11. Compound Interest

Exercise 11A

1. Question

Find the amount and the compound interest on Rs. 2500 for 2 years at 10% per annum, compounded annually.

Answer

Present value = Rs.2500

Interest rate = 10% per annum

Time = 2 years

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

[Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 2500 $(1 + 10/100)^2$

⇒ A = 2500 $(11/10)^2$

⇒ A = 2500 × 121/100

⇒ A = 25 × 121

⇒ A = 3025

∴ Amount = Rs.3025

∴ Compound interest = Rs.(3025 – 2500)

= Rs.525

2. Question

Find the amount and the compound interest on Rs. 15625 for 3 years at 12% per annum, compounded annually.

Answer

Present value = Rs.15625

Interest rate = 12% per annum

Time = 3 years

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 15625 $(1 + 12/100)^3$

⇒ A = 15625 $(112/100)^3$

⇒ A = 15625 $(28/25)^3$

⇒ A = 15625 × 21952/15625

⇒ A = 21952

∴ Amount = Rs.21952

∴ Compound interest = Rs.(21952 – 15625)

= Rs.6327

3. Question

Find the difference between the simple interest and the compound interest on Rs. 5000 for 2 years at 9% per annum.

Answer

Present value = Rs.5000

Interest rate = 9% per annum

Time = 2 years

Simple interest (SI) = PRT/100 [where, P = Present value

R = Interest rate, T = Time]

∴ SI = (5000 × 9 × 2)/100

⇒ SI = 50 × 9 × 2

⇒ SI = 900

Now,

Compound interest (CI),

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 5000 $(1 + 9/100)^2$

⇒ A = 5000 $(109/100)^2$

⇒ A = 5000 $(1.09)^2$

⇒ A = 5000 × 1.1881

⇒ A = 5940.5

∴ Amount = Rs.5940.5

∴ Compound interest = Rs.(5940.5 – 5000)

= Rs.940.5

Now,

Difference between the simple interest and the compound interest = (CI – SI)

= (940.5 – 900)

= 40.5

4. Question

Ratna obtained a loan of Rs. 25000 from the Syndicate Bank to renovate her house. If the rate of interest is 8% per annum, what amount will she have to pay to the bank after 2 years to discharge her debt?

Answer

Present value = Rs.25000

Interest rate = 8% per annum

Time = 2 years

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 25000 $(1 + 8/100)^2$

⇒ A = 25000 $(108/100)^2$

⇒ A = 25000 $(1.08)^2$

⇒ A = 25000 × 1.1664

⇒ A = 29160

∴ Amount = Rs.29160

5. Question

Harpreet borrowed Rs. 20000 from her friend at 12% per annum simple interest. She lent it to Alam at the same rate but compounded annually. Find her gain after 2 years.

Answer

Present value = Rs.20000

Interest rate = 12% per annum

Time = 2 years

Simple interest (SI) = PRT/100 [where, P = Present value

R = Interest rate, T = Time]

∴ SI = (20000 × 12 × 2)/100

⇒ SI = 200 × 12 × 2

⇒ SI = 4800

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 20000 $(1 + 12/100)^2$

⇒ A = 20000 $(112/100)^2$

⇒ A = 20000 $(1.12)^2$

⇒ A = 20000 × 1.2544

⇒ A = 25088

∴ Amount = Rs.25088

∴ Compound interest = Rs.(25088 – 20000)

= Rs.5088

Now,

(CI – SI) = 5088 -4800

= Rs.288

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

6. Question

Manoj deposited a sum of Rs. 64000 in a post office for 3 years, compounded annually at $7\frac{1}{2}$ % per annum. What amount will he get on maturity?

Answer

Present value = Rs.64000

Interest rate = (15/2) % per annum

Time = 3 years

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 64000 $[1 + (15/2 × 1/100)]^3$

⇒ A = 64000 $[1 + 3/40]^3$

⇒ A = 64000 $(43/40)^3$

⇒ $A = 64000 \times \frac{43}{40} \times \frac{43}{40} \times \frac{43}{40}$

⇒ A = 1 × 43 × 43 × 43

⇒ A = 79507

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

7. Question

Divakaran deposited a sum of Rs. 6250 in the Allahabad Bank for 1 year, compounded half-yearly at 8% per annum. Find the compound interest he gets.

Answer

Present value = Rs.6250

Interest rate = 8 % per annum

Time = 1 years

∵ Interest is compounded half-yearly.

∴ Amount (A) = P $[1 + (R/2)/100]^{2n}$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 6250 $[1 + (8/2)/100]^2$

⇒ A = 6250 $[1 + 4/100]^2$

⇒ A = 6250 $[26/25]^2$

⇒ A = 6250 × 26/25 × 26/25

⇒ A = 10 × 26 × 26

⇒ A = 6760

∴ Amount = Rs.6760

∴ Compound interest = Rs.(6760 – 6250)

= Rs.510

∴ Divakaran gets a CI of Rs.510.

8. Question

Michael borrowed Rs.16000 from a finance company at 10% per annum, compounded half-yearly. What amount of money will discharge his debt after $1\frac{1}{2}$ years?

Answer

Present value = Rs.16000

Interest rate = 10% per annum

Time = (3/2) years

∵ Interest is compounded half-yearly.

∴ Amount (A) = P $[1 + (R/2)/100]^{2n}$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 16000 $[1 + (10/2)/100]^3$

⇒ A = 16000 $[1 + 5/100]^3$

⇒ A = 16000 $[1 + 1/20]^3$

⇒ A = 16000 $[21/20]^3$

⇒ A = 16000 × 21/20 × 21/20 × 21/20

⇒ A = 2 × 21 × 21 × 21

⇒ A = 18522

∴ Amount = Rs.18522

Exercise 11B

1. Question

Rs. 6000 for 2 years at 9% per annum compounded annually.

Answer

Present value = Rs.6000

Interest rate = 9% per annum

Time = 2 years

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 6000 $(1 + 9/100)^2$

⇒ A = 6000 $(109/100)^2$

⇒ A = 6000 × 109/100 × 109/100

⇒ A = 6 × 109 × 109/10

⇒ A = 7128.6

∴ Amount = Rs.7128.6

∴ Compound interest = Rs.(7128.6 – 6000)

= Rs.1128.6

2. Question

Rs. 10000 for 2 years at 11% per annum compounded annually.

Answer

Present value = Rs.10000

Interest rate = 11% per annum

Time = 2 years

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 10000 $(1 + 11/100)^2$

⇒ A = 10000 $(111/100)^2$

⇒ A = 10000 × 111/100 × 111/100

⇒ A = 1 × 111 × 111

⇒ A = 12321

∴ Amount = Rs.12321

∴ Compound interest = Rs.(12321 – 10000)

= Rs.2321

3. Question

Rs. 31250 for 3 years at 8% per annum compounded annually.

Answer

Present value = Rs.31250

Interest rate = 8% per annum

Time = 3 years

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 31250 $(1 + 8/100)^3$

⇒ A = 31250 $(1 + 2/25)^3$

⇒ A = 31250 $(27/25)^3$

⇒ A = 31250 × 27/25 × 27/25 × 27/25

⇒ A = 31250 × 19683/15625

⇒ A = 2 × 19683

⇒ A = 39366

∴ Amount = Rs.39366

∴ Compound interest = Rs.(39366 – 31250)

= Rs.8116

4. Question

Rs. 10240 for 3 years at $12\frac{1}{2}$ % per annum compounded annually.

