Compound Interest
Ex 11A

1. Let Principal = P, Rate = R% per annum, Time = n years.

2. **When interest is compound Annually:**

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

3. **When interest is compounded Half-yearly:**

$$\text{Amount} = P\left[1 + \frac{(R/2)}{100}\right]^{2n}$$

4. **When interest is compounded Quarterly:**

$$\text{Amount} = P\left[1 + \frac{(R/4)}{100}\right]^{4n}$$

5. **When interest is compounded Annually but time is in fraction, say $3\frac{2}{5}$ years.**

$$\text{Amount} = P\left(1 + \frac{R}{100}\right)^3 \times \left(1 + \frac{\frac{2}{5}R}{100}\right)$$

6. **When Rates are different for different years, say $R_1\%$, $R_2\%$, $R_3\%$ for 1st, 2nd and 3rd year respectively.**

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

7. **Present worth of Rs. x due n years hence is given by:**

$$\text{Present Worth} = \frac{x}{\left(1 + \frac{R}{100}\right)^n}.$$

Future Value Formula (compound interest)

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

Where:

A = resulting amount (future value)
P = amount of principal (present value)
r = annual interest rate
n = number of compounding periods per year
t = time (in years)

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Let Principal = P, Rate = R% per annum,
Time = n years.

1. When interest is compounded annually :

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

2. When interest is compounded half-yearly :

$$\text{Amount} = P\left[1 + \frac{(R/2)}{100}\right]^{2n}$$

3. When interest is compounded quarterly :

$$\text{Amount} = P\left[1 + \frac{(R/4)}{100}\right]^{4n}$$

4. When interest is compounded annually but time is in fraction, say $3\frac{2}{5}$ years.

$$\text{Amount} = P\left(1 + \frac{R}{100}\right)^3 \times \left(1 + \frac{\frac{2}{5}R}{100}\right)$$

5. When rates are different for different years, say $R_1\%$, $R_2\%$, $R_3\%$ for 1st, 2nd and 3rd year respectively. Then,

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

6. Growth : If the rate of growth is constant, then

$$V = V_0\left(1+\frac{r}{100}\right)^n$$

where $r\%$ is the rate of growth per year, n is the number of years, V_0 is the present measure of the quantity and V is the measure of the quantity after n years.

Similarly, if V_0 is the measure of the quantity n years ago and V is the present measure of the quantity, then

$$V = V_0\left(1+\frac{r}{100}\right)^n$$

7. Depreciation : If the rate of depreciation is constant, then

$$V = V_0\left(1-\frac{r}{100}\right)^n$$

where $r\%$ is the rate of depreciation per year, n is the number of years, V_0 is the present value and V is the value after n years.

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Q1.

Answer :

Principal for the first year = Rs. 2500

Interest for the first year = Rs. $\left(\frac{2500\times10\times1}{100}\right)$ = Rs. 250

Amount at the end of the first year = Rs. $(2500 + 250)$ = Rs. 2750

Principal for the second year = Rs. 2750

Interest for the second year = Rs. $\left(\frac{2750\times10\times1}{100}\right)$ = Rs. 275

Amount at the end of the second year = Rs. $(2750 + 275)$ = Rs. 3025

$\therefore$ Compound interest = Rs. $(3025 - 2500)$ = Rs. 525

Q2.

Answer :

Principal for the first year = Rs. 15625

Interest for the first year = Rs. $\left(\frac{15625\times12\times1}{100}\right)$ = Rs. 1875

Amount at the end of the first year = Rs. $\left(15625 + 1875\right)$ = Rs. 17500

Principal for the second year = Rs. 17500

Interest for the second year = Rs. $\left(\frac{17500\times12\times1}{100}\right)$ = Rs. 2100

Amount at the end of the second year = Rs. $\left(17500 + 2100\right)$ = Rs. 19600

Principal for the third year = Rs. 19600

Interest for the third year = Rs. $\left(\frac{19600\times12\times1}{100}\right)$ = Rs. 2352

Amount at the end of the second year = Rs $\left(19600 + 2352\right)$ = Rs. 21952

$\therefore$ Compound interest = Rs. $(21952 - 15625)$ = Rs. 6327

Q3.

Answer :

Principal amount = Rs. 5000

Simple interest = Rs. $\left(\frac{5000\times2\times9}{100}\right)$ = Rs. 900

The compound interest can be calculated as follows :

Principal for the first year = Rs. 5000

Interest for the first year = Rs. $\left(\frac{5000\times9\times1}{100}\right)$ = Rs. 450

Amount at the end of the first year = Rs. $\left(5000 + 450\right)$ = Rs. 5450

Principal for the second year = Rs. 5450

Interest for the second year = Rs. $\left(\frac{5450\times9\times1}{100}\right)$ = Rs. 490.5

Amount at the end of the second year = Rs. $\left(5450 + 490.5\right)$ = Rs. 5940.5

$\therefore$ Compound interest = Rs. $(5940.5 - 5000)$ = Rs. 940.5

Now, difference between the simple interest and the compound interest = (CI − SI) = Rs. $(940.5 - 900)$ = Rs. 40.5

Q4.

Answer :

Principal for the first year = Rs. 25000

Interest for the first year = Rs. $\left(\frac{25000\times8\times1}{100}\right)$ = Rs. 2000

Amount at the end of the first year = Rs. $\left(25000 + 2000\right)$ = Rs. 27000

Principal for the second year = Rs. 27000

Interest for the second year = Rs. $\left(\frac{27000\times8\times1}{100}\right)$ = Rs. 2160

Amount at the end of the second year = Rs. $\left(27000 + 2160\right)$ = Rs. 29160

Therefore, Ratna has to pay Rs. 29160 after 2 years to discharge her debt.

Q5.

Answer :

Principal amount = Rs. 20000

Simple interest = Rs. $\left(\frac{20000\times2\times12}{100}\right)$ = Rs. 4800

The compound interest can be calculated as follows :

Principal for the first year = Rs. 20000

Interest for the first year = Rs. $\left(\frac{20000\times12\times1}{100}\right)$ = Rs. 2400

Now, amount at the end of the first year = Rs. $\left(20000 + 2400\right)$ = Rs. 22400

Principal for the second year = Rs. 22400

Interest for the second year = Rs. $\left(\frac{22400\times12\times1}{100}\right)$ = Rs. 2688

Now, amount at the end of the second year = Rs. $\left(22400 + 2688\right)$ = Rs. 25088

Hence, compound interest = Rs. $(25088 - 20000)$ = Rs. 5088

Now, CI − SI = Rs. $(5088 - 4800)$ = Rs. 288

∴ The amount of money Harpreet will gain after two years is Rs 288.

Q6.

Answer :

Principal for the first year = Rs. 64000

Interest for the first year = Rs. $\left(\frac{64000\times15\times1}{100\times2}\right)$ = Rs. 4800

Now, amount at the end of the first year = Rs. $\left(64000 + 4800\right)$ = Rs. 68800

Principal for the second year = Rs. 68800

Interest for the second year = Rs. $\left(\frac{68800\times15\times1}{100\times2}\right)$ = Rs. 5160

Now, amount at the end of the second year = Rs. $\left(68800 + 5160\right)$ = Rs. 73960

Principal for the third year = Rs. 73960

Interest for the third year = Rs. $\left(\frac{73960\times15\times1}{100\times2}\right)$ = Rs. 5547

Now, amount at the end of the third year = Rs. $\left(73960 + 5547\right)$ = Rs. 79507

∴ Manoj will get an amount of Rs. 79507 after 3 years.

Q7.

Answer :

Principal amount = Rs. 6250

Rate of interest = 8% per annum = 4% for half year

Time = 1 year = 2 half years

Principal for the first half year = Rs. 6250

Interest for the first half year = Rs. $\left(\frac{6250\times4\times1}{100}\right)$ = Rs. 250

Now, amount at the end of the first half year = Rs. $\left(6250 + 250\right)$ = Rs. 6500

Principal for the second half year = Rs. 6500

Interest for the second half year = Rs. $\left(\frac{6500\times4\times1}{100}\right)$ = Rs. 260

Now, amount at the end of the second half year = Rs $\left(6500 + 260\right)$ = Rs. 6760

∴ Compound interest = Rs $(6760 - 6250)$ = Rs 510

Hence, Divakaran gets a compound interest of Rs 510.

