Problem 1:

Susan and Jeff each make deposits of 100 at the end of each year for 40 years.

Starting at the end of the 41st year, Susan makes annual withdrawals of X for 15 years and Jeff makes annual withdrawals of Y for 15 years. Both funds have a balance of 0 after the last withdrawal.

Susan's fund earns an annual effective interest rate of 8%. Jeff's fund earns an annual effective interest rate of 10%.

Calculate $Y - X$. [SAMPLE/00 #27]

(A) 2792 (B) 2824 (C) 2859 (D) 2893 (E) 2925

Problem 2:

An investment requires an initial payment of 10,000 and annual payments of 1,000 at the end of each of the first 10 years. Starting at the end of the eleventh year, the investment returns five equal annual payments of X.

Determine X to yield an annual effective rate of 10% over the 15-year period. [SOA 11/92 #9]

Problem 3:

A person age 40 wishes to accumulate a fund for retirement by depositing an amount X at the end of each year into an account paying 4% interest. At age 65, the person will use the entire account balance to purchase a 15-year 5% annuity-immediate with annual payments of $10,000.

Find X. [SOA SAMPLE/84 #1]

(A) $2,490 (B) $2,520 (C) $2,550 (D) $2,580 (E) $2,610

Problem 4:

The present values of the following three annuities are equal:

(i) perpetuity-immediate paying 1 each year, calculated at an annual effective interest rate of 7.25%

(ii) 50-year annuity-immediate paying 1 each year, calculated at an annual effective interest rate of j%

(iii) n-year annuity-immediate paying 1 each year, calculated at an annual effective interest rate of $j - 1$%

Calculate n. [5/01 #50]

Problem 5:

Eloise plans to accumulate 100,000 at the end of 42 years. She makes the following deposits:

(i) X at the beginning of years 1–14;
(ii) No deposits at the beginning of years 15–32, and
(iii) Y at the beginning of years 33–42.

The annual effective interest rate is 7%.

$$X - Y = 100.$$

Calculate Y. [SOA 5/98 #7]

(A) 479 (B) 499 (C) 519 (D) 539 (E) 559

Problem 6:

At an effective annual interest rate i, you are given:

(i) the present value of an annuity-immediate with annual payments of 1 for n years is 40; and
(ii) the present value of an annuity-immediate with annual payments of 1 for $3n$ years is 70.

Calculate the accumulated value of an annuity-immediate with annual payments of 1 for $2n$ years. [SOA 5/90 #6]

(A) 240 (B) 243 (C) 260 (D) 268 (E) 280

Problem 7:

At a rate of interest, i, where $i > 0$, a 36-year annuity-immediate with annual payments of \$4 has the same present value as an 18-year annuity-immediate with annual payments of \$5.

In how many years does money double at rate of interest, i? [SOA SAMPLE/84 #8]

(A) 9 (B) 12 (C) 18 (D) 27 (E) 36

Problem 8:

Raj deposits 100 into a fund at the end of each 2-year period for 20 years. The fund pays interest at an annual effective rate of i. The total amount of interest earned by the fund during the 19th and 20th years is 250. Calculate the accumulated amount in Raj's account at the end of year 20. [SOA 5/98 #12]

(A) 1925 (B) 1950 (C) 1975 (D) 2000 (E) 2025

Problem 9:

You currently have \$1000 in an account which pays a nominal rate of interest of 8% compounded quarterly. You plan to deposit \$200 every two months with the first deposit one month from now. What will be the value of the account one month after the eighteenth deposit? [CAS 5/87 #10]

(A) Less than \$5,280
(B) At least \$5,280, but less than \$5,300 (C) At least \$5,300, but less than \$5,320 (D) At least \$5,320, but less than \$5,340 (E) \$5,340 or more

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Problem 10:

Francois purchases a 10-year annuity-immediate with annual payments of $10X$. Jacques purchases a 10-year decreasing annuity-immediate which also makes annual payments. The payment at the end of year 1 is equal to 50. At the end of year 2, and at the end of each year through year 10, each subsequent payment is reduced over what was paid in the previous year by an amount equal to X. At an annual effective interest rate of 7.072%, both annuities have the same present value. Calculate X, where $X < 5$. [SOA 5/98 #6]

(A) 3.29 (B) 3.39 (C) 3.49 (D) 3.59 (E) 3.69

Problem 11:

Jeff bought an increasing perpetuity-due with annual payments starting at 5 and increasing by 5 each year until the payment reaches 100. The payments remain at 100 thereafter. The annual effective interest rate is 7.5%. Determine the present value of this perpetuity. [SOA 5/98 #8]

(A) 700 (B) 735 (C) 760 (D) 785 (E) 810

Problem 12:

Two annuities have equal present values. The first is an annuity-immediate with quarterly payments of \$$X$ for 10 years. The second is an increasing annuity-immediate with 10 annual payments. The first payment is \$500 and subsequent payments increase by \$50 per year. You may assume an annual effective interest rate of 5%. Determine X. [CAS 5/97 #1]

(A) Less than \$170
(B) At least \$170, but less than \$175
(C) At least \$175, but less than \$180
(D) At least \$180, but less than \$185
(E) \$185 or more

Problem 13:

A perpetuity-immediate pays 100 per year. Immediately after the fifth payment, the perpetuity is exchanged for a 25-year annuity-immediate that will pay X at the end of the first year. Each subsequent annual payment will be 8% greater than the preceding payment. Immediately after the 10th payment of the 25-year annuity, the annuity will be exchanged for a perpetuity-immediate paying Y per year. The annual effective rate of interest is 8%. Calculate Y. [5/03 #45]

(A) 110 (B) 120 (C) 130 (D) 140 (E) 150

Problem 14:

Chris makes annual deposits into a bank account at the beginning of each year for 20 years. Chris's initial deposit is equal to 100, with each subsequent deposit $k\%$ greater than the previous year's deposit. The bank credits interest at an annual effective rate of 5%. At the end of 20 years, the accumulated amount in Chris' account is equal to 7276.35. Given $k > 5$, calculate k. [SAMPLE/00 #29]

(A) 8.06 (B) 8.21 (C) 8.36 (D) 8.51 (E) 8.68

Problem 15:

Jeff and Jason spend X dollars to purchase an annuity. Jeff buys a perpetuity-immediate, which makes annual payments of 30. Jason buys a 10-year annuity-immediate, also with annual payments. The first payment is 53, with each subsequent payment $k\%$ larger than the previous year's payment. Both annuities use an annual effective interest rate of $k\%$. Calculate k. [SOA 11/96 #6]

(A) 5.00 (B) 5.33 (C) 5.50 (D) 5.67 (E) 6.00