Answer

Present value = Rs.10240

Interest rate = (25/2) % per annum

Time = 3 years

Amount (A) = P (1 + R/100)^n [Where, P = Present value

R = Annual interest rate

n = Time in years]

$\therefore$ A = 10240 [1 + (25/2)/100]^3

$\Rightarrow$ A = 10240 [1 + 1/8]^3

$\Rightarrow$ A = 10240 [9/8]^3

$\Rightarrow$ A = 10240 × 9/8 × 9/8 × 9/8

$\Rightarrow$ A = 10240 × 729/512

$\Rightarrow$ A = 20 × 729

$\Rightarrow$ A = 14580

$\therefore$ Amount = Rs.14580

$\therefore$ Compound interest = Rs.(14580 – 10240)

= Rs.4340

5. Question

Rs. 62500 for 2 years 6 months at 12% per annum compounded annually.

Answer

Present value = Rs.62500

Interest rate = 12 % per annum

Time = 2 years 6 month = (2 + 1/2) years = (5/2) years

Amount (A) = P (1 + R/100)^n [Where, P = Present value

R = Annual interest rate

n = Time in years]

$\therefore$ A = 62500 (1 + 12/100)^2 × [1 + (1/2 × 12)/100]

$\Rightarrow$ A = 62500 (1 + 3/25)^2 × [1 + 6/100]

$\Rightarrow$ A = 62500 (28/25)^2 × [106/100]

$\Rightarrow$ A = 62500 × 28/25 × 28/25 × 106/100

$\Rightarrow$ A = 625 × 784/625 × 106

$\Rightarrow$ A = 1 × 784 × 106

$\Rightarrow$ A = 83104

∴ Amount = Rs.83104

∴ Compound interest = Rs.(83104 – 62500)

= Rs.20604

6. Question

Rs. 9000 for 2 years 4 months at 10% per annum compounded annually.

Answer

Present value = Rs.9000

Interest rate = 10 % per annum

Time = 2 years 4 month = (2 + 1/3) years = (7/2) years

Amount (A) = P $(1 + R/100)^n$ × [1 + (1/3 × R)/100]

[Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 9000 $(1 + 10/100)^2$ × [1 + (1/3 × 10)/100]

⇒ A = 9000 $(1 + 1/10)^2$ × [1 + 1/30]

⇒ A = 9000 $(11/10)^2$ × [31/30]

⇒ A = 9000 × 121/100 × 31/30

⇒ A = 9 × 121 × 31/3

⇒ A = 3 × 121 × 31

⇒ A = 11253

∴ Amount = Rs.11253

∴ Compound interest = Rs.(11253 – 9000)

= Rs.2253

7. Question

Find the amount of Rs. 8000 for 2 years compounded annually and the rates being 9% per annum during the first year and 10% per annum during the second year.

Answer

Present value = Rs.8000

Interest rate for 1st year, p = 9 % per annum

Interest rate for 2nd year, q = 10 % per annum

Time = 2 years

Amount (A) = P × (1 + p/100) × (1 + q/100)

A = 8000 × (1 + 9/100) × (1 + 10/100)

= 8000 × (109/100) × (1 + 1/10)

= 8000 × 109/100 × 11/10

= 8 × 109 × 11

= 9592

∴ Amount = Rs.9592

8. Question

Anand obtained a loan of Rs. 125000 from the Allahabad Bank for buying computers. The bank charges compound interest at 8% per annum, compounded annually. What amount pwill he have to pay after 3 years to clear the debt?

Answer

Present value = Rs.125000

Interest rate = 8% per annum

Time = 3 years

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 125000 $(1 + 8/100)^3$

⇒ A = 125000 $(108/100)^3$

⇒ A = 125000 × 108/100 × 108/100 × 108/100

⇒ A = 125000 × 1259712/1000000

⇒ A = 125 × 1259712/1000

⇒ A = 1259712/8

⇒ A = 157464

∴ Amount = Rs.157464

∴ Anand has to pay Rs.157464 after 3 years to clear the debt.

9. Question

Three years ago, Beeru purchased a buffalo from Surjeet for Rs. 11000. What payment will discharge his debt now, the rate of interest being 10% per annum, compounded annually?

Answer

Present value = Rs.11000

Interest rate = 10% per annum

Time = 3 years

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 11000 $(1 + 10/100)^3$

⇒ A = 11000 $(1 + 1/10)^3$

⇒ A = 11000 $(11/10)^3$

⇒ A = 11000 × 11/10 × 11/10 × 11/10

⇒ A = 11000 × 1331/1000

⇒ A = 11 × 1331

⇒ A = 14641

∴ Amount = Rs.14641

∴ Beeru has to pay Rs.14641 to clear the debt.

10. Question

Shubhalaxmi took a loan of Rs. 18000 from Surya Finance to purchase a TV set. If the company charges compound interest at 12% per annum during the first year and $12\frac{1}{2}$% per annum during the second year, how much will she have to pay after 2 years?

Answer

Present value = Rs.18000

Interest rate for 1st year, p = 12 % per annum

Interest rate for 2nd year, q = (25/2) % per annum

Time = 2 years

Amount (A) = P × (1 + p/100) × (1 + q/100)

A = 18000 × (1 + 12/100) × [1 + (25/2)/100]

= 18000 × (112/100) × [1 + 25/200]

= 18000 × (112/100) × [1 + 1/8]

= 18000 × 112/100 × 9/8

= 180 × 112 × 9/8

= 180 × 14 × 9

= 22680

∴ Amount = Rs.22680

∴ Shubhlaxmi has to pay Rs.157464 after 2 years.

11. Question

Neha borrowed Rs. 24000 from the State Bank of India to buy a scooter. If the rate of interest be 10% per annum compounded annually, what payment will she have to make after 2 years 3 months?

Answer

Present value = Rs.24000

Interest rate = 10 % per annum

Time = 2 years 3 month = (2 + 1/4) years = $2\frac{1}{4}$ years.

Amount (A) = P (1 + R/100)^n × [1 + (1/4 × R)/100]

[Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 24000 (1 + 10/100)^2 × [1 + (1/4 × 10)/100]

⇒ A = 24000 (1 + 1/10)^2 × [1 + 1/40]

⇒ A = 24000 (11/10)^2 × [41/40]

⇒ A = 24000 × 121/100 × 41/40

⇒ A = 24 × 121 × 41/4

⇒ A = 6 × 121 × 41

⇒ A = 29766

∴ Amount = Rs.29766

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

12. Question

Abhay borrowed Rs. 16000 at $7\frac{1}{2}$ % per annum simple interest. On the same day, he lent it to Gurmeet at the same rate but compounded annually. What does he gain at the end of 2 years?

Answer

Present value = Rs.16000

Interest rate = $7\frac{1}{2}$ % = (15/2) % per annum

Time = 2 years

Simple interest (SI) = PRT/100 [where, P = Present value

R = Interest rate, T = Time]

∴ SI = (16000 × (15/2) × 2)/100

⇒ SI = 160 × 15

⇒ SI = 2400

Now,

Amount (A) = P (1 + R/100)^n [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 16000 [1 + (15/2)/100]^2

⇒ A = 16000 [1 + 3/40]^2

⇒ A = 16000 [43/40]^2

⇒ A = 16000 × 1849/1600

⇒ A = 10 × 1849

⇒ A = 18490

∴ Amount = Rs.18490

∴ Compound interest = Rs.(18490 – 16000)

= Rs.2490

Now,

(CI – SI) = 2490 -2400

= Rs.90

∴ Abhay gains Rs.90 at the end of 2 years.