Q8.

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Answer :

Principal amount = Rs. 16000

Rate of interest = 10% per annum = 5% for half year

Time = $1\frac{1}{2}$ years = 3 half years

Principal for the first half year = Rs. 16000

Interest for the first half year = Rs. $\left(\frac{16000 \times 5 \times 1}{100}\right)$ = Rs. 800

Now, amount at the end of the first half year = Rs. $\left(16000 + 800\right)$ = Rs. 16800

Principal for the second half year = Rs. 16800

Interest for the second half year = Rs. $\left(\frac{16800 \times 5 \times 1}{100}\right)$ = Rs. 840

Now, amount at the end of the second half year = Rs. $\left(16800 + 840\right)$ = Rs. 17640

Principal for the third half year = Rs. 17640

Interest for the third half year = Rs. $\left(\frac{17640 \times 5 \times 1}{100}\right)$ = Rs. 882

Now, amount at the end of the third half year = Rs. $\left(17640 + 882\right)$ = Rs. 18522

$\therefore$ The amount of money Michael has to pay the finance company after $1\frac{1}{2}$ years is Rs 18522.

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Compound Interest
Ex 11B

1. Let Principal = P, Rate = R% per annum, Time = n years.
2. **When interest is compound Annually:**

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

3. **When interest is compounded Half-yearly:**

   $$\text{Amount} = P\left[1+\frac{(R/2)}{100}\right]^{2n}$$

4. **When interest is compounded Quarterly:**

   $$\text{Amount} = P\left[1+\frac{(R/4)}{100}\right]^{4n}$$

5. **When interest is compounded Annually but time is in fraction, say $3\frac{2}{5}$ years.**

   $$\text{Amount} = P\left(1+\frac{R}{100}\right)^{3} \times \left(1+\frac{\frac{2}{5}R}{100}\right)$$

6. **When Rates are different for different years,** say R_1%, R_2%, R_3% for 1st, 2nd and 3rd year respectively.

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

7. **Present worth of Rs. x due n years hence is given by:**

   $$\text{Present Worth} = \frac{x}{\left(1+\frac{R}{100}\right)}.$$

Future Value Formula (compound interest)

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

Where:

A = resulting amount (future value)

P = amount of principal (present value)

r = annual interest rate

n = number of compounding periods per year

t = time (in years)

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Q1.

Answer :

Principal amount, P = Rs 6000
Rate of interest, R = 9% per annum
Time, n = 2 years.
The formula for the amount including the compound interest is given below :

$$A = \text{Rs. } P\left(1+\frac{R}{100}\right)^{n}$$

$$\Rightarrow A = \text{Rs. } 6000\left(1+\frac{9}{100}\right)^{2}$$

$$\Rightarrow A = \text{Rs. } 6000\left(\frac{100+9}{100}\right)^{2}$$

$$\Rightarrow A = \text{Rs. } 6000\left(\frac{109}{100}\right)^{2}$$

$$\Rightarrow A = \text{Rs. } 6000\,(1.09 \times 1.09)^{2}$$

$$\Rightarrow A = \text{Rs. } 7128.6$$

i.e., the amount including the compound interest is Rs 7128.6.

$\therefore$ Compound interest = Rs (7128.6 − 6000) = Rs 1128.6

Q2.

Answer :

Principal amount, $P =$ Rs. 10000
Rate of interest, $R = 11\%$ per annum.
Time, $n = 2$ years.
The formula for the amount including the compound interest is given below :

$A = \text{Rs. } P\left(1 + \frac{R}{100}\right)^n$

$\Rightarrow A = \text{Rs. } 10000\left(1 + \frac{11}{100}\right)^2$

$\Rightarrow A = \text{Rs. } 10000\left(\frac{100+11}{100}\right)^2$

$\Rightarrow A = \text{Rs. } 10000\left(\frac{111}{100}\right)^2$

$\Rightarrow A = \text{Rs. } 10000\,(1.11 \times 1.11)^2$

$\Rightarrow A = \text{Rs. } 12321$

i.e., the amount including the compound interest is Rs 12321.

$\therefore$ Compound interest $= \text{Rs. } (12321 - 10000) = \text{Rs. } 2321$

Q3.

Answer :

Principal amount, $P = \text{Rs. } 31250$
Rate of interest, $R = 8\%$ per annum.
Time, $n = 3$ years.
The formula for the amount including the compound interest is given below :

$A = \text{Rs. } P\left(1 + \frac{R}{100}\right)^n$

$\Rightarrow A = \text{Rs. } 31250\left(1 + \frac{8}{100}\right)^3$

$\Rightarrow A = \text{Rs. } 31250\left(\frac{100+8}{100}\right)^3$

$\Rightarrow A = \text{Rs. } 31250\left(\frac{108}{100}\right)^3$

$\Rightarrow A = \text{Rs. } 31250\,(1.08 \times 1.08 \times 1.08)^3$

$\Rightarrow A = \text{Rs. } 39366$

i.e., the amount including the compound interest is Rs 39366.

$\therefore$ Compound interest $= \text{Rs. } (39366 - 31250) = \text{Rs. } 8116$

Q4.

Answer :

Principal amount, $P = \text{Rs. } 10240$
Rate of interest, $R = 12\frac{1}{2}\%$ p.a.
Time, $n = 3$ years
The formula for the amount including the compound interest is given below :

$A = \text{Rs. } P\left(1 + \frac{R}{100}\right)^n$

$\Rightarrow A = \text{Rs. } 10240\left(1 + \frac{25}{100\times 2}\right)^3$

$\Rightarrow A = \text{Rs. } 10240\left(1 + \frac{25}{200}\right)^3$

$\Rightarrow A = \text{Rs. } 10240\left(1 + \frac{1}{8}\right)^3$

$\Rightarrow A = \text{Rs. } 10240\left(\frac{8+1}{8}\right)^3$

$\Rightarrow A = \text{Rs. } 10240\left(\frac{9}{8}\right)^3$

$\Rightarrow A = \text{Rs. } 10240\,(1.125 \times 1.125 \times 1.125)^3$

$\Rightarrow A = \text{Rs. } 14580$

i.e., the amount including the compound interest is Rs 14580.

$\therefore$ Compound interest $= \text{Rs } (14580 - 10240) = \text{Rs. } 4340$

Q5.

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Answer :

Principal amount, P = Rs 62500
Rate of interest, R = 12% p. a.
Time, n = 2 years 6 months = $\frac{5}{2} = 2\frac{1}{2}$ years
The formula for the amount including the compound interest is given below :

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

$\Rightarrow A$ = Rs. $62500\left(1+\frac{12}{100}\right)^{2} \times \left(1+\frac{\frac{1}{2}\times 12}{100}\right)$

$\Rightarrow A$ = Rs. $62500\left(1+\frac{12}{100}\right)^{2} \times \left(1+\frac{6}{100}\right)$

$\Rightarrow A$ = Rs. $62500 \times 1.12 \times 1.12 \times 1.06$

$\Rightarrow A$ = Rs. 83104

i. e., the amount including the compound interest is Rs 83104.

$\therefore$ Compound interest = Rs. (83104 − 62500) = Rs. 20604

Q6

Answer :

Principal amount, P = Rs. 9000
Rate of interest, R = 10% p. a.
Time, n = 2 years 4 months = $2\frac{1}{3}$ years = $\frac{7}{3}$ years
The formula for *the* amount including the compound interest is given below :

A = Rs. $P \times \left(1+\frac{R}{100}\right)^{n}$

= Rs. $\left(9000 \times \left(1+\frac{10}{100}\right)^{2} \times \left(1+\frac{\frac{1}{3}\times 10}{100}\right)\right)$

= Rs. $(9000 \times 1.10 \times 1.10 \times 1.033)$

= Rs. $11252.9 \approx 11253$

i. e., the amount including the compound interest is Rs 11253.

$\therefore$ Compound interest = Rs. (11253 − 9000) = Rs. 2253

Q7.

