CAT

MBA PIONEER 2024

QUANTITATIVE APTITUDE

DPP: 7

Simple Interest and Compound Interest - 2

Q1 Compound interest on Rs. 5Y at 40% per annum for one year when compounded half-yearly is Rs. 196 more than the compound interest on Rs. 8(100 + Y) at 10% per annum for two years when compounded annually. Find the value of 'Y'.

(A) 500 (B) 600
(C) 700 (D) 800

Q2 An online shopping site sells a smartphone for ₹ 36000 or on the terms that the buyer should pay ₹ 5325 as cash down payment and the rest in three equal half-yearly installments. They charge interest at the rate 15% p.a. compounded half-yearly. If the smartphone is purchased under installment plan, find the value of each installment (in Rs). [Round off to the nearest integer]

(A) 10576 (B) 11796
(C) 12676 (D) 13596

Q3 In a loan installment plan, the monthly payment remains constant while the interest portion decreases with each payment. If the first month's payment consisted of 40% interest and the twelfth month's payment consisted of 20% interest, what is the ratio of the principal portion in the first payment to the principal portion in the twelfth payment?

(A) 3:7 (B) 2:3
(C) 1:2 (D) 3:4

Q4 Mira deposits $5000 into a bank account that compounds interest semi-annually at a 6% annual rate. After 3 years, she withdraws $2000 from the account. What is the approximate balance (in $) in the account after 5 years?

(A) 4139 (B) 4249
(C) 4359 (D) 4469

Q5 Suman deposits Rs. x with a bank at r% p.a compound interest and in 40 years it becomes Rs.1024x . If he had invested the same amount at r% p.a simple interest for 40 years, then which among the below options would be the correct approx. range of the amount?

1) Rs. 6.7x < The amount < Rs. 7x
2) Rs. 7x < The amount < Rs. 7.7x
3) Rs. 7.7x < The amount < Rs. 8x
4) Rs.8x < The amount < Rs. 8.7x

Q6 A bank offers two investment plans for a principal amount of $10,000. Plan A is a simple interest plan with an interest rate of 5% p.a., and Plan B is a compound interest plan with an interest rate of 4% p.a., compounded annually. If an investor wants to make a total of $20,000 after investing in one of these plans, what is the difference in the number of years required for Plan A and Plan B to reach this goal? [ln(2) ≈ 0.693, ln(1.04) ≈ 0.0392]

(A) 2 years (B) 3 years
(C) 4 years (D) 5 years

Q7 An investor deposits an equal sum of money at the end of each year in a bank account with an annual interest rate of 10% compounded annually. If the total amount in the account after 4 years is $14641, what is the annual approximate deposit?

(A) $3000 (B) $3155
(C) $3250 (D) $3355

Q8 In a country, the government issues a special bond for wealthy citizens that has a face value of $1,000,000. The bond pays simple interest at a rate of 7% annually for the first 5 years and compound interest at a rate of 5%

compounded quarterly for the next 5 years. What will be the total approximate interest (in $) earned by the end of the 10th year? [$(1.0125)^{20} \approx 1.282$]

(A) 707400 (B) 718500

(C) 729600 (D) 730700

Q9 A rare painting was purchased at an auction for $100,000. Its value is expected to increase at a compound interest rate of 7% per annum. In how many years will the value of the painting be closest to triple its original purchase price? [Assume, ln(3) = 1.0986, ln(1.07) = 0.0677]

(A) 15 years (B) 16 years

(C) 17 years (D) 18 years

Q10 What is the least number of years required for an investment to triple its principal if the interest is compounded annually at a rate of 12%? [Assume, ln(3) = 1.0986, ln(1.12) = 0.1133]

(A) 8 years (B) 9 years

(C) 10 years (D) 11 years

Q11 A car financing company offers a loan for a car worth $25,000 at a simple interest rate of 6.5% per annum. After 3 years, the borrower decides to make a single lump sum payment to clear the remaining balance on the loan. What is the amount of the lump sum payment (Note: A lump-sum payment is an amount paid all at once, as opposed to an amount that is paid in installments.)?

(A) $25,087 (B) $26,125

(C) $27,250 (D) $29,875

Q12 A man invests $5,000 at a simple interest rate of 4% per annum for a certain number of years. At the end of the investment period, he receives the same amount of interest as if he had invested the same principal at 7% per annum compounded annually for half the number of years. From the following options, how many years may he invest the $5,000 at simple interest?

(A) 6 years (B) 10 years

(C) 12 years (D) 14 years

Q13 A student takes out a loan of $15,000 for his college tuition, with an interest rate of 5% per annum compounded monthly. He has to start repaying the loan in equal monthly installments 3 years after taking the loan. If he repays the loan in 4 years (48 installments), what will be the value of each installment? [$(1.0041667)^{36} \approx 1.16147$, $(1.0041667)^{-48} \approx 0.81907$]

[Note: PV = $\frac{P \times (1-(1+i)^{-n})}{i}$, where PV is the present value of the loan (loan amount), i is the monthly interest rate, and n is the number of installments.]

(A) $381.82 (B) $388.16

(C) $392.37 (D) $401.22

Q14 A company invests $10,000 in a project that yields a 5% annual return, compounded semi-annually. After the first year, they increase the investment by $5,000. What will be the total value of the investment after 4 years? [$(1.025)^8 \approx 1.218402$]

(A) $17,982 (B) $19,657

(C) $21,045 (D) $23,503

Q15 A bank offers a special savings account with an interest rate of 3% p.a compounded quarterly. To encourage customers, the bank adds a bonus simple interest rate of 1% per annum on the initial amount. If a customer deposits $15,000 in the account, what will be the balance after 6 years? [$(1.0075)^{24} \approx 1.1964$]

(A) $18,846 (B) $20,115

(C) $22,848 (D) $24,423.51

Q16 An investor deposits $20,000 in a bank offering a 4% annual interest rate compounded annually for 3 years. After 3 years, the bank changes its interest rate to 5% compounded semi-annually. What will be the approximate account balance at the end of 6 years?

(A) $26089.87 (B) $28,917.23

(C) $30,623.41 (D) $32,062.39

Q17 An investor invests $5,000 in a bank that offers a 5% annual interest rate compounded semi-annually. After 3 years, the investor reinvests the entire amount in another account offering a 6% annual interest rate compounded quarterly for 2 years. What will be the total interest earned at the end of the 5 years? [$(1.015)^8 \approx 1.1265$]

(A) $1,798.62 (B) $1,531.98

(C) $1,353.17 (D) $1,175.54

Q18 A man borrows $30,000 from a bank to buy a car. The bank charges an annual interest rate of 8% compounded monthly. The man pays off the loan in equal monthly installments over a period of 4 years. What is the approximate total interest paid by the man at the end of the loan period? [$(1.0067)^{-48} \approx 0.72577$]

[Note: The formula for the present value of an annuity to calculate the monthly installment amount.