13. Question

The simple interest on a sum of money for 2 years at 8% per annum is Rs. 2400. What will be the compound interest on that sum at the same rate and for the same period?

Answer

Simple interest = Rs.2400

Interest rate = 8% per annum

Time = 2 years

Simple interest (SI) = PRT/100 [where, P = Present value

R = Interest rate

∴ 2400 = (P × 8 × 2)/100 T = Time]

⇒ 2400 = P × 16/100

⇒ 2400 = P × 4/25

⇒ P = 2400 × 25/4

⇒ P = 600 × 25

⇒ P = 15000

∴ Sum = Rs.15000

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 15000 $[1 + 8/100]^2$

⇒ A = 15000 $[1 + 2/25]^2$

⇒ A = 15000 $[27/25]^2$

⇒ A = 15000 × 27/25 × 27/25

⇒ A = 600 × 27 × 27/25

⇒ A = 24 × 27 × 27

⇒ A = 17496

∴ Amount = Rs.17496

∴ Compound interest = Rs.(17496 – 15000)

= Rs.2496

14. Question

The difference between the compound interest and the simple interest on a certain sum for 2 years at 6% per annum is Rs. 90.

Find the sum.

Answer

Let sum = P

Interest rate = 6% per annum

Time = 2 years

Simple interest (SI) = PRT/100 [Where, P = Present value

R = Annual interest rate

T = Time in years]

∴ SI = (P × 6 × 2)/100

⇒ SI = 3P/25 _____ (i)

Compound interest (CI) = P $(1 + R/100)^n$ - P [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ CI = P $(1 + 6/100)^2$ - P

⇒ CI = P $(1 + 3/50)^2$ - P

⇒ CI = P $(53/50)^2$ - P

⇒ CI = (2809P/2500)- P

⇒ CI = (2809P – 2500P)/2500

⇒ CI = 309P/2500 _____ (ii)

Now,

CI – SI = (309P/2500) – (3P/25)

⇒ 90 = (309P/2500) – (3P/25) [Given, CI – SI = 90]

⇒ 90 = (309P – 300P)/2500

⇒ 90 = 9P/2500

⇒ P = 90 × 2500/9

⇒ P = 10 × 2500

⇒ P = 25000

∴ Sum = Rs.25000

15. Question

The difference between the compound interest and the simple interest on a certain sum for 3 years at 10% per annum is Rs. 93. Find the sum.

Answer

Let sum = P

Interest rate = 10% per annum

Time = 3 years

Simple interest (SI) = PRT/100 [Where, P = Present value

R = Annual interest rate

T = Time in years]

∴ SI = (P × 10 × 3)/100

⇒ SI = 3P/10 _____ (i)

Compound interest (CI) = P $(1 + R/100)^n$ - P [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ CI = P $(1 + 10/100)^3$ - P

⇒ CI = P $(1 + 1/10)^3$ - P

⇒ CI = P (11/10)^3 - P

⇒ CI = (1331P/1000)- P

⇒ CI = (1331P – 1000P)/1000

⇒ CI = 331P/1000 _____ (ii)

Now,

CI – SI = (331P/1000) – (3P/10)

⇒ 93 = (331P/1000) – (3P/10) [Given, CI – SI = 93]

⇒ 93 = (331P – 300P)/1000

⇒ 93 = 31P/1000

⇒ P = 93 × 1000/31

⇒ P = 3 × 1000

⇒ P = 3000

∴ Sum = Rs.3000

16. Question

A sum of money amounts to Rs. 10240 in 2 years at $6\frac{2}{3}$ % per annum, compounded annually. Find the sum.

Answer

Let sum = P

Interest rate = $6\frac{2}{3}$ % = (20/3) % per annum

Time = 2 years

Now,

Amount (A) = P (1 + R/100)^n [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = P[1 + (20/3)/100]^2

⇒ 10240 = P [1 + 1/15]^2

⇒ 10240 = P [16/15]^2

⇒ 10240 = P × 256/225

⇒ P = 10240 × 225/256

⇒ P = 40 × 225

⇒ P = 9000

∴ Sum = Rs.9000

17. Question

What sum of money will amount to Rs. 21296 in 3 years at 10% per annum, compounded annually?

Answer

Let sum = P

Interest rate = 10% per annum

Time = 3 years

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = P $(1 + 10/100)^3$

⇒ 21296 = P $(1 + 1/10)^3$

⇒ 21296 = P $(11/10)^3$

⇒ 21296 = P × 1331/1000

⇒ P = 21296 × 1000/1331

⇒ P = 16 × 1000

⇒ P = 16000

∴ Sum = Rs.16000

18. Question

At what rate per cent per annum will Rs. 4000 amount to Rs. 4410 in 2 years when compounded annually?

Answer

Let rate = R % per annum

P = Rs.4000

A = Rs.4410

Time = 2 years

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ A = P $(1 + R/100)^2$

⇒ 4410 = 4000 $(1 + R/100)^2$

⇒ $(1 + R/100)^2$ = 4410/4000

⇒ $(1 + R/100)^2$ = 441/400

⇒ $(1 + R/100)$ = √(441/400)

⇒ R/100 = (21/20) - 1

⇒ R/100 = (21 – 20)/20

⇒ R/100 = 1/20

⇒ R = 100/20

⇒ R = 5

∴ Rate = 5% per annuam.

19. Question

At what rate per cent per annum will Z 640 amount to Rs. 774.40 in 2 years when compounded annually?

Answer

Let rate = R % per annum

P = Rs.640

A = Rs.774.40

Time = 2 years

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ A = P $(1 + R/100)^2$

⇒ 774.40 = 640 $(1 + R/100)^2$

⇒ $(1 + R/100)^2$ = 774.40/640

⇒ $(1 + R/100)^2$ = 1.21

⇒ (1 + R/100) = √(1.21)

⇒ R/100 = (1.1) - 1

⇒ R/100 = 0.1

⇒ R = 0.1 × 100

⇒ R = 10

∴ Rate = 10% per annuam.

20. Question

In how many years will Rs. 1800 amount to Rs. 2178 at 10% per annum when compounded annually?

Answer

Let time = n years

P = Rs.1800

A = Rs.2178

R = 10% per annum

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ A = P $(1 + R/100)^n$

⇒ 2178 = 1800 $(1 + 10/100)^n$

⇒ $(1 + 1/10)^n$ = 2178/1800

$\Rightarrow (11/10)^n = 121/100$

$\Rightarrow (11/10)^n = (11/10)^2$

$\Rightarrow n = 2$

$\therefore$ Time = 2 years.

21. Question

In how many years will Rs. 6250 amount to Rs. 7290 at 8% per annum, compounded annually?

Answer

Let time = n years

P = Rs.6250

A = Rs.7290

R = 8% per annum

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

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

$\Rightarrow 7290 = 6250 (1 + 8/100)^n$

$\Rightarrow (1 + 2/25)^n = 7290/6250$

$\Rightarrow (27/25)^n = 729/625$

$\Rightarrow (27/25)^n = (27/25)^2$

$\Rightarrow n = 2$

$\therefore$ Time = 2 years.

22. Question

The population of a town is 125000. It is increasing at the rate of 2% per annum. What will be its population after 3 years?

Answer

Population of a town, P = 125000

Time, n = 3 years

Increasing rate, R = 2% per annum

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

$\therefore$ Population = P $(1 + R/100)^n$

= 125000 $(1 + 2/100)^3$

= 125000 (1 + 1/50)^3

= 125000 (51/50)^3

= 125000 × 51/50 × 51/50 × 51/50

= 1 × 51 × 51 × 51

= 132651

∴ Population of a town after 3 years is 132651.