Answer :

Principal amount, P = Rs. 8000
Rate of interest for the first year, p = 9% p. a.
Rate of interest for the second year, q = 10% p. a.
Time, n = 2 years.
Formula for the amount including the compound interest for the first year :

A = Rs. $\left\{P \times \left(1+\frac{p}{100}\right) \times \left(1+\frac{q}{100}\right)\right\}$

= Rs. $\left\{8000 \times \left(1+\frac{9}{100}\right) \times \left(1+\frac{10}{100}\right)\right\}$

= Rs. $\left\{8000 \times \left(\frac{109}{100}\right) \times \left(\frac{110}{100}\right)\right\}$

= Rs. $\{8000 \times (1.09) \times (1.1)\}$

= Rs. 9592

i. e., the amount including the compound interest for first year is Rs 9592.

Q8.

Answer :

Principal amount, P = Rs. 125000
Rate of interest, R = 8% p. a.
Time, n = 3 year *s*
The amount including the compound interest is calculated using the formula,

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

= Rs. $125000\left(1+\frac{8}{100}\right)^{3}$

= Rs. $125000\left(\frac{100+8}{100}\right)^{3}$

= Rs. $125000\left(\frac{108}{100}\right)^{3}$

= Rs. $125000\,(1.08)^{3}$

= Rs. $125000\,(1.08 \times 1.08 \times 1.08)$

= Rs. 157464

$\therefore$ Anand has to pay Rs 157464 after 3 years to clear the debt.

Q9.

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Answer :

Principal amount, P = Rs. 11000
Rate of interest, R = 10% p. a.
Time, n = 3 years
The amount including the compound interest is calculated using the formula,

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

= Rs. $11000\left(1+\frac{10}{100}\right)^3$

= Rs. $11000\left(\frac{100+10}{100}\right)^3$

= Rs. $11000\left(\frac{110}{100}\right)^3$

= Rs. $11000\,(1.1)^3$

= Rs. $11000\,(1.1\times1.1\times1.1)$

= Rs. 14641

Therefore, Beeru has to pay Rs 14641 to clear the debt.

Q10.

Answer :

Principal amount, P = Rs. 18000
Rate of interest for the first year, p = 12% p. a.
Rate of interest for the second year, $q = 12\frac{1}{2}$ % p. a.
Time, n = 2 years
The formula for *the* amount including the compound interest for the first year is *given below* :

$A = \left\{P\times\left(1+\frac{p}{100}\right)\times\left(1+\frac{q}{100}\right)\right\}$

= Rs. $\left\{18000\times\left(1+\frac{12}{100}\right)\times\left(1+\frac{25}{100\times2}\right)\right\}$

= Rs. $\left\{18000\times\left(\frac{100+12}{100}\right)\times\left(1+\frac{25}{200}\right)\right\}$

= Rs. $\left\{18000\times\left(\frac{100+12}{100}\right)\times\left(1+\frac{1}{8}\right)\right\}$

= Rs. $\left\{18000\times\left(\frac{100+12}{100}\right)\times\left(\frac{8+1}{8}\right)\right\}$

= Rs. $\left\{18000\times\left(\frac{112}{100}\right)\times\left(\frac{9}{8}\right)\right\}$

= Rs. $\{18000\times(1.12)\times(1.125)\}$

= Rs. 22680

∴ Shubhalaxmi has to pay Rs 22680 to the finance company after 2 years.

Q11.

Answer :

Principal amount, P = Rs. 24000
Rate of interest, R = 10% p. a.
Time, n = 2 years 3 months = $2\frac{1}{4}$ years
The formula for the amount including the compound interest is *given below* :

A = $P\times\left(1+\frac{R}{100}\right)^n\times\left(1+\frac{\frac{1}{4}R}{100}\right)$

= Rs. $24000\times\left(1+\frac{10}{100}\right)^2\times\left(1+\frac{\frac{1}{4}\times10}{100}\right)$

= Rs. $24000\times\left(\frac{100+10}{100}\right)^2\times\left(\frac{100+2.5}{100}\right)$

= Rs. $24000\times\left(\frac{110}{100}\right)^2\times\left(\frac{100+2.5}{100}\right)$

= Rs. $24000\times(1.1\times1.1\times1.025)$

= Rs. $24000\times(1.250)$

= Rs. 29766

Therefore, Neha should pay Rs 29766 to the bank after 2 years 3 months.

Q12.

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Answer :

Principal amount, P = Rs 16000
Rate of interest, $R = \frac{15}{2}\%\ p.a.$
Time, n = 2 years
Now, simple interest = Rs $\left(\frac{16000\times2\times15}{100\times2}\right)$ = Rs. 2400
Amount including the simple interest = Rs $(16000 + 2400)$ = Rs 18400
The formula for *the* amount including the compound interest is *given below* :

$$A = P\left(1+\frac{R}{100}\right)^n$$
$$= \text{Rs. } 16000\left(1+\frac{15}{100\times2}\right)^2$$
$$= \text{Rs. } 16000\left(1+\frac{15}{200}\right)^2$$
$$= \text{Rs. } 16000\left(1+\frac{3}{40}\right)^2$$
$$= \text{Rs. } 16000\left(\frac{40+3}{40}\right)^2$$
$$= \text{Rs. } 16000\left(\frac{43}{40}\right)^2$$
$$= \text{Rs. } 16000\,(1.075\times1.075)$$

i.e., the amount including the compound interest is Rs 18490.
Now, (CI − SI) = Rs. (18490 − 18400) = Rs. 90
Therefore, Abhay *gains* Rs. 90 as profit at the end of 2 years.

Q13.

Answer :

Simple interest (SI) = Rs. 2400
Rate of interest, R = 8%
Time, n = 2 years
The principal can be calculated using the formula :

$$\text{Sum} = \left(\frac{100\times SI}{R\times T}\right)$$
$$\Rightarrow \text{Sum} = \text{Rs. } \left(\frac{100\times2400}{8\times2}\right) = \text{Rs. } 15000$$

i.e., the principal is Rs. 15000.
The amount including the compound interest is calculated using the formula *given below* :

$$A = P\left(1+\frac{R}{100}\right)^n$$
$$= \text{Rs. } 15000\left(1+\frac{8}{100}\right)^2$$
$$= \text{Rs. } 15000\left(\frac{100+8}{100}\right)^2$$
$$= \text{Rs. } 15000\left(\frac{108}{100}\right)^2$$
$$= \text{Rs. } 15000\,(1.08\times1.08)$$
$$= \text{Rs. } 17496$$

i.e., the amount including the compound interest is Rs. 17496.
$\therefore$ Compound interest (CI) = Rs. (17496 − 15000) = Rs. 2496

Q14.

Answer :

Let Rs P *be the* sum.
Then SI $= \left(\frac{P\times2\times6}{100}\right) = \text{Rs. } \frac{12P}{100} = \text{Rs. } \frac{3P}{25}$

$$\text{Also, CI} = \left\{P\times\left(1+\frac{6}{100}\right)^2 - P\right\}$$
$$= \text{Rs. } \left\{P\times\left(\frac{100+6}{100}\right)^2 - P\right\}$$
$$= \text{Rs. } \left\{P\times\left(\frac{53}{50}\right)^2 - P\right\}$$
$$= \text{Rs. } \left\{\left(\frac{2809P}{2500}\right) - P\right\}$$
$$= \text{Rs. } \left\{\frac{2809P-2500P}{2500}\right\} = \text{Rs. } \frac{309P}{2500}$$
$$\textit{Now, (CI} - \text{SI}) = \text{Rs. } \left(\frac{309P}{2500} - \frac{3P}{25}\right)$$
$$= \text{Rs. } \left(\frac{309P-300P}{2500}\right)$$
$$= \text{Rs. } \frac{9P}{2500}$$

Now, Rs. 90 $= \frac{9P}{2500}$
$\Rightarrow P = \left(\frac{90\times2500}{9}\right) = \text{Rs. } 25000$
Hence, the *required* sum is Rs. 25000.

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Q15.

Answer :

Let P be the sum.

