Chapter-4

Population Growth and Depreciation

H/w

Formulae:

i. Final Population $(P_t) = P\left(1+\frac{R}{100}\right)^T$

ii. Actual Population $(P_t) = P\left(1+\frac{R}{100}\right)^T$ − no. of death − Mout + Min

iii. Increased population $= P_t - P$

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

iv. $P_t = P\left(1+\frac{R_1}{100}\right)\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_3}{100}\right)$

2a. The population of a village was 7200. If 5% of the population out-migrated and 2% died due to different causes within a year. What will be the population after a years

Solution

By question:

Population after 1 year $= 7200 - \left(\frac{5}{100}\times 7200\right) - \left(\frac{2}{100}\times 7200\right)$

$$= 7200 - 360 - 144$$

$$= 6696$$

∴ The population will be 6696.

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b. The population of a small village was 2,000. Within a year the population increased 3% by birthrate and 2% by immigration. Find the present population of the village?

Solution:

A.T.Q

Present Population $= 2000 + 2\%$ of $2000 + 3\%$ of 2000

$$= 2000 + \frac{2}{100}\times 2000 + \frac{3}{100}\times 2000$$

c. The population of a village increased from 10,000 to 11,000 in one year. Find the rate of growth of population.

Solution:

Total no. of increased population $= 11,000 - 10,000$

$= 1,000$

Now, Rate of growth $= \frac{1000}{10,000} \times 100\%$

$= 10\%$

$\therefore$ The rate of growth is 10% p.a.

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d. One year ago, the population of a village was 10,000. If the present population of the village is 10,210. Find the population growth rate.

Solution:

Present population $(P_t) = 10,210$

Population 1 year ago $(P) = 10,000$

Time $(T) = 1$ year

we know,

$$P_t = P\left(1 + \frac{R}{100}\right)^T$$

$$\text{or } 10210 = 10,000\left(\frac{100 + R}{100}\right)$$

$$\text{or } 1021000 = 1000000 + 10,000R$$

$$\text{or } \frac{1021000 - 1000000}{10,000} = R$$

$\therefore R = 2.1\%$ p.a.

Creative Section

3.a. The present population of a village is 30,000. If it is increased at the rate of 10% per annum, what will be the population after 2 years.

Solution:

Initial population (P) = 30,000

Rate (R) = 10% p.a

Time (t) = 2 yrs

Final Population (P_t) = ?

we know,

$$P_t = P\left(1+\frac{R}{100}\right)^T$$

$$= 30,000\left(1+\frac{10}{100}\right)^2$$

$$= 36300$$

b. According to the student enrollment statistics published in 2072 BS, the no. of admitted students in 2071 in a region was 3,20,000. If the annual rate of growth is 5%, how many student will be admitted in 2074 BS?

Solution:

Initial Population (P) = 3,20,000

Time (T) = 3yrs

Rate = 5%

we know,

$$\text{Final population } (P_t) = P\left(1+\frac{R}{100}\right)^T$$

$$= 320000\left(1+\frac{5}{100}\right)^3$$

$$= 320000 \times 1.1576$$

$$= 370440$$

∴ 370440 students will be admitted on 2074 BS.

c. 3 years ago, the population of a village was 16,000. The rate of growth of that village is 5%. What is the population at present

Solution:

Initial population (P) = 16,000

Time (T) = 3 yrs

Rate (R) = 5%

We know,

$$\text{final population } (P_t) = P\left(1+\frac{R}{100}\right)^T$$

$$= 16000\left(1+\frac{5}{\cancel{100}_{20}}\right)^3$$

$$= 16000 \times 1.5208$$

$$= \cancel{24334}\ 18522$$

∴ The present population is 18522.

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d. After two years the population of a town will be 33,620 at the population growth rate of 2.5% P.a. find the present population of the town.

Solution:

final population (P_t) = 33620

Rate = 2.5%

Time (T) = 2 years

Initial population (P) = ?

we know

$$P_t = P\left(1+\frac{R}{100}\right)^T$$

or, $33620 = P\left(1+\frac{2.5}{100}\right)^2$

or, $\frac{33620}{1.050625} = P$

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e. A village has population 1,75,760. If its population growth rate is 4% p.a. find its population ~~after 3 years~~ before 3 yrs?

Solution:

~~Initial~~ final population (P_t) = 175760

Time (T) = 3 yrs

Rate (R) = 4% p.a.

we know,

Final population (P_t) = $P\left(1+\frac{R}{100}\right)^T$

or, $175760 = \cancel{175760}\left(1+\frac{4}{100}\right)^3$

or, $175760 = \cancel{175760} \times 1.124864P$

or, $P = \frac{175760}{1.124864}$

$\therefore P = 156250$

$\therefore$ The population ~~after~~ before 3 yrs is 156250

4.a. In how many years will the population of a town be 2,09475 from 1,90,000 at the growth rate of 5% per annum.