23. Question

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

Answer

Population of a town, P = 50000

Interest rate for 1st year, p = 5%

Interest rate for 2nd year, q = 4%

Interest rate for 3rd year, r = 3%

Time, n = 3 years

Now,

Present population = P × (1 + p/100) × (1 + q/100) × (1 + r/100)

= 50000 × (1 + 5/100) × (1 + 4/100) × (1 + 3/100)

= 50000 × (1 + 1/20) × (1 + 1/25) × (1 + 3/100)

= 50000 × 21/20 × 26/25 × 103/100

= 50 × 21/2 × 26/25 × 103

= 1 × 21 × 26 × 103

= 56238

∴ Present population of a town is 56238.

24. Question

The population of a city was 120000 in the year 2013. During next year it increased by 6% but due to an epidemic it decreased by 5% in the following year. What was its population in the year 2015?

Answer

Population of a city in 2013, P = 120000

Time, n = 3 years

Increasing rate, R = 6% per annum

Now,

Amount (A) = P (1 + R/100)^n [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴Population of the city in the year 2014,

∴ Population = P (1 + R/100)^n

= $120000 (1 + 6/100)^1$

= $120000 (1 + 3/50)$

= $120000 (53/50)$

= $120000 × 53/50$

= $2400 × 53$

= 127200

∴ Population of a city in 2014 is 127200.

Now,

Decreasing rate = 8%

∴Population of the city in the year 2015,

∴ Population = $P (1 - R/100)^n$

= $127200 (1 - 5/100)^1$

= $127200 (1 - 1/20)$

= $127200 (19/20)$

= $127200 × 19/20$

= $6360 × 19$

= 120840

∴ Population of a city in 2015 is 120840.

25. Question

The count of bacteria in a certain experiment was increasing at the rate of 2% per hour. Find the bacteria at the end of 2 hours if the count was initially 500000.

Answer

Count of bacteria, P = 500000

Time, n = 2 hours

Increasing rate, R = 2% per hour

Now,

Amount (A) = $P (1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time]

∴ Count of bacteria = $P (1 + R/100)^n$

= $500000 (1 + 2/100)^2$

= $500000 (102/100)^2$

= $500000 × 102/100 × 102/100$

= $50 × 102 × 102$

= 520200

∴ Count of bacteria at the end of 2 hours is 520200.

26. Question

The bacteria in a culture grows by 10% in the first hour, decreases by 10% in the second hour and again increases by 10% in the third hour. Find the bacteria at the end of 3 hours if the count was initially 20000.

Answer

Initial count of bacteria, P = 20000

Time, n = 3 hours

Increasing rate, R = 10% per hour

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time]

∴Count of bacteria at the end of 1st hour,

∴ Count of bacteria = P $(1 + R/100)^n$

= 20000 $(1 + 10/100)^1$

= 20000 (1 + 1/10)

= 20000 (11/10)

= 20000 × 11/10

= 2000 × 11

= 22000

∴ Count of bacteria at the end of 1st hour is 22000.

Now,

Decreasing rate = 10%

∴Count of bacteria at the end of 2nd hour,

∴ Count of bacteria = P $(1 + R/100)^n$

= 22000 $(1 - 10/100)^1$

= 22000 (1 - 1/10)

= 22000 × 9/10

= 2200 × 9

= 19800

∴ Count of bacteria at the end of 2nd hours is 19800.

Now,

Increasing rate = 10%

∴Count of bacteria at the end of 3rd hour,

∴ Count of bacteria = P $(1 + R/100)^n$

= 19800 $(1 + 10/100)^1$

= 19800 (1 + 1/10)

= 19800 (11/10)

= 19800 × 11/10

= 1980 × 11

= 21780

∴ Count of bacteria at the end of 3rd hours is 21780.

27. Question

A machine is purchased for Rs. 625000. Its value depreciates at the rate of 8% per annum. What will be its value after 2 years?

Answer

Present value of machine, P = Rs.625000

Time, n = 2 years

Rate of depreciates, R = 8% per annum

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ Value = P $(1 - R/100)^n$ [∵ Rate decreases]

= 625000 $(1 - 8/100)^2$

= 625000 $(1 - 2/25)^2$

= 625000 $(23/25)^2$

= 625000 × 729/625

= 1000 × 529

= 529000

∴ Value of machine after 2 years will be Rs.529000.

28. Question

A scooter is bought at Rs. 56000. Its value depreciates at the rate of 10% per annum. What will be its value after 3 years?

Answer

Present value of scooter, P = Rs.56000

Time, n = 3 years

Rate of depreciates, R = 10% per annum

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ Value = P $(1 - R/100)^n$ [∵ Rate decreases]

= 56000 (1 - 10/100)^3

= 56000 (1 - 1/10)^3

= 56000 (9/10)^3

= 56000 × 729/1000

= 56 × 729

= 40824

∴ Value of scooter after 3 years will be Rs.40824.

29. Question

A car is purchased for Rs. 348000. Its value depreciates at 10% per annum during the first year and at 20% per annum during the second year. What will be its value after 2 years?

Answer

Present value of car, P = Rs.348000

Rate of depreciates for 1st year, p = 10%

Rate of depreciates for 2nd year, q = 20%

Time, n = 2 years

Now,

Value = P × (1 - p/100) × (1 - q/100)

= 348000 × (1 - 10/100) × (1 - 20/100)

= 348000 × (1 - 1/10) × (1 - 1/5)

= 348000 × 9/10 × 4/5

= 34800 × 9 × 4/5

= 6960 × 9 × 4

= 25056

∴ Value of the car after 2 years is Rs.25056.

30. Question

The value of a machine depreciates at the rate of 10% per annum. It was purchased 3 years ago. If its present value is Rs. 291600, for how much was it purchased?

Answer

Let the 3 years ago machine value = P

Rate of depreciates, R = 10%

Time, n = 3 years

Now,

Value = P (1 + R/100)^n [Where,

P = Present value

R = Annual interest rate

n = Time in years]

∴ Value = P (1 - 10/100)^n [∵ Rate decreases]

⇒ 291600 = P (1 - 1/10)^3

⇒ 291600 = P (9/10)^3

⇒ 291600 = P × 729/1000

⇒ P = 291600 × 1000/729

⇒ P = 400 × 1000

⇒ P = 400000

∴ Initial value of machine is Rs.400000.

Exercise 11C

1. Question

Find the amount and the compound interest on Rs. 8000 for 1 year at 10% per annum, compounded half-yearly.

Answer

Present value, P = Rs.8000

Interest rate, R = 10% per annum

Time, n = 1 years

∵ Compounded half-yearly.

∴ Amount (A) = P [1 + (R/2)/100]^{2n} [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 8000 [1 + (10/2)/100]^2

⇒ A = 8000 [1 + 5/100]^2

⇒ A = 8000 [1 + 1/20]^2

⇒ A = 8000 [21/20]^2

⇒ A = 8000 × 441/400

⇒ A = 20 × 441

⇒ A = 8820

∴ Amount = Rs.8820

∴ Compound interest = Rs.(8820 – 8000) [∵CI = A – P]

= Rs.820

2. Question

Find the amount and the compound interest on Rs. 31250 for $1\frac{1}{2}$% years at 8% per annum, compounded half-yearly.

Answer

Present value, P = Rs.31250

Interest rate, R = 8% per annum

Time, n = (3/2) years

∵ Compounded half-yearly.