PV = P × $\frac{(1-(1+r)^{-n})}{r}$

Where PV is the present value of the loan (loan amount), r is the monthly interest rate, and n is the number of installments.]

(A) $11,784.84 (B) $9,258.52

(C) $7,036.91 (D) $5,182.08

Q19 An investor deposits $15,000 in a bank that offers an interest rate of 5% per annum compounded annually. After 5 years, the investor withdraws the entire amount and deposits it in another bank that offers an interest rate of 4% p.a compounded semi-annually. What will be the approximate account balance at the end of 10 years (in the nearest integer dollars)?
[$(1.02)^{10} \approx 1.2190$]

Q20 A man invests $8,000 in a scheme that offers a simple interest rate of 6% per annum for the first 3 years and a compound interest rate of 5% per annum compounded annually for the next 4 years. What will be the approximate total interest earned at the end of the 7 years (in the nearest integer dollars)? [$(1.05)^4 \approx 1.2155$]

Q21 Mrs. Adani invested a certain sum at 20% p.a. simple interest for 4 years. She then invested 30% of the amount received in PMJDY, offering 30% p.a. simple interest for 2 years and the remaining in PMJJBY, offering 10% p.a. compound interest, compounded annually for 2 years. If the sum of the interest received from the two schemes is Rs. 10,000. Find the approx. initial invested sum(in Rs.) Mrs. Adani had.

Q22 An e-commerce website offers a laptop for sale at a price of ₹ 45000. Alternatively, the buyer can pay ₹ 13,000 upfront and the remaining amount in three equal installments, subject to an interest rate of 12% p.a. compounded half-yearly. If the laptop is purchased through the installment plan, determine the value of each installment. (Round off the answer to the nearest integer.)

Q23 Mr. Musk received a prize of $65,000. He deposited one-fifth of the amount in SVB bank for two years with annual compounding. He invested $4,000 less than the remaining money with the Tawta company in a business. After 5 months, Tawta withdrew $4,800 from the business. Two months later, Mr. Musk increased his investment by 10%. At the end of one year, Mr. Musk's share of profit was $40,625, which is 625/88 times the interest received from SVB bank. The total profit from the business was $87,100. Determine the amount (in $) invested by Tawta in the business.

Q24 Ritesh put Rs. 18000 at 6% simple annual interest into a local bank, and exactly after three years, Firoz also invested Rs. 14000 at 12% simple annual interest. How long will it take (in years) for Firoz's balance i.e., their principal plus accumulated interest—to be almost equal with Ritesh's investment?

Q25

A bank offers two schemes of interest on a fixed deposit of Rs. 10,000 for 3 years. Scheme A pays simple interest at 12% per annum for the first year, 15% per annum for the second year, and 18% per annum for the third year, with interest calculated only on the principal amount. Scheme B pays compound interest at 10% per annum, compounded annually. However, both schemes deduct 10% of the interest earned as tax at the end of the tenure. What is the difference between the final amounts received from the two schemes?

(A) Rs. 453 (B) Rs. 1540
(C) Rs. 931 (D) Rs. 1071

Q26 In a new housing scheme, the builder offers a unique payment plan. A buyer can pay 40% of the house value upfront and the remaining amount in 3 equal annual installments at a compound interest rate of 6% per annum. If Alex bought a house for \$350,000 and used this payment plan, what will be the approximate value of each installment he has to pay?

[Note: The present value of annuity formula is: PV = P × [$\frac{(1-(1+r)^{-n})}{r}$], where PV is the present value, P is the periodic payment, r is the interest rate, and n is the number of periods.]

(A) \$74,777 (B) \$83,333
(C) \$62,222 (D) \$78,563

Q27 A company invests in two projects, A and B, with a combined value of \$50,000. Project A yields a simple interest of 6% per annum, while project B yields a compound interest of 4% per annum compounded annually. After 4 years, the combined value of both investments is \$60,000. What is the initial investment in project A?

(A) \$19,030.27 (B) \$21,485.60
(C) \$23,205.50 (D) \$25,030.20

Q28 An investor deposits \$10,000 in a bank account with an interest rate of 3% compounded annually. Every year, the investor withdraws the interest earned and reinvests it in another account with an interest rate of 4% compounded quarterly. At the end of 5 years, what will be the total amount in the second account, including both principal and interest? [$(1.01)^{16} \approx 1.1726$, $(1.01)^{12} \approx 1.1268$, $(1.01)^{8} \approx 1.0829$]

(A) \$1,575.09 (B) \$1,626.87
(C) \$1,821.47 (D) \$1,935.06

Q29 An investor deposits \$10,000 in a bank account with a 4% annual interest rate compounded semi-annually. At the beginning of each year (starting from year 2), the investor withdraws the interest earned in the previous year and deposits it into another account with an interest rate of 6% p.a compounded quarterly. What is the total amount in the second account after 6 years(from beginning), including both principal and interest? [$(1.015)^{24} \approx 1.4295$, $(1.015)^{20} \approx 1.3468$, $(1.015)^{16} \approx 1.2690$, $(1.015)^{12} \approx 1.1956$, $(1.015)^{8} \approx 1.1265$]

(A) \$2,396.34 (B) \$2,912.67
(C) \$2,740.89 (D) \$2,423.71

Q30 A businesswoman borrows \$60,000 from a bank at an interest rate of 9% p.a compounded quarterly. She repays the loan in 5 equal annual installments starting one year after the loan is granted. What is the approximate value of each installment?

