comparison to its previous year. 3 years before number of users of cold drink in a town was 80000. Let us write by calculating, the number of users of cold drink in the present year.

Answer

The number of users of cold drink in the town 3 years before was 80000.

Let present number of users of cold drink be x.

: At present the number of users of cold drink = $80000 \left(1 - \frac{25}{100}\right)^3$

By the condition, 80000 $\left(1 - \frac{25}{100}\right)^3 = x$

$$\Rightarrow x = 80000 \times \frac{75}{100} \times \frac{75}{100} \times \frac{75}{100}$$

 \therefore The number of users of cold drink in the present year is 33750.

15. Question

As a result of publicity on smoking, the number of smoker is decreased by

 $6\frac{1}{2}$ % every year in comparison to its previous year. If the number of

smokers at present in a city is 33750, let us write by calculating, the number of smoker in the city 3 years before.

Answer

Let the number of smokers in the city 3 years before be x.

 \therefore At present the number of smokers in the city = $x \left(1 - \frac{\frac{13}{2}}{100}\right)^3$

By the condition,
$$\left(1 - \frac{\frac{13}{2}}{100}\right)^3 = 33750$$

$$\Rightarrow x \left(1 - \frac{13}{200}\right)^3 = 33750$$
$$\Rightarrow x \times \frac{187}{200} \times \frac{187}{200} \times \frac{187}{200} = 33750$$
$$\Rightarrow x = \frac{33750 \times 200 \times 200 \times 200}{187 \times 187 \times 187}$$

∴ x = 41289.43

 \therefore The number of smokers in the city before 3 years was 41289.43.

16 A1. Question

In case of compound interest, the rate of compound interest per annum is-

A. equal

B. unequal

C. both equal or unequal

D. none of these

Answer

In case of compound interest, the time period and the rate of compound interest are constant. So the rate of compound interest per annum is equal.

16 A2. Question

In case of compound interest

- A. The Principal remains unchanged each year
- B. Principal changes in each year
- C. principal may be equal or unequal in each year

In compound interest, after a definite period of time, the interest is accrued to the principal to get the new principal.

So, the principal changes every year.

16 A3. Question

At present the population of a village is p and if increase rate of population per year be 2r%, the population will be after n years

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

B. $P\left(1+\frac{r}{50}\right)^n$
C. $P\left(1+\frac{r}{100}\right)^{2n}$
D. $P\left(1-\frac{r}{100}\right)^n$

Answer

We know that population after n year = $p\left(1 + \frac{r}{100}\right)^n$

Where p = present population, r% = rate of increase in population in one year and n = number of years.

Given r% = 2r%

$$\Rightarrow$$
 Population after n years = $p\left(1 + \frac{2r}{100}\right)^n$

$$= p \left(1 + \frac{r}{50}\right)^n$$

16 A4. Question

present price of a machine is 32p and if price of the machine decreases by 2r% in each year, the price of machine will be.

$$\mathbf{A} \cdot \mathbf{P} \left(1 - \frac{\mathbf{r}}{100} \right)^n$$

B. ₹2P
$$\left(1-\frac{r}{50}\right)^n$$

C. ₹P $\left(1-\frac{r}{100}\right)^{2n}$
D. ₹2P $\left(1-\frac{r}{100}\right)^{2n}$

We know that after depreciation, the price of machine after n years = $p\left(1-\frac{r}{100}\right)^n$

Where p = present price of machine, r% = rate of decrease in a year and n = number of years.

Given p = 32p and r% = 2r%

⇒ Price of machine after n years = $₹2p\left(1-\frac{2r}{100}\right)^n$

$$= 32p \left(1 - \frac{r}{50}\right)^n$$

16 A5. Question

A person deposited $\gtrless 100$ in a bank and got the amount $\gtrless 121$ for two years the rate of compound interest is

A. 10%

B. 20%

C. 5%

D.
$$10\frac{1}{2}\%$$

Answer

Let the rate of compound interest per annum be r% per annum.

We know that the amount at rate of r% compound interest per annum for 2 $years = \exists p \left(1 + \frac{r}{100}\right)^2$

By the condition, $100\left(1+\frac{r}{100}\right)^2 = 121$

$$\Rightarrow \left(1 + \frac{r}{100}\right)^2 = \frac{121}{100}$$
$$\Rightarrow \left(1 + \frac{r}{100}\right)^2 = \left(\frac{11}{10}\right)^2$$
$$\Rightarrow 1 + \frac{r}{100} = \frac{11}{10}$$
$$\Rightarrow \frac{r}{100} = \frac{11}{10} - 1$$
$$\Rightarrow \frac{r}{100} = \frac{1}{10}$$
$$\Rightarrow r = \frac{100}{10}$$
$$\therefore r = 10$$

 \therefore Rate of interest per annum is 10%.

16 B. Question

Let us write true or false for the following statements

2

(i) The compound interest will be always less than simple interest for some money at fixed rate of interest for fixed time.

(ii) In case of compound interest, interest is to be added to principal at the fixed time interval. i.e the amount of principal increases continuously.

Answer

(i) False

The compound interest is always higher than simple interest.