∴ Amount (A) = P [1 + (R/2)/100]^{2n} [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 31250 [1 + (8/2)/100]^3 [2n = 2 × 3/2]

⇒ A = 31250 [1 + 4/100]^3

⇒ A = 31250 [1 + 1/25]^3

⇒ A = 31250 [26/25]^3

⇒ A = 31250 × 17576/15625

⇒ A = 2 × 17576

⇒ A = 35152

∴ Amount = Rs.35152

∴ Compound interest = Rs.(35152 – 31250) [∵CI = A – P]

= Rs.3902

3. Question

Find the amount and the compound interest on Rs. 12800 for 1 year at $7\frac{1}{2}$ % per annum, compounded half-yearly.

Answer

Present value, P = Rs.12800

Interest rate, R = (15/2)% per annum

Time, n = 1 years

∵ Compounded half-yearly.

∴ Amount (A) = P [1 + (R/2)/100]^{2n} [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 12800 [1 + (15/4)/100]^2

⇒ A = 12800 [1 + 3/80]^2

⇒ A = 12800 [83/80]^2

⇒ A = 12800 × 6889/6400

⇒ A = 128 × 6889/64

⇒ A = 2 × 6889

⇒ A = 13778

∴ Amount = Rs.13778

∴ Compound interest = Rs.(13778 – 12800) [∵CI = A – P]

= Rs.978

4. Question

Find the amount and the compound interest on Rs. 160000 for 2 years at 10% per annum, compounded half-yearly.

Answer

Present value, P = Rs.160000

Interest rate, R = 10% per annum

Time, n = 2 years

∵ Compounded half-yearly.

∴ Amount (A) = P [1 + (R/2)/100]^{2n} [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 160000 [1 + (10/2)/100]^4

⇒ A = 160000 [1 + 5/100]^4

⇒ A = 160000 [1 + 1/20]^4

⇒ A = 160000 [21/20]^4

⇒ A = 160000 × 21/20 × 21/20 × 21/20 × 21/20

⇒ A = 160000 × 194481/160000

⇒ A = 1 × 194481

⇒ A = 194481

∴ Amount = Rs.8820

∴ Compound interest = Rs.(194481 – 160000) [∵CI = A – P]

= Rs.34481

5. Question

Swati borrowed Rs. 40960 from a bank to buy a piece of land. If the bank charges $12\frac{1}{2}$% per annum, compounded half-yearly, what amount will she have to pay after $1\frac{1}{2}$ years? Also, find the interest paid by her.

Answer

Present value, P = Rs.40960

Interest rate, R = (25/2)% per annum

Time, n = 3/2 years

∵ Compounded half-yearly.

∴ Amount (A) = P [1 + (R/2)/100]^{2n} [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 40960 [1 + (25/4)/100]^3 [R = 25/2 and n = 3/2 years]

⇒ A = 40960 [1 + 1/16]^3

⇒ A = 40960 [17/16]^3

⇒ A = 40960 × 4913/4096

⇒ A = 10 × 4913

⇒ A = 49130

∴ Amount = Rs.49130

∴ Compound interest = Rs.(49130 – 40960) [∵CI = A – P]

= Rs.8170

6. Question

Mohd. Aslam purchased a house from Avas Vikas Parishad on credit. If the cost of the house is Rs. 125000 and the Parishad charges interest at 12% per annum compounded half-yearly, find the interest paid by Aslam after a year and a half.

Answer

Initial value, P = Rs.125000

Interest rate, R = 12% per annum

Time, n = (1 + 1/2) years = 3/2 years

∵ Compounded half-yearly.

∴ Amount (A) = P $[1 + (R/2)/100]^{2n}$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 125000 $[1 + (12/2)/100]^3$ [n = 3/2 years]

⇒ A = 125000 $[1 + 6/100]^3$

⇒ A = 125000 $[1 + 3/50]^3$

⇒ A = 125000 $[53/50]^3$

⇒ A = 125000 × 53/50 × 53/50 × 53/50

⇒ A = 125000 × 148877/125000

⇒ A = 1 × 148877

⇒ A = 148877

∴ Amount = Rs.148877

∴ Compound interest = Rs.(148877 – 125000) [∵CI = A – P]

= Rs.23877

∴ Rs.23877 interest paid by Aslam after (3/2) years.

7. Question

Sheela deposited Rs. 20000 in a bank, where the interest is credited half-yearly. If the rate of interest paid by the bank is 6% per annum, what amount will she get after 1 year?

Answer

Present value, P = Rs.20000

Interest rate, R = 6% per annum

Time, n = 1 years

∵ Compounded half-yearly.

∴ Amount (A) = P $[1 + (R/2)/100]^{2n}$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 20000 [1 + (6/2)/100]^2

⇒ A = 20000 [1 + 3/100]^2

⇒ A = 20000 [103/100]^2

⇒ A = 20000 × 103/100 × 103/100

⇒ A = 2 × 103 × 103

⇒ A = 21218

∴ Amount = Rs.21218

∴ Shella gets Rs.21218 after 1 year.

8. Question

Neeraj lent Rs. 65536 for 2 years at $12\frac{1}{2}$ % per annum, compounded annually. How much 2 more could he earn if the interest were compounded half-yearly?

Answer

Initial value, P = Rs.65536

Interest rate, R = (25/2)% per annum

Time, n = 2 years

∵ Compounded annually.

∴ Amount (A) = P [1 + R/100]^n [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 65536 [1 +(25/2) /100]^2

⇒ A = 65536 [1 + 1/8]^2

⇒ A = 65536 [9/8]^2

⇒ A = 65536 × 9/8 × 9/8

⇒ A = 65536 × 81/64

⇒ A = 1024 × 81

⇒ A = 82944

∴ Amount = Rs.82944

∴ Compound interest = Rs.(82944 – 65536) [∵CI = A – P]

= Rs.17408

Now,

∵ Compounded half-yearly.

∴ Amount (A) = P [1 + (R/2)/100]^{2n} [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 65536 [1 + (25/4)/100]^4 [R = (25/2)% and n = 2 years]

⇒ A = 65536 [1 + 1/16]^4

⇒ A = 65536 [17/16]^4

⇒ A = 65536 × 17/16 × 17/16 × 17/16 × 17/16

⇒ A = 65536 × 83521/65536

⇒ A = 1 × 83521

⇒ A = 83521

∴ Amount = Rs.83521

∴ Compound interest = Rs.(83521 – 65536) [∵CI = A – P]

= Rs.17985

Now,

Difference between interests compound half-yearly and yearly,

= Rs.(17985 – 17408)

= Rs.577

9. Question

Sudershan deposited Rs. 32000 in a bank, where the interest is credited quarterly. If the rate of interest be 5% per annum, what amount will he receive after 6 months?

Answer

Present value, P = Rs.32000

Interest rate, R = 5% per annum

Time, n = 6 months = (1/2) years

∵ Compounded quarterly,

∴ Amount (A) = P $[1 + (R/4)/100]^{4n}$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 362000 $[1 + (5/4)/100]^2$ [4n = 4 × 1/2]

⇒ A = 32000 $[1 + 1/80]^2$

⇒ A = 32000 $[81/80]^2$

⇒ A = 32000 × 81/80 × 81/80

⇒ A = 400 × 81 × 81/80

⇒ A = 5 × 81 × 81

⇒ A = 32805

∴ Amount = Rs.32805

∴ Sudershan will receive amount of Rs.32805 after 6 months.

10. Question

Arun took a loan of Rs. 390625 from Kuber Finance. If the company charges interest at 16% per annum, compounded quarterly, what amount will discharge his debt after one year?

