Exercise 14.4

Q.1 The present population of a town is 28000. If it increases at the rate of 5% p.a. what will be its population after 2 years.

Sol: Given. Present population (P) = 28000

Rate of increase = 5% p.a.

$n = 2$ yrs.

$\therefore$ Population after 2 yrs $= P\left(1+\frac{R}{100}\right)^n$

$= 28000\left(1+\frac{5}{100}\right)^2$

$= 28000\left(1+\frac{1}{20}\right)^2$

$\Rightarrow 28000\left(\frac{21}{20}\right)^2$

$= 28000 \times \frac{441}{400}$

$= 30870$

$\therefore$ Population after 2 years = 30870

Q.2 The population of a city is 125000. If the annual birth rate and death rate are 5.5% and 3.5% respectively. Calculation the population of city after 2 years?

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Sol Population of city (P) = 125000

birth rate = 5.5%

death rate = 3.5%

∴ Annual increase rate = (5.5 − 3.5) = 2%.

∴ No. of years = 3

∴ Population after 3 yrs = $P\left(1+\frac{R}{100}\right)^n$

$= 125000\left(1+\frac{2}{100}\right)^3$

$= 125000\left(\frac{51}{50}\right)^3$

$= 125000 \times \frac{132651}{125000}$

$= 132651$

Q3 The present population of a town is 25000. It grows at 4%, 5% and 8% during first year, second year and third year respectively. Find its population after 3 yrs

Sol: Present population (P) = Rs 25000

growths of next three years

$R_1 = 4\%$

$R_2 = 5\%$

$R_3 = 8\%$

∴ Population after 3 yrs = $P\left(1+\frac{R_1}{100}\right)\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_3}{100}\right)$

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$$= 25000\left(1+\frac{4}{100}\right)\left(1+\frac{5}{100}\right)\left(1+\frac{8}{100}\right)$$

$$= 25000\left(\frac{104}{100}\right)\times\left(\frac{105}{100}\right)\times\left(\frac{108}{100}\right)$$

$$= 29484$$

Q.4 Three years ago, the population of a town was 50000. If the annual increase during three successive years be at 4%, 5%, 3% respectively. Find the present population.

Sol: let 3 yrs ago population (P) = 50000

Growth in next 3 years = 4%, 5%, 3%

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

$$= 50000\left(1+\frac{4}{100}\right)\left(1+\frac{5}{100}\right)\left(1+\frac{3}{100}\right)$$

$$= 50000\left(\frac{104}{100}\right)\left(\frac{105}{100}\right)\left(\frac{103}{100}\right)$$

$$= 56238$$

Q.5 There is a continuous growth in population of a village at the rate of 5% p.a. If its present population is 9261, what it was 3 years ago?

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Sol: Present population = 9261

growth = 5%

∴ let population before 3 years = x

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

$$\Rightarrow 9261 = x\left(1+\frac{5}{100}\right)^n$$

$$\Rightarrow 9261 = x\left(1+\frac{1}{20}\right)^3$$

$$\Rightarrow 9261 = x\left(\frac{21}{20}\right)^3$$

$$\Rightarrow x = \frac{9261 \times (20)^3}{(21)^3} = \frac{9261 \times 8000}{9261}$$

$$\Rightarrow x = 8000$$

Q.6 In a factory the production of scooters rose to 46305 from 40000 in 3 years. Find the annual rate of growth of the production of scooters.

Sol: Initial production (P) = 40000

Final production (A) = 46305

n = 3 years.

R = ?

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

$$\Rightarrow 46305 = 40000\left(1+\frac{R}{100}\right)^3$$

$$\Rightarrow \frac{46305}{40000} = \left(1+\frac{R}{100}\right)^3$$

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$$\Rightarrow \frac{9261}{8000} = \left(1+\frac{R}{100}\right)^3$$

$$\Rightarrow \left(\frac{21}{20}\right)^3 = \left(1+\frac{R}{100}\right)^3 \Rightarrow 1+\frac{R}{100} = \frac{21}{20}$$

$$\Rightarrow \frac{R}{100} = \frac{21}{20} - 1 = \frac{1}{20}$$

$$\Rightarrow R = \frac{100}{20}$$

$$= 5\%.$$

Q.7 The annual rate of growth in population of a certain city is 8%. If its present population is 196830. what was it 3 years ago.

Sol: Rate of annual growth = 8%.

Present population (A) = 196830

T = 3 yrs.

let population 3 yrs ago = x

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

$$\Rightarrow 196830 = x\left(1+\frac{8}{100}\right)^3$$

$$\Rightarrow 196830 = x \times \left(\frac{27}{25}\right)^3$$

$$\Rightarrow x = 196830 \times \left(\frac{25}{27}\right)^3$$

$$= 196830 \times \frac{15625}{19683} = 156250$$

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Q.8 The population of a town increases at the rate of 50 per thousand. Its population after 2 yrs will be 22050. Find its present population.