Then SI $= \text{Rs}\left(\frac{P\times3\times10}{100}\right) = \text{Rs}\ \frac{30P}{100} = \text{Rs}\ \frac{3P}{10}$

Also, CI $= \text{Rs.}\left\{P\times\left(1+\frac{10}{100}\right)^3 - P\right\}$

$= \text{Rs.}\left\{P\times\left(\frac{100+10}{100}\right)^3 - P\right\}$

$= \text{Rs.}\left\{P\times\left(\frac{11}{10}\right)^3 - P\right\}$

$= \text{Rs.}\left\{\left(\frac{1331P}{1000}\right) - P\right\}$

$= \text{Rs.}\left\{\frac{1331P-1000P}{1000}\right\}$

$= \text{Rs.}\ \frac{331P}{1000}$

Now, (CI $-$ SI) $= \text{Rs}\left(\frac{331P}{1000} - \frac{3P}{10}\right)$

$= \text{Rs}\left(\frac{331P-300P}{1000}\right)$

$= \text{Rs}\ \frac{31P}{1000}$

Now, Rs. 93 $= \frac{31P}{1000}$

$\Rightarrow P = \left(\frac{93\times1000}{31}\right) = \text{Rs. } 3000$

Hence, the *required* sum is Rs. 3000.

Q16.

Answer :

Let P be the sum.

Rate of interest, $R = 6\frac{2}{3}\% = \frac{20}{3}\%$

Time, $n = 2$ years

Now, $A = P\times\left(1+\frac{20}{100\times3}\right)^2$

$= \text{Rs. } P\times\left(1+\frac{20}{300}\right)^2$

$= \text{Rs. } P\times\left(\frac{300+20}{300}\right)^2$

$= \text{Rs. } P\times\left(\frac{320}{300}\right)^2$

$= \text{Rs. } P\times\left(\frac{16}{15}\times\frac{16}{15}\right)$

$= \text{Rs. } \frac{256P}{225}$

$\Rightarrow$ Rs. 10240 $= \text{Rs. } \frac{256P}{225}$

$\Rightarrow \text{Rs.}\left(\frac{10240\times225}{256}\right) = P$

$\therefore P = \text{Rs. } 9000$

Hence, the *required* sum is Rs. 9000

Q17.

Answer :

Let P be the sum.

Rate of interest, $R = 10\%$

Time, $n = 3$ years

Now, $A = P\times\left(1+\frac{10}{100}\right)^3$

$= \text{Rs. } P\times\left(\frac{100+10}{100}\right)^3$

$= \text{Rs. } P\times\left(\frac{110}{100}\right)^3$

$= \text{Rs. } P\times\left(\frac{11}{10}\times\frac{11}{10}\times\frac{11}{10}\right)$

$= \text{Rs. } \frac{1331P}{1000}$

However, amount $=$ Rs. 21296

Now, Rs. 21296 $= \text{Rs. } \frac{1331P}{1000}$

$\Rightarrow \text{Rs.}\left(\frac{21296\times1000}{1331}\right) = P$

$\therefore P = \text{Rs. } 16000$

Hence, the *required* sum is Rs. 16000.

Q18.

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Answer :

Let $R\%$ p. a. be the required rate.
$A = 4410$
$P = 4000$
$n = 2$ years
$Now,\ A = P\left(1+\frac{R}{100}\right)^n$
$\Rightarrow 4410 = 4000\left(1+\frac{R}{100}\right)^2$
$\Rightarrow \frac{4410}{4000} = \left(1+\frac{R}{100}\right)^2$
$\Rightarrow \frac{441}{400} = \left(1+\frac{R}{100}\right)^2$
$\Rightarrow \left(\frac{21}{20}\right)^2 = \left(1+\frac{R}{100}\right)^2$
$\Rightarrow \frac{21}{20} - 1 = \frac{R}{100}$
$\Rightarrow \frac{21-20}{20} = \frac{R}{100}$
$\Rightarrow \frac{1}{20} = \frac{R}{100}$
$\Rightarrow R = \left(\frac{1\times 100}{20}\right) = 5$
Hence, the required rate is 5% p. a.

Q19.

Answer :

Let the required rate be $R\%$ p. a.
$A = 774.40$
$P = 640$
n $= 2$ years
$Now,\ A = P\left(1+\frac{R}{100}\right)^n$
$\Rightarrow 774.40 = 640\left(1+\frac{R}{100}\right)^2$
$\Rightarrow \frac{774.40}{640} = \left(1+\frac{R}{100}\right)^2$
$\Rightarrow 1.21 = \left(1+\frac{R}{100}\right)^2$
$\Rightarrow (1.1)^2 = \left(1+\frac{R}{100}\right)^2$
$\Rightarrow 1.1 - 1 = \frac{R}{100}$
$\Rightarrow 0.1 = \frac{R}{100}$
$\Rightarrow R = (0.1\times 100) = 10$
Hence, the required rate is 10% p. a.

Q20.

Answer :

Let the required time be n years.
Rate of interest, $R = 10\%$
Principal amount, $P =$ Rs. 1800
Amount with compound interest, $A =$ Rs. 2178
Now, $A = P\times\left(1+\frac{R}{100}\right)^n$
$=$ Rs. $1800\times\left(1+\frac{10}{100}\right)^n$
$=$ Rs. $1800\times\left(\frac{100+10}{100}\right)^n$
$=$ Rs. $1800\times\left(\frac{110}{100}\right)^n$
$=$ Rs. $1800\times\left(\frac{11}{10}\right)^n$
However, amount $=$ Rs. 2178
$Now,$ Rs. $2178 =$ Rs. $1800\times\left(\frac{11}{10}\right)^n$
$\Rightarrow \frac{2178}{1800} = \left(\frac{11}{10}\right)^n$
$\Rightarrow \frac{121}{100} = \left(\frac{11}{10}\right)^n$
$\Rightarrow \left(\frac{11}{10}\right)^2 = \left(\frac{11}{10}\right)^n$
$\Rightarrow n = 2$
$\therefore$ Time, $n = 2$ years

Q21.

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Answer :

Let the required time be n years.
Rate of interest, $R = 8\%$
Principal amount, $P =$ Rs. 6250
Amount with compound interest, $A =$ Rs. 7290
Then, $A = P \times \left(1 + \frac{R}{100}\right)^n$
$\Rightarrow A =$ Rs. $6250 \times \left(1 + \frac{8}{100}\right)^n$
$=$ Rs. $6250 \times \left(\frac{100+8}{100}\right)^n$
$=$ Rs. $6250 \times \left(\frac{108}{100}\right)^n$
$=$ Rs. $6250 \times \left(\frac{27}{25}\right)^n$
However, amount $=$ Rs. 7290
Now, Rs. $7290 =$ Rs. $6250 \times \left(\frac{27}{25}\right)^n$
$\Rightarrow \frac{7290}{6250} = \left(\frac{27}{25}\right)^n$
$\Rightarrow \frac{729}{625} = \left(\frac{27}{25}\right)^n$
$\Rightarrow \left(\frac{27}{25}\right)^2 = \left(\frac{27}{25}\right)^n$
$\Rightarrow n = 2$
$\therefore$ Time, $n = 2$ years

Q22.

Answer :

Population of the town, $P = 125000$
Rate of increase, $R = 2\%$
Time, $n = 3$ years
Then the population of the town after 3 years is *given by*
Population $= P \times \left(1 + \frac{R}{100}\right)^3$
$= 125000 \times \left(1 + \frac{2}{100}\right)^3$
$= 125000 \times \left(\frac{100+2}{100}\right)^3$
$= 125000 \times \left(\frac{102}{100}\right)^3$
$= 125000 \times \left(\frac{51}{50}\right)^3$
$= 125000 \times \left(\frac{51}{50}\right) \times \left(\frac{51}{50}\right) \times \left(\frac{51}{50}\right)$
$= (51 \times 51 \times 51)$
$= 132651$
Therefore, the population of the town after three years is 132651.

Q23.

Answer :

Let the population of the town be 50000.
Rate of increase for the first year, $p = 5\%$
Rate of increase for the second year, $q = 4\%$
Rate of increase for the third year, $r = 3\%$
Time $= 3$ years
Now, present population $= \left\{P \times \left(1 + \frac{p}{100}\right) \times \left(1 + \frac{q}{100}\right) \times \left(1 + \frac{r}{100}\right)\right\}$
$= \left\{50000 \times \left(1 + \frac{5}{100}\right) \times \left(1 + \frac{4}{100}\right) \times \left(1 + \frac{3}{100}\right)\right\}$
$= \left\{50000 \times \left(\frac{100+5}{100}\right) \times \left(\frac{100+4}{100}\right) \times \left(\frac{100+3}{100}\right)\right\}$
$= \left\{50000 \times \left(\frac{105}{100}\right) \times \left(\frac{104}{100}\right) \times \left(\frac{103}{100}\right)\right\}$
$= \left\{50000 \times \left(\frac{21}{20}\right) \times \left(\frac{26}{25}\right) \times \left(\frac{103}{100}\right)\right\}$
$= (21 \times 26 \times 103)$
$= 56238$
Therefore, the present population of the town is 56238.