Answer

Present value, P = Rs.390625

Interest rate, R = 16% per annum

Time, n = 1 year

∵ Compounded quarterly,

∴ Amount (A) = P [1 + (R/4)/100]^{4n} [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 390625 [1 + (16/4)/100]^4

⇒ A = 390625 [1 + 4/100]^4

⇒ A = 390625 [1 + 1/25]^4

⇒ A = 390625 [26/25]^4

⇒ A = 390625 × 26/25 × 26/25 × 26/25 × 26/25

⇒ A = 390625 × 456976/390625

⇒ A = 1 × 456976

⇒ A = 456976

∴ Amount = Rs.456976

∴ Arun has to pay Rs.45976 after 1 year.

CCE Test Paper-11

1. Question

Find the amount and the compound interest on Rs. 3000 for 2 years at 10% per annum.

Answer

Present value = Rs.3000

Interest rate = 10% per annum

Time = 2 years

Amount (A) = P (1 + R/100)^n [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 3000 (1 + 10/100)^2

⇒ A = 3000 (1 + 1/10)^2

⇒ A = 3000 (11/10)^2

⇒ A = 3000 × 11/10 × 11/10

⇒ A = 3000 × 121/100

⇒ A = 30 × 121

⇒ A = 3630

∴ Amount = Rs.3630

∴ Compound interest = Rs.(3630 – 3000)

= Rs.630

2. Question

Find the amount of Rs. 10000 after 2 years compounded annually; the rate of interest being 10% per anum during the first year and 12% per annum during the second year. Also, find the compound interest.

Answer

Present value = Rs.10000

Interest rate for 1st year, p = 10 % per annum

Interest rate for 2nd year, q = 12 % per annum

Time = 2 years

Amount (A) = P × (1 + p/100) × (1 + q/100)

A = 10000 × (1 + 10/100) × (1 + 12/100)

= 10000 × (1 + 1/10) × (112/100)

= 10000 × 11/10 × 112/100

= 10 × 11 × 112

= 12320

∴ Amount = Rs.12320

∴ Compound interest = Rs.(12320 – 10000)

= Rs.2320

3. Question

Find the amount and the compound interest on Rs. 6000 for 1 year at 10% per annum compounded half-yearly.

Answer

Present value = Rs.6000

Interest rate = 10 % per annum

Time = 1 years

∵ Interest is compounded half-yearly.

∴ Amount (A) = P $[1 + (R/2)/100]^{2n}$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 6000 $[1 + (10/2)/100]^2$

⇒ A = 6000 $[1 + 5/100]^2$

⇒ A = 6000 $[1 + 1/20]^2$

⇒ A = 6000 $[21/20]^2$

⇒ A = 6000 × 21/20 × 21/20

⇒ A = 300 × 21 × 21/20

⇒ A = 15 × 21 × 21

⇒ A = 6615

∴ Amount = Rs.6615

∴ Compound interest = Rs.(6615 – 6000)

= Rs.615

4. Question

A sum amounts to Rs. 23762 in 2 years at 9% per annum, compounded annually. Find the sum.

Answer

Let sum = P

Amount (A) = Rs.23762

Interest rate = 9 % per annum

Time = 2 years

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = P$(1 + 9/100)^2$ 2

⇒ 23762 = P $(109/100)^2$

⇒ 23762 = P × 11881/10000

⇒ P = 23762 × 10000/11881

⇒ P = 2 × 10000

⇒ P = 20000

∴ Sum = Rs.20000

5. Question

A scooter is bought for Rs. 32000. Its value depreciates at 10% per annum. What will be its value after 2 years?

Answer

Present value, P = Rs.32000

Time, n = 2 years

Rate of depreciates, R = 10% per annum

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ Value = P $(1 - R/100)^n$ [∵ Rate decreases]

= 32000 $(1 - 10/100)^2$

= 32000 $(1 - 1/10)^2$

= 32000 $(9/10)^2$

= 32000 × 9/10 × 9/10

= 320 × 9 × 9

= 25920

∴ Value of scooter will be Rs.25920 after 2 years.

6. Question

The compound interest on Rs. 5000 at 10% per annum for 2 years is

A. Rs. 550

B. Rs. 1050

C. Rs. 950

D. Rs. 825

Answer

Present value = Rs.5000

Interest rate = 10% per annum

Time = 2 years

Amount $(A) = P (1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = $5000 (1 + 10/100)^2$

⇒ A = $5000 (1 + 1/10)^2$

⇒ A = $5000 (11/10)^2$

⇒ A = $5000 × 11/10 × 11/10$

⇒ A = $5000 × 121/100$

⇒ A = $50 × 121$

⇒ A = 6050

∴ Amount = Rs.6050

∴ Compound interest = Rs.(6050 – 5000)

= Rs.1050

7. Question

The annual rate of growth in population of a town is 5%. If its present population is 4000, what will be its population after 2 years?

A. Rs. 4441

B. Rs. 4400

C. Rs. 4410

D. Rs. 4800

Answer

Population of a town, P = 4000

Time, n = 2 years

Increasing rate, R = 5% per annum

Now,

Amount $(A) = P (1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ Population = P (1 + R/100)^n

= 4000 (1 + 5/100)^2

= 4000 (1 + 1/20)^2

= 4000 (21/20)^2

= 4000 × 21/20 × 21/20

= 200 × 21 × 21/20

= 10 × 21 × 21

= 4410

∴ Population of a town after 2 years is 4410.

8. Question

At what rate per cent per annum will 5000 amount to Rs. 5832 in 2 years, compounded annually?

A. 11%

B. 10%

C. 9%

D. 8%

Answer

Present value, P = Rs.5000

Amount, A = Rs.5832

Time, n = 2 years

Now,

Amount (A) = P (1 + R/100)^n [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ Amount (A) = P (1 + R/100)^n

⇒ 5832 = 5000 (1 + R/100)^2

⇒ (1 + R/100)^2 = 5832/5000

⇒ (1 + R/100)^2 = 2916/2500

⇒ (1 + R/100)^2 = (54/50)^2

⇒ 1 + R/100 = 54/50

⇒ R/100 = (54/50) - 1

⇒ R/100 = (54 – 50)/50

⇒ R/100 = 4/50

⇒ R = 400/50

⇒ R = 8

∴ Rate = 8 %.

9. Question

If the simple interest on a sum of money at 10% per annum for 3 years is Rs. 1500, then the compound interest on the same sum at the same rate for the same period is

A. Rs. 1655

B. Rs. 1155

C. Rs. 1555

D. Rs. 1855

Answer

Simple interest = Rs.1500

Interest rate = 10% per annum

Time = 3 years

Simple interest (SI) = PRT/100 [where, P = Present value

R = Interest rate

∴ 1500 = (P × 10 × 3)/100 T = Time]

⇒ 1500 = P × 30/100

⇒ 1500 = P × 3/10

⇒ P = 1500 × 10/3

⇒ P = 500 × 10

⇒ P = 5000

∴ Sum = Rs.5000

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 5000 $[1 + 10/100]^3$

⇒ A = 5000 $[1 + 1/10]^3$

⇒ A = 5000 $[11/10]^3$

⇒ A = 5000 × 11/10 × 11/10 × 11/10

⇒ A = 5000 × 1331/1000

⇒ A = 5 × 1331

⇒ A = 6655

∴ Amount = Rs.6655

∴ Compound interest = Rs.(6655 – 5000)

= Rs.1655

10. Question

If the compound interest on a certain sum for 2 years at 10% per annum is Rs. 1050, the sum is

A. Rs. 3000

B. Rs. 4000

C. Rs. 5000

D. Rs. 6000

Answer

Compound interest, CI = Rs.1050

Interest rate, R = 10% per annum

Time = 2 years

$\therefore$ CI = P $(1 + R/100)^n$ – P

$\Rightarrow 1050 = P (1 + 10/100)^2 – P$

$\Rightarrow 1050 = P (1 + 1/10)^2 – P$

$\Rightarrow 1050 = P (11/10)^2 – P$

$\Rightarrow 1050 = 121P/100 – P$

$\Rightarrow 1050 = (121P – 100P)/100$

$\Rightarrow 1050 = 21P/100$

$\Rightarrow P = 1050 \times 100/21$

$\Rightarrow P = 50 \times 100$

$\Rightarrow P = 5000$

$\therefore$ Sum = Rs.5000

11. Question

Fill in the blanks:

(i) $A = P\left(1 + \dfrac{\text{.......}}{100}\right)^{n}$

(ii) (Amount) - (Principal) = ...