$[(1.09308)^{-5} \approx 0.6408,\ (1.0225)^4 \approx 1.09308]$

[Note: Present Value of Annuity = $\frac{(Present\ Value \times Interest\ Rate)}{[1-(1+Interest\ Rate)^{(-Number\ of\ Periods)}]}$]

(A) \$14,737 (B) \$16,995
(C) \$18,312 (D) \$20,639

Answer Key

Q1	(C)
Q2	(B)
Q3	(D)
Q4	(D)
Q5	4
Q6	(A)
Q7	(B)
Q8	(D)
Q9	(B)
Q10	(C)
Q11	(D)
Q12	(B)
Q13	(D)
Q14	(A)
Q15	(A)
Q16	(A)
Q17	(B)
Q18	(D)
Q19	23337
Q20	3474
Q21	16989.46
Q22	11970
Q23	60000
Q24	15
Q25	(D)
Q26	(D)
Q27	(B)
Q28	(B)
Q29	(D)
Q30	(B)

Hints & Solutions

Q1 Text Solution:

Compound interest when compounded annually

= sum × ((1+ $\frac{\frac{rate}{2}}{100}$)$^{2 \times time}$ – 1)

Then, compound interest on Rs. 8(100+ Y) at 10% per annum for two years when compounded annually = 8(100+ Y) × ((1+ $\frac{10}{100}$)^2 –1)

= 8(100+ Y) × $\frac{21}{100}$

= 168 +1.68Y

And compound interest when compounded half yearly

= sum × ((1+ $\frac{rate}{200}$)$^{2 \times time}$ – 1)

Then, compound interest on Rs. 5Y at 40% per annum for one year when compounded half-yearly

= 5Y × ((1 + $\frac{40}{200}$)$^{2\times1}$ – 1)

= 5Y × $\frac{11}{25}$

= 2.2Y

Now, 168 + 1.68Y= 2.2Y - 196

0.52Y = 364

Y = 700

Q2 Text Solution:

The cost of the smartphone is ₹ 36000. Now, if the person could either buy a smartphone by paying ₹36000 or through an installment plan. Since the smartphone was purchased through an installment plan then the loan amount = ₹36000 –₹5325 (down payment) = ₹30675.

Here r = 15% compounded half-yearly in 3 equal installments.

Let x be the amount of installment. Then,

₹30675 = $\frac{x}{(1+\frac{15}{200})^3} + \frac{x}{(1+\frac{15}{200})^2} + \frac{x}{(1+\frac{15}{200})}$

x ≈ ₹11796

Q3 Text Solution:

Let's assume the constant monthly payment is P.

First Month's Payment:

The first month's payment consists of 40% interest. Therefore, the principal portion of the first month's payment is 60%.

Interest portion = 40% of P = 0.4P

Principal portion = 60% of P = 0.6P

Twelfth Month's Payment:

The twelfth month's payment consists of 20% interest. Therefore, the principal portion of the twelfth month's payment is 80%.

Interest portion = 20% of P = 0.2P

Principal portion = 80% of P = 0.8P

Now we need to find the ratio of the principal portion in the first payment to the principal portion in the twelfth payment:

Principal Ratio = (Principal portion in the first payment) : (Principal portion in the twelfth payment)

Principal Ratio = 0.6P : 0.8P

To simplify the ratio, we can divide both parts of the ratio by the common factor, which in this case is 0.2P:

Principal Ratio = ($\frac{0.6P}{0.2P}$) : ($\frac{0.8P}{0.2P}$)

Principal Ratio = 3 : 4

The ratio of the principal portion in the first payment to the principal portion in the twelfth payment is 3:4.

Q4 Text Solution:

Step 1: Calculate the account balance after 3 years with compounded interest

The formula for compound interest is:

Amount = Principal × (1 + ($\frac{Rate}{n}$))$^{(n \times Time)}$

Here, the Principal is \$5000, the annual Rate is 6% (0.06 as a decimal), n is the number of times interest is compounded in a year (semi-annually, so n = 2), and Time is 3 years.

Amount = \$5000 × (1 + ($\frac{0.06}{2}$))$^{(2 \times 3)}$

Amount = \$5000 × (1 + 0.03)^6

Amount = \$5000 × (1.03)^6

Amount ≈ \$5970.26

Step 2: Account balance after the withdrawal of \$2000

Mira withdraws \$2000 from the account after 3 years.

New balance = \$5970.26 - \$2000

New balance = \$3970.26

Step 3: Calculate the account balance after 5 years

Now we have 2 years left (5 years - 3 years), so we need to find the account balance after these 2 years.

Amount = Principal × (1 + ($\frac{\text{Rate}}{n}$))$^{(n \times \text{Time})}$

Amount = \$3970.26 × (1 + ($\frac{0.06}{2}$))$^{(2 \times 2)}$

Amount = \$3970.26 × $(1.03)^4$

Amount ≈ \$4468.56 = \$4469 (approx.)

Q5 Text Solution:

$x(1+r)^{40} = 1024x$

$\Rightarrow (1+r)^{40} = 1024$

$\Rightarrow \left((1+r)^{20}\right)^2 = 32^2$

$\Rightarrow (1+r)^{20} = 32$

$\Rightarrow \left((1+r)^4\right)^5 = 2^5$

$\Rightarrow \left((1+r)^4\right) = 2$

In order for the money to double, the approximate value of r = 19 %

If he had invested this in simple interest,

A = x + x × 40 × $\frac{19}{100}$ = 8.6x.

Hence, (4) is correct.

Q6 Text Solution:

Let the number of years required for Plan A be n_A, and the number of years required for Plan B be n_B.

For Plan A (Simple Interest):

Total amount = Principal + Simple Interest

20,000 = 10,000 + (10,000 × n_A × $\frac{5}{100}$)

Let's solve for n_A:

20,000 = 10,000 + (500 × n_A)

10,000 = 500 n_A

$n_A = \frac{10{,}000}{500}$

n_A = 20 years

For Plan B (Compound Interest):

Total amount = Principal × (1 + Interest rate $)^{\text{Time\ span}}$

20,000 = 10,000 × $(1 + \frac{4}{100})^{n_B}$

Let's solve for n_B:

2 = $(1 + 0.04)^{n_B}$

Taking the natural logarithm of both sides:

ln(2) = n_B × ln(1.04)

$n_B = \frac{ln(2)}{ln(1.04)}$

n_B ≈ 0.693/0.0392

n_B ≈ 17.68 years

Since the number of years must be an integer, the investor will need to wait for 18 years in Plan B to reach the goal.

Now, let's find the difference between n_A and n_B:

Difference = $n_A - n_B$

Difference = 20 - 18

Difference = 2 years

Q7 Text Solution:

To solve this question, we need to find the amount deposited at the end of each year. Let's denote the annual deposit as D. The account pays 10% interest compounded annually, and the total amount in the account after 4 years is \$14,641.

We can break down the problem as follows:

· At the end of the first year, the investor deposits D. No interest is earned during the first year since the deposit happens at the end of the year.

· At the end of the second year, the first deposit earns 10% interest, and the investor makes the second deposit of D. The total amount in the account is D × 1.1 + D.