Q24.

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Answer :

Population of the city in 2009, P = 120000
Rate of increase, R = 6%
Time, n = 3 years
Then the population of the city in the year 2010 is *given by*

$$\text{Population} = P \times \left(1 + \frac{R}{100}\right)^n$$

$$= 120000 \times \left(1 + \frac{6}{100}\right)^1$$

$$= 120000 \times \left(\frac{100+6}{100}\right)$$

$$= 120000 \times \left(\frac{106}{100}\right)$$

$$= 120000 \times \left(\frac{53}{50}\right)$$

$$= 2400 \times 53$$

$$= 127200$$

Therefore, the population of the city in 2010 is 127200.
Again, *p*opulation of the city in 2010, $P = 127200$
Rate of decrease, $R = 5\%$
Then the population of the city in the year 2011 is *given by*

$$\text{Population} = P \times \left(1 - \frac{R}{100}\right)^n$$

$$= 127200 \times \left(1 - \frac{5}{100}\right)^1$$

$$= 127200 \times \left(\frac{100-5}{100}\right)$$

$$= 127200 \times \left(\frac{95}{100}\right)$$

$$= 127200 \times \left(\frac{19}{20}\right)$$

$$= 6360 \times 19$$

$$= 120840$$

Therefore, the population of the city in 2011 is 120840.

Q25.

Answer :

Initial count of bacteria, $P = 500000$
Rate of increase, $R = 2\%$
Time, $n = 2$ hours
Then the count of bacteria at the end of 2 hours is *given by*

$$\text{Count of bacteria} = P \times \left(1 + \frac{R}{100}\right)^n$$

$$= 500000 \times \left(1 + \frac{2}{100}\right)^2$$

$$= 500000 \times \left(\frac{100+2}{100}\right)^2$$

$$= 500000 \times \left(\frac{102}{100}\right)^2$$

$$= 500000 \times \left(\frac{51}{50}\right)^2$$

$$= 500000 \times \left(\frac{51}{50}\right) \times \left(\frac{51}{50}\right)$$

$$= (200 \times 51 \times 51)$$

$$= 520200$$

Therefore, the count of bacteria at the end of 2 hours is 520200.

Q26.

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Answer :

Initial count of bacteria, $P = 20000$
Rate of increase, $R = 10\%$
Time, $n = 3$ hours
Then the count of bacteria at the end of the first hour is given by

$$\text{Count of bacteria} = P \times \left(1 + \frac{10}{100}\right)^n$$

$$= 20000 \times \left(1 + \frac{10}{100}\right)^1$$

$$= 20000 \times \left(\frac{100+10}{100}\right)$$

$$= 20000 \times \left(\frac{110}{100}\right)$$

$$= 20000 \times \left(\frac{11}{10}\right)$$

$$= 2000 \times 11$$

$$= 22000$$

Therefore, the count of bacteria at the end of the first hour is 22000.
The count of bacteria at the end of the second hour is given by

$$\text{Count of bacteria} = P \times \left(1 - \frac{10}{100}\right)^n$$

$$= 22000 \times \left(1 - \frac{10}{100}\right)^1$$

$$= 22000 \times \left(\frac{100-10}{100}\right)$$

$$= 22000 \times \left(\frac{90}{100}\right)$$

$$= 22000 \times \left(\frac{9}{10}\right)$$

$$= 2200 \times 9$$

$$= 19800$$

Therefore, the count of bacteria at the end of the second hour is 19800.
Then the count of bacteria at the end of *the* third hour is *is given by*

$$\text{Count of bacteria} = P \times \left(1 + \frac{10}{100}\right)^n$$

$$= 19800 \times \left(1 + \frac{10}{100}\right)^1$$

$$= 19800 \times \left(\frac{100+10}{100}\right)$$

$$= 19800 \times \left(\frac{110}{100}\right)$$

$$= 19800 \times \left(\frac{11}{10}\right)$$

$$= 1980 \times 11$$

$$= 21780$$

Therefore, the count of bacteria at the end of *the* first 3 hours is 21780.

Q27.

Answer :

Initial value of the machine, $P =$ Rs 625000
Rate of depreciation, $R = 8\%$
Time, $n = 2$ years
Then the value of the machine after two years is given by

$$\text{Value} = P \times \left(1 - \frac{R}{100}\right)^n$$

$$= \text{Rs } 625000 \times \left(1 - \frac{8}{100}\right)^2$$

$$= \text{Rs } 625000 \times \left(\frac{100-8}{100}\right)^2$$

$$= \text{Rs } 625000 \times \left(\frac{92}{100}\right)^2$$

$$= \text{Rs } 625000 \times \left(\frac{23}{25}\right)^2$$

$$= \text{Rs } 625000 \times \left(\frac{23}{25}\right) \times \left(\frac{23}{25}\right)$$

$$= \text{Rs } (1000 \times 23 \times 23)$$

$$= \text{Rs } 529000$$

Therefore, the value of the machine after two years will be Rs. 529000.

Q28.

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Answer :

Initial value of the scooter, $P =$ Rs 56000
Rate of depreciation, $R = 10\%$
Time, $n = 3$ years
Then the value of the scooter after three years is given by

$$\text{Value} = P \times \left(1 - \frac{R}{100}\right)^n$$
$$= \text{Rs. } 56000 \times \left(1 - \frac{10}{100}\right)^3$$
$$= \text{Rs. } 56000 \times \left(\frac{100-10}{100}\right)^3$$
$$= \text{Rs. } 56000 \times \left(\frac{90}{100}\right)^3$$
$$= \text{Rs. } 56000 \times \left(\frac{9}{10}\right)^3$$
$$= \text{Rs. } 56000 \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right)$$
$$= \text{Rs. } (56 \times 9 \times 9 \times 9)$$
$$= \text{Rs. } 40824$$

Therefore, the value of the scooter after three years will be Rs. 40824.

Q29.

Answer :

Initial value of the car, $P =$ Rs 348000
Rate of depreciation for the first year, $p = 10\%$
Rate of depreciation for the second year, $q = 20\%$
Time, $n = 2$ years.
Then the value of the car after two years is given by

$$\text{Value} = \left\{P \times \left(1 - \frac{p}{100}\right) \times \left(1 - \frac{q}{100}\right)\right\}$$
$$= \text{Rs. } \left\{348000 \times \left(1 - \frac{10}{100}\right) \times \left(1 - \frac{20}{100}\right)\right\}$$
$$= \text{Rs. } \left\{348000 \times \left(\frac{100-10}{100}\right) \times \left(\frac{100-20}{100}\right)\right\}$$
$$= \text{Rs. } \left\{348000 \times \left(\frac{90}{100}\right) \times \left(\frac{80}{100}\right)\right\}$$
$$= \text{Rs. } \left\{348000 \times \left(\frac{9}{10}\right) \times \left(\frac{8}{10}\right)\right\}$$
$$= \text{Rs. } (3480 \times 9 \times 8)$$
$$= \text{Rs. } 250560$$

$\therefore$ The value of the car after two years is Rs 250560.

Q30.

Answer :

Let the initial value of the machine, P be Rs x.
Rate of depreciation, $R = 10\%$
Time, $n = 3$ years
The present value of the machine is Rs 291600.
Then the initial value of the machine is given by

$$\text{Value} = P \times \left(1 - \frac{R}{100}\right)^n$$
$$= \text{Rs. } x \times \left(1 - \frac{10}{100}\right)^3$$
$$= \text{Rs. } x \times \left(\frac{100-10}{100}\right)^3$$
$$= \text{Rs. } x \times \left(\frac{90}{100}\right)^3$$
$$= \text{Rs. } x \times \left(\frac{9}{10}\right)^3$$

$\therefore$ Present value of the machine $=$ Rs 291600

$$\text{Now, Rs } 291600 = \text{Rs } x \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right)$$
$$\Rightarrow x = \text{Rs } \frac{291600 \times 10 \times 10 \times 10}{9 \times 9 \times 9}$$
$$\Rightarrow x = \text{Rs } \frac{291600000}{729}$$
$$\Rightarrow x = \text{Rs } 400000$$

$\therefore$ The initial value of the machine is Rs 400000.