(iii) If the value of a machine is Rs. P and it depreciates at R% per annum, then its value after 2 years is

(iv) If the population P of a town increases at R% per annum, then its population after 5 years is ....

Answer

(i) R

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

(ii) Compound interest

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

And Compound interest = P $(1 + R/100)^n$ - P

(iii) Rs. $P\left(1-\dfrac{R}{100}\right)^{2}$

∵ Rate decreases.

∴ Value = P (1 - R/100)^{n}

Present value of machine = Rs.P

Interest rate = R% per annum

Time, n = 2

∴ Value = Rs. $P\left(1-\dfrac{R}{100}\right)^{2}$

(iv) $P\left(1+\dfrac{R}{100}\right)^{5}$

Present population of a town = P

Increases rate = R% per annum

Time, n = 5 years

∴ Population = P (1 + R/100)^{n} [Where,

P = Present value

R = Annual interest rate

n = Time in years]

∴ Population after 5 years = $P\left(1+\dfrac{R}{100}\right)^{5}$

Exercise 11D

1. Question

The compound interest on Z 5000 at 8% per annum for 2 years, compounded annually, is

A. Rs. 800

B. Rs. 825

C. Rs. 832

D. Rs.850

Answer

Present value, P = Rs.5000

Interest rate, R = 8% per annum

Time, n = 2 years

∴ Amount (A) = P (1 + R/100)^{n} [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 5000 (1 + 8/100)^{2}

⇒ A = 5000 (1 + 2/25)^{2}

⇒ A = 5000 (27/25)^{2}

⇒ A = 5000 × 27/25 × 27/25

⇒ A = 200 × 27 × 27/25

⇒ A = 8 × 27 × 27

⇒ A = 5832

∴ Amount = Rs.5832

∴ Compound interest = Rs.(5832 – 5000) [∵CI = A – P]

= Rs.832

2. Question

The compound interest on Z 10000 at 10% per annum for 3 years, compounded annually, is

A. Rs. 1331

B. Rs.3310

C. Rs.3130

D. Rs. 13310

Answer

Present value, P = Rs.10000

Interest rate, R = 8% per annum

Time, n = 3 years

∴ Amount (A) = P $(1 + R/100)^n$ [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 10000 $(1 + 10/100)^3$

⇒ A = 10000 $(1 + 1/10)^3$

⇒ A = 10000 $(11/10)^3$

⇒ A = 10000 × 11/10 × 11/10 × 11/10

⇒ A = 10 × 11 × 11 × 11

⇒ A = 13310

∴ Amount = Rs.13310

∴ Compound interest = Rs.(13310 – 10000) [∵CI = A – P]

= Rs.3310

3. Question

The compound interest on Z 10000 at 12% per annum for $1\frac{1}{2}$ years, compounded annually, is

A. Rs. 1872

B. Rs. 1720

C. Rs. 1910.16

D. Rs. 1782

Answer

Present value, P = Rs.10000

Interest rate, R = 12% per annum

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

∴ Amount (A) = P (1 + R/100)^n × [1 + (R/2)/100] [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 10000 (1 + 12/100)^1 × [1 + (12/2)/100]

⇒ A = 10000 (1 + 12/100) × [1 + 6/100]

⇒ A = 10000 (112/100) × [106/100]

⇒ A = 10000 × 112/100 × 106/100

⇒ A = 1 × 112 × 106

⇒ A = 11872

∴ Amount = Rs.11872

∴ Compound interest = Rs.(11872 – 10000) [∵CI = A – P]

= Rs.1872

4. Question

The compound interest on Rs. 4000 at 10% per annum for 2 years 3 months, compounded annually, is

A. Rs. 916

B. Rs. 900

C. Rs. 961

D. Rs. 896

Answer

Present value, P = Rs.4000

Interest rate, R = 10% per annum

Time, n =2 years 3 months = (2 + 1/4) years

∴ Amount (A) = P (1 + R/100)^n × [1 + (R/4)/100] [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 4000 (1 + 10/100)^2 × [1 + (10/4)/100]

⇒ A = 4000 (1 + 1/10)^2 × [1 + 1/40]

⇒ A = 4000 (11/10)^2 × [41/40]

⇒ A = 4000 × 121/100 × 41/40

⇒ A = 40 × 121 × 41/40

⇒ A = 121 × 41

⇒ A = 4961

∴ Amount = Rs.4961

∴ Compound interest = Rs.(4961 – 4000) [∵CI = A – P]

= Rs.961

5. Question

A sum of Rs. 25000 was given as loan on compound interest for 3 years compounded annually at 5% per annum during the first year, 6% per annum during the second year and 8% per annum during the third year. The compound interest is

A. Rs. 5035

B. Rs. 5051

C. Rs. 5072

D. Rs. 5150

Answer

Sum, P = 25000

Interest rate for 1st year, p = 5%

Interest rate for 2nd year, q = 6%

Interest rate for 3rd year, r = 8%

Time, n = 3 years

Now,

Amount (A) = P × (1 + p/100) × (1 + q/100) × (1 + r/100)

= 25000 × (1 + 5/100) × (1 + 6/100) × (1 + 8/100)

= 25000 × (1 + 1/20) × (1 + 3/50) × (1 + 2/25)

= 25000 × 21/20 × 53/50 × 27/25

= 250 × 21/2 × 53/5 × 27/25

= 10 × 21/2 × 53/5 × 27

= 1 × 21 × 53 × 27

= 30051

∴ Compound interest = Rs.(30051 – 25000) [∵CI = A – P]

= Rs.50051

6. Question

The compound interest on Rs. 6250 at 8% per annum for 1 year, compounded half yearly, is

A. Rs. 500

B. Rs. 510

C. Rs. 550

D. Rs. 512.50

Answer

Initial value, P = Rs.6250

Interest rate, R = 8% per annum

Time, n = 1 years

∵ Compounded half-yearly.

∴ Amount (A) = P [1 + (R/2)/100]^{2n} [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 6250 [1 +(8/2) /100]^2

⇒ A = 6250 [1 + 4/100]^2

⇒ A = 6250 [1 + 1/25]^2

⇒ A = 6250 [26/25]^2

⇒ A = 6250 × 26/25 × 26/25

⇒ A = 6250 × 26/25 × 26/25

⇒ A = 250 × 26 × 26/25

⇒ A = 10 × 26 × 26

⇒ A = 6760

∴ Amount = Rs.6760

∴ Compound interest = Rs.(6760 – 6250) [∵CI = A – P]

= Rs.510

7. Question

The compound interest on Rs. 40000 at 6% per annum for 6 months, compounded quarterly, is

A. Rs. 1209

B. Rs. 1902

C. Rs. 1200

D. Rs. 1306

Answer

Present value, P = Rs.40000

Interest rate, R = 6% per annum

Time, n =6 months = 1/2 years

∵ Compounded quarterly.