· At the end of the third year, the first deposit earns interest for 2 years, the second deposit earns interest for 1 year, and the investor makes the third deposit of D. The total amount in the account is D × 1.1^2 + D × 1.1 + D.

· At the end of the fourth year, the first deposit earns interest for 3 years, the second deposit earns interest for 2 years, the third deposit earns interest for 1 year, and the investor makes the fourth deposit of D. The total amount in the account is D × 1.1^3 + D × 1.1^2 + D × 1.1 + D.

According to the problem, the total amount in the account after 4 years is \$14,641:

\$14,641 = D × 1.1^3 + D × 1.1^2 + D × 1.1 + D

Now, we can factor out D from the equation:

\$14,641 = D (1.1^3 + 1.1^2 + 1.1 + 1)

Calculate the sum inside the parentheses:

$1.1^3 + 1.1^2 + 1.1 + 1 = 1.331 + 1.21 + 1.1 + 1 = 4.641$

Now, we have the equation:

$\$14,641 = D \times 4.641$

Now, divide both sides of the equation by 4.641 to find the value of D:

$D = \frac{\$14,641}{4.641}$

$D \approx \$3155$

The investor should deposit approximately $3155 annually to have a total amount of $14,641 in the account after 4 years.

Q8 Text Solution:

First, let's calculate the interest earned during the first 5 years when the bond pays simple interest at a rate of 7% annually:

Simple Interest = Principal × Rate × Time

Simple Interest = $1,000,000 × 0.07 × 5

Simple Interest = $350,000

The principal after 5 years will be:

Principal = Initial Principal + Simple Interest

Principal = $1,000,000 + $350,000

Principal = $1,350,000

Now, let's calculate the interest earned during the next 5 years when the bond pays compound interest at a rate of 5% compounded quarterly:

Since the interest is compounded quarterly, we need to divide the annual rate by 4 to get the quarterly rate, and multiply the number of years by 4 to get the number of quarters:

Quarterly Rate = $\frac{0.05}{4} = 0.0125$

Number of Quarters = 5 × 4 = 20

Next, we will use the compound interest formula:

$\text{Amount} = \text{Principal} \times (1 + \text{Rate})^{\text{Time}}$

In this case, the principal amount for the next 5 years is $1,350,000:

Principal = $1,350,000

Now, we can plug the values into the compound interest formula:

$\text{Amount} = \$1,350,000 \times (1 + 0.0125)^{20}$

Amount = $1,350,000 × 1.282

Amount = $1730700

Now, we subtract the principal amount ($1,350,000) to find the compound interest earned during the next 5 years:

Compound Interest = $1730700 - $1,350,000

Compound Interest = $380700

Finally, we add the simple interest and the compound interest to find the total interest earned by the end of the 10th year:

Total Interest = $350,000 + $380700

Total Interest = $730700

The total interest earned by the end of the 10th year is approximately $730700.

Q9 Text Solution:

Let's break down the problem step by step.

We need to find the number of years it takes for the value of the painting to be closest to triple its original purchase price. Since the value increases at a compound interest rate of 7% per annum, we can represent the future value (A) of the painting as follows:

$A = P \times (1 + r)^t$

Where:

A = future value of the painting

P = original purchase price ($100,000)

r = interest rate (0.07)

t = number of years

We want the value of the painting to be closest to triple its original purchase price, which is:

Triple Value = 3 × $100,000 = $300,000

Now, we can set up the equation as follows:

$\$300,000 \approx \$100,000 \times (1 + 0.07)^t$

To solve for t, we can first divide both sides of the equation by $100,000:

$3 = (1.07)^t$

To find the value of t, we can take the logarithm of both sides of the equation. Using the natural logarithm (ln), we have:

$\ln(3) = t \times \ln(1.07)$

Now, we can divide both sides of the equation by ln(1.07) to find the value of t:

$t = \frac{\ln(3)}{\ln(1.07)}$

$= \frac{1.0986}{0.0677}$

$t \approx 16.2$

Since t must be a whole number, we can round the value to the nearest whole number. In this case, 16.2 is closest to 16. Therefore, it will take approximately 16 years for the value of the painting to be closest to triple its original purchase price.

The correct answer is (B) 16 years.

Q10 Text Solution:

We need to find the least number of years it takes for an investment to triple its principal when the interest is compounded annually at a rate of 12%. We can represent the future value (A) of the investment as follows:

$A = P \times (1 + r)^t$

Where:

A = future value of the investment

P = principal (original investment)

r = interest rate (0.12)

t = number of years

We want the value of the investment to be triple its principal, so we can set up the equation as follows:

$3P = P \times (1 + 0.12)^t$

To solve for t, we can first divide both sides of the equation by P:

$3 = (1.12)^t$

To find the value of t, we can take the logarithm of both sides of the equation. Using the natural logarithm (ln), we have:

$\ln(3) = t \times \ln(1.12)$

Now, we can divide both sides of the equation by ln(1.12) to find the value of t:

$t = \frac{ln(3)}{ln(1.12)}$

$= \frac{1.0986}{0.1133}$

$t \approx 9.696$

Since t must be a whole number, we can round the value up to the nearest whole number. In this case, 9.696 is closest to 10. Therefore, it will take a minimum of 10 years for an investment to triple its principal when the interest is compounded annually at a rate of 12%.

The correct answer is (C) 10 years.

Q11 Text Solution:

To solve this problem, let's first calculate the total interest accrued over the 3-year period.

Simple Interest = Principal × Rate × Time

Simple Interest = $25,000 × 0.065 × 3

Simple Interest = $4,875

Now, let's add the interest to the principal amount to find the total amount owed after 3 years:

Total Amount Owed = Principal + Simple Interest

Total Amount Owed = $25,000 + $4,875

Total Amount Owed = $29,875

Since the borrower decides to make a single lump sum payment to clear the remaining balance on the loan, the amount of the lump sum payment will be equal to the total amount owed after 3 years:

Lump Sum Payment = Total Amount Owed

Lump Sum Payment = $29,875

Q12 Text Solution:

Let's denote the number of years of the simple interest investment as "x." According to the problem, the man invests the same amount at simple interest at a 4% rate and receives the same amount of interest as if he had invested the same principal at 7% per annum compounded annually for $\frac{x}{2}$ years.