Solution:

Initial population (P) = 1,90,000

Final Population (P_t) = 2,09475

Rate (R) = 5%

Time (T) = ?

we know,

$$P_t = P\left(1+\frac{R}{100}\right)^T$$

or, $209475 = 1,90,000\left(1+\frac{5}{100}\right)^T$

or, $\frac{209475}{190000} = \left(\frac{105}{100}\right)^T$

or $\frac{441}{400} = \left(\frac{21}{20}\right)^T$

or $\left(\frac{21}{20}\right)^2 = \left(\frac{21}{20}\right)^T$

$\therefore T = 2$ years

$\therefore$ The population of town will be 2,09,475 in 2 years.

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b. The population of a town is 96,250. In how many yrs would it be 1,04,104 if the population increases by the rate of 4% every year.

Solution:

Initial population (P) = 96,250

final population (Pt) = 1,04,104

Time (T) = ?

Rate (R) = 4%

We know,

$$P_t = P\left(1 + \frac{R}{100}\right)^T$$

or $1,04,104 = 96,250\left(1 + \frac{4}{100}\right)^T$

or $\frac{1,04,104}{96,250} = \left(\frac{104}{100}\right)^T$

or $\frac{676}{625} = \left(\frac{26}{25}\right)^T$

or $\left(\frac{26}{25}\right)^2 = \left(\frac{26}{25}\right)^T$

$\therefore T = 2$ years.

$\therefore$ The population of the town will be 1,04,104 in 2 years.

c. At present the population of a town is 80,000. At what growth rate of population would be 88,200 in two years?

Solution:

Here:
Initial population $(P) = 80,000$

Final Population $(P_t) = 88,200$

Time $(T) = 2$ yrs.

we know

$$P_t = P\left(1 + \frac{R}{100}\right)^T$$

$$\text{or, } 88,200 = 80,000\left(1 + \frac{R}{100}\right)^2$$

$$\text{or, } \frac{88200}{80,000} = \left(1 + \frac{R}{100}\right)^2$$

$$\text{or, } \frac{441}{400} = \left(1 + \frac{R}{100}\right)^2$$

$$\text{or, } \left(\frac{21}{20}\right)^2 = \left(1 + \frac{R}{100}\right)^2$$

$$\text{or, } \frac{21}{20} = \frac{100 + R}{100}$$

$$\text{or, } 2100 = 2000 + 20R$$

$$\text{or, } R = \frac{2100 - 2000}{20}$$

$$\therefore R = 5\% \text{ p.a.}$$

$\therefore$ The growth rate is 5% p.a.

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d. The population of a municipality in the beginning of 2071 B.S was 2,80,000 and at the end of 2073 BS was 2,39,580. Find the rate of growth per year.

Solution:

Initial population $(P) = 2,80,000$

Final population $(P_t) = 2,39,580$

Time (T) = 3 years

We know,

$$P_t = P\left(1+\frac{R}{100}\right)^T$$

or, $239580 = 180,000\left(1+\frac{R}{100}\right)^3$

or, $\frac{239580}{180,000} = \left(1+\frac{R}{100}\right)^3$

or, $\frac{1331}{1000} = \left(1+\frac{R}{100}\right)^3$

or, $\left(\frac{11}{10}\right)^3 = \left(1+\frac{R}{100}\right)^3$

or, $\frac{11}{10} = \frac{100+R}{100}$

or, $1100 = 1000+10R$

or, $\frac{1100-1000}{10} = R$

$\therefore R = 10\%$ p.a

$\therefore$ The rate of growth is 10% per annum.

5.a. The population of a town before 3 years was 3,75,000 and the annual growth rate is 2%. If the number of in-migrant and out migrants at the end of 3 years were 1,480 and 875 respectively and 2750 people died within the times, find the present population of the town.

Solution:

Population before 3 years (P) = 375000

Growth Rate (R) = 2%

In-migrants (M_{in}) = 1480

Out-migrants (M_{out}) = 875

No. of death (d) = 2750

we know,

$$\text{Present population } (P_t) = P\left(1+\frac{R}{100}\right)^T + M_{in} - M_{out} - \text{no. of death}$$

$$= 375000\left[1+\frac{2}{100}\right]^3 + 1480 - 275875 - 2750$$

$$= 375000\,(1.02)^3 - 2145$$

$$= 375000 \times 1.0612 - 2145$$

$$= 397953 - 2145$$

$$= 395808$$

∴ The present population is 395808.