Sol: Growth rate $= \frac{50}{1000} \times 100 = 5\%$

population after 2 yrs $= 22050$

Let present population $= ₹ x$

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

$\Rightarrow 22050 = x\left(1+\frac{5}{100}\right)^2$

$\Rightarrow 22050 = x\left(\frac{21}{20}\right)^2$

$\Rightarrow 22050 = x \times \frac{441}{400} \Rightarrow x = \frac{22050 \times 400}{441}$

$= 20000$

$\therefore$ Present population $= 20000$

Q.9 The count of bacteria in a culture grows by 10% in first hour, decreases by 8% in second hour and again increases by 12% in the third hour. If the count of bacteria in the sample is 13125000. What was its population at the end of year 2000.

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Sol: Count of bacteria = 13125000.

Increase / Decrease rate = 10%, −8%, 12%

So, let count of bacteria after 3 hours = x

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

$$\Rightarrow 13125000 = x\left(1+\frac{10}{100}\right)\left(1-\frac{8}{100}\right)\left(1+\frac{12}{100}\right)$$

$$\Rightarrow 13125000 = x\left(\frac{11}{10}\right)\left(\frac{92}{100}\right)\left(\frac{112}{100}\right)$$

$$\Rightarrow x = \frac{13125000\times 10\times 100\times 100}{11\times 92\times 112}$$

$$= 14876400$$

9.10 The population of a certain city was 72000 on the last day of the year 1998. During next year it increased by 7% but due to an epidemic it decreased by 10% in the following year. What was its population at the end of year 2000.

Sol: Population of city on last day year of 1998 = 72000

Increase (1999) = 7%

Decreasing rate (2000) = 10%

∴ population at the end of year 2000

$$= 72000\left(1+\frac{7}{100}\right)\left(1-\frac{10}{100}\right)$$

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$$= 72000\left(\frac{107}{100}\right) \times \left(\frac{90}{100}\right)$$

$$= 69336$$

Q11 6400 workers were employed to construct a dike bridge in four years. At the end of the first year, 25% workers were retrenched. At the end of second year 25% of those working at that time were retrenched. However, to complete the project in time, the number of workers was increased by 25% at the end of third year How many workers were working during the fourth year?

Sol: Initial no. of workers = 6400

At the end of first year = 25% retrenched

Second year = 25% retrenched.

Third year = 25% increased

By using formula

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

$$= 6400\left(1 - \frac{25}{100}\right)\left(1 - \frac{25}{100}\right)\left(1 + \frac{25}{100}\right)$$

$$= 6400 \times \frac{75}{100} \times \frac{75}{100} \times \frac{125}{100}$$

$$= 6400 \times (0.75)(0.75)(1.25)$$

$$= 4500 \text{ workers.}$$

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Q.12 Aman started a factory with an initial investment of Rs 100000. In the first year, he incurred a loss of 5%. However during the second year he earned a profit of 10% which in the third year rose to 12%. Calculate his net profit for the entire period of three years.

Sol: Given, Initial investment by Aman = Rs 100000

In first year = Incurred a loss of 5%.

Second year = Profit of 10%.

Third year = Profit of 12%.

By using formula

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

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

$$= 100000\left(1-\frac{5}{100}\right)\left(1+\frac{10}{100}\right)\left(1+\frac{12}{100}\right)$$

$$= 100000\left(\frac{95}{100}\right)\times\left(\frac{110}{100}\right)\times\left(\frac{112}{100}\right)$$

$$= 117040$$

∴ Aman's net profit = 117040 − 100000

= Rs 17040

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Q.13 The population of a town increases at the rate of 40 per thousand annually. If the present population be 175760. What was the population three years ago.

Sol: Annual increase rate $= \frac{40}{1000} \times 100 = 4\%$.

Present population = 175760

Let population of town 3 years ago = x

By using formula

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

$$\Rightarrow 175760 = x\left(1 + \frac{4}{100}\right)^n$$

$$\Rightarrow 175760 = x\left(\frac{26}{25}\right)^3$$

$$\Rightarrow x = 175760 \times \frac{25}{26} \times \frac{25}{26} \times \frac{25}{26} = 156250$$

$\therefore$ population 3 years ago = 156250

Q.14 The population of mixi company in 1996 was 8000 mixies. Due to increase in demand it increases its production by 15% in the next two years and after two years its demand decreases by 5%. What will its production after 3 years?

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Sol:

Given population of mixie Company = 8000 mixies.

population growth in next 2 years = 15%.

Decrease in 3rd year = 5%.

Now $A = P\left(1+\frac{R_1}{100}\right)^2\left(1-\frac{R_2}{100}\right)$

$\Rightarrow A = 8000\left(1+\frac{15}{100}\right)\left(1+\frac{15}{100}\right)\left(1-\frac{5}{100}\right)$

$= 8000\left(\frac{115}{100}\right)\left(\frac{115}{100}\right)\left(\frac{95}{100}\right)$

$= 10051$

Q.15 The population of a city increases each year by 4% of what it had been at the beginning of each year. If the population in 1999 had been 6760000, find population of City (i) 2001 (ii) 1997

Sol: Annual increase = 4%.

population in 1999 = 6760000.

(i) Population of city in 2001 (2 years)

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

$= 6760000\left(1+\frac{4}{100}\right)^2$

$= 6760000\left(\frac{26}{25}\right)^2 = 7311616$

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