First, we'll calculate the simple interest earned:

Simple Interest = Principal × Rate × Time

Simple Interest = $5,000 × 0.04 × x

Now, we'll calculate the compound interest earned after $\frac{x}{2}$ years at an 7% rate:

Amount = Principal × $(1 + \text{Rate})^{\text{Time}}$

Amount = $5,000 × $(1 + 0.07)^{(x/2)}$

To find the compound interest, we'll subtract the principal from the amount:

Compound Interest = Amount – Principal

Compound Interest = $5,000 × $((1 + 0.07)^{(x/2)} - 1)$

Since the simple interest earned is the same as the compound interest earned, we can set these two expressions equal to each other:

$5,000 × 0.04 × x = $5,000 × $((1 + 0.07)^{(x/2)} - 1)$

We can simplify this equation by dividing both sides by $5,000:

$0.04x = (1.07)^{(x/2)} - 1$

Now we can try each of the given answer choices:

Option A) x = 6 years

$0.04 \times 6 = 1.07^3 - 1$

$0.24 = 1.225 - 1$

$0.24 \approx 0.225$ (Not equal)

Option B) x = 10 years

$0.04 \times 10 = 1.07^5 - 1$

$0.4 \approx 1.40 - 1$

$0.4 \approx 0.4$ (Almsot equal)

Option C) x = 12 years

$0.04 \times 12 = 1.07^6 - 1$

$0.48 \approx 1.5 - 1$

$0.48 \approx 0.5$ (Not equal)

Option D) x = 14 years

$0.04 \times 14 = 1.07^7 - 1$

$0.56 \approx 1.6 - 1$

$0.56 \approx 0.6$ (Not equal)

From these calculations, we can see that the answer choice (b) 10 years gives us the closest match:

$0.04x \approx (1.07)^{(x/2)} - 1$

Thus, the man invested the $5,000 at simple interest for 10 years.

Q13 Text Solution:

Calculate the loan amount after 3 years:

Annual interest rate = 5%

Monthly interest rate = $\left(\frac{5\%}{12}\right)$ = 0.41667% or 0.0041667

Number of months in 3 years = 3 years × 12 months = 36 months

Future Value = Principal × $(1 + \text{Rate})^{\text{Time}}$

Future Value = $15,000 × $(1 + 0.0041667)^{36}$

Future Value ≈ $15,000 × 1.16147

Future Value ≈ $17422.05

Calculate the monthly interest rate for the repayment period:

The monthly interest rate remains the same as before, which is 0.41667% or 0.0041667.

Calculate the value of each monthly installment:

We will use the formula for the present value of an annuity and derive an expression to calculate the monthly installment amount. Let "P" be the monthly installment.

$PV = \frac{P \times (1 - (1+i)^{-n})}{i}$

Where PV is the present value of the loan (loan amount), i is the monthly interest rate, and n is the number of installments.

$\$17422.05 = \frac{P \times (1 - (1 + 0.0041667)^{-48})}{0.0041667}$

Now, we need to solve for P:

$P = \frac{\frac{\$17422.05}{(1 - (1 + 0.0041667)^{-48}}\,)}{0.0041667}$

$P = \frac{\$17422.05}{\frac{(1 - 0.81907)}{0.0041667}}$

P ≈ $401.22

The value of each monthly installment is approximately $401.22.

Q14 Text Solution:

Calculate the future value of the initial investment of $10,000:

Future Value = Principal × $(1 + \text{Rate})^{\text{Time}}$

Future Value = $10,000 × $(1 + 0.025)^{8}$

Future Value ≈ $10,000 × 1.218402

Future Value ≈ $12,184.02

Calculate the future value of the additional investment of $5,000:

After the first year, the company increases the investment by $5,000. The additional investment will grow for the remaining 3 years (6 periods).

Future Value = Principal × $(1 + \text{Rate})^{\text{Time}}$

Future Value = $5,000 × $(1 + 0.025)^{6}$

Future Value ≈ $5,000 × 1.15969

Future Value ≈ $5798.45

Add the future values of both investments to find the total value:

Total Value = Future Value of Initial Investment + Future Value of Additional Investment

Total Value = $12,184.02 + $5,798.45

Total Value ≈ $17,982.47 = $17,982 (approx.)

Q15 Text Solution:

Calculate the interest earned from the 3% compounded quarterly interest:

Annual interest rate = 3%

Quarterly interest rate = $(\frac{3\%}{4})$ = 0.75% or 0.0075

Number of quarters in 6 years = 6 years × 4 quarters = 24 quarters

Future Value = Principal × $(1 + \text{Rate})^{\text{Time}}$

Future Value = \$15,000 × $(1 + 0.0075)^{24}$

Future Value ≈ \$15,000 × 1.1964

Future Value ≈ \$17,946

Interest earned from compounded interest = \$17,946 - \$15,000

Interest earned ≈ \$2946

Calculate the interest earned from the 1% simple annual bonus interest:

Annual bonus interest rate = 1%

Time = 6 years

Simple Interest = Principal × Rate × Time

Simple Interest = \$15,000 × 0.01 × 6

Simple Interest = \$900

Add the interest earned from both sources to the initial deposit:

Total Interest = Interest from compounded interest + Interest from simple interest

Total Interest = \$2946 + \$900

Total Interest = \$3846

Balance after 6 years = Initial deposit + Total Interest

Balance = \$15,000 + \$3846

Balance ≈ \$18,846

Q16 Text Solution:

Let's solve this problem step by step.

Calculate the account balance after the first 3 years at 4% annual interest compounded annually:

Principal (P) = \$20,000

Annual interest rate (R) = 4% = 0.04

Time (T) = 3 years

Future Value (FV) = P × $(1 + R)^T$

FV = \$20,000 × $(1 + 0.04)^3$

FV ≈ \$20,000 × 1.124864

FV ≈ \$22,497.28

The account balance after 3 years is approximately \$22,497.28.

Calculate the account balance after the next 3 years at 5% annual interest compounded semi-annually:

Principal (P) = \$22,497.28

Annual interest rate (R) = 5% = 0.05

Semi-annual interest rate $(\frac{R}{2})$ = $\frac{0.05}{2}$ = 0.025

Time (T) = 3 years

Since the interest is compounded semi-annually, we have to double the time and use the semi-annual interest rate.

Number of periods (N) = 3 years × 2 = 6 periods

Future Value (FV) = P × $(1 + \frac{R}{2})^{2T}$

FV = \$22,497.28 × $(1 + 0.025)^6$

FV ≈ \$22,497.28 × 1.15969

FV ≈ \$26089.87

The account balance at the end of 6 years is approximately \$26089.87.