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b. The population of a village increases every year by 5%. At the end of two years, if 460 people were migrated to other village and the population of the village remained 26,000. What was the population of the village in the beginning.

Solution:

Time (T) = 2 years

Growth Rate (R) = 5%

Out migrants (M_o) = 460

Final population (P_t) = 26,000

We know,

$$P_t = P\left(1+\frac{R}{100}\right)^T - M_o$$

$$\text{or, } 26{,}000 = P\left(1+\frac{5}{100}\right)^2 - 460$$

$$\text{or, } 26000 + 460 = 1.1025P$$

$$\text{or, } P = \frac{26460}{1.1025}$$

$$\therefore P = 24000$$

∴ The population of a village in the beginning was 24000.

c. The population of a town increases every year by 10%. At the end of two years, if 5800 people were added by migration and the total population of the town became 30,000, what was the population of the town in the beginning?

Solution:

Growth Rate (R) = 20%

Time (T) = 2 years

Initial population (P) = ?

We know,

$$P_t = P\left(1 + \frac{R}{100}\right)^T + M_i$$

$$\text{or, } 30000 = P\left(1 + \frac{10}{100}\right)^2 + 5800$$

$$\text{or } 30000 - 5800 = 1.21P$$

$$\text{or } P = \frac{24200}{1.21}$$

$$\therefore P = 20,000$$

d. The population of a village increases every year by 2%. If 950 people migrated to other place at the end of 2 years and the population of the village remained 9,454. What was the population of the village in the beginning?

Solution:

Rate = 2%

Out migrants (M_o) = 950

Final population (P_t) = 9,454

We know,

$$\cancel{\text{for}}\ P_t = P\left(1 + \frac{R}{100}\right)^T - M_o$$

$$\text{or } 9454 = P\left(1 + \frac{2}{100}\right)^2 - \cancel{M_o}\ 950$$

or $9454 + 950 = 1.0404 P$

or, $P = \frac{10404}{1.0404}$

$\therefore P = 10,000$

So, the population was 10,000 in the beginning.

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e. In the beginning of 2071 B.S, The population of a town was 10,00,00 and the rate of growth of population is 2% every year. If 8,000 people migrated there from different places in the beginning of 2072 BS. What will be the population of the town in the beginning of 2074 B.S?

Solution:

Population of 2071 (P) = 10,00,00

Growth rate = 2%

Population at the end of ~~2072~~ 2071 $= P\left(1 + \frac{R}{100}\right)^T + M_{in}$

$= 100000\left(1 + \frac{2}{100}\right)^1 + 8000$

$= 102000 + 8000$

$= 11,0000$

Also,

Rate (R) = 2%

Time (T) = 2yrs

Initial population (P) = 11,0000

So, $P_t = P\left(1 + \frac{R}{100}\right)^T$

$= 11,0000\left(1 + \frac{R}{100}\right)^2$

$= 1.0404 \times 11,0000$

$= 114444$

$\therefore$ The population of the town will be 11,444 in the begining of 2002

f. In the beginning of the year 2014, the population of a village was 25,000 and the rate of growth of population is 10% every year. In the beginning of 2015, if 500 people migrated to other places, what will be the population of 2015, the town in the beginning of 2018?

Solution:

Initial population of 2014 $(P) = 25,000$

Rate $(R) = 10\%$

Population at the end of 2014 $(P_t) = P\left(1+\frac{R}{100}\right)^T - M_{out}$

$= 25000\left(1+\frac{10}{100}\right)^1 - 500$

$= 27500 - 500$

$= 27000$

Again,

Time $(T) = 3$ years

Initial population $(P_t) = 27000$

we know,

$P_t = P\left(1+\frac{R}{100}\right)^T$

$= 27000\left(1+\frac{10}{100}\right)^3$

$= 27000 \times (1.1)^3$

$= 27000 \times 1.331$

$= 35937$

$\therefore$ The population of the town in the beginning of 2018 is 35937.

6.a. The population of a town before 3 years was 1,75,000. If the annual growth rates of the population in the last 3 years were 2%, 4% and 5% respectively every year, find the population of the town at the end of 3 years.

Solution:

Population before 3 years (P) = 175000

Rate $(R_1) = 2\%$ $R_2 = 4\%$, $R_3 = 5\%$

Now, population at the end of 3 years;

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

$$= 175000\left(1+\frac{2}{100}\right)\left(1+\frac{4}{100}\right)\left(1+\frac{5}{100}\right)$$

$$= 175000 \times \frac{51}{50} \times \frac{26}{25} \times \frac{21}{20}$$

$$= 194922$$

∴ The population of the town at the end of 3 years is 194922.