(ii) True

The principal in compound interest changes each time interest is compounded as the interest earned is added to the principal amount.

16 C. Question

Let us fill in the blanks:

(i) The compound interest and simple interest for one year at the fixed rate of interest on fixed sum of money are_____.

(ii) If some things are increased by fixed rate with respect to time, that is

(iii) If some things are decreased by fixed rate with respect to time this is uniform rate of _____.

Answer

(i) The compound interest and simple interest for one year at the fixed rate of interest on fixed sum of money are **<u>unequal</u>**.

In simple interest, the interest is calculated on principal only.

While in compound interest, the interest accrued is added to the principal to get the new principal.

(ii) If some things are increased by fixed rate with respect to time, that is **uniform rate of growth**.

Examples are increase in population, increase in the number of learners, etc.

(iii) If some things are decreased by fixed rate with respect to time this is uniform rate of **<u>decreases or depreciation</u>**.

Examples are fall of efficiency of machine, decrease valuations of old building and furniture, etc.

17 A. Question

Let us write the rate of compound interest per annum, so that the amount on 3400 for 2 years becomes 3441.

Answer

Let the rate of compound interest per annum be r% per annum.

We know that the amount at rate of r% compound interest per annum for 2 $years = \exists p \left(1 + \frac{r}{100}\right)^2$

By the condition, $400\left(1+\frac{r}{100}\right)^2 = 441$

2

$$\Rightarrow \left(1 + \frac{r}{100}\right)^2 = \frac{441}{400}$$
$$\Rightarrow \left(1 + \frac{r}{100}\right)^2 = \left(\frac{21}{20}\right)$$
$$\Rightarrow 1 + \frac{r}{100} = \frac{21}{20}$$
$$\Rightarrow \frac{r}{100} = \frac{21}{20} - 1$$
$$\Rightarrow \frac{r}{100} = \frac{1}{20}$$

$$\Rightarrow r = \frac{100}{20}$$
$$\therefore r = 5$$

 \therefore Rate of interest per annum is 5%.

17 B. Question

If a sum of money doubles itself at compound interest in n years, let us write in how many years will it become four times.

Answer

Let A = amount, P = principal, r = rate of interest compounded per annum and n = number of years.

Let it be in 'n' years A in compound interest will amount to 2A.

 \therefore Amount for n years = A (1 + r)ⁿ

By the condition, A $(1 + r)^n = 2A$

$$\Rightarrow (1 + r)^n = 2A/A$$

$$\Rightarrow (1 + r)^n = 2$$

$$\Rightarrow (1+r) = 2^{1/n} \dots (1)$$

Let the amount become 4 times in t years.

$$\Rightarrow 4A = A(1 + r)^{t}$$

$$\Rightarrow (1 + r)^{t} = 4$$

$$\Rightarrow (1 + r)^{t} = 2^{2}$$

$$\Rightarrow (1 + r) = 2^{2/t} \dots (2)$$
From (1) and (2),
$$\Rightarrow 2^{1/n} = 2^{2/t}$$
1 2

$$\Rightarrow \frac{1}{n} = \frac{1}{t}$$

∴ t = 2n

 \div The sum of money will become four times in 2n years.

17 C. Question

Let us calculate the principal that at the rate of 5% compound interest per annum becomes \gtrless 615 after two years.

Let principal = ₹x

At the rate of 5% compound interest per the annum the amount for 2 years $= \overline{\mathbf{x}} \left(1 + \frac{5}{100}\right)^{2}$ $= \overline{\mathbf{x}} \times \frac{105}{100} \times \frac{105}{100}$ $= \frac{\overline{\mathbf{x}} 441x}{400}$ $\therefore \text{ Compound interest for 2 years} = \overline{\mathbf{x}} \left(\frac{441x}{400} - x\right)$ By the condition, $\frac{441x}{400} - x = \overline{\mathbf{x}} 615$ $\Rightarrow \frac{441x - 400x}{400} = \overline{\mathbf{x}} 615$ $\Rightarrow \frac{41x}{400} = \overline{\mathbf{x}} 615$ $\Rightarrow x = \frac{\overline{\mathbf{x}} 615 \times 400}{41}$ $\therefore x = \overline{\mathbf{x}} 6000$

∴ Principal is ₹6000

17 D. Question

The price of a machine depreciates at the rate of r% per annum, let us find the price of the machine that was n years before.

Answer

Let the Price of Machine at present = Rs x

Price of machine depreciates at the rate of r%

Therefore, Price of machine before one year was = $X \times \left(\frac{100}{100-r}\right)$

Price of machine before n years = $\frac{x}{\left(1-\frac{r}{100}\right)^n}$

17 E. Question

If the rate of increase in population is r% per year, the population after n year is p; let us find the population that was n years before.

Answer

Given : The present population = p

Let previous year's population be x

Then,

As the population increases by rate $\ensuremath{\mathrm{r}\%}$

$$x + \left(\frac{r}{100}\right) \times x = p$$
$$x = \frac{100p}{100 + r}$$

And population before n years was $\frac{p}{\left(1+\frac{r}{100}\right)^n}$