Q17 Text Solution:

First investment (3 years at 5% compounded semi-annually):

Principal (P_1) = \$5,000

Annual interest rate (R_1) = 5% = 0.05

Semi-annual interest rate (r_1) = $\frac{0.05}{2}$ = 0.025

Number of compounding periods (t_1) = 3 years × 2 = 6

Future Value (FV_1) = $P_1 \times (1 + r_1)^{t_1}$

FV_1 = \$5,000 × $(1 + 0.025)^6$

FV_1 ≈ \$5798.47

Interest earned during the first investment:

$\text{Interest}_1 = FV_1 - P_1$

Interest_1 = \$5798.47 - \$5,000

Interest_1 ≈ \$798.47

Second investment (2 years at 6% compounded quarterly):

Principal (P_2) = FV_1 (reinvesting the entire amount)

Annual interest rate (R_2) = 6% = 0.06

Quarterly interest rate (r_2) = $\frac{0.06}{4}$ = 0.015

Number of compounding periods (t_2) = 2 years × 4 = 8

Future Value (FV_2) = $P_2 \times (1 + r_2)^{t_2}$

FV_2 = \$5798.47 × $(1 + 0.015)^8$

FV_2 ≈ \$6531.98

Interest earned during the second investment:

$Interest_2 = FV_2 - P_2$

$Interest_2$ = \$6531.98 - \$5798.47

$Interest_2$ ≈ \$733.51

Total interest earned at the end of the 5 years:

Total Interest = $Interest_1 + Interest_2$

Total Interest ≈ \$798.47 + \$733.51

Total Interest ≈ \$1531.98

Q18 Text Solution:

To calculate the total interest paid by the man at the end of the loan period, we first need to determine the monthly installment amount and then calculate the total interest paid over 4 years.

Calculate the monthly interest rate:

Annual interest rate (R) = 8% = 0.08

Monthly interest rate (r) = $\frac{R}{12} = \frac{0.08}{12}$ = 0.0067

Determine the number of installments:

Loan period = 4 years

Number of installments (n) = 4 years × 12 months = 48 installments

Calculate the monthly installment (P):

We will use the formula for the present value of an annuity to calculate the monthly installment amount.

$$PV = P \times \frac{(1 - (1 + r)^{-n})}{r}$$

Where PV is the present value of the loan (loan amount), r is the monthly interest rate, and n is the number of installments.

$$\$30{,}000 = P \times \frac{(1 - (1 + 0.0067)^{-48})}{0.0067}$$

Now, we need to solve for P:

$$P = \times \frac{\$30{,}000}{\frac{(1 - (1 + 0.0067)^{-48})}{0.0067}}$$

P ≈ \$732.96

Calculate the total amount paid by the man:

Total Amount = Monthly Installment × Number of Installments

Total Amount = \$732.96 × 48

Total Amount ≈ \$35,182.08

Calculate the total interest paid by the man:

Total Interest = Total Amount - Initial Loan Amount

Total Interest = \$35,182.08 - \$30,000

Total Interest ≈ \$5,182.08

The total interest paid by the man at the end of the loan period is approximately \$5,182.08.

Q19 Text Solution:

To solve this problem, we will first find the account balance after 5 years in the first bank, then calculate the account balance in the second bank after another 5 years.

Step 1: Calculate the account balance after 5 years in the first bank

We will use the compound interest formula to find the account balance (A) after 5 years in the first bank.

Principal (P) = \$15,000

Annual interest rate (r) = 5% = 0.05

Number of years (t) = 5

$A = P \times (1 + r)^t$

A = \$15,000 × $(1 + 0.05)^5$

A ≈ \$19,144.22

The account balance after 5 years in the first bank is approximately \$19,144.22.

Step 2: Calculate the account balance after 5 years in the second bank

Now, the investor withdraws the entire amount from the first bank and deposits it in the second bank that offers an interest rate of 4% compounded semi-annually. We will use the compound interest formula again to find the account balance (A) after 5 years in the second bank.

Principal (P) = \$19,144.22 (amount withdrawn from the first bank)

Annual interest rate (r) = 4% = 0.04

Number of compounding periods per year (n) = 2 (semi-annual compounding)

Number of years (t) = 5

The interest rate per compounding period (r') = $\frac{r}{n}$

r' = $\frac{0.04}{2}$ = 0.02

The total number of compounding periods (t') = n × t

t' = 2 × 5 = 10

Now, we can use the compound interest formula:

$A = P \times (1 + r')^{t'}$

$A = \$19{,}144.22 \times (1 + 0.02)^{10}$

A = $19,144.22 × 1.2190

A ≈ $23,336.80 = 23,337 (approx.)

The account balance at the end of 10 years, considering both banks, is approximately $23,337.

Q20 Text Solution:

To solve this problem, we will first calculate the interest earned during the first 3 years when the interest rate is simple, and then during the next 4 years when the interest rate is compounded. Finally, we will sum up the interest earned in both periods.

Step 1: Calculate the simple interest for the first 3 years

Principal (P) = $8,000

Simple interest rate (r) = 6% = 0.06

Number of years (t) = 3

Simple Interest (SI) = P × r × t

SI = $8,000 × 0.06 × 3

SI = $1,440

The simple interest earned during the first 3 years is $1,440.

Step 2: Calculate the compound interest for the next 4 years

For this step, we will first find the new principal amount after the first 3 years.

New Principal = Initial Principal + Simple Interest

New Principal = $8,000 + $1,440

New Principal = $9,440

Now, we will calculate the compound interest for the next 4 years.

Principal (P) = $9,440

Compound interest rate (r) = 5% = 0.05

Number of years (t) = 4

We will use the compound interest formula to find the final amount (A) at the end of 4 years:

$A = P \times (1 + r)^t$

$A = \$9{,}440 \times (1 + 0.05)^4$

A ≈ $11474.32

Now, we can find the compound interest earned during these 4 years:

Compound Interest (CI) = Final Amount - New Principal

CI = $11474.32 - $9,440

CI ≈ $2,034.32

The compound interest earned during the next 4 years is approximately $2,034.32.

Step 3: Calculate the total interest earned at the end of 7 years

Total Interest = Simple Interest + Compound Interest

Total Interest = $1,440 + $2,034.32

Total Interest ≈ $3474.32 = $3474 (Approx.)

The total interest earned at the end of the 7 years is approximately $3474.

