

## EXERCISE 14.4

**The present population of a town is 28000. If it increases at the rate of 5% per annum, what will be its population after 2 years?**

**Solution:**

Given details are,

Present population of town is = 28000

Rate of increase in population is = 5% per annum

Number of years = 2

By using the formula,

$$A = P (1 + R/100)^n$$

$$\begin{aligned} \text{Population of town after 2 years} &= 28000 (1 + 5/100)^2 \\ &= 28000 (1.05)^2 \\ &= 30870 \end{aligned}$$

∴ Population of town after 2 years will be 30870

**1. The population of a city is 125000. If the annual birth rate and death rate are 5.5% and 3.5% respectively, calculate the population of city after 3 years.**

**Solution:**

Given details are,

Population of city (P) = 125000

Annual birth rate  $R_1 = 5.5\%$

Annual death rate  $R_2 = 3.5\%$

Annual increasing rate  $R = (R_1 - R_2) = 5.5 - 3.5 = 2\%$

Number of years = 3

By using the formula,

$$A = P (1 + R/100)^n$$

$$\begin{aligned} \text{So, population after two years is} &= 125000 (1 + 2/100)^3 \\ &= 125000 (1.02)^3 \\ &= 132651 \end{aligned}$$

∴ Population after 3 years will be 132651

**2. 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 years.**

**Solution:**

Given details are,

Present population is = 25000

First year growth  $R_1 = 4\%$

Second year growth  $R_2 = 5\%$

Third year growth  $R_3 = 8\%$

Number of years = 3

By using the formula,

$$A = P (1 + R/100)^n$$

$$\begin{aligned}\text{So, population after three years} &= P (1 + R_1/100) (1 + R_2/100) (1 + R_3/100) \\ &= 25000(1 + 4/100) (1 + 5/100) (1 + 8/100) \\ &= 25000 (1.04) (1.05) (1.08) \\ &= 29484\end{aligned}$$

$\therefore$  Population after 3 years will be 29484

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

**Solution:**

Given details are,

Three years ago population of town was = 50000

Annual increasing in 3 years = 4%, 5%, 3% respectively

So, let present population be = x

By using the formula,

$$A = P (1 + R/100)^n$$

$$\begin{aligned}x &= 50000 (1 + 4/100) (1 + 5/100) (1 + 3/100) \\ &= 50000 (1.04) (1.05) (1.03) \\ &= 56238\end{aligned}$$

$\therefore$  Present population of the town is 56238

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

**Solution:**

Given details are,

Present population of town is = 9261

Continuous growth of population is = 5%

So, let population three years ago be = x

By using the formula,

$$A = P (1 + R/100)^n$$

$$\begin{aligned}9261 &= x (1 + 5/100) (1 + 5/100) (1 + 5/100) \\ 9261 &= x (1.05) (1.05) (1.05) \\ &= 8000\end{aligned}$$

$\therefore$  Present population of the town is 8000

**5. 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.**

**Solution:**

Given details are,

Initial production of scooters is = 40000

Final production of scooters is = 46305

Time = 3 years

Let annual growth rate be = R%

By using the formula,

$$A = P (1 + R/100)^n$$

$$46305 = 40000 (1 + R/100) (1 + R/100) (1 + R/100)$$

$$46305 = 40000 (1 + R/100)^3$$

$$(1 + R/100)^3 = 46305/40000$$

$$= 9261/8000$$

$$= (21/20)^3$$

$$1 + R/100 = 21/20$$

$$R/100 = 21/20 - 1$$

$$R/100 = (21-20)/20$$

$$= 1/20$$

$$R = 100/20$$

$$= 5$$

∴ Annual rate of growth of the production of scooters is 5%

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

**Solution:**

Given details are,

Annual growth rate of population of city is = 8%

Present population of city is = 196830

Let population of city 3 years ago be = x

By using the formula,

$$A = P (1 + R/100)$$

$$196830 = x (1 + 8/100) (1 + 8/100) (1 + 8/100)$$

$$196830 = x (27/25) (27/25) (27/25)$$

$$196830 = x (1.08) (1.08) (1.08)$$

$$196830 = 1.259712x$$

$$x = 196830/1.259712$$

$$= 156250$$

∴ Population 3 years ago was 156250

**7. The population of a town increases at the rate of 50 per thousand. Its population after 2 years will be 22050. Find its present population.**

**Solution:**

Given details are,

Growth rate of population of town is =  $50/1000 \times 100 = 5\%$

Population after 2 years is = 22050

So, let present population of town be =  $x$

By using the formula,

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

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

$$22050 = x \left( \frac{105}{100} \right) \left( \frac{105}{100} \right)$$

$$22050 = x (1.05) (1.05)$$

$$22050 = 1.1025x$$

$$x = \frac{22050}{1.1025}$$

$$= 20000$$

$\therefore$  Present population of the town is 20000

**8. The count of bacteria in a culture grows by 10% in the first hour, decreases by 8% in the second hour and again increases by 12% in the third hour. If the count of bacteria in the sample is 13125000, what will be the count of bacteria after 3 hours?**