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Compound Interest
Ex 11C

1. Let Principal = P, Rate = R% per annum, Time = n years.

2. **When interest is compound Annually:**

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

3. **When interest is compounded Half-yearly:**

$$\text{Amount} = P\left[1+\frac{(R/2)}{100}\right]^{2n}$$

4. **When interest is compounded Quarterly:**

$$\text{Amount} = P\left[1+\frac{(R/4)}{100}\right]^{4n}$$

5. **When interest is compounded Annually but time is in fraction, say $3\frac{2}{5}$ years.**

$$\text{Amount} = P\left(1+\frac{R}{100}\right)^{3} \times \left(1+\frac{\frac{2}{5}R}{100}\right)$$

6. **When Rates are different for different years**, say $R_1\%$, $R_2\%$, $R_3\%$ for 1st, 2nd and 3rd year respectively.

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

7. **Present worth of Rs. x due n years hence is given by:**

$$\text{Present Worth} = \frac{x}{\left(1+\frac{R}{100}\right)}.$$

Future Value Formula (compound interest)

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

Where:

A = resulting amount (future value)

P = amount of principal (present value)

r = annual interest rate

n = number of compounding periods per year

t = time (in years)

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Let Principal = P, Rate = R% per annum,
Time = n years.

1. When interest is compounded annually :

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

2. When interest is compounded half-yearly :

$$\text{Amount} = P\left[1+\frac{(R/2)}{100}\right]^{2n}$$

3. When interest is compounded quarterly :

$$\text{Amount} = P\left[1+\frac{(R/4)}{100}\right]^{4n}$$

4. When interest is compounded annually but time is in fraction, say $3\frac{2}{5}$ years.

$$\text{Amount} = P\left(1+\frac{R}{100}\right)^{3} \times \left(1+\frac{\frac{2}{5}R}{100}\right)$$

5. When rates are different for different years, say $R_1\%$, $R_2\%$, $R_3\%$ for 1st, 2nd and 3rd year respectively. Then,

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

6. Growth : If the rate of growth is constant, then

$$V = V_0\left(1+\frac{r}{100}\right)^n$$

where $r\%$ is the rate of growth per year, n is the number of years, V_0 is the present measure of the quantity and V is the measure of the quantity after n years.

Similarly, if V_0 is the measure of the quantity n years ago and V is the present measure of the quantity, then

$$V = V_0\left(1+\frac{r}{100}\right)^n$$

7. Depreciation : If the rate of depreciation is constant, then

$$V = V_0\left(1-\frac{r}{100}\right)^n$$

where $r\%$ is the rate of depreciation per year, n is the number of years, V_0 is the present value and V is the value after n years.

Similarly, if V_0 is the value n years ago and V is the present value, then

$$V = V_0\left(1-\frac{r}{100}\right)^n$$

8. Population :

(i) Population after n years = Present population $\left(1+\frac{r}{100}\right)^n$

(ii) Present population = Population n years ago $\left(1+\frac{r}{100}\right)^n$

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Q1.

Answer :

Principal, P = Rs. 8000
Time, n = 1 year = 2 half years
Rate of interest per annum = 10%
Rate of interest for half year, $R = \frac{10\%}{2} = 5\%$
The amount with the compound interest is given by

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

$$= \text{Rs. } 8000\times\left(1+\frac{5}{100}\right)^2$$

$$= \text{Rs. } 8000\times\left(\frac{105}{100}\right)^2$$

$$= \text{Rs. } 8000\times\left(\frac{21}{20}\right)^2$$

$$= \text{Rs. } 8000\times\left(\frac{21}{20}\right)\times\left(\frac{21}{20}\right)$$

$$= \text{Rs. } (20\times 21\times 21)$$

$$= \text{Rs. } 8820$$

$\therefore$ Compound interest = amount − principal = Rs. $\left(8820-8000\right)$ = Rs. 820

Q3.

Principal, P = Rs. 12800

Annual rate of interest, $R = \frac{15}{2}\%$

Rate of interest for a half year $= \frac{1}{2}\left(\frac{15}{2}\right)\% = \frac{15}{4}\%$

Time, n = 1 year = 2 half years

Then the amount with the compound interest is given by

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

$$= 12800 \times \left(1+\frac{\frac{15}{4}}{100}\right)^2$$

$$= 12800 \times \left(1+\frac{15}{100\times 4}\right)^2$$

$$= 12800 \times \left(\frac{400+15}{400}\right)^2$$

$$= 12800 \times \left(\frac{415}{400}\right)^2$$

$$= 12800 \times \left(\frac{83}{80}\right) \times \left(\frac{83}{80}\right)$$

$$= (2 \times 83 \times 83)$$

= Rs 13778

Therefore, compound interest = amount − principal = Rs $\left(13778 - 12800\right)$ = Rs 978

Q4.

Answer :

Principal, P = Rs. 160000

Annual rate of interest, R = 10%

Rate of interest for a half year $= \frac{10}{2}\% = 5\%$

Time, n = 2 years = 4 half years

Then the amount with the compound interest is given by

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

$$= 160000 \times \left(1+\frac{5}{100}\right)^4$$

$$= 160000 \times \left(\frac{100+5}{100}\right)^4$$

$$= 160000 \times \left(\frac{105}{100}\right)^4$$

$$= 160000 \times \left(\frac{21}{20}\right) \times \left(\frac{21}{20}\right) \times \left(\frac{21}{20}\right) \times \left(\frac{21}{20}\right)$$

$$= (21 \times 21 \times 21 \times 21)$$

= Rs 194481

Therefore, compound interest = amount − principal = Rs $\left(194481 - 160000\right)$ = Rs 34481

Q5.

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Principal, P = Rs. 40960

Annual rate of interest, $R = \frac{25}{2}\%$

Rate of interest for half year $= \frac{25}{4}\%$

Time, $n = 1\frac{1}{2}$ years $= 3$ half years

Then the amount with the compound interest is given by

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

$= 40960 \times \left(1 + \frac{25}{100 \times 4}\right)^3$

$= 40960 \times \left(\frac{400+25}{400}\right)^3$

$= 40960 \times \left(\frac{425}{400}\right)^3$

$= 40960 \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right)$

$= (10 \times 17 \times 17 \times 17)$

= Rs 49130

Therefore, compound interest = amount − principal = Rs $\left(49130 - 40960\right)$ = Rs 8170

Therefore, Swati has to pay Rs. 49130, which includes an interest of Rs. 8170, to the bank after $1\frac{1}{2}$ years.

Q6.

Answer :

Let the principal amount be P = Rs. 125000.

Annual rate of interest, $R = 12\%$

Rate of interest for a half year $= 6\%$

Time, $n = 1\frac{1}{2}$ years $= 3$ half years

Then the amount with the compound interest is given by

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

= Rs. $125000 \times \left(1 + \frac{6}{100}\right)^3$

= Rs. $125000 \times \left(\frac{100+6}{100}\right)^3$

= Rs. $125000 \times \left(\frac{106}{100}\right)^3$

= Rs. $125000 \times \left(\frac{53}{50}\right) \times \left(\frac{53}{50}\right) \times \left(\frac{53}{50}\right)$

= Rs. $(53 \times 53 \times 53)$

= Rs. 148877

Now, $CI = A - P$ = Rs. $\left(148877 - 125000\right)$ = Rs. 23877

Therefore, Aslam has to pay an interest of Rs. 23877 to the bank after $1\frac{1}{2}$ years.

Q7.

