ACTU 363

Chapter 1

1.

Bruce deposits 100 into a bank account. His account is credited interest at an annual nominal rate of interest of 4% convertible semiannually.

At the same time, Peter deposits 100 into a separate account. Peter's account is credited interest at an annual force of interest of δ.

After 7.25 years, the value of each account is the same.

Calculate δ.

(A) 0.0388

(B) 0.0392

(C) 0.0396

(D) 0.0404

(E) 0.0414

9.

A 20-year loan of 1000 is repaid with payments at the end of each year.

Each of the first ten payments equals 150% of the amount of interest due. Each of the last ten payments is X.

The lender charges interest at an annual effective rate of 10%.

Calculate X.

(A) 32

(B) 57

(C) 70

(D) 97

(E) 117

12.

Jeff deposits 10 into a fund today and 20 fifteen years later. Interest for the first 10 years is credited at a nominal discount rate of d compounded quarterly, and thereafter at a nominal interest rate of 6% compounded semiannually. The accumulated balance in the fund at the end of 30 years is 100.

Calculate d.

(A) 4.33%

(B) 4.43%

(C) 4.53%

(D) 4.63%

(E) 4.73%

13.

Ernie makes deposits of 100 at time 0, and X at time 3. The fund grows at a force of interest $\delta_t = \frac{t^2}{100}, t > 0$.

The amount of interest earned from time 3 to time 6 is also X.

Calculate X.

(A) 385

(B) 485

(C) 585

(D) 685

(E) 785

17.

To accumulate 8000 at the end of $3n$ years, deposits of 98 are made at the end of each of the first n years and 196 at the end of each of the next $2n$ years.

The annual effective rate of interest is i. You are given $(1+i)^n = 2.0$.

Calculate i.

(A) 11.25%

(B) 11.75%

(C) 12.25%

(D) 12.75%

(E) 13.25%

20.

David can receive one of the following two payment streams:

(i) 100 at time 0, 200 at time n years, and 300 at time $2n$ years

(ii) 600 at time 10 years

At an annual effective interest rate of i, the present values of the two streams are equal.

Given $v^n = 0.76$, calculate i.

(A) 3.5%

(B) 4.0%

(C) 4.5%

(D) 5.0%

(E) 5.5%

21.

Payments are made to an account at a continuous rate of $(8k + tk)$, where $0 \le t \le 10$.

Interest is credited at a force of interest $\delta_t = \frac{1}{8+t}$.

After time 10, the account is worth 20,000.

Calculate k.

(A) 111

(B) 116

(C) 121

(D) 126

(E) 131

21.

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(A) 111

(B) 116

(C) 121

(D) 126

(E) 131

23.

Project P requires an investment of 4000 today. The investment pays 2000 one year from today and 4000 two years from today.

Project Q requires an investment of X two years from today. The investment pays 2000 today and 4000 one year from today.

The net present values of the two projects are equal at an annual effective interest rate of 10%.

Calculate X.

(A) 5400

(B) 5420

(C) 5440

(D) 5460

(E) 5480

45.

You are given the following information about an investment account:

(i) The value on January 1 is 10.

(ii) The value on July 1, prior to a deposit being made, is 12.

(iii) On July 1, a deposit of X is made.

(iv) The value on December 31 is X.

Over the year, the time-weighted return is 0%, and the dollar-weighted (money-weighted) return is Y.

Calculate Y.

(A) -25%

(B) -10%

(C) 0%

(D) 10%

(E) 25%

49.

Happy and financially astute parents decide at the birth of their daughter that they will need to provide 50,000 at each of their daughter's 18^{th}, 19^{th}, 20^{th} and 21^{st} birthdays to fund her college education. They plan to contribute X at each of their daughter's 1^{st} through 17^{th} birthdays to fund the four 50,000 withdrawals. They anticipate earning a constant 5% annual effective interest rate on their contributions.

Let $v = 1/1.05$.

Determine which of the following equations of value can be used to calculate X.

(A) $X\sum_{k=1}^{17} v^k = 50,000[v + v^2 + v^3 + v^4]$

(B) $X\sum_{k=1}^{16} 1.05^k = 50,000[1 + v + v^2 + v^3]$

(C) $X\sum_{k=0}^{17} 1.05^k = 50,000[1 + v + v^2 + v^3]$

(D) $X\sum_{k=1}^{17} 1.05^k = 50,000[1 + v + v^2 + v^3]$

(E) $X\sum_{k=0}^{17} v^k = 50,000[v^{18} + v^{19} + v^{20} + v^{21} + v^{22}]$

61.

The annual force of interest credited to a savings account is defined by

$$\delta_t = \frac{\frac{t^2}{100}}{3 + \frac{t^3}{150}}$$

with t in years. Austin deposits 500 into this account at time 0.

Calculate the time in years it will take for the fund to be worth 2000.

(A) 6.7

(B) 8.8

(C) 14.2

(D) 16.5

(E) 18.9

77.

Lucas opens a bank account with 1000 and lets it accumulate at an annual nominal interest rate of 6% convertible semiannually. Danielle also opens a bank account with 1000 at the same time as Lucas, but it grows at an annual nominal interest rate of 3% convertible monthly.

For each account, interest is credited only at the end of each interest conversion period.

Calculate the number of months required for the amount in Lucas's account to be at least double the amount in Danielle's account.

(A) 276

(B) 282

(C) 285

(D) 286

(E) 288

79.

Bill and Joe each put 10 into separate accounts at time $t = 0$, where t is measured in years.

Bill's account earns interest at a constant annual effective interest rate of $K/25$, $K > 0$.

Joe's account earns interest at a force of interest, $\delta_t = \dfrac{1}{K + 0.25t}$.

At the end of four years, the amount in each account is X.

Calculate X.

(A) 20.7

(B) 21.7

(C) 22.7

(D) 23.7

(E) 24.7

94.

A couple decides to save money for their child's first year college tuition.

The parents will deposit 1700 n months from today and another 3400 $2n$ months from today.

All deposits earn interest at a nominal annual rate of 7.2%, compounded monthly.

Calculate the maximum integral value of n such that the parents will have accumulated at least 6500 five years from today.

(A) 11

(B) 12

(C) 18

(D) 24

(E) 25