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b. The population of a village decreased by 5% in 2072 B.S and by 10% in 2073 B.S. What would be the population of the ~~town~~ ~~the~~ the Population in the town in the beginning of 2074 if its Population in the beginning of 2072 B.S was 32,000?

Solution:

Initial population for 2072 (P) = 32000

Decreasing rate for 2072 $(R_1) = 5\%$

Decreasing rate for 2073 $(R_2) = 10\%$

We know

$$P_t = P\left(1-\frac{R_1}{100}\right)\left(1-\frac{R_2}{100}\right)$$

$$= 32000\left(1-\frac{5}{100}\right)\left(1-\frac{10}{100}\right)$$

$= 32000 \times \frac{95}{100} \times \frac{90}{100}$

$= 32 \times 95 \times 9$

$= 27360$

$\therefore$ The population of the town in the beginning of 2074 is 27360.

7.a. The population of a town in the beginning of 2016 was 1,68,000. If the annual rate of growth of population is 2.5%, find the increased population at the end of 2017.

Solution:

Initial Population (P) = 1,68,000

Rate (R) = 2.5%

Time (T) = 2 years

Increased Population $= P\left[\left(1 + \frac{R}{100}\right)^T - 1\right]$

$= 168000\left[\left(1 + \frac{2.5}{100}\right)^2 - 1\right]$

$= 168000\left[\frac{1661}{1600} - 1\right]$

$= 168000 \times 0.050625$

$= 8505$

$\therefore$ The increased population is 8505.

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b. The present population of a state is 9765625. If the rate of growth of population is 4% p.a, find the increased population after 2 years.

Solution:

Initial Population (P) = 9765625

Growth Rate (R) = 4%

Time (T) = 2 years

we know;

Increased Population (P_t) $= P\left[\left(1+\frac{R}{100}\right)^T - 1\right]$

$= 9765625\left[\left(1+\frac{4}{100}\right)^2 - 1\right]$

$= 9765625 \times 0.0816$

$= \cancel{796878}\ 796875$

$\therefore$ The increased population after 2 years is 796875.

8.a. The rate of growth of a plant is 5% every month. If the height of the plant in the begining of Baisakh 2074 is 20cm, find its height at the end of Asar 2074

Solution:

Initial height (P) = 20cm

Rate of growth (R) = 5% every month

Time (T) = 3 months

final height (P_t) $= P\left(1+\frac{R}{100}\right)^T$

$= 20\left(1+\frac{5}{100}\right)^3$

$= 20 \times 1.157$

$= 23.15$

$\therefore$ The height of plant at the end of Asar 2074 is 23.15

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b. The growth rate of a certain type of useful bacteria is 10% per day. During a research work in laboratory, if the bacteria are grown up to the number of 2.662×10^{12} in 3 days, how many bacteria were there before 3 days?

Solution:

Growth Rate (R) = 10%

Time (T) = 3 days

final number $(P_t) = 2.662 \times 10^{12}$

we know

$$P_t = P\left(1 + \frac{R}{100}\right)^T$$

or, $2.662 \times 10^{12} = P \times \left(1 + \frac{10}{100}\right)^3$

or, $2.662 \times 10^{12} = 1.331P$

or, $P = \frac{2.662 \times 10^{12}}{1.331}$

$\therefore P = 2 \times 10^{12}$

$\therefore$ The no. of bacteria before 3 days is 2×10^{12}.

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c. A house owner made an agreement to increase the house rent by 10% every year. If the rent of the house this year is 16,000 find the ~~rat~~ rent after 3 years?

Solution:

Rate of growth $(R) = 10\%$

Time $(T) = 3$ years

Initial Price $(P) = 16,000$

final Price $(P_t) = ?$

We know,

$$P_t = P\left(1 + \frac{R}{100}\right)^T$$

$$= 16000\left(1 + \frac{10}{100}\right)^3$$

$$= 16000 \times 1.331$$

$$= 21296$$

$\therefore$ The rent of the house after 3 years is 21296.

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d. Due to the annual increment of price of land in a rapidly growing arena by 25%, the present value of the land is Rs 12,50,000

Per ropani. How much was the value of the land before 4 years

Solution:

Time (T) = 4 years

Initial Price (P) = ~~Rs. 12,50,000~~ ?