Q21 Text Solution:

Let the initial sum Mrs. Adani had be Rs. x

Amount received = $\frac{(x \times 20 \times 4)}{100}$ + x = Rs. 9x/5

Sum invested in PMJDY = 30% × $\frac{9x}{5}$ = Rs. 0.54x

Interest received from PMJDY = $\frac{(0.54x \times 30 \times 2)}{100}$ = Rs. 0.324x

Sum invested in PMJJBY = $70\% \times \frac{9x}{5}$ = Rs. 1.26x

Interest received from PMJJBY

$= 1.26x\{(1 + \frac{10}{100})^2 - 1\}$ = Rs. 0.2646x

According to the question, 0.324x + 0.2646x = 10,000

=> 0.5886x = 10,000

=> x $\approx$ Rs. 16989.46

Q22 Text Solution:

The cost of the laptop is ₹ 45000.

Now, if the person could either buy the laptop by paying ₹45000 or through an installment plan.

Since the laptop was purchased through installment plan then the loan amount

= ₹45000 – 13,000 (upfront payment) = ₹32,000.

Here r = 12% compounded half-yearly in 3 equal installments.

Let x be the amount of installment.

Then,

₹32000 = $\frac{x}{(1+\frac{12}{200})^3} + \frac{x}{(1+\frac{12}{200})^2} + \frac{x}{(1+\frac{12}{200})}$

x = 11970 Rs

Q23 Text Solution:

Money invested by Mr. Musk in business = 4 × $\frac{65000}{5}$ - 4000 = 48,000

Investment of Tawta = m

Ratio of share of profit of Mr. Musk and Tawta is,

40,625: (87,100 - 40,625) = 125: 143

i.e.,

(48000×7 + 48000 × 1.1 × 5): (m × 5 + (m – 4800) ×7) = 125: 143

⇒ 600000 : (12m - 33600) = 125 : 143

Thus, we get, m = $ 60,000

Q24 Text Solution:

Let's assume it's equal after N years.

Ritesh's investment after N years = 18000 + 18000 × $\frac{6}{100}$ × N

Firoz's investment after N years = 14000 + 14000 × $\frac{12}{100}$ × (N – 3)

Equating both, we have

18000 + 18000 × $\frac{6}{100}$ × N = 14000 + 14000 × $\frac{12}{100}$ × (N – 3)

18000 + 1080N = 14000 + 1680N – 5040

9040 = 600N

N ≈15.06 or N = 15

Q25 Text Solution:

For scheme A, the simple interest for the first year is Rs. $\frac{(10{,}000 \times 12 \times 1)}{100}$

= Rs. 1200.

The simple interest for the second year is Rs. $\frac{(10{,}000 \times 15 \times 1)}{100}$ = Rs. 1500.

The simple interest for the third year is Rs. $\frac{(10{,}000 \times 18 \times 1)}{100}$ = Rs. 1800.

The total simple interest for three years is Rs. (1200 + 1500 + 1800)

= Rs. 4500.

The amount received after deducting tax is Rs. (4500 - 4500 $\times \frac{10}{100}$)

= Rs. 4050.

The final amount received from scheme A is Rs. (10,000 + 4050)

= Rs. 14,050.

For scheme B, the compound interest for three years is calculated as follows:

The amount after the first year is Rs. (10,000 $\times$ (1 + $\frac{10}{100}$)) = Rs. 11,000.

The amount after the second year is Rs. (11,000 $\times$ (1 + $\frac{10}{100}$)) = Rs. 12,100.

The amount after the third year is Rs. (12,100 $\times$ (1 + $\frac{10}{100}$)) = Rs. 13,310.

The compound interest for three years is Rs. (13,310 - 10,000) = Rs. 3310.

The amount received after deducting tax is Rs. (3310 - 3310 $\times$ $\frac{10}{100}$)

= Rs. 2979.

The final amount received from scheme B is Rs. (10,000 + 2979)

= Rs. 12,979.

The difference between the final amounts received from the two schemes is Rs. (14,050 - 12,979) = Rs. 1071.

Q26 Text Solution:

Calculate the upfront payment (40% of the house value):

Upfront Payment = 0.40 × $350,000

Upfront Payment = $140,000

Calculate the remaining amount to be paid in installments:

Remaining Amount = Total House Value - Upfront Payment

Remaining Amount = $350,000 - $140,000

Remaining Amount = $210,000

Now, we need to find the value of each installment. Since the remaining amount is paid in 3 equal annual installments at a compound interest rate of 6% per annum, we can represent the installment value as 'P.'

The present value of annuity formula is:

PV = P $\times$ [$\frac{(1-(1+r)^{-n})}{r}$]

Where PV is the present value, P is the periodic payment, r is the interest rate, and n is the number of periods.

In our case, PV = \$210,000, r = 0.06, and n = 3.

We need to find P:

$\$210,000 = P \times \left[\frac{(1-(1+0.06)^{-3})}{0.06} \right]$

Now, let's calculate the value inside the parentheses:

$\frac{(1-(1+0.06)^{-3})}{0.06} \approx 2.67301$

Now, we can plug the value back into the equation:

$\$210,000 = P \times 2.67301$

To find P, we can divide both sides by 2.67301:

$P \approx \frac{\$210,000}{2.67301}$

$P \approx \$78,563$

Since Alex has to pay 3 equal annual installments, the value of each installment is approximately \$78,563.

Q27 Text Solution:

Let the initial investment in project A be x and the initial investment in project B be y. According to the problem, the combined value of both investments is \$50,000. So, we have:

x + y = \$50,000 (Equation 1)

Now, after 4 years, the combined value of both investments is \$60,000. Let's calculate the values of investments A and B separately after 4 years.

For project A (simple interest):

Principal (P_1) = x, Annual interest rate (R_1) = 6% = 0.06 , Time (T_1) = 4 years

Simple Interest (SI_1) = $P_1 \times R_1 \times T_1$

$SI_1 = x \times 0.06 \times 4$

$SI_1 = 0.24x$

Value of investment A after 4 years = $P_1 + SI_1 = x + 0.24x = 1.24x$

For project B (compound interest):

Principal (P_2) = y, Annual interest rate (R_2) = 4% = 0.04, Time (T_2) = 4 years

Future Value (FV_2) = $P_2 \times (1 + R_2)^{T_2}$

$FV_2 = y \times (1 + 0.04)^4$

$FV_2 = y \times 1.16986$

Value of investment B after 4 years = 1.16986y

Now, the combined value of both investments after 4 years is \$60,000:

1.24x + 1.16986y = \$60,000 (Equation 2)

We already have Equation 1: x + y = \$50,000

Now, we need to solve these equations simultaneously. We can rewrite Equation 1 as:

x = \$50,000 - y

Now, substitute this value of x into Equation 2:

1.24(\$50,000 - y) + 1.16986y = \$60,000

Expand and simplify the equation:

\$62,000 - 1.24y + 1.16986y = \$60,000

Combine the terms:

-0.07014y = -\$2,000

Divide by -0.07014:

y ≈ \$28514.40

Now, find x using Equation 1:

x = \$50,000 - y

x = \$50,000 - \$28514.40

x ≈ \$21,485.60

Q28 Text Solution:

The calculations and explanations are as follows:

Step 1: Calculate the annual interest from the initial deposit.