∴ Amount (A) = P [1 + (R/4)/100]^{4n} [Where, P = Present value

R = Annual interest rate

n = Time in years]

∴ A = 40000 [1 +(6/4) /100]^2 [4n = 4 × 1/2]

⇒ A = 40000 [1 + 3/200]^2

⇒ A = 40000 [1 + 3/200]^2

⇒ A = 40000 [203/200]^2

⇒ A = 40000 × 203/200 × 203/200

⇒ A = 40000 × 203/200 × 203/200

⇒ A = 200 × 203 × 203/200

⇒ A = 1 × 203 × 203

⇒ A = 41209

∴ Amount = Rs.41209

∴ Compound interest = Rs.(41209 – 40000) [∵CI = A – P]

= Rs.1209

8. Question

The present population of a town is 24000. If it increases at the rate of 5% per annum, what will be its population after 2 years?

A. 26400

B. 26460

C. 24460

D. 26640

Answer

Population of a town, P = 24000

Time, n = 2 years

Increasing rate, R = 5% per annum

Amount (A) = $P (1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ Population = $P (1 + R/100)^n$

= $24000 (1 + 5/100)^2$

= $24000 (1 + 1/20)^2$

= $24000 (21/20)^2$

= 24000 × 21/20 × 21/20

= 240 × 21/2 × 21/2

= 60 × 21 × 21

= 26460

∴ Population of a town is 26460 after 2 years.

9. Question

The value of a machine depreciates at the rate of 10% per annum. It was purchased 3 years ago for Rs. 60000. What is the present value of the machine?

A. Rs. 53640

B. Rs. 51680

C. Rs. 43740

D. Rs. 43470

Answer

Value of a machine 3 years ago, P = Rs.60000

Time, n = 3 years

Rate of depreciates, R = 10% per annum

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ Value = P $(1 - R/100)^n$ [∵ Rate decreases]

= 60000 $(1 - 10/100)^3$

= 60000 $(1 - 1/10)^3$

= 60000 $(9/10)^3$

= 60000 × 9/10 × 9/10 × 9/10

= 60 × 9 × 9 × 9

= 43740

∴ Present value of the machine is Rs.43740.

10. Question

The value of a machine depreciates at the rate of 20% per annum. It was purchased 2 years ago. If its present value is Rs. 40000 for how much was it purchased?

A. Rs. 56000

B. Rs. 62500

C. Rs. 65200

D. Rs. 56500

Answer

Let value of a machine 2 years ago, = P

Present value of machine = Rs.40000

Time, n = 2 years

Rate of depreciates, R = 20% per annum

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ Value = P $(1 - R/100)^n$ [∵ Rate decreases]

⇒ 40000 = P $(1 - 20/100)^2$

⇒ 40000 = P $(1 - 1/5)^2$

⇒ 40000 = P $(4/5)^2$

⇒ 40000 = P × 16/25

⇒ P = 40000 × 25/16

⇒ P = 2500 × 25

⇒ P = 62500

∴ Value of a machine 2 years ago is Rs.62500.

11. Question

The annual rate of growth in population of a town is 10%. If its present population is 33275, what was it 3 years ago?

A. Rs. 25000

B. Rs. 27500

C. Rs. 30000

D. Rs. 26000

Answer

Let 3 years ago population = P

Present population = 33275

Time, n = 3 years

Increases rate, R = 10% per annum

Now,

Amount (A) = P $(1 + R/100)^n$ [Where, A = Amount with compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ Population = P $(1 + R/100)^n$

⇒ 33275 = P $(1 + 10/100)^3$

⇒ 33275 = P $(1 + 1/10)^3$

⇒ 33275 = P $(11/10)^3$

⇒ 33275 = P × 1331/1000

⇒ P = 33275 × 1000/1331

⇒ P = 25 × 1000

⇒ P = 25000

∴ 3 years ago population is 25000.

12. Question

If the simple interest on a sum of money at 5% per annum for 3 years is Rs. 1200 then the compound interest on the same sum for the same period at the same rate will be

A. Rs. 1225

B. Rs. 1236

C. Rs. 1248

D. Rs. 1261

Answer

Interest rate, R = 5% per annum

Time = 3 years

Simple interest = Rs.1200

Simple interest = PRT/100

$\Rightarrow$ 1200 = (P × 5 × 3)/100

$\Rightarrow$ 1200 = P × 15/100

$\Rightarrow$ P = 1200 × 100/15

$\Rightarrow$ P = 8000

Now,

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

= 8000 $(1 + 5/100)^3$

= 8000 $(1 + 1/20)^3$

= 8000 $(21/20)^3$

= 8000 × 9261/8000

= 9261

$\therefore$ Amount = 9261

$\therefore$ Compound interest = Rs.(9261 – 8000) [$\because$ CI = A – P]

= Rs.1261

13. Question

If the compound interest on a sum for 2 years at $12\frac{1}{2}$% per annum is Rs. 510, the simple interest on the same sum at the same rate for the same period of time is

A. Rs. 400

B. Rs. 450

C. Rs. 460

D. Rs. 480

Answer

Compound interest, CI = Rs.510

Interest rate, R = $12\frac{1}{2}$% = 25/2% per annum

Time = 2 years

CI = P $(1 + R/100)^n$ – P

$\Rightarrow$ 510 = P $(1 + (25/2)/100)^2$ – P

$\Rightarrow$ 510 = P $(1 + 1/8)^2$ – P

$\Rightarrow$ 510 = P $(9/8)^2$ – P

$\Rightarrow$ 510 = 81P/64 – P

$\Rightarrow$ 510 = (81P – 64P)/64

$\Rightarrow$ 510 = 17P/64

⇒ P = 510 × 64/17

⇒ P = 30 × 64

⇒ P = 1920

Now,

SI = PRT/100

= (1920 × 25/2 × 2)/100

= (1920 × 25)/100

= 480

∴ Simple interest = Rs.480

14. Question

The sum that amounts to Rs.4913 in 3 years at (25/4)% per annum compounded annually, is

A. Rs. 3096

B. Rs. 4076

C. Rs. 4085

D. Rs. 4096

Answer

Amount, A = Rs.4913

Interest rate, R = (25/4)% per annum

Time = 3 years

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

⇒ 4913 = P $(1 + (25/4)/100)^3$

⇒ 4913 = P $(1 + 1/16)^3$

⇒ 4913 = P $(17/16)^3$

⇒ 4913 = P × 4913/4096

⇒ P = 4913 × 4096/4913

⇒ P = 4096

∴ Sum = Rs.4096

15. Question

At what rate per cent per annum will a sum of Rs. 7500 amount to Rs. 8427 in 2 years, compounded annually?

A. 4%

B. 5%

C. 6%

D. 8%

Answer

Present value, P = Rs.7500

Amount, A = Rs.8427

Time, n = 2 years

Now,

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

⇒ 8427 = 7500 $(1 + R/100)^2$

⇒ $(1 + R/100)^2$ = 8427/7500

⇒ $(1 + R/100)^2$ = $(53/50)^2$

⇒ (1 + R/100) = (53/50)

⇒ R/100 = 53/50 – 1

⇒ R/100 = (53 – 50)/50

⇒ R = 3/50 × 100

⇒ R = 6

∴ Rate = 6%