Rate (R) = 25%

We know,

$$P_t = P\left(1+\frac{R}{100}\right)^T$$

$$12,50,000 = \cancel{12,50,000}\ P\left(1+\frac{25}{100}\right)^4$$

$$\text{or, } 12,50,000 = P(1.25)^4$$

$$\text{or, } P = \frac{1250,000}{(1.25)^4}$$

$$\therefore P = 512000$$

$\therefore$ The value of the land before 4 years is 512000.

Depreciation

Formulae:

i. ~~Initial Price (P) =~~

i. Final Price $(P_t) = P\left[1-\frac{R}{100}\right]^T$

ii. Depreciated value $(P_t) = P - P_t$

$$= P - P\left(1-\frac{R}{100}\right)^T$$

$$= P\left[1-\left(1-\frac{R}{100}\right)^T\right]$$

iii. For different rates:

$$P_t = P\left(1-\frac{R_1}{100}\right)\left(1-\frac{R_2}{100}\right)\left(1-\frac{R_3}{100}\right)$$

Exercise - 4.2

2.a. The value of a machine is Rs 2,60,000. If its value is depreciated by 5% every year, find its value after 1 year.

solnution:

Initial Price (P) = Rs 2,60,000

Rate of depreciation (R) = 5% p.a

Time (T) = 1 year

we know,

$$\text{final price } (P_t) = P\left(1 - \frac{R}{100}\right)^T$$

$$= 2,60,000\left(1 - \frac{5}{100}\right)^1$$

$$= 2,60,000 \times 0.95$$

$$= 247000$$

∴ The value of machine after 1 year is Rs 247,000.

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b. After the depreciation at the rate of 10% p.a. The value of a vehicle become Rs 5,80,500 after 1 year. find the original value of the vehicle.

Solution:

final value (P_t) = Rs 5,80,500

Time (T) = 1 year

Depreciation rate (R) = 10% p.a

Initial Price (P) = ?

we know

$$P_t = P\left(1 - \frac{R}{100}\right)^T$$

$$\text{or, } 580,500 = P\left(1 - \frac{10}{100}\right)^1$$

$$\text{or, } 5,80,500 = 0.9P$$

$$\therefore P = 645000$$

∴ The original price is Rs 6,45,000

c. At what rate of depreciation is the price of an article reduced by to Rs 42,500 from Rs 50,000 in 1 year.

Solution:

Initial Price (P) = Rs 50,000

final Price (P_t) = Rs 42,500

Time (T) = 1 year

Rate of depreciation (R) = ?

We know,

$$P_t = P\left(1 - \frac{R}{100}\right)^T$$

$$\text{or, } 42,500 = 50,000\left(1 - \frac{R}{100}\right)^1$$

$$\text{or, } \frac{42500}{50,000} = \frac{100 - R}{100}$$

$$\text{or, } R = 100 - 85$$

$$\therefore R = 15\%$$

∴ The depreciation rate is 15% p.a.

Creative section

3.a. If the value of a computer which was bought for Rs 40,000 depreciates at 10% annually, find its value after 2 years.

Solution:

Initial value (P) = Rs 40,000

Time (T) = 2 years

Depreciation rate (R) = 10%

final value (P_t) = ?

We know,

$$P_t = P\left(1 - \frac{R}{100}\right)^T$$

$$= 40,000\left(1 - \frac{10}{100}\right)^2$$

$= 40,000 \times 0.81$

$= Rs\ 32,400$

$\therefore$ The value of computer after 2 years is Rs 32,400

b. A cupboard costing Rs 16,800 is depreciated at the rate of 15% per year. What will be its cost after 2 years?

Solution:

Initial value (P) = Rs 16,800

Rate of depreciation (R) = 15% p.a

Time (T) = 2 years

Final value (P_t) = ?

we know,

$$P_t = P\left(1 - \frac{R}{100}\right)^T$$

$$= 16,800\left(1 - \frac{15}{100}\right)^2$$

$$= 16,800 \times 0.7225$$

$$= Rs\ 12138$$

$\therefore$ The final value after 2 years is Rs 12138.

c. The value of an article is depreciated every year by 10%. What will be the value of the article worth Rs 45,000 after 3 years?

Solution

Initial value (P) = Rs 45,000

Time (T) = 3 years

Rate (R) = 10%

Final value (P_t) = ?

we know, $P_t = P\left(1 - \frac{R}{100}\right)^T$

$$= 45000\left(1 - \frac{10}{100}\right)^3$$

$= 45,000 \times 0.729$

$= Rs\ 32805$

$\therefore$ The value of article will be Rs 32805 after 3 years.