**Solution:**

Given details are,

Count of bacteria in sample is = 13125000

The increase and decrease of growth rates are = 10%, -8%, 12%

So, let the count of bacteria after 3 hours be =  $x$

By using the formula,

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

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

$$x = 13125000 \left( \frac{110}{100} \right) \left( \frac{92}{100} \right) \left( \frac{112}{100} \right)$$

$$x = 13125000 (1.1) (0.92) (1.12)$$

$$= 14876400$$

$\therefore$  Count of bacteria after three hours will be 14876400

**9. 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 the year 2000?**

**Solution:**

Given details are,

Population of city on last day of year 1998 = 72000

Increasing rate (R) in 1999 = 7%

Decreasing rate (R) in 2000 = 10 %

By using the formula,

$$A = P (1 + R/100)$$

$$\begin{aligned}x &= 72000 (1 + 7/100) (1 - 10/100) \\ &= 72000 (107/100) (90/100) \\ &= 72000 (1.07) (0.9) \\ &= 69336\end{aligned}$$

∴ Population at the end of the year 2000 will be 69336

**10. 6400 workers were employed to construct a river bridge in four years. At the end of the first year, 25% workers were retrenched. At the end of the 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 the third year. How many workers were working during the fourth year?**

**Solution:**

Given details are,

Initial number of workers are = 6400

At the end of first year = 25% retrenched

At the end of second year = 25% retrenched

At the end of third year = 25% increased

By using the formula,

$$A = P (1 + R/100)$$

$$\begin{aligned}x &= 6400 (1 - 25/100) (1 - 25/100) (1 + 25/100) \\ &= 6400 (75/100) (75/100) (125/100) \\ &= 6400 (0.75) (0.75) (1.25) \\ &= 4500\end{aligned}$$

∴ Number of workers working during the fourth year is 4500

**11. 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.**

**Solution:**

Given details are,

Initial investment by Aman = Rs.100000

In first year = incurred a loss of 5%

In second year = earned a profit of 10%

In third year = earned a profit of 12 %

By using the formula,

$$A = P (1 + R/100)$$

$$\begin{aligned}x &= 100000 (1 - 5/100) (1 + 10/100) (1 + 12/100) \\&= 100000 (95/100) (110/100) (112/100) \\&= 100000 (0.95) (1.1) (1.12) \\&= 117040\end{aligned}$$

∴ Aman's net profit for entire three years is  $117040 - 100000 = \text{Rs } 17040$

**12. 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.**

**Solution:**

Given,

$$\text{Annul increase rate of population of town} = 40/1000 \times 100 = 4\%$$

$$\text{Present population of town} = 175760$$

So, let the population of town 3 years ago be = x

By using the formula,

$$A = P (1 + R/100)$$

$$175760 = x (1 + 4/100) (1 + 4/100) (1 + 4/100)$$

$$175760 = x (104/100) (104/100) (104/100)$$

$$175760 = x (1.04) (1.04) (1.04)$$

$$175760 = 1.124864x$$

$$x = 175760/1.124864$$

$$= 156250$$

∴ Population 3 years ago was 156250

**13. The population of a 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?**

**Solution:**

Given,

$$\text{Population of mixi company in 1996 was} = 8000 \text{ mixies}$$

$$\text{Production growth rate in next 2 years is} = 15\%$$

$$\text{Decrease rate in 3}^{\text{rd}} \text{ year is} = 5\%$$

By using the formula,

$$A = P (1 + R/100)$$

$$x = 8000 (1 + 15/100) (1 + 15/100) (1 - 5/100)$$

$$= 8000 (115/100) (115/100) (95/100)$$

$$= 8000 (1.15) (1.15) (0.95)$$

$$= 10051$$

∴ Production after three years will be 10051 mixies

**14. 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 the population of the city in (i) 2001 (ii) 1997.**

**Solution:**

Given details are,

Annual increase rate of population of city is = 4%

Population in 1999 was = 6760000

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

By using the formula,

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

$$\begin{aligned}x &= 6760000 \left(1 + \frac{4}{100}\right) \left(1 + \frac{4}{100}\right) \\&= 6760000 \left(\frac{104}{100}\right) \left(\frac{104}{100}\right) \\&= 6760000 (1.04) (1.04) \\&= 7311616\end{aligned}$$

∴ Population in the year 2001 is 7311616

(ii) Population of city in 1997 (2 years ago)

By using the formula,

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

$$\begin{aligned}x &= 6760000 \left(1 - \frac{4}{100}\right) \left(1 - \frac{4}{100}\right) \\&= 6760000 \left(\frac{96}{100}\right) \left(\frac{96}{100}\right) \\&= 6760000 (0.96) (0.96) \\&= 6230016\end{aligned}$$

∴ Population in the year 1997 was 6230016

**15. Jitendra set up a factory by investing Rs. 2500000. During the first two successive years his profits were 5% and 10% respectively. If each year the profit was on previous year's capital, compute his total profit.**

**Solution:**

Given details are,

Initial investment by Jitendra was = Rs 2500000

Profit in first 2 successive years were = 5% and 10%

$$\begin{aligned}\text{Final investment after two successive profits} &= 2500000 \left(1 + \frac{5}{100}\right) \left(1 + \frac{10}{100}\right) \\&= 2500000 \left(\frac{105}{100}\right) \left(\frac{110}{100}\right) \\&= 2500000 (1.05) (1.1) \\&= 2887500\end{aligned}$$

∴ Jitendra total profit is =  $2887500 - 2500000 = \text{Rs } 387500$