Principal (P) = \$10,000

Annual interest rate (r) = 3% = 0.03

Annual interest earned = P × r

Annual interest earned = \$10,000 × 0.03

Annual interest earned = \$300

Step 2: Calculate the interest earned in the second account for each year.

As the annual interest earned from the first account is reinvested in the second account every year, we will calculate the interest earned in the second account for each year separately.

Interest rate for the second account (annual) = 4% = 0.04

Interest rate for the second account (quarterly) $= \frac{0.04}{4} = 0.01$

Now, we will calculate the future value of the interest reinvested in the second account for each year:

Year 1:

Principal = \$300 (interest from the first year)

Number of quarters (n) = (5 years - 1 year) × 4 quarters = 4 years × 4 quarters = 16 quarters

FV = \$300 × $(1 + 0.01)^{16}$

FV ≈ \$351.78

Year 2:

Principal = \$300 (interest from the second year)

Number of quarters (n) = (5 years - 2 years) × 4 quarters = 3 years × 4 quarters = 12 quarters

FV = \$300 × $(1 + 0.01)^{12}$

FV ≈ \$338.04

Year 3:

Principal = \$300 (interest from the third year)

Number of quarters (n) = (5 years - 3 years) × 4 quarters = 2 years × 4 quarters = 8 quarters

FV = \$300 × $(1 + 0.01)^{8}$

FV ≈ \$324.87

Year 4:

Principal = \$300 (interest from the fourth year)

Number of quarters (n) = (5 years - 4 years) × 4 quarters = 1 year × 4 quarters = 4 quarters

FV = \$300 × $(1 + 0.01)^{4}$

FV ≈ \$312.18

Year 5:

For the fifth year, the interest is deposited at the end of the year, so there is no additional interest earned in the second account.

Principal = \$300 (interest from the fifth year)

FV = \$300

Step 4: Calculate the total amount in the second account.

Total amount = FV (Year 1) + FV (Year 2) + FV (Year 3) + FV (Year 4) + FV (Year 5)

Total amount = \$351.78 + \$338.04 + \$324.87 + \$312.18 + \$300

Total amount ≈ \$1626.87

Q29 Text Solution:

To solve this problem, we'll calculate the interest earned in the first account each year and then find the amount in the second account after 6 years by reinvesting the withdrawn interest. We'll use the compound interest formula, $A = P(1 + \frac{r}{n})^{\mathrm{nt}}$, where A is the future value, P is the principal, r is the annual interest rate, n is the number of times interest is compounded per year, and t is the number of years.

Step 1: Calculate the interest earned in the first account each year

Principal (P) = \$10,000

Annual interest rate (r) = 4% = 0.04

Compounded semi-annually (n) = 2

Interest earned at the end of each year can be calculated using the formula: Interest = A - P, where A is the future value of the account at the end of the year.

For the first year:

$A_1 = P(1 + \frac{r}{n})^{n\times1}$

A1 = $\$10,000 \times (1 + \frac{0.04}{2})^{2\times1}$

A1 = \$10,000 × $(1.02)^2$

A1 = \$10,404

Interest1 = A1 - P = \$10,404 - \$10,000 = \$404

Step 2: Calculate the amount in the second account after 6 years

For each year's interest deposit (starting from year 2), we'll calculate its future value in the second account after 6 years and then sum up all the future values.

Year 1:

No interest deposit in the second account.

Year 2:

Principal_2 = \$404

FV2 = $\$404 \times (1 + \frac{0.06}{4})^{4\times5}$

FV2 = \$404 × $(1.015)^{20}$

FV2 ≈ \$544.11

Year 3:

Principal_3 = \$404

FV3 = $\$404 \times (1 + \frac{0.06}{4})^{4\times4}$

FV3 = \$404 × $(1.015)^{16}$

FV3 ≈ \$512.676

Year 4:

Principal_4 = \$404

FV4 = $\$404 \times (1 + \frac{0.06}{4})^{4\times3}$

FV4 = \$404 × $(1.015)^{12}$

FV4 ≈ \$483.02

Year 5:

Principal$_5$ = \$404

FV5 = $\$404 \times (1 + \frac{0.06}{4})^{4\times2}$

FV5 = \$404 × $(1.015)^8$

FV5 ≈ \$455.11

Year 6:

Principal$_6$ = \$404

FV6 = $\$404 \times (1 + \frac{0.06}{4})^{4\times1}$

FV6 ≈ \$428.79

Step 3: Calculate the total amount in the second account after 6 years

Total amount = FV2 + FV3 + FV4 + FV5 + FV6

Total amount ≈ \$544.11 + \$512.676+ \$483.02 + \$455.11 + \$428.79

Total amount ≈ \$2423.71

Q30 **Text Solution:**

Calculate the quarterly interest rate:

Annual interest rate = 9%

Quarterly interest rate = $(\frac{9\%}{4})$ = 2.25% or 0.0225

Calculate the future value of the loan after 1 year (4 quarters), since the installments start after one year:

Future Value = Principal × $(1 + \text{Rate})^{\text{Time}}$

Future Value = \$60,000 × $(1 + 0.0225)^4$

Future Value ≈ \$60,000 × 1.09308

Future Value ≈ 65,585

Now, we have a loan of \$65,585 to be paid in 5 equal annual installments. Since the interest is compounded quarterly, we need to find the equivalent annual interest rate:

Equivalent Annual Rate = $(1 + 0.0225)^4 - 1$

Equivalent Annual Rate ≈ 0.09308

Now, we will use the formula for the present value of an annuity:

Annuity = $\frac{(Present\ Value \times Interest\ Rate)}{[1 - (1 + Interest\ Rate)^{(-Number\ of\ Periods)}]}$

In our case, the Present Value is \$65,537.22, and the Number of Periods is 5.

Annuity = $\frac{(\$65{,}585 \times 0.09308)}{[1 - (1 + 0.09308)^{-5}]}$

Annuity ≈ $\frac{\$6104.6518}{[1 - 0.6408]}$

Annuity ≈ $\frac{\$6104.6518}{0.3592}$

Annuity ≈ \$16,995

The approximate value of each annual installment is \$16,995.