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d. Mr. Tamang bought a tripper for Rs 32,00,000. He earned a profit of Rs 7,80,000 in 2 years and sold it at 10% p.a compound depreciation. Find his profit or loss.

Solution:

Initial Price (P) = Rs 32,00,000

Time (T) = 2 years

Depreciation rate (R) = 10%

$$\text{Final Price } (P_T) = P\left(1 - \frac{R}{100}\right)^T$$

$$= 32,00,000\left(1 - \frac{10}{100}\right)^2$$

$$= 32,00,000 \times 0.81$$

$$= Rs\ 2592000$$

Total Price with Profit = 2592000 + 780,000

$= Rs\ 3372000$

Now,

Profit = 3372000 − 32,00,000

$= Rs\ 172,000$

$\therefore$ The profit amount is Rs 172,000

4.a. If the cost is depreciated at the rate of 12% p.a, the cost of the motorcycle becomes Rs 92,928 after 2 years. Find the original price of the computer.

Solution:

Final Price (P_T) = Rs 92,928

Time (T) = 2 years

Rate (R) = 12% p.a.

Initial price (P) = ?

we know $P_t = P\left(1 - \frac{R}{100}\right)^T$

or $92,928 = P\left(1 - \frac{12}{100}\right)^2$

or $92928 = \cancel{0.9604P}\ 0.7744P$

$\therefore P = $ Rs 120000

$\therefore$ The original price is Rs 12,0000.

b. If the cost is depreciated at the rate of 10% per annum, the cost of a motorcycle after 3 years become Rs ~~95~~ 92583. Calculate the original price of the motorcycle.

Solution:

Final value (P_t) = Rs ~~95~~ 92,583

Time (T) = 3 years

Rate of depreciation (R) = 10% p.a

Initial Price (P) = ?

We know, $P_t = P\left(1 - \frac{R}{100}\right)^T$

or, $92,583 = P\left(1 - \frac{10}{100}\right)^3$

or, $92,583 = 0.729P$

$\therefore P = $ Rs 1,27,000

$\therefore$ The original price of motorcycle is Rs 1,27,000

c. A woman sold a type-writer for Rs 13,718 in the system of compound depreciation at the rate of 5% p.a. If she had purchased it 3 years before, how much did she pay for it by that time?

Solution:

Final Price (P) = Rs 13,718

Time (T) = 3 years
Rate of depreciation (R) = 5% p.a
Initial price (P) = ?
we know,

$$P_t = P\left(1-\frac{R}{100}\right)^T$$

or $13718 = P\left(1-\frac{5}{100}\right)^3$

or, $P = \frac{13718}{0.857375}$

$\therefore P =$ Rs 16,000

$\therefore$ she pay Rs 16,000 for purchasing the type-writer.

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d. The compound depreciation of shares of business company for 2 years is at the rate of 2.5% p.a. If the present value of certain number of shares is Rs 45,630. how many shares at Rs 200 per shares were sold before 2 years?

Solution:

Final value (P_t) = Rs 45,630
Time (T) = 2 years
Rate of depreciation (R) = 2.5% p.a
Initial value (P) = ?
we know,

$$P_t = P\left(1-\frac{R}{100}\right)^T$$

or, $45,630 = P\left(1-\frac{2.5}{100}\right)^2$

or, $P = \frac{45630}{0.950625}$

$\therefore P =$ Rs 48,000

Now, Total no. of shares = (48000/200) = 240

5a. The original value of the computer is Rs 96,000. If it is depreciated by 15% every year with the compound depreciated, by how much is its value depreciated in 3 years?

Solution:

Initial Price (P) = Rs 96000

Depreciation Rate (R) = 15% p.a

Time (T) = 3 years

we know,

$$\text{final Price } (P_t) = P\left(1-\frac{R}{100}\right)^T$$

$$= 96000\left(1-\frac{15}{100}\right)^3$$

$$= 96000 \times 0.614125$$

$$= \text{Rs } 58956$$

Now, Depreciated value = 96000 − 58956

= Rs 37044

∴ The depreciated value is Rs 37044.

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b. Mrs. Yadav bought a vehicle for Rs 12,50,000. She used it for 3 years and sold at the rate of compound depreciation of 12% p.a. By how much was the value of vehicle depreciated.

Solution:

Initial Price (P) = Rs 12,50,000

Time (T) = 3 years

Rate of depreciation (R) = 12%

final Rate (P_t) = ?

Depreciation amount = ?

We know,

$$P_t = P\left(1-\frac{R}{100}\right)^T$$

$$= 12,50,000\left(1-\frac{12}{100}\right)^3$$

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$= 12,50,000 \times 0.681472$

$=$ Rs 851840

Also,

Depreciated amount $= 12,50,000 - 8,51,840$

$=$ Rs 398160

$\therefore$ The depreciated amount is Rs 3,98,160.