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Answer :

Let the principal amount be $P =$ Rs. 20000.
Annual rate of interest, $R = 6\%$
Rate of interest for half year $= 3\%$
Time, $n = 1$ year $= 2$ half years
Then the amount with the compound interest is given by

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

$= \text{Rs. } 20000 \times \left(1 + \frac{3}{100}\right)^2$

$= \text{Rs. } 20000 \times \left(\frac{100+3}{100}\right)^2$

$= \text{Rs. } 20000 \times \left(\frac{103}{100}\right)^2$

$= \text{Rs. } 20000 \times \left(\frac{103}{100}\right) \times \left(\frac{103}{100}\right)$

$= \text{Rs. } (2 \times 103 \times 103)$

$= \text{Rs. } 21218$

Therefore, Sheela gets Rs. 21218 after 1 year.

Q8.

Answer :

Let the principal amount be $P =$ Rs. 65536.
Annual rate of interest, $R = \frac{25}{2}\%$
Rate of interest for a half year $= \frac{25}{4}\%$
Time, $n = 2$ years $= 4$ half years
Then the amount with the compound interest is given by

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

$= \text{Rs. } 65536 \times \left(1 + \frac{25}{100 \times 4}\right)^4$

$= \text{Rs. } 65536 \times \left(\frac{400+25}{400}\right)^4$

$= \text{Rs. } 65536 \times \left(\frac{425}{400}\right)^4$

$= \text{Rs. } 65536 \times \left(\frac{17}{16}\right)^4$

$= \text{Rs. } 65536 \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right)$

$= \text{Rs. } (17 \times 17 \times 17 \times 17)$

$= \text{Rs. } 83521$

Now, CI $= A - P$

$= \text{Rs. } (83521 - 65536) = \text{Rs. } 17985$

Therefore, interest earned when compounded half yearly $= \text{Rs. } 17985$
Amount when the interest is compounded yearly is given by

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

$= Rs. \ 65536 \times \left(1 + \frac{25}{100 \times 2}\right)^2$

$= \text{Rs. } 65536 \times \left(\frac{200+25}{200}\right)^2$

$= \text{Rs. } 65536 \times \left(\frac{225}{200}\right)^2$

$= \text{Rs. } 65536 \times \left(\frac{9}{8}\right)^2$

$= \text{Rs. } 65536 \times \left(\frac{9}{8}\right) \times \left(\frac{9}{8}\right)$

$= \text{Rs. } 82944$

Therefore, CI $= A - P = \text{Rs. } (82944 - 65536) = \text{Rs. } 17408$

$\therefore$ Difference between the interests compounded half yearly and yearly $= \text{Rs. } (17985 - 17408) = \text{Rs. } 577$

Q9.

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Answer :

Let the principal amount be $P =$ Rs 32000.
Annual rate of interest, $R = 5\%$
Rate of interest for a quarter year $= \frac{5}{4}\%$
Time, $n = 6$ months $= 2$ quarter years
Then the amount with the compound interest is given by

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

$= \text{Rs. } 32000 \times \left(1 + \frac{5}{100 \times 4}\right)^2$

$= \text{Rs. } 32000 \times \left(\frac{400+5}{400}\right)^2$

$= \text{Rs. } 32000 \times \left(\frac{405}{400}\right)^2$

$= \text{Rs. } 32000 \times \left(\frac{81}{80}\right)^2$

$= \text{Rs. } 32000 \times \left(\frac{81}{80}\right) \times \left(\frac{81}{80}\right)$

$= \text{Rs. } (5 \times 81 \times 81)$

$= \text{Rs. } 32805$

Therefore, Sudershan will receive an amount of Rs. 32805 after 6 months.

Q10.

Let the principal amount be $P =$ Rs 390625.
Annual rate of interest, $R = 16\%$
Rate of interest for a quarter year $= \frac{16}{4}\% = 4\%$
Time, $n = 1$ year $= 4$ quarter years
Then the amount with the compound interest is given by

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

$= \text{Rs. } 390625 \times \left(1 + \frac{4}{100}\right)^4$

$= \text{Rs. } 390625 \times \left(\frac{100+4}{100}\right)^4$

$= \text{Rs. } 390625 \times \left(\frac{104}{100}\right)^4$

$= \text{Rs. } 390625 \times \left(\frac{26}{25}\right)^4$

$= \text{Rs. } 390625 \times \left(\frac{26}{25}\right) \times \left(\frac{26}{25}\right) \times \left(\frac{26}{25}\right) \times \left(\frac{26}{25}\right)$

$= \text{Rs. } (26 \times 26 \times 26 \times 26)$

$= \text{Rs. } 456976$

Therefore, Arun has to pay Rs 456976 after 1 year.

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Compound Interest
Ex 11D

Q1.

Answer :

(c) Rs. 832

$$A = P \times \left(1 + \frac{R}{100}\right)^n$$
$$= \text{Rs. } 5000 \times \left(1 + \frac{8}{100}\right)^2$$
$$= \text{Rs. } 5000 \times \left(\frac{108}{100}\right)^2$$
$$= \text{Rs. } 5000 \times \left(\frac{27}{25}\right)^2$$
$$= \text{Rs. } 5000 \times \left(\frac{27}{25}\right) \times \left(\frac{27}{25}\right)$$
$$= \text{Rs. } (8 \times 27 \times 27)$$
$$= \text{Rs. } 5832$$
$$\therefore \text{ Interest } = \text{ amount } - \text{ principal} = \text{ Rs } \left(5832 - 5000\right) = \text{ Rs } 832$$

Q2.

Answer :

(b) Rs. 3310

$$A = P \times \left(1 + \frac{R}{100}\right)^n$$
$$= \text{Rs. } 10000 \times \left(1 + \frac{10}{100}\right)^3$$
$$= \text{Rs. } 10000 \times \left(\frac{110}{100}\right)^3$$
$$= \text{Rs. } 10000 \times \left(\frac{11}{10}\right)^3$$
$$= \text{Rs. } 10000 \times \left(\frac{11}{10}\right) \times \left(\frac{11}{10}\right) \times \left(\frac{11}{10}\right)$$
$$= \text{Rs. } (10 \times 11 \times 11 \times 11)$$
$$= \text{Rs. } 13310$$
$$\therefore \text{ Compound interest } = \text{amount } - \text{ principal} = \text{ Rs } \left(13310 - 10000\right) = \text{ Rs } 3310$$

Q3.

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Answer :

(a) Rs 1872

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

$$= \text{Rs } 10000 \times \left(1+\frac{12}{100}\right) \times \left(1+\frac{\frac{1}{2}\times 12}{100}\right)$$

$$= \text{Rs } 10000 \times \left(\frac{100+12}{100}\right) \times \left(\frac{100+6}{100}\right)$$

$$= \text{Rs } 10000 \times \left(\frac{112}{100}\right) \times \left(\frac{106}{100}\right)$$

$$= \text{Rs } 10000 \times \left(\frac{28}{25}\right) \times \left(\frac{53}{50}\right)$$

$$= \text{Rs } (8 \times 28 \times 53)$$

$$= \text{Rs } 11872$$

$$\therefore \text{ Compound interest } = \text{amount } - \text{principal} = \text{ Rs } \left(11872 - 10000\right) = \text{ Rs } 1872$$

Q4.

Answer :

(c) Rs 961

$$\text{Here, } A = P \times \left(1+\frac{R}{100}\right)^2 \times \left(1+\frac{\frac{1}{4}R}{100}\right)$$

$$= \text{Rs. } 4000 \times \left(1+\frac{10}{100}\right)^2 \times \left(1+\frac{\frac{1}{4}\times 10}{100}\right)$$

$$= \text{Rs. } 4000 \times \left(\frac{100+10}{100}\right)^2 \times \left(\frac{40+1}{40}\right)$$

$$= \text{Rs. } 4000 \times \left(\frac{110}{100}\right)^2 \times \left(\frac{41}{40}\right)$$

$$= \text{Rs. } 4000 \times \left(\frac{11}{10}\right) \times \left(\frac{11}{10}\right) \times \left(\frac{41}{40}\right)$$

$$= \text{Rs. } (11 \times 11 \times 41)$$

$$= \text{Rs. } 4961$$

$$\therefore \text{ Compound interest } = \text{ amount } - \text{principal} = \text{ Rs } \left(4961 - 4000\right) = \text{ Rs } 961$$

Q5.