6.a. The original price of a motorcycle is 1,80,000. If the rate of depreciation is 10% per annum, after how many years will its price become Rs 1,31,220?

Solution:

Initial Price (P) = Rs 1,80,000

Final Price (P_t) = Rs 1,31,220

Rate of depreciation (R) = 10% p.a

Time (T) = ?

we know

$$P_t = P\left(1 - \frac{R}{100}\right)^T$$

$$\text{or, } 1,31,220 = 1,80,000\left(1 - \frac{10}{100}\right)^T$$

$$\text{or } \frac{1,31,220}{1,80,000} = \left(\frac{90}{100}\right)^T$$

$$\text{or, } \frac{729}{1000} = \left(\frac{90}{100}\right)^T$$

$$\text{or } \left(\frac{9}{10}\right)^3 = \left(\frac{9\cancel{0}}{10\cancel{0}}\right)^T$$

$\therefore$ T = 3 years

$\therefore$ The time is 3 years.

b. A factory was bought for Rs, 40,00,00 some years ago and now its value is Rs 1,96,000. If the value of depreciation is 30% p.a compound depreciation when was the factory bought?

Solution.

Initial Price (P) = Rs, 400,000

Final Price (P_t) = Rs 1,96,000

Rate of depreciation (R) = 30% p.a

Time (T) = ?

we know,

$$P_t = P\left(1-\frac{R}{100}\right)^T$$

$$\text{or, } 1,96,000 = 4,00,000\left(1-\frac{30}{100}\right)^T$$

$$\text{or } \frac{196000}{4,00,000} = \left(\frac{70}{100}\right)^T$$

$$\text{or, } \frac{49}{100} = \left(\frac{7}{10}\right)^T$$

$$\text{or } \left(\frac{7}{10}\right)^2 = \left(\frac{7}{10}\right)^T$$

$\therefore T = 2$ years

$\therefore$ The factory was bought 2 years ago.

---

c. A few years ago a man bought a computer for Rs. 1,25,000. In the recent years, he sold it for Rs 64,000 at 20% annual rate of depreciation. How long did he used the computer?

Solution.

Initial Price (P) = Rs. 1,25,000

Final Price (P_t) = Rs 64,000

Rate of depreciation (R) = 20% p.a

Time (T) = ?

We know,

$$P_t = P\left(1 - \frac{R}{100}\right)^T$$

or, $64,000 = 1,25,000\left(1 - \frac{20}{100}\right)^T$

or, $\frac{64,000}{1,25,000} = \left(\frac{80}{100}\right)^T$

or, $\frac{64}{125} = \left(\frac{8}{10}\right)^T$

or, $\left(\frac{4}{5}\right)^3 = \left(\frac{4}{5}\right)^T$

$\therefore T = 3$ years

$\therefore$ He used the computer for 3 years.

---

d. Mrs. Jha had purchased a scooter for Rs 1,20,000. In the recent year, she sold it for Rs 86,700 at 15% annual rate of compound depreciation. How long did she used the scooter.

Solution:

Initial Price (P) = Rs. 120,000

Final Price (P_t) = Rs 86,700

Depreciation Rate (R) = 15%

Time (T) = ?

We know,

$$P_t = P\left(1 - \frac{R}{100}\right)^T$$

or, $86,700 = 120,000\left(1 - \frac{15}{100}\right)^T$

or, $\frac{86,700}{120,000} = \left(\frac{85}{100}\right)^T$

or, $\left(\frac{17}{20}\right)^2 = \left(\frac{17}{20}\right)^T$

$\therefore T = 2$ years.

7.a. A radio costing Rs 60,000 is depreciated per year and after 2 years its price become Rs 5415. find the rate of depreciation.

Solution:

Initial Price (P) = Rs 60,00

final Price (P_T) = Rs 5415

Time (T) = 2 years

Depreciation rate (R) = ?

We know,

$$P_T = P\left(1 - \frac{R}{100}\right)^T$$

$$\text{or, } 5415 = 6,000\left(1 - \frac{R}{100}\right)^2$$

$$\text{or, } \frac{5415}{6,000} = \left(1 - \frac{R}{100}\right)^2$$

$$\text{or, } \left(\frac{19}{20}\right)^2 = \left(1 - \frac{R}{100}\right)^2$$

$$\text{or, } \frac{19}{20} = \frac{100 - \cancel{100R}\,R}{100}$$

$$\text{or, } 1900 = 2000 - 20R$$

$$\text{or, } R = \frac{2000 - 1900}{20}$$

$$\therefore R = 5\%$$

∴ The rate of depreciation is 5%.

b. If the value of an article depreciated from Rs 18,000 to Rs 14,580 in 2 years, find the rate of depreciation.

Solution:

Initial Price (P) = Rs 18,000

final Price (P_T) = 14,580

Time (T) = 2 years

Rate of depreciation (R) = ?

we know

$$P_t = P\left(1 - \frac{R}{100}\right)^T$$

$$\text{or, } 14580 = 18,000\left(1 - \frac{R}{100}\right)^2$$

$$\text{or, } \frac{14580}{18,000} = \left(\frac{100-R}{100}\right)^2$$

$$\text{or, } \left(\frac{9}{10}\right)^2 = \left(\frac{100-R}{100}\right)^2$$

$$\text{or, } \frac{9}{10} = \frac{100-R}{100}$$

$$\text{or, } 900 = 1000 - \cancel{100R}\ 10R$$

$$\text{or, } R = \frac{1000-900}{10}$$

$$\therefore R = 10\%$$

∴ The rate of depreciation is 10% per annum.

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c The women bought a motorcycle for Rs 16,0000 and after using it for 3 years, she sold it for Rs 1,16,640. Find the rate of compound depreciated of the motorcycle.

Soln:

Initial Price (P) = Rs 16,0000

Final Price (P_t) = Rs 1,16,640

Time (T) = 3 years

Rate of depreciation (R) = ?

we know,

$$P_t = P\left(1 - \frac{R}{100}\right)^T$$

$$\text{or, } 1,16,640 = 16,0000\left(1 - \frac{R}{100}\right)^3$$

or, $\frac{116,640}{1,60,000} = \left(1-\frac{R}{100}\right)^3$

or, $\left(\frac{9}{10}\right)^3 = \left(\frac{100-R}{100}\right)^3$

or, $\frac{9}{10} = \frac{100-R}{100}$

or $900 = 1000 - 10R$

or $R = \frac{1000-900}{10}$

$\therefore R = 10\%$

$\therefore$ The rate of depreciation is 10% per year

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d. The value of a motorcycle is depreciated from Rs, 250,000 ~~from~~ to Rs 1,70,368 in 3 years. find the rate of depreciation.

Solution:

Initial Price (P) = Rs 2,50,000

final Price (P_t) = Rs 1,70,368

Time (T) = 3 years

Rate of depreciation (R) = ?

we know,

$$P_t = P\left(1-\frac{R}{100}\right)^3$$

or, $170,368 = 2,50,000\left(\frac{100-R}{100}\right)^3$

or $\frac{170,368}{250,000} = \left(\frac{100-R}{100}\right)^3$

or $\left(\frac{22}{25}\right)^3 = \left(\frac{100-R}{100}\right)^3$

or, $22 \times 100 = 25(100-R)$

$\therefore R = 12\%$ p.a.

8.a. A man bought a computer 3 years before for Rs 75,000. If the value of the computer is depreciated by 2%, 4% and 5% in the first, second and in the third year respectively, at what price did he sell the computer ~~and to~~ at the end of 3 years.

Solution:

Initial price (P) = Rs 75,000

Depreciation rate (R) = 2%, 4% and 5%

Time (T) = 3 years

Final Price (P_t) = ?

We know,

$$P_t = P\left(1-\frac{R_1}{100}\right)\left(1-\frac{R_2}{100}\right)\left(1-\frac{R_3}{100}\right)$$

$$= 75000\left(1-\frac{2}{100}\right)\left(1-\frac{4}{100}\right)\left(1-\frac{5}{100}\right)$$

$$= 75000 \times 0.98 \times 0.96 \times 0.95$$

$$= \text{RS } 67032$$

∴ The man sold the computer at Rs 67,032 at the end of 3 years

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b. The present value of a printing machine is Rs 2,40,000. If its value is depreciated by 5% in the first year, 10% in the second year and 15% in the third year, find its value after 3 years

Solution:

Initial Price (P) = Rs, 2,40,000

Time (T) = 3 years

R_1 = 5%, R_2 = 10%, R_3 = 15%

Final Price (P) = ?

We know,

$$P_t = P\left(1-\frac{R_1}{100}\right)\left(1-\frac{R_2}{100}\right)\left(1-\frac{R_3}{100}\right)$$

$$= 2,40,000 \times \left(1-\frac{5}{100}\right) \times \left(1-\frac{10}{100}\right)\left(1-\frac{15}{100}\right)$$