Answer :

(b) Rs. 5051

$$\text{Here, } A = \text{ Rs. } P \times \left(1+\frac{p}{100}\right) \times \left(1+\frac{q}{100}\right) \times \left(1+\frac{r}{100}\right)$$

$$= \text{Rs. } 25000 \times \left(1+\frac{5}{100}\right) \times \left(1+\frac{6}{100}\right) \times \left(1+\frac{8}{100}\right)$$

$$= \text{Rs. } 25000 \times \left(\frac{105}{100}\right) \times \left(\frac{106}{100}\right) \times \left(\frac{108}{100}\right)$$

$$= \text{Rs. } 25000 \times \left(\frac{21}{20}\right) \times \left(\frac{53}{50}\right) \times \left(\frac{27}{25}\right)$$

$$= \text{Rs. } (21 \times 53 \times 27)$$

$$= \text{Rs. } 30051$$

$$\therefore \text{ Compound interest } = \text{ amount } - \text{principal} = \text{ Rs. } \left(30051 - 25000\right) = \text{ Rs. } 5051$$

Q6.

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Answer :

(b) Rs. 510

Rate of interest compounded half yearly $= \frac{8}{2}\% = 4\%$
Time $= 1$ year $= 2$ half years
Now, $A = P \times \left(1 + \frac{R}{100}\right)^n$
$= \text{Rs. } 6250 \times \left(1 + \frac{4}{100}\right)^2$
$= \text{Rs. } 6250 \times \left(\frac{104}{100}\right)^2$
$= \text{Rs. } 6250 \times \left(\frac{26}{25}\right) \times \left(\frac{26}{25}\right)$
$= \text{Rs. } (10 \times 26 \times 26)$
$= \text{Rs. } 6760$
$\therefore$ Compound interest $=$ amount $-$ principal $= \text{Rs. } \left(6760 - 6250\right) = \text{Rs. } 510$

Q7.

Answer :

(a) Rs.1209

Time $= 6$ months $= 2$ quater years
Rate compounded quarter yearly $= \frac{6}{4}\% = \frac{3}{2}\%$
Now, $A = P \times \left(1 + \frac{R}{100}\right)^n$
$= \text{Rs. } 40000 \times \left(1 + \frac{3}{100 \times 2}\right)^2$
$= \text{Rs. } 40000 \times \left(\frac{203}{200}\right)^2$
$= \text{Rs. } 40000 \times \left(\frac{203}{200}\right) \times \left(\frac{203}{200}\right)$
$= \text{Rs. } (203 \times 203)$
$= \text{Rs. } 41209$
$\therefore$ Compound interest $=$ amount $-$ principal $= \text{Rs. } 41209 - \text{Rs. } 40000 = \text{Rs. } 1209$

Q8.

Answer :

(b) 26460

Here, $A = P \times \left(1 + \frac{R}{100}\right)^n$
$= \text{Rs. } 24000 \times \left(1 + \frac{5}{100}\right)^2$
$= \text{Rs. } 24000 \times \left(\frac{105}{100}\right)^2$
$= \text{Rs. } 24000 \times \left(\frac{21}{20}\right) \times \left(\frac{21}{20}\right)$
$= \text{Rs. } (60 \times 21 \times 21)$
$= \text{Rs. } 26460$

Q9.

Answer :

(c) Rs. 43740

Here, $A = \text{Rs. } P \times \left(1 - \frac{R}{100}\right)^n$
$= \text{Rs. } 60000 \times \left(1 - \frac{10}{100}\right)^3$
$= \text{Rs. } 60000 \times \left(\frac{90}{100}\right)^3$
$= \text{Rs. } 60000 \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right)$
$= \text{Rs. } (60 \times 9 \times 9 \times 9)$
$= \text{Rs. } 43740$

Q10.

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Answer :

(b) Rs. 62500

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

$= P \times \left(1 - \frac{20}{100}\right)^2$

$= P \times \left(\frac{80}{100}\right)^2$

$= P \times \left(\frac{4}{5}\right) \times \left(\frac{4}{5}\right)$

$\Rightarrow 40000 = \frac{16P}{25}$

$\therefore P = \frac{40000 \times 25}{16} = \text{Rs } 62500$

Q11.

Answer :

(a) 25000

Let P be the popultion 3 years ago.
Now, present population $= 33275$

$\Rightarrow 33275 = P \times \left(1 + \frac{10}{100}\right)^3$

$\Rightarrow 33275 = P \times \left(\frac{110}{100}\right)^3$

$\Rightarrow 33275 = P \times \left(\frac{11}{10}\right) \times \left(\frac{11}{10}\right) \times \left(\frac{11}{10}\right)$

$\Rightarrow 33275 = \frac{1331P}{1000}$

$\therefore P = \frac{33275 \times 1000}{1331} = 25000$

Q12.

Answer :

(d) Rs 1261

Here, $\text{SI} = \frac{P \times 5 \times 3}{100}$

$\Rightarrow 1200 = \frac{P \times 5 \times 3}{100}$

$\Rightarrow P = \frac{1200 \times 100}{5 \times 3} = \text{Rs } 8000$

Amount at the end of 3 years $= \text{Rs } 8000 \times \left(1 + \frac{5}{100}\right)^3$

$= \text{Rs } 8000 \times \left(\frac{105}{100}\right)^3$

$= \text{Rs } 8000 \times \left(\frac{21}{20}\right) \times \left(\frac{21}{20}\right) \times \left(\frac{21}{20}\right)$

$= \text{Rs } (21 \times 21 \times 21)$

$= \text{Rs } 9261$

$\therefore \text{CI} = A - P = \text{Rs } \left(9261 - 8000\right) = \text{Rs } 1261$

Q13.

Answer :

(d) Rs 480

We have : $510 = \left\{P \times \left(1 + \frac{25}{100 \times 2}\right)^2\right\} - P$

$\Rightarrow 510 \Longrightarrow \left\{P \times \left(\frac{8+1}{8}\right)^2\right\} - P$

$\Rightarrow 510 = \left\{P \times \left(\frac{9}{8}\right) \times \left(\frac{9}{8}\right)\right\} - P$

$\Rightarrow 510 = \left(\frac{81\text{P}}{64} - \text{P}\right)$

$\Rightarrow 510 = \left(\frac{81\text{P} - 64\text{P}}{64}\right)$

$\Rightarrow 510 = \frac{17P}{64}$

$\therefore P = \frac{510 \times 64}{17} = \text{Rs } 1920$

Now, $\text{SI} = \frac{P \times R \times T}{100}$

$= \text{Rs } \frac{1920 \times 2 \times 25}{100 \times 2} = \text{Rs } 480$

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Q14.

Answer :

(d) Rs 4096

$$\text{We have Rs } 4913 = \left\{P \times \left(1+\frac{25}{100\times 4}\right)^3\right\}$$

$$\Rightarrow \text{Rs } 4913 = \left\{P \times \left(\frac{16+1}{16}\right)^3\right\}$$

$$\Rightarrow \text{Rs } 4913 = \left\{P \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right)\right\}$$

$$\Rightarrow \text{Rs } 4913 = \frac{4913P}{4096}$$

$$\Rightarrow P = \text{Rs } \frac{4913\times 4096}{4913} = \text{Rs } 4096$$

Q15.

Answer :

(c) 6%

$$\text{Here, } A = P \times \left(1+\frac{R}{100}\right)$$

$$= \text{Rs. } 7500 \times \left(1+\frac{R}{100}\right)^2$$

$$= \text{Rs. } 7500 \times \left(1+\frac{R}{100}\right)^2$$

$$\text{However, amount} = \text{Rs. } 8427$$

$$\text{Now, Rs. } 8427 == \text{ Rs. } 7500 \times \left(1+\frac{R}{100}\right)^2$$

$$\Rightarrow \frac{\text{Rs. } 8427}{\text{Rs. } 7500} = \left(1+\frac{R}{100}\right)^2$$

$$\Rightarrow \left(\frac{53}{50}\right)^2 = \left(1+\frac{R}{100}\right)^2$$

$$\Rightarrow \left(1+\frac{R}{100}\right) = \left(\frac{53}{50}\right)$$

$$\Rightarrow \frac{R}{100} = \frac{53}{50} - 1$$

$$\Rightarrow \frac{R}{100} = \frac{53-50}{50} = \frac{3}{50}$$

$$\therefore R = \frac{300}{50} = 6